# *Chipped stone variability and approaches to cultural classification in the Epipalaeolithic of the south Levantine arid zone*

Anne Pirie

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This thesis examines how our picture of the Epipalaeolithic of the southern Levant has been structured, what its evidential base is and how it has gained authority. Hitherto, research has focused on describing variability in microliths, the type-fossil of the period, in terms of archaeological cultures using typology.

Narrative analysis was used in the first part of this thesis to explore the work of three main researchers in the field. This has shown that narrative strategies are indeed employed in archaeological texts to describe lithic and other data creating a picture of the period that relies substantially on ideas 'imported' from modern attitudes to the region and the relations of people within it. The techniques of narrative are used to pull together the disparate and conflicting data we work with into a unity of significance, embodying authority and plausibility.

In the second part of the thesis, a study of 12 chipped stone assemblages from the Negev and southern Jordan was undertaken. Attribute analysis was used to explore variability within and between sites. This has revealed a complex and cross-cutting pattern of personal or local decisions taken within a context of wider norms, which has created very specific tool forms at individual sites. A picture of context dependent variability was discovered that has not been reflected in the traditional typological methods. This offers new ways of seeing the relationships between social organisations and material culture.

# Chipped stone variability and approaches to cultural classification in the Epipalaeolithic of the south Levantine arid zone

**Anne Pirie**

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Department of Archaeology
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## Table of contents

## List of figures

### Chapter 2



### Chapter 3



### Chapter 4

## Chapter 5



## Chapter 6

## Chapter 7 figures

## Declaration

I confirm that the thesis conforms with prescribed word length for the degree for which I am submitting it for examination.

I confirm that no part of the material has previously been submitted by me for a degree in this or any other University. If material has been generated through joint work, my independent contribution has been clearly indicated. In all other cases material from the work of others has been acknowledged and quotations and paraphrases suitably indicated.

Signed:

Dated:

## Acknowledgements

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# 1. Introduction

The Middle Epipalaeolithic of the Levant has been the subject of research over the past 30 years. From 15,000- 12,500 BP, more or less mobile hunter-gatherers lived in all parts of the region and left an archaeological record consisting in large measure of chipped stone assemblages. Research has focused on describing variability in microliths, the type-fossil of the period, in terms of archaeological cultures. This thesis attempts to understand how variability has been perceived and interpreted within researchers' own historical context. The degree to which linguistic structures inform chipped stone analytical methods and interpretation within this wider context is used to understand the relationship between data and our picture of Epipalaeolithic cultures. A different way of describing and understanding morphological variability, in terms of decision-making within the tool-making process, is then developed, using 12 microlithic assemblages from the southern Levant.

## *1.1 Microlith variability*

Microlithic variability has seemed enigmatic. As presented in various accounts of the period, there are absolute differences *between* cultures and near-absolute homogeneity *within* cultures in terms of tool morphology. These are somehow related to different 'peoples' – for example, a group of people who made trapeze-rectangles for nearly 2,000 years (the Geometric Kebarans), then stopped this practice in order to make lunates (the Natufians). Meanwhile, their close neighbours were making arched-backed bladelets (the Mushabians). What does it all mean? How can this be understood in human terms?

Triangles, lunates, rectangles, obliquely truncated bladelets, arched-backed bladelets - tool shapes themselves, as currently conceived, seem mysterious. What role could variability between tool shapes play in people's lives? How had these shapes been arrived at? In what lived contexts do makers create these shapes? While variability at the level of *culture* has been stressed, the idea that variability could arise out of the way people do things, how they think about those things and the choices they had made, have not been explored. Variability seems a very abstract, disconnected concept.

Furthermore, as I looked at more chipped stone in person, I began see a different relationship between the microliths I was studying and the overall picture of variability and morphology presented in publications. There seemed to be a great deal of unexplored, and undescribed, variability - between tool types, sites and cultures. And each assemblage seemed to have its own strong character, made up of many tiny traits that comprised the 'feel' of an assemblage. This individuality is not represented in our picture of microlith variability in the Epipalaeolithic. Homogeneity of microliths within a culture is stressed, with little reference to something everybody working closely with these assemblages knows: that any given microlith bears more resemblance to all the other microliths, of whatever type, within its assemblage and less resemblance to microliths, even of the same 'type', in other assemblages.

I therefore wanted to develop an alternative way of describing variability that would reveal patterns rather than types. Individuals made tools, in a context comprised of, amongst other things, other people and wider structures, traditions, memories, methods of learning and motivations in tool-making. Within that context, it seems likely that patterns of variability will be cross-cutting, messy and complex. I wanted to allow each assemblage to reveal its full range and pattern of variability, as a way of examining the tool-making decisions and traditions within the site. Comparisons of this site-based pattern, or 'fingerprint', with that of other sites or groups of sites might reveal more about the contexts that makers were working in, within wider rules or traditions at different levels.

## 1.2 Why tools are described in this way

I was intrigued not only by the possibility of a closer description of actual microlith variability and what avenues of interpretation that would reveal, but also by the question of why researchers described tools, types and assemblages in the way they did.

If the reason is not in an overwhelming imperative of the data 'telling a story', then why were assemblages and their relationships described in the way they were and what gives these accounts their plausibility and authority? It seemed that the answer lay in the texts themselves. Researchers had described and interpreted their chipped stone data in publications, using language to represent and pull together raw data into a convincing and compelling account. This process seemed to involve 'storytelling' techniques in the same way that all accounts of observations of the world around us do. A close investigation of texts and data in them could be used to reveal the 'tracks' of narrative in texts and between key texts.

They were also carrying out their research on the Epipalaeolithic within the context of the turbulent history of the modern Levant over the past 30 years. The peculiar position of the region, and the relationships between the people within it, has loomed large both for people living there and for those from other countries, like the UK and the US, that have played a role within it.

I believe that these two key elements – how we narrate our understanding and how we use what we know and believe about familiar things, such as the present, to underpin and explain the new or strange - has played a key role in development and maintenance of the current picture of Epipalaeolithic cultures and their relationships.

It seemed important to me to investigate this, not because practice in this region and period was worse or different than that in other periods or parts of the world. While Mortimer Wheeler (1956:53) speaks of archaeology in the Near East as an "unfailing source of cautionary examples", I believe that the strategies discussed above are fundamental ones that we all use to make sense of the world. However, it is crucial in accounts purporting an authority over some body of material or area of investigation that all parts of the descriptive and explanatory process - that is to say methodology and its fundamental epistemology - be open to scrutiny. Those aspects of a discipline, which remain hidden from view while creating authority for one interpretation, are hegemonic in effect. It becomes impossible to see the 'working parts' of data analysis and interpretation. Text can only build on past text, without taking a healthy critical stance on methodologies or findings. And this is what has happened in Epipalaeolithic research in the region.

Meaningful debate between researchers has become almost non-existent. Published replies or comments on research are rare and usually written by researchers either working outside the immediate field of Levantine Epipalaeolithic research, or whose career paths did not depend on validation from within the close-knit Near Eastern archaeological community (e.g. Dunnell 1996, Baird 1996, Neeley and Barton 1994, Jochim 1994, but see Rosen 1991). The response of the research community to one of these was instructive. A paper focused on alternative explanations of microlith variability (Neeley and Barton 1994) was the object of rebuttal, that ranged from vociferous to vituperative (Fellner 1995, Kaufman 1995, Goring-Morris 1996, Henry 1996, Phillips 1996), rather than of considered debate and assessment. It seemed unlikely that nothing more than our understanding of a few 12,000 year old tool shapes was at stake: these debates appear to touch something more fundamental within the established traditions. This study set out to investigate the inner workings of Epipalaeolithic stories to understand what lay underneath our picture of Epipalaeolithic cultures.

## 1.3 Structure of thesis

Chapter 2 of this thesis examines the history of prehistoric research in the region, looking particularly at the historical context of research methods from the 1930s through the present day. Current knowledge of the Epipalaeolithic will be outlined and the use of various types of data will be discussed: chipped stone, radiocarbon data and environmental evidence.

Chapter 3 examines the role of chipped stone assemblages within Epipalaeolithic research. Methods of analysis and description, and problems associated with them, will be discussed. Particular attention will be paid to microlith typology in Levantine assemblages.

Chapter 4 analyses the published accounts of three major figures in the field: Ofer Bar-Yosef, Nigel Goring-Morris and Don Henry. A close reading of narrative structures in the description and analysis of data, and the overall interpretations based on them, is undertaken.

Chapter 5 describes the methodology I have used to analyse 12 Middle Epipalaeolithic assemblages from southern Jordan and the Negev.

Chapter 6 examines the range and patterns of variability within 12 Middle Epipalaeolithic assemblages from the Shunera dunes in the Negev and the Ras en-Naqb area of southern Jordan.

Chapter 7 analyses the results of this analysis at various levels, in terms of relationships between individual or site-based decision making and wider rules or structures shared with the assemblages from other sites.

Chapter 8 discusses the implications of this variability analysis in terms of previous research on archaeological cultures and their interpretation, the use of microlithic tools within technological systems and ideas of ethnicity and group in arid environments.

## *1.4 Summary*

I will show that narrative strategies have informed the way chipped stone assemblages have been described and analysed. It is through these linguistic tropes that disparate pieces of information are pulled together and given the unity of significance that we expect of prehistory. The work on Epipalaeolithic chipped stone has taken its own regional character in the Levant. This study will show that narrative structures have employed elements of the 'scientific' paradigm of processualism and the traditional cultural-historical paradigm, in a complex layering and cross-referencing of paradigms and their associated goals, research questions and methodologies.

Research into the prehistory of the Levant has developed within a local and international set of attitudes to the Middle East and the relations, modern and historical, of people within it. It is this, together with the changing state of political affairs in the region and developing ideas within the discipline of archaeology, that has moulded the view we have constructed of the Epipalaeolithic. Views of ethnicity, homeland, group relationships and tradition in the modern world have informed and structured data analysis and interpretations of the Epipalaeolithic.

In the second part of the thesis, I suggest an alternative method of chipped stone analysis. I will identify underlying design principles of assemblages through ranges of variability within and between sites. Assemblages will be shown to be amalgams of attributes held in common with some other sites and site-specific interpretations and choices. Both personal and rule-based behaviour occur at every stage of the knapping process. This results in a complex 'pulling-together' of rules with personal interpretations and habits into an integrated process that results in very specific microlithic forms. This creates a picture of context dependent variability not reflected in the traditional typologies that offers new ways of seeing the relationships between social organisation and material culture.

## 2. The Epipalaeolithic

This chapter outlines the history of research into the Epipalaeolithic of the Southern Levant and sets out the traditional framework of the Epipalaeolithic through 12,500bp. The role of chipped stone typology is discussed, followed by the evidence provided by radiocarbon dating and palaeoclimatic data.

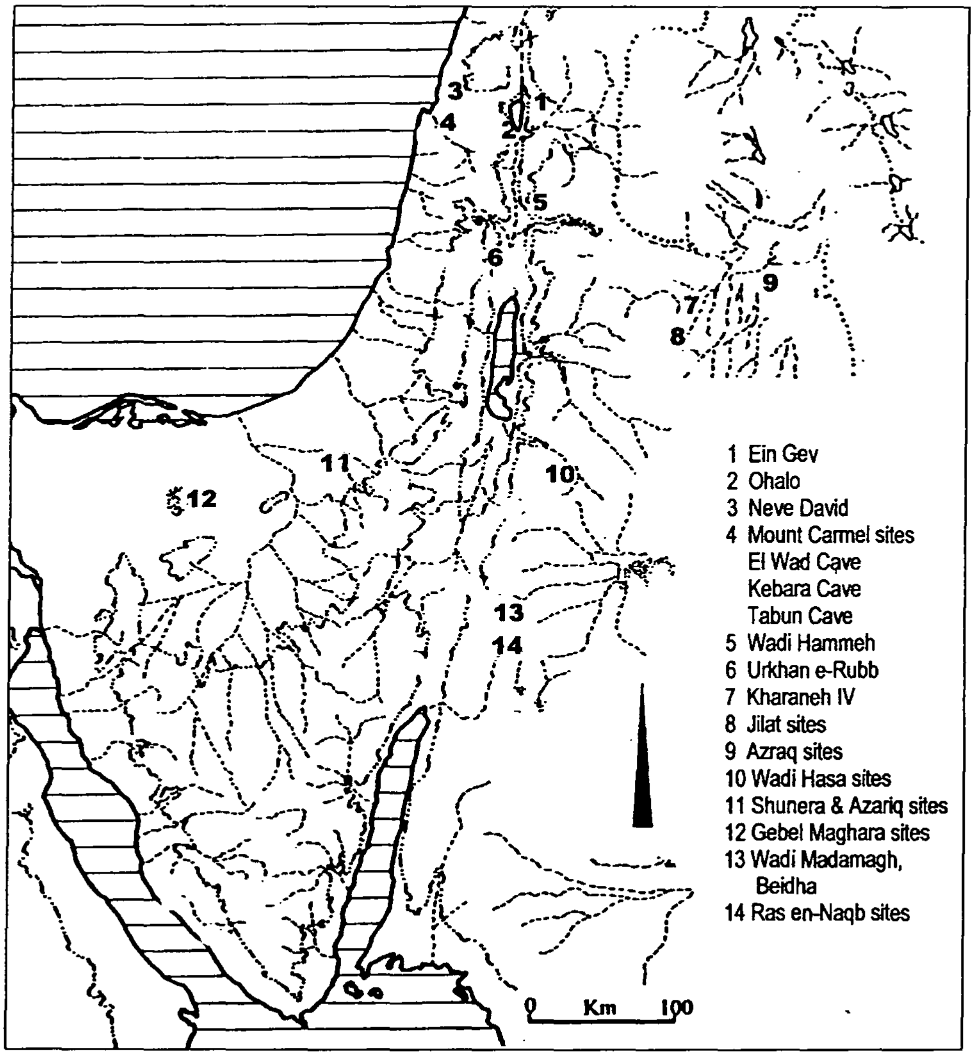



Figure 2: 1 Map of the southern Levant showing sites mentioned in text

## *2.1 History of research*

The role of the history of prehistoric research in the region, and of the political context in which archaeology has operated, is rarely commented on (but see Chazan 1993, Whitelam 1996, Rosen 1991, Glock 1985, Glock 1999, and King 1983). However, the practice of archaeology in the Levant has been formed by the politicohistorical context in which it occurred. Western attitudes to the region as the 'Holy Land' and its subsequent political vicissitudes, involving different groups of inhabitants, shifting national boundaries and the changing colonial and post-colonial involvement of Western powers, have all affected the type of archaeology practised.

Archaeology in the Levant has been focused very largely on biblical periods. Most archaeologists have been primarily concerned with uncovering links between the Bible and the archaeological record of the region. This has been true of the majority of foreign excavators, both Protestant and Catholic, as well as local Jewish ones. For example, many American archaeologists in the region have by training been primarily biblical scholars, and only secondarily archaeologists (Glock, 1985:464). Earlier prehistoric archaeology thus grew up within this context, and there have been periods when it was not a part of archaeology in the region. An initial interest in the earlier periods did not develop until the 1920's in Palestine (e.g. Garrod and Bate 1937) and slightly later in Jordan. During the period 1940-1965 (see below), prehistory was again largely ignored in favour of the biblical periods. The precedence of biblical archaeology and archaeologists in the region has also influenced how archaeology has been carried out, even in earlier prehistoric periods. Glock (1985) comments on how theoretical concerns and methodological practices current in American archaeology have not been fully transferred to American archaeologists working in the Near East, because of their historical focus.

## Mandate period

French interest in the prehistory of the region began early, with Paul Emile Botta's visits to the region in 1830's, and was further developed by Edouard Lartet (Lartet 1864). Early prehistory was placed firmly within the context of the Bible, with investigations summarised by Paul Karge (1925) in a work called '*Raphaim*', named after the giants said to occupy the Holy Land before the Canaanites and the Israelites.

Professional prehistory in the Southern Levant did not begin until after the First World War, when various European states were governing the region. The period during which Britain governed what was to become Israel and Jordan (1919-1948) saw the beginnings of concerted efforts to study prehistory in the area. This meant that the pioneers of prehistoric investigation in the region were developing basic time-space frameworks up to 100 years later than this was done in many parts of Europe.

It was the colonial powers of the day that commanded the resources for major excavations. British archaeologists Dorothy Garrod and Francis Turville-Petre conducted the first major excavations. The Mount Carmel caves, in the north of what is now Israel, were excavated during the 1930s. Garrod used her deep excavations at these caves to map out a cultural succession from the Middle Palaeolithic through the Epipalaeolithic. Meanwhile the French archaeologist René Neuville was excavating in the Judean Desert, near Jerusalem. Also focusing on cave stratigraphy, he developed a similar succession of cultures (Neuville 1951). It is Garrod and Neuville's work which sets out the initial framework for thinking on the prehistory of the region. Neuville classified the entire period which we now call the Epipalaeolithic as part of the Palaeolithic, while Garrod saw the bulk of the period as part of the Palaeolithic, while the Natufian was seen as significantly different, and defined as the Mesolithic. These cultures were seen as part of a universal development in prehistory, with Levantine cultures in some sense mirroring European ones. This view of the role of European-defined cultures, alongside the importance of Biblical history within the region, sometimes created strange bedfellows. Père Buzy, writing on a site in the Negev, commented, "The site, being neither Aurignacian nor Capsian, can only be Magdalenian....Anything concerning the history of the Holy Land is of interest to us: we are glad to know that for a few years or a few centuries a Magdalenian tribe mounted guard on the road from Sinai into Canaan" (Père Buzy, 1929).

Garrod focused on creating a temporal framework for the near eastern Palaeolithic. This was built on her colleague Dorothy Bate's interpretations of climate change, based on changing proportions of large mammal bones in the faunal assemblage. Human periods thus had a similar, geologic timescale. Excavated levels were thick – Garrod's lower Natufian level (B2) at El Wad was 3 metres thick, with one lithic assemblage from the entire level. Her eight levels at Tabun Cave were later excavated by Jelinek (1981) in 85 levels. Garrod's focus was on the macro level, embodied by abrupt changes from one level to another, thus de-emphasising internal variability. Although increasing variability within the latter part of the Palaeolithic was being identified, for example the Kebaran (Turville-Petre, 1932) and the Atlitien at El Wad (Garrod and Bate 1937), this variability was not commented on. The goal of a European-linked succession of periods meant that local variability was not noteworthy.

Change between levels was seen as created by diffusion of people, and was signalled by changes in material culture. Garrod's major concern was to trace these migrations of people. She had studied with the French archaeologist Abbé Breuil after World War I. Brueil and his followers had famously de-linked a progressive viewpoint of increasing complexity in material culture such as stone tools as a way of determining chronological sequence. Instead, stratigraphic relationships between assemblages became paramount. A strongly regional approach meant that local sequences were delineated by Breuil and his students in various parts of France and internationally. Change was explained by diffusion and migration from one region to another.

Breuil had pointed out that the existing map of archaeological cultures was limited to Western Europe. Garrod wanted to expand this in order to investigate migrations within the Palaeolithic. She saw the Near East as a possible origin for the European Upper Palaeolithic. This reason for studying the Near East maintained some currency for many years – Kenyon, working in the 1950's, similarly saw the significance of the region in its importance for understanding the origins of European culture (Kenyon, 1960).

However, other workers following Garrod often took a different view on the potential influence of the Near East on Europe. The political context of historical and then-current relations between the Middle East and Europe/the United States gave a particular cast to perceptions of prehistoric relations between the regions. Edward Said (1985:33) quotes British Prime Minister Arthur Balfour's speech to Parliament on the subject of British relations with the Near East in 1910. He said, "conqueror has succeeded conqueror…but never in all the revolutions of fate and fortune have you seen one of those nations of its own motion establish what we, from a Western point of view, call self-government". This view of 'conqueror succeeding conqueror' was widely transferred to archaeological periods. Europe is shown as the source and prime mover of progress and cultural change. William Albright, head of the American Schools of Oriental Research in Israel, compared the situation in the Near East to that in China, "Nearly all basic elements of Chinese civilisation penetrated from the west at different periods, so that the eminent sinologist E.W. Bishop can justly call the Chinese culture 'a civilisation by osmosis'" (1940:5). Some years later, the influential French archaeologist de Vaux showed that this point of view towards the Palaeolithic continued. "The tools belonging to this age share many of the characteristics of those of the Aurignacian culture and would appear to have been subject to a European influence" (de Vaux 1978:30).

Interpretation of the Natufian is illuminating in this respect. Garrod saw the earlier Natufian as a rich and exciting period analogous to the European Mesolithic (Garrod 1932). However, the later Natufian was seen as a degenerative period, and this view continued for many years. Chester McCown (1943:31) saw the last Natufian level at El Wad as different from its European 'contemporaries' in having no bone tools. It deteriorated towards its close and was "unable to resist the intrusion of the more primitive culture which appears in Stratum C. This shows that the cultural unity of the Western and Near Eastern world was broken, with the result that Palestine began to develop along a path of it's own". A separation of the trajectory of the Near East and Europe was instigated, without which the justification of then-current political ideas of difference between the Near East and Europe could not be justified.

The only professional local archaeologist working during this period was the Russian-trained Moshe Stekelis. Later to concentrate on more recent periods, at this time he was working at the Judean Caves with Neuville, and also with the American Schools of Oriental Research at Mount Carmel in 1941.

## State of Israel 1948 – 1970

In 1948 the state of Israel was formed, giving a great impetus to Israeli archaeology. Most archaeologists of this period focused on the biblical connections of Bronze/Iron Age sites and very little prehistoric work was carried out. The desire to link the new state to Old Testament occurrences was a major political and popular concern in Israel. British archaeologists largely left Israel, focusing on Jordan, where some work on earlier periods was carried out. In 1952, Kenyon began work at Jericho, where the lowest levels revealed Natufian occupation. Kirkbride was also working in Jordan during the 1950's and 1960's at Beidha, a largely PPNB site with Natufian levels. She also spent a brief season at Wadi Madamagh, an Epipalaeolithic site nearby. But the early Neolithic and later periods were the focus of research in both Kenyon and Kirkbride's work. It was not until the late 1960's/early 1970's that major work was done augmenting our knowledge and understanding of the Epipalaeolithic on either side of the Rift Valley.

The French had continued working near Jerusalem. 'Ain Mallaha, a large Natufian site, was excavated from the 1960s by Perrot (1966), who had worked with Neuville on his material from the Judean Desert. Then Director of the French Archaeological Mission in Israel, Perrot published a major synthesis of prehistory in the northern and southern Levant (1968), and suggested a reappraisal of periodisation. He proposed the basic framework that most archaeologists work to today: that the Natufian should be considered part of the Palaeolithic, as should the Kebaran, and that together these should form a major sub-division, the Epipalaeolithic. Following Tixier's work in North Africa, which had defined an Epipalaeolithic and resulted in a major typology of microliths (Tixier 1963), Perrot suggested that the period should be called the Epipalaeolithic. He was one of the first archaeologists to publish a detailed discussion of the paleoclimate of the period (1968), and argued that the Epipalaeolithic did not represent a significantly new adaptation to a new environmental context different from earlier Palaeolithic periods. On this basis, he argued that the Kebaran and the Natufian were the final part of the Palaeolithic, rather than a separate 'Mesolithic' modelled on European periodisation.

In 1970 Ofer Bar-Yosef completed his doctoral thesis, which had been carried out under the supervision of Stekelis (Bar-Yosef 1970). The French influence was continued in Bar-Yosef's work through his training with Bordes. Bar-Yosef brought together various assemblages, which had been collected or excavated in Israel over the years since statehood, by archaeologists or amateurs. He used these to develop a picture of the cultural distribution of the Epipalaeolithic in Israel. It was this influential work which formalised the use of the term Epipalaeolithic and further subdivided the cultural framework of the period on explicitly typological grounds into the Kebaran, the Geometric Kebaran and the Natufian.

### 1970 - present

The political impact of the Six Days' War in 1967 also meant major changes in archaeology in the region. American influence increased dramatically, with the US taking over from Britain's role, which had waned following the end of the Mandate (Said 1985). American archaeological influence also increased, seen particularly in work on earlier multi-period prehistoric projects. The American influence came through the work of Butzer and others in Egypt (Butzer 1975, Phillips and Mintz 1977) and was reflected in a concern with environmental adaptations.

The Six Days' War resulted in the Negev and Sinai becoming available for Israeli and joint Israeli/American archaeological projects. The American archaeologist Marks conducted a large project in the Negev highlands between 1969 and 1980, locating many Middle, Upper and Epipalaeolithic sites (e.g. Marks and Scott 1976). Joint Israeli projects included Phillips and Bar-Yosef's work in the Sinai from1971-76 (Bar-Yosef and Phillips 1977) and Valla, Gilead and Bar-Yosef's in the Northern Negev during the late 1970's.

In 1979, Israel signed the Camp David Accord, agreeing to a realignment of national borders following its massive increase in territory during the Six Days War. Hand-over was to happen in tranches, with part in 1980 and the rest in 1982. This brought work in the Sinai, such as Bar-Yosef and Gilead's work at Qadesh Barnea in North Sinai (Gilead 1977), to an end. The Negev was to become the new border with Egypt.

The Emergency Survey of the Negev began in 1979, with the goal of surveying the area for all archaeological occurrences before they were destroyed due to redeployment of Israel's military forces and the building of airfields in the area. The Epipalaeolithic part of this project, which involved surveying large parts of the West and Central Negev, was directed by Nigel Goring-Morris. This survey resulted in the location and collation of very many Epipalaeolithic occurrences, and together with the earlier 1970's work in Sinai, a picture of several new cultural occurrences associated with arid zones – the Mushabian, Ramonian and Harifian.

By the early 1980s, more US and British prehistorians were also active in Jordan. Some initial surveys had been carried out (Rhotert 1938, Kirkbride and Harding 1947, Kirkbride 1959, Copeland and Hours 1971, Price and Garrod 1975, Henry 1973) but there had been no earlier systematic, full-scale surveys or excavations of prehistoric sites, except Kirkbride's PPN/Natufian excavation at Beidha.

Henry began survey work in Wadi Hisma in 1980, with others following in the Petra area (Schyle and Uerpmann 1988, Gebel 1983-84), Wadi Hasa (MacDonald *et al.* 1982, Clark *et al.* 1988 ) and the Azraq Basin (Garrard *et al.* 1988). Mujahed Muheisen, the only indigenous archaeologist working on early prehistoric periods, published his dissertation bringing together all the then published works on the Epipalaeolithic in Jordan (Muheisen 1988). He later published his work on excavations at Kharaneh IV, a stratified Early Epipalaeolithic site in Eastern Jordan (Muheisen 1988). To date the only comprehensively published work coming out of the extensive survey/excavation projects of the 1980's is Henry's (1995), although the Wadi Hasa has been the subject of numerous interim reports. This has limited the effect that these projects have had on our understanding of the period to date.

More recently, work in Wadi Hasa continues (Olszewski *et al.* 1994), as does work at Azraq (Rollefson *et al.* 1997). Recent work in Israel, which has yet to be fully published, includes that at Ohalo (Nadel 1990). In addition, the systematic archaeological survey of all Israel continues, with each site being very briefly published as a note in each regional volume.

## 2.2 Framework for the Epipalaeolithic 19,000-12,800 bp

This section sets out the traditional framework of the Epipalaeolithic, developed largely from the analysis of chipped stone technology by researchers across the last century. The more recent availability of radiocarbon dates raises some challenges to this framework. These are explored in more detail in the following section.

### 2.2.1 The early Epipalaeolithic 19,000-14,500 bp

Initially coined by Turville-Petre (1932) to describe Kebara Cave in the North of Israel, the Kebaran came to be considered the first Epipalaeolithic culture. It was first analysed in depth by Bar-Yosef (1970). Some sites in Wadi Hisma have been defined by Henry (1995) as a sub-grouping of the Kebaran culture called the Early Hamran. The Kebaran is sometimes further divided into various cultures, such as the Masraqan and the Nizzanan (Goring-Morris 1995), although these subdivisions have not gained wide currency. The Qalkhan was also defined by Henry (1995) to describe two sites located in Jordan, believed to date to this period or later, and representative of an early non-Kebaran development. Broadly contemporary sites in the Azraq Basin of Jordan have been compared to this entity by some (e.g. Henry 1995) or considered part of another complex, the Triangle Industry (Fellner 1995). Some sites in the Negev, the Mount Carmel area and the Jordan Valley continue to exhibit Upper Palaeolithic traits into the early Epipalaeolithic. They are considered to represent a continuation of earlier traditions alongside Kebaran populations, and are called the Terminal Upper Palaeolithic (Goring-Morris 1987).

Chipped stone typology

Temporal ordering of Early Epipalaeolithic sites has relied on typology, with increasing numbers of radiocarbon dates only becoming more recently available.

As defined by Bar-Yosef (1981, 1990) and Bar-Yosef and Vogel (1987), the Kebaran is characterised by

- a high frequency of microliths
- a prevalence of arched forms of non-geometric microliths (micropoints,

microgravettes, arched and pointed bladelets and obliquely truncated bladelets)

- infrequent use of the microburin technique.

Bar-Yosef (1970) discerned four groups based on proportions of principle microlithic tool types but it is not clear how far these clusters represent geographically limited occurrences, temporal change or should be attributed to other factors. Generally, Kebaran sites have been divided into 2 phases, characterised by differing proportions of microlith types. The earlier Kebaran is dominated by micropoints, curved or arched backed bladelets and microgravettes. Late Kebaran assemblages contain obliquely truncated backed microliths, although curved backed bladelets continue to be present. There is a gradual shift from early to late proportions. It has also been suggested (Bar-Yosef 1981, 1990) that the later Kebaran has more homogeneity between assemblages.

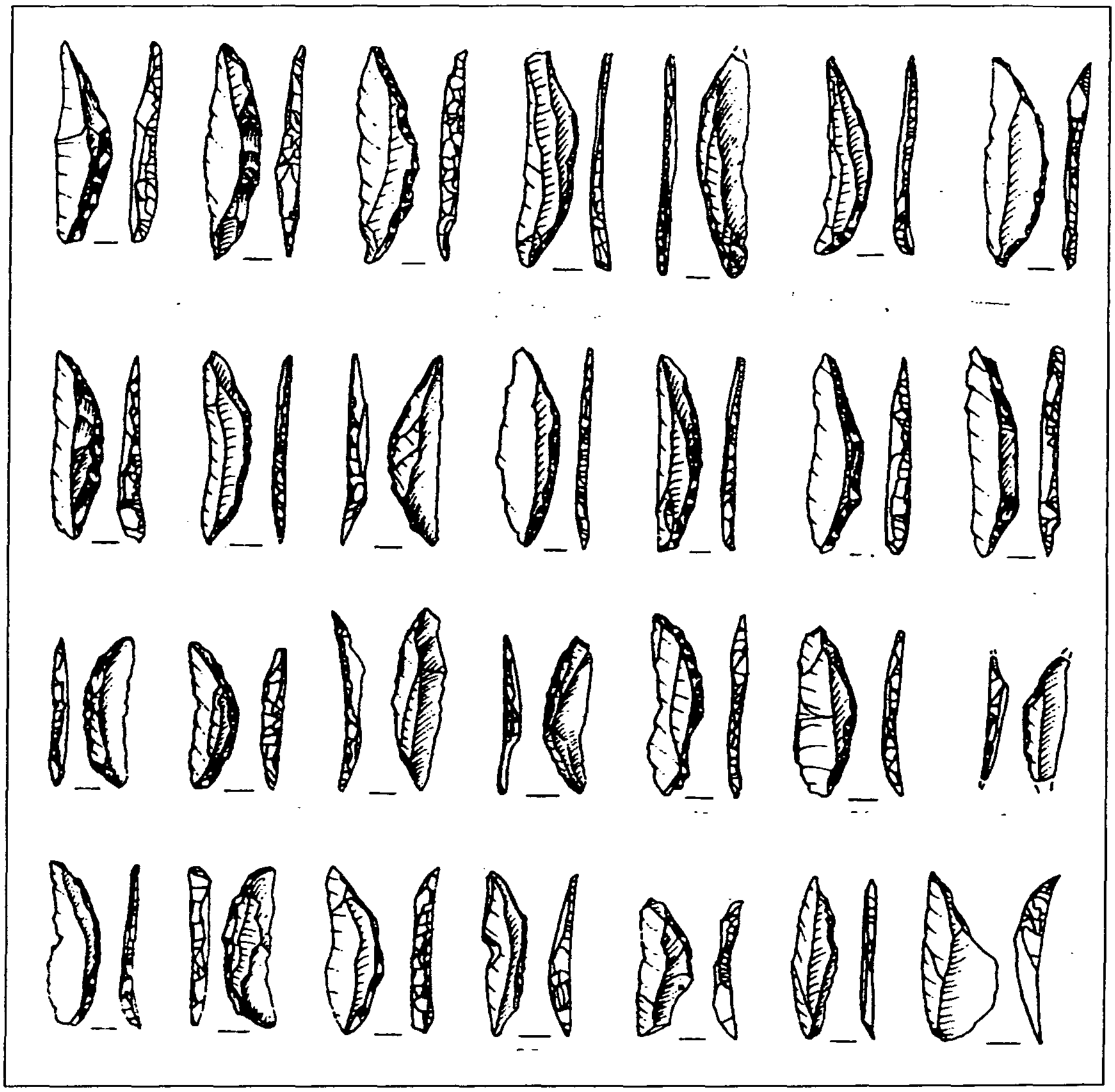


Figure 2:2 Kebaran tools from Azariq 6, after Goring-Morris (1987)

In the eastern Levant, Henry (1988, 1989) has defined the early Hamran industry as part of the Kebaran Complex. It is characterised by:

- low uses of the microburin technique
- short, relatively wide bladelets
- few narrow micropoints
- backed bladelets common, with straight backed medial fragments and snapped and truncated bladelets predominating.

Henry points out (1988) that these assemblages fall outside the usual techno-typological parameters used in defining the Kebaran in the western Levant, but feels there are enough similarities to consider it a regional variant.

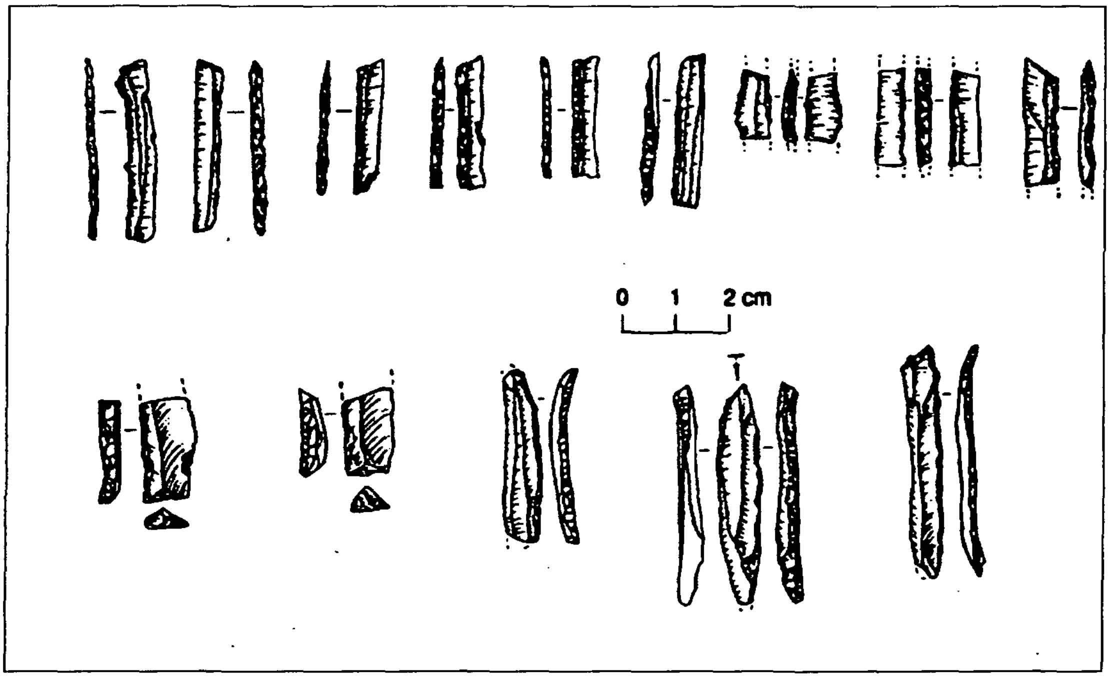



Figure 2:3 Early Hamran tools from site J504, after Henry 1995.

Henry's Qalkhan complex differs from the Hamran by a more intensive use of the microburin technique, and the presence of the triangular Qalkhan point. Byrd (1994) suggests that there may be affinities with other eastern Levantine sites of this period with triangles. The use of the microburin technique in these assemblages has shed a new light on the origins of the technique. Previously thought to have North African affinities, the early dates of some assemblages from Jordan now suggest an Eastern Levantine origin. The technique is used at Uwaynid 18 at 23,000-19,800 bp (Byrd 1994), and continues throughout this period.

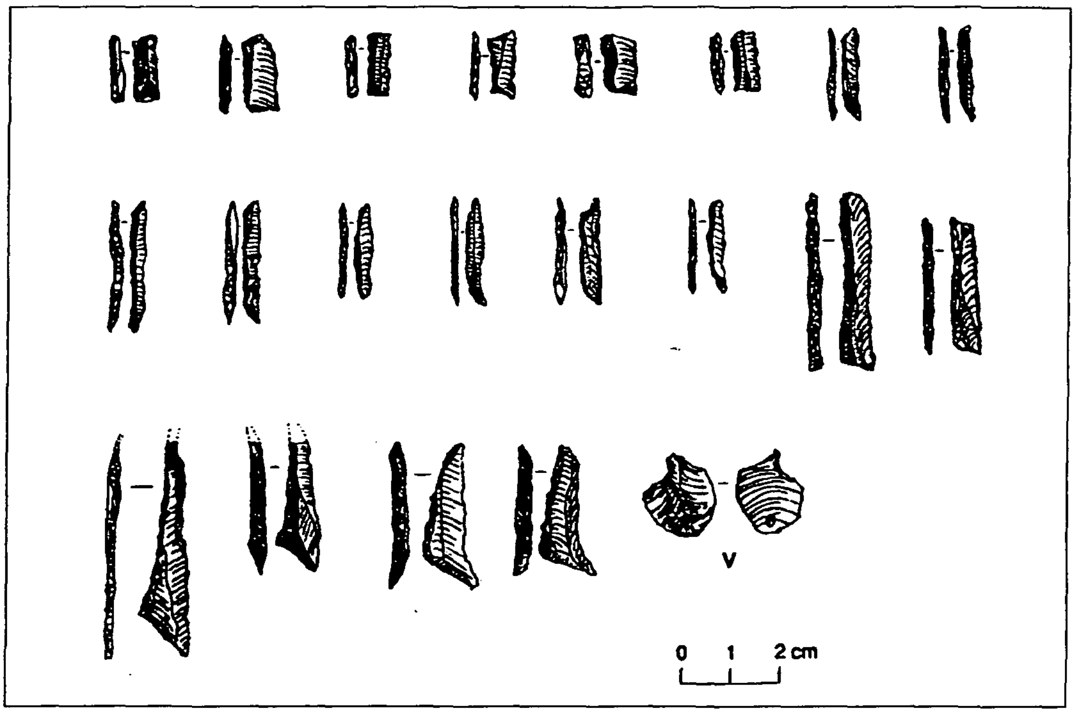



Figure 2:4 Qalkhan tools from site J431, after Henry 1995.

Radiocarbon dating

Sites that have been identified as Early Kebaran through chipped stone typology are located in the Northern and Central areas of Israel. Late Kebaran sites are also found in the Negev and east of the Rift Valley. Radiocarbon dates from Ohalo II (Nadel *et al.* 1995) and Urkan e-Rubb (Hovers and Marder, 1991), two recently well-dated sites, confirm the temporal distribution of the Kebaran. However, dates from Urkan e-Rub challenge the temporal ordering of tool types, as small and narrow tools are found here with very late Kebaran dates. There are no accepted radiocarbon dates for Early Hamran sites. The Azraq sites have been well dated, with Jilat 6 placed around 15,400-16,700bp, and Uwaynid 14 18,400-18,900bp.

Site characteristics

Most Early Epipalaeolithic sites appear to be small, short term occurrences, with site sizes under 100 m$^2$, and few features. However, throughout the period some larger sites, of 1000m$^2$ or more, also occur. Some contain the remains of structures, including semi-subterranean huts, or living floors, together with one or more hearths. Sites in the Azraq basin are much larger than others, at around 20,000 m$^2$, and include the remains of structures. These may have been created by repeated occupations, each of which may have lasted for several months at a time.

The only plant remains recovered from sites of this period in the region are wild barley and wheat, as well as nuts and fruit, from Ohalo 2 (Kislev *et al.* 1992). Fish bones have been found at Ein Gev IV (Bar-Yosef 1970) as well as Ohalo 2 (Nadel 1994). Gazelle bones outnumber all others at the rare early Epipalaeolithic sites with faunal assemblages.

A few bone tools have been found at Kebaran sites, including Ein Gev 1, Urkan e Rubb and Wadi Hammeh 26, as well as at Wadi Jilat 6, an arched-tool site. Ground stone mortars and pestles, probably for processing of plants have been found at these sites and also at Ohalo 2.

Marine molluscs, originating from the Mediterranean, also appear with *Columbella* and *Mirella* particularly popular (Fellner 1995). *Dentalium* is also common in the Azraq sites, with origins in the Red Sea and the Mediterranean, quite distant from the sites.

### 2.2.2 Middle Epipalaeolithic 14,500-12,800 bp

The Geometric Kebaran was first defined by Bar-Yosef (1970) within the Middle Epipalaeolithic, based on coastal plain and northern sites. Henry identified the Middle, Late and Final Hamran as part of this complex in Jordan (1988). The Mushabian was proposed as a contemporary culture some few years later from work in the Sinai by Bar-Yosef and Phillips (1977), with the Ramonian seen either as a regional facie (Henry 1995) or a later Mushabian occurrence, sometimes considered to overlap into the late Epipalaeolithic and co-occur with the Natufian (Goring-Morris 1987). Again Henry identified a Jordanian variant, the Madamaghan (Henry 1995).

Chipped stone typology

The Geometric Kebaran is seen as differentiated from the Kebaran assemblages by the appearance of geometric trapeze-rectangle microliths (Bar-Yosef 1970). Overall, the complex is characterised by:

- high frequencies of backed bladelets and geometric microliths
- backed bladelets in mainly straight backed forms
- geometric microliths, mainly trapeze rectangles
- long bladelet blanks
- only occasional use of the microburin technique - mainly in making lunates and triangles.

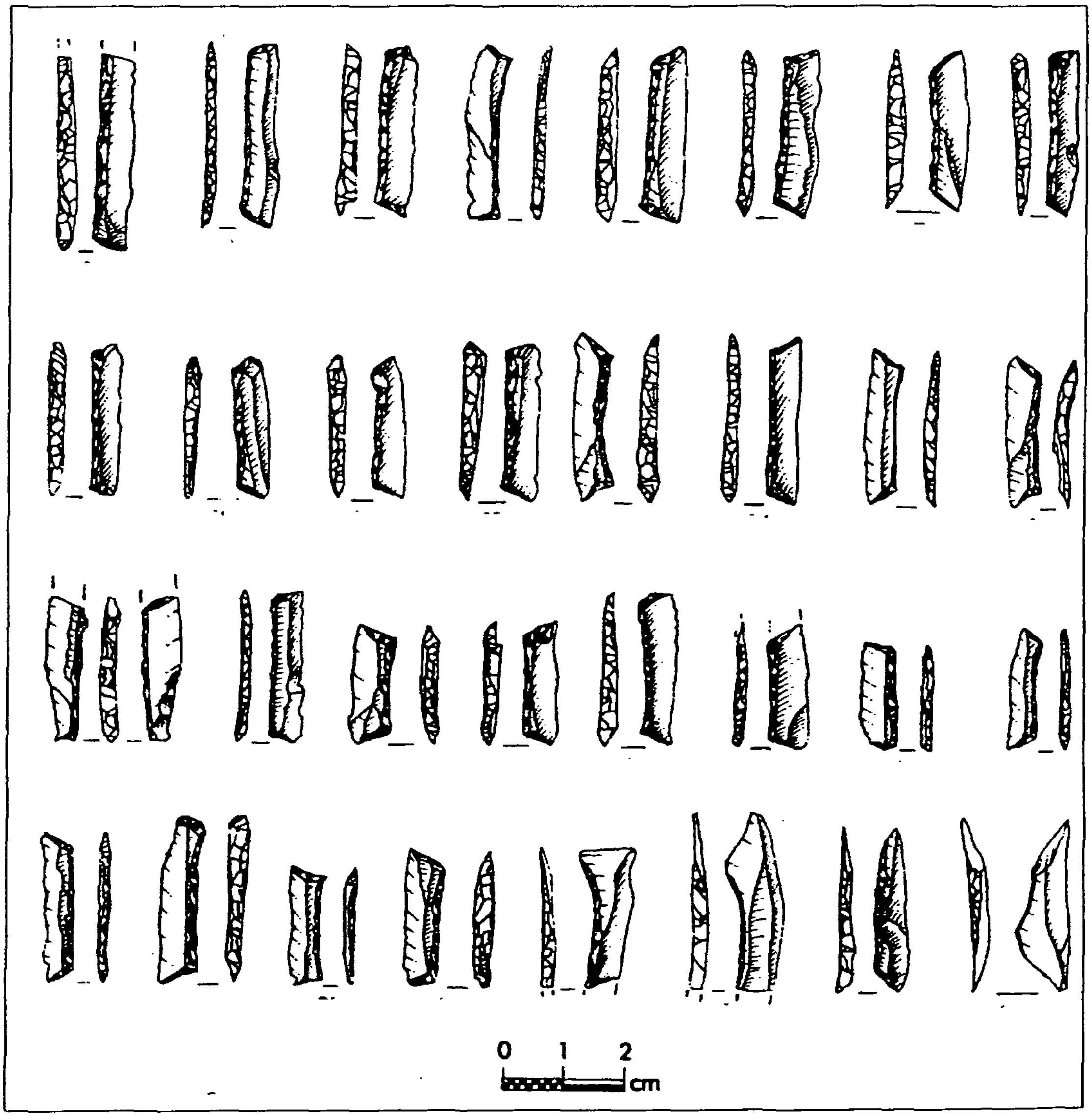



Figure 2:5 Geometric Kebaran tools from site Azariq 2, after Goring-Morris 1987

In Jordan, Henry (1988) suggests that the Middle, Late and Final Hamran are part of the Geometric Kebaran complex, although, as for the early Hamran's relationship to the Kebaran complex, there are techno-typological differences between the east and west. The Middle Hamran looks most like the Geometric Kebaran of the southern sites - geometric microliths occur only as trapeze-rectangles. It has high frequencies of backed microliths, and wide bladelets. Henry (1988) defines a temporal trend in the rise in microburin indices, with lunates replacing trapezes and shorter bladelets, and interprets this as transitional to the Natufian in the Late Epipalaeolithic.

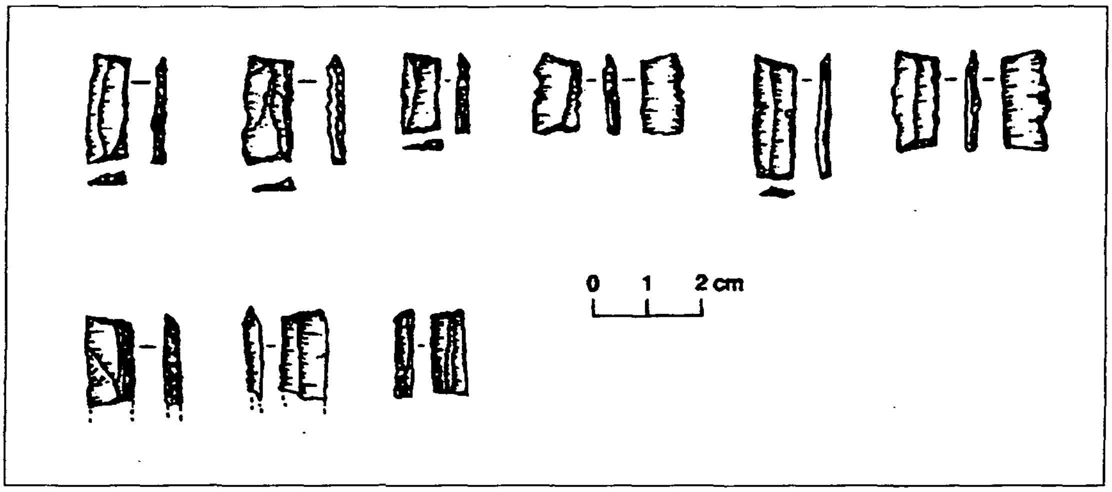



Figure 2:6 Middle Hamran tools from Jebel Hamra, after Henry 1995

Co-existing with the Geometric Kebaran, the Mushabian is characterised (Goring-Morris 1987, Bar-Yosef and Phillips 1977) by:

- predominant non-geometric backed bladelets
- intensive use of microburin technique in making them
- microliths which are arched backed bladelets, including La Mouillah points
- low frequencies of geometric microliths

short wide bladelets from single platforms cores.

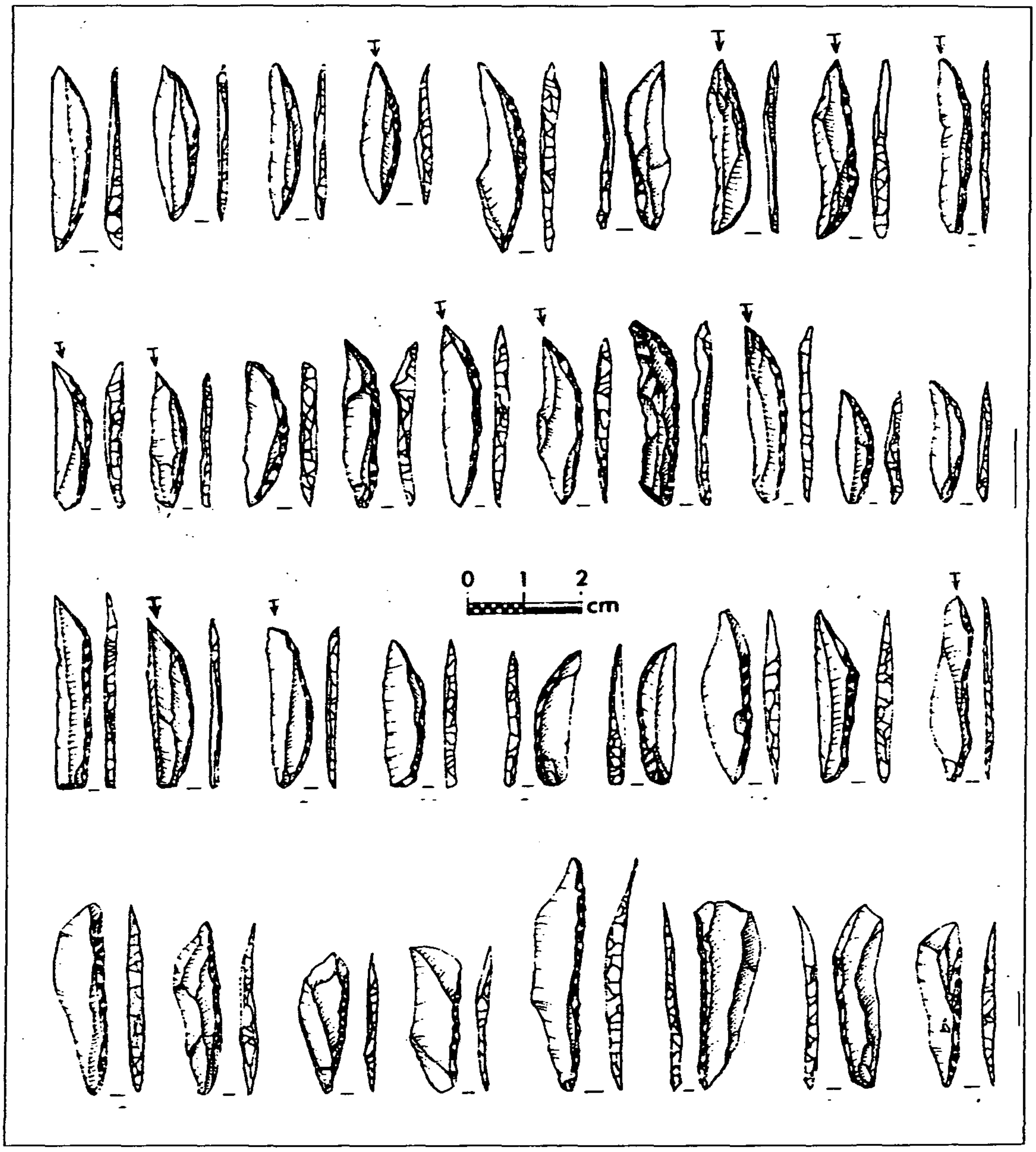



Figure 2:7 Mushabian tools from Azariq 12, after Groring-Morris 1987

Various regional and temporal subdivisions have been suggested (Goring-Morris 1987, Henry 1989) based on backed bladelet classes, and geometric microlith types. These have not been universally accepted (Byrd 1994). The Ramonian, also called the Negev Kebaran (Phillips and Mintz 1977), and the Negev Mushabian (Henry 1995), is seen as part of the Mushabian complex. Goring-Morris sees it as developing out of the Mushabian, while Henry sees it as a Negev variant of the complex. It is characterised by large quantities of Ramon Points (an obliquely truncated bladelet), and high proportions of microburins.

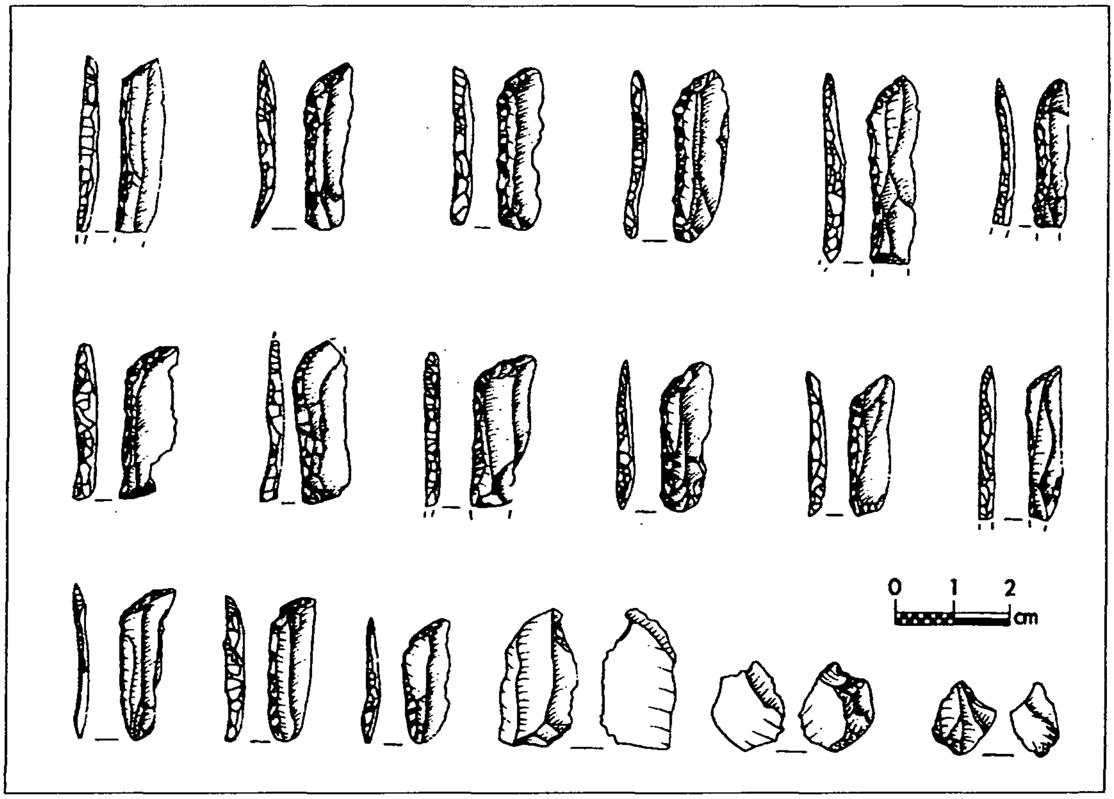



Figure 2:8 Ramonian tools from Azariq 3, after Goring-Morris 1987

In southern Jordan, Henry (1986) has identified the Madamaghan as a regional part of the Mushabian Complex at Wadi Jilat 8 and 6 and Uwaynid 14. It is characterised (Henry 1988) by:

- high proportions of microburins
- long wide bladelets
- moderate frequencies of points - La Mouillah, microgravettes and arched backed
- low proportions of geometric microliths.

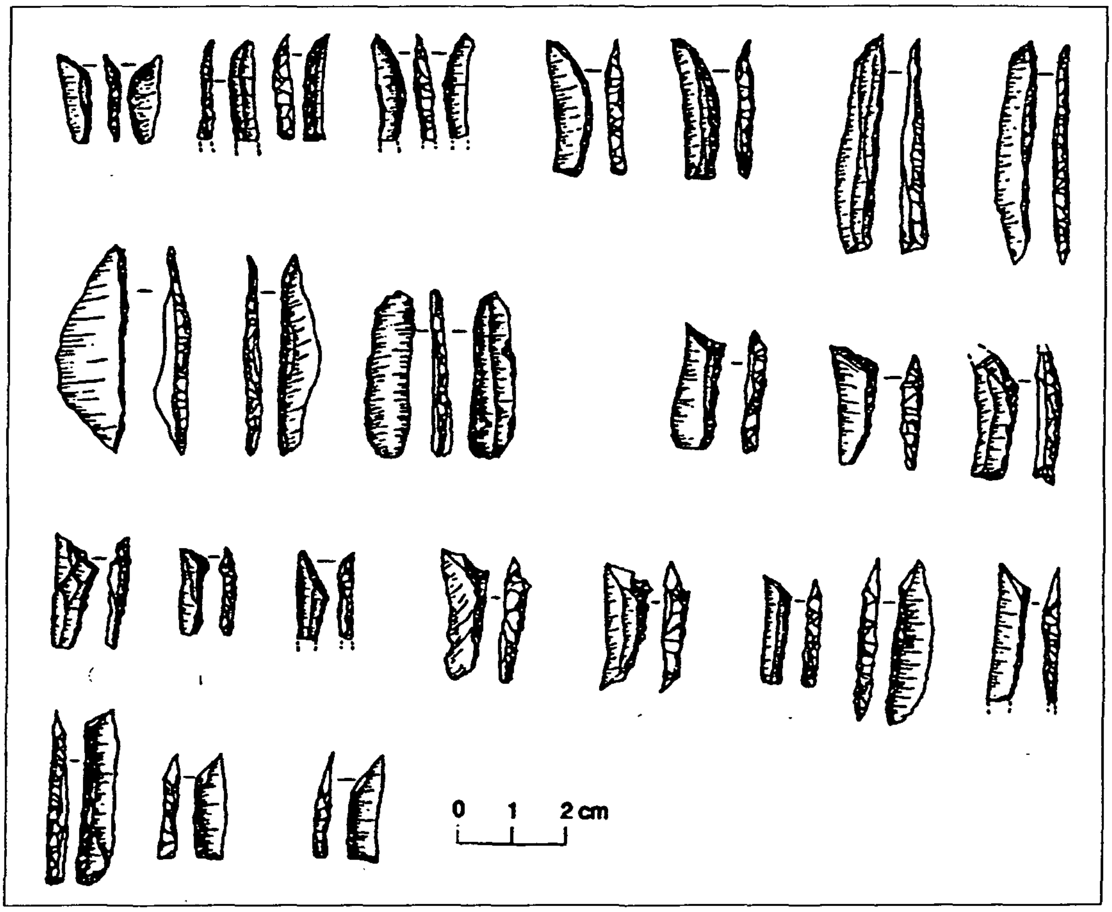



Figure 2:9 Madamaghan tools from site J431, after Henry 1995

The Madamaghan is characterised as part of a long lived Jordanian tradition using the microburin technique, possibly originating in the Qalkhan (Henry 1995) and either related to the Mushabian (Henry 1995) or not (Byrd 1994, Olszewski *et al.* 1994).

Non-microlithic assemblages found in the Azraq Basin (Byrd 1994), although few in number, are interesting because of their very few microliths in a period defined elsewhere by very high proportions of microliths, and because of the high proportions of an apparently unique tanged knife. Byrd suggests that they may be task-specific sites, and possibly the first examples of a non-microlithic tradition.

Radiocarbon dating

The Geometric Kebaran has few radiocarbon dates, with the vast majority of determinations coming from the Sinai sites (Bar-Yosef and Phillips 1977) and the Negev (Goring-Morris 1987). There is only one date from the Geometric Kebaran-related sites in Jordan, and this is considered unreliable. The culture has been subdivided into two temporal groups based on the width of backed microliths (Bar-Yosef 1981), with narrower microliths in earlier assemblages. In addition, assemblages from southern sites often have wider microliths (Goring-Morris 1987). This has contributed to a perception that the Geometric Kebaran originated in the north, and that southern sites are later. However, radiocarbon dates from Neve David in the north (Kaufman 1988) cast some doubt on this, as this site has produced late dates with narrow microliths. In addition, a newly discovered site in the north contains wide microliths (Shimelmitz *et al.* 2001). Both challenge the traditional distinction between early, northern sites with narrow microliths and later, southern sites with wider ones.

The Mushabian is seen as contemporary with the Geometric Kebaran, with possible territory overlap (Goring-Morris 1987) and has also been suggested as contemporary with the Natufian (Henry 1988), although the error limits of radiocarbon dates involved makes this difficult to pin down (Byrd 1994). The Ramonian, although no reliable radiocarbon determinations are associated with it, is seen as a late Mushabian occurrence, which in its latest phase may have co-occurred with the Natufian. The Mushabian is mostly dated from Sinai sites (Bar-Yosef and Phillips 1977). Dates from Jordanian sites include the Madamaghan site Tor Hamar with two dates, and some from Jilat 8 in Azraq.

Site characteristics

Geometric Kebaran sites are very widely distributed from the southern Sinai to Syria. Most sites are small (<100m2), although some few in northern Israel are considerably larger. These sites also have the remains of hut foundations similar to those in the Kebaran, and very occasionally burials. The sites in the south have no structural remains, and only single hearths. Limited subsistence evidence suggests a reliance on gazelles and roe deer.

Ground stone tools have been found at Geometric Kebaran sites in north and central Israel, as have very rare bone tools. Some few incised bone and ostrich shell pieces have been found. Shell bead assemblages vary in their origin, with some being largely Red Sea in origin, others Mediterranean, and yet others are mixed. Overall *Dentalium* are most common.

Mushabian, Ramonian and Madamaghan sites are small, often 100-200m2. There is little evidence of structures, but one or multiple hearths have been found at larger sites. There is less marked evidence of site differentiation amongst these sites, with only limited differences in site size. The Mushabian (sensu stricto) is found only in the Negev and Sinai. Ramonian occupation is limited to the Negev, and unlike the Mushabian, extends into the Negev highlands. Both larger and smaller Ramonian sites are found at lower and higher elevations. Two sites in Azraq have been dated to the Middle Epipalaeolithic and contain arched tool types similar to Mushabian sites. These latter sites are very large (19000m2 and 6300m2).

Only Jilat 6 in Azraq has produced a seed assemblage, which contained chenopod seeds and other steppe/desert plants. Faunal remains are slightly better represented. Tor Hamar contained gazelle, ovi-caprids and some equus, while Azraq sites have gazelle and equus.

Negev sites contain some ground stone tools made of limestone. Shell assemblages are largely of Mediterranean origin in the Negev, although there are some of Red Sea origin as well. Azraq sites contain both Red Sea and Mediterranean shells.

## 2.3 The role of chipped stone

The role of chipped stone in our understanding of the Epipalaeolithic is paramount. Typology and technological classifications form the definition of the whole period, with its character classified as uniquely and overwhelmingly microlithic. Its immediate successor, the early Neolithic, was traditionally defined as emphasising new tool classes such as points and bifaces in response to new subsistence methods, while the earlier Upper Palaeolithic was seen as a blade based industry. More recently, Upper Palaeolithic assemblages with a microlithic element dating back to at least 30,000 BP (Bar-Yosef and Belfer Cohen 1977, Gilead 1988) have been found. In addition, debate about the role of the substantial microlithic component in early Neolithic assemblages is rife (Kuijt 1996, Nadel 1998, Ronen and Lechevallier 1999). The uniquely microlithic status of the Epipalaeolithic is no longer as clear as it once seemed.

Some have argued that other, non-lithic data should be emphasised in defining the Epipalaeolithic (Gilead 1988, Donaldson 1991). Gilead emphasises differences in settlement and subsistence as showing a major break between the Natufian and earlier periods. Both support what is in effect a return to Neuville's scheme in suggesting that only the Natufian should be considered a separate entity from the Palaeolithic. These researchers emphasise an economic divide between the Natufian and earlier periods, despite continuity in chipped stone typology and technology, and suggest that periodisation should be based on economic considerations. However, some of the more potentially complex Kebaran sites such as Ohalo II and Neve David suggest that a progressive trend in complexity and subsistence methods may not be accurate. None of these schemes have received wide acceptance, and most Epipalaeolithic cultures continue to be defined solely by chipped stone typology and technological attributes.

Chipped stone has been emphasised for a number of reasons, including its traditional historic role in typological schemes for ordering assemblages in space and time. While this role is influential, there is no question that chipped stone comprises by far the largest body of data available for analysis. It is not therefore surprising that researchers have focused on it. Both because of the mobile nature of settlement at this time, and because of lack of preservation over long time spans especially in surface sites, other classes of data are all too scarce. In a recent attempt to synthesise the full range of data available, Fellner (1995) had to rely heavily on lithic data. Few sites had other information available (see figure 2.10).

| Cultures | Total no. of sites | Faunal report | C14 | Features |
|---|---|---|---|---|
| Kebaran | 20 | 35% | 30% | 30% |
| Geometric Kebaran | 31 | 6% | 13% | 22% |
| Mushabian | 18 | - | 28% | 33% |
| Ramonian | 20 | - | 10% | 35% |

Figure 2:10 Types of data retrieved from Epipalaeolithic sites (data from Fellner 1995).

## 2.4 Radiocarbon dating

The obvious alternative to chipped stone for time-space classification is radiocarbon dating. Despite its limitations, the data available do raise questions about some key assumptions of typological schemes. Radiocarbon methodology and interpretation in the region has been extensively commented on (Waterbolk 1994,1987, Byrd 1994, Byrd 1998). Byrd (1994) points out that the practice of single-dating occupation horizons is widespread, with only four Geometric Kebaran and three Mushabian sites with more than one date. It is common practice to evaluate radiocarbon dates against the results expected on the basis of chipped stone typology, with dates that do not confirm the typology rejected as aberrant. For example, the single radiocarbon date from site J504 in the Wadi Hisma of 11,985+-110BP "is obviously too young for a non-geometric assemblage" (Henry 1995:39).

However, extensive dating programmes suggest that, when *multiple* dates for one horizon are acquired, at least 20% do not overlap at 2 standard deviations (Nadel *et al.* 1992) and can thus be considered aberrant because of possible contamination, intrusive sample, or laboratory error. Unreliable dates may be the result of using certain materials such as bone (e.g. dates from Wadi Madamagh and Kharaneh IV) or reliance on accelerator dates on very small samples which may have been subject to movements through archaeological levels. Single accelerator determinations accepted as unreliable include those from Azraq 17, Shunera 17, Azariq 16, Shluhat Qeren 2 and Shunera 21, and Nahal Oren has produced several wildly varying accelerator dates. Further single accelerator determinations *not* considered unreliable because of their congruence with typological expectations include those from Hamifgash 4, Nahal Sekher 23, and. It is impossible to evaluate these dates further.

Single radiocarbon determinations from multi-level sites, or from sites that may have been disturbed through later occupation or through non-anthropogenic factors such as erosion, are also common. This suggests that there may be many more aberrant determinations which happen to have produced dates congruent with typological expectations. With only one date from a given horizon, there is no way of independently evaluating its relationship to stone tool typology. Only 19 sites throughout the Epipalaeolithic have more than one date where the dates overlap at 2 standard deviations (Fellner 1995), and 11 of these are from the Late Epipalaeolithic. Byrd (1998) has suggested a focus on acquiring in-situ material from features such as hearths, trampled surfaces and short term occupations, and acquiring multiple determinations from any given horizon.

| Cultures | Total no. sites in Israel | % of sites with dates | Total no. of dates | Considered aberrant by excavator |
|---|---|---|---|---|
| Geometric Kebaran | 31 | 13% | 20 | 6 |
| Mushabian | 18 | 28% | 13 | 4 |
| Ramonian | 20 | 10% | 2 | 1 |

Figure 2:11 Radiocarbon dating in the Epipalaeolithic (data from Fellner 1995).

Because of the long time-lag between the development of the cultural-historical sequence for the region and the use of radiocarbon dating, there are naturally some contradictions between the two. For example, the presence of non-microlithic assemblages in Azraq (Garrard 1998) in a period considered to be overwhelmingly microlithic, suggests that there may be other sites that could not be recognised as Epipalaeolithic without the use of radiocarbon dating. Only the fact that these sites in the Azraq Basin were more extensively dated, with 3 and 5 dates respectively, allowed them to be accurately placed within a temporal sequence. Another conflict between typological chronology and radiocarbon dating is in the dating of variability in the Geometric Kebaran. Radiocarbon dates, while limited in number, are suggestive of problems in the perceived progression from early narrow microliths in the north to late wide ones, located in the south. Neve David, with late Geometric Kebaran dates and narrow bladelets, suggests at the least that this may not be a universal progression (Kaufman 1989). In addition, it seems hard to support the idea of a northern/central origin for the Geometric Kebaran in the absence of any early dates from northern/central sites. Geometric Kebaran dates range across the whole proposed length of the period in the Negev and Sinai. The evidence of radiocarbon dating is limited but does suggest that there may be potentially serious flaws in the generally accepted time-space frameworks, based on typology alone.

The application of dating has been 'regionally skewed' due to the history of research projects. Few radiocarbon dates for the Middle Epipalaeolithic are available from northern or coastal Israel where many sites where excavated earlier than those in the south or east, with the major dating programmes located in the Negev and Sinai. Only one Geometric Kebaran site from outside this area has been dated. Dates from Jordan began to be published in the late 1980's and early 1990's (Henry 1989, Garrard and Byrd 1992). Accelerator dates for Azraq, the Negev and one site in Northern Israel were published in 1994. Overall, radiocarbon dates are largely limited to sites in the Sinai, the Negev to a lesser extent, and the Azraq Basin. The amount of datable material retrieved from the Hisma Project proved disappointing.

| Date published | Region | Middle Epipalaeolithic Cultures |
|---|---|---|
| 1977 | Sinai | Geometric Kebaran, Mushabian |
| 1987 | Negev | Geometric Kebaran, Mushabian |
| 1989 | Hisma | Madamaghan, Early Hamran |
| 1992 | Azraq | Non-microlithic, arched/pointed |
| 1994 | Azraq, N. Israel, Negev | Geometric Kebaran, Mushabian, arched/pointed |

Figure 2:12 Publication dates of radiocarbon determinations in the Epipalaeolihic

Much of this radiocarbon evidence accrued some years after Bar-Yosef's scheme was worked out, yet scholars are trying to interpret, even invalidate, some radiocarbon dates in the light of a pre-existing typological scheme. Overall, typology remains dominant in our picture of the Epipalaeolithic, and in temporal relationships between different regions and sites within it.

| Site | Region | Dates | Site culture/typ | Date published |
|---|---|---|---|---|
| Jilat 10 | Azraq | 14,790+-200<br>13,120+-180<br>12,700+-300 | Non-microlithic | |
| Jilat 22 | Azraq | 13,040+-180<br>12,840+-140<br>13,490+-110<br>13,540+-120 | Non-microlithic | |
| Jilat 8 | Azraq | 13,310 +-120<br>10,540+-160* | Curved/pointed | 1988 |
| J431 | Hisma | 12,683+-320<br>12,320+-95 | Madamaghan | 1988, 1995 |
| Jilat 6 | Azraq | 11,740+-80*<br>11,450+-200* | Arched/pointed, Qalkhann point | |
| Mushabi I | Sinai | 13,310+-100 | Ramonian | 1977 |
| Nahal Sekher23 | Negev | 12,200+-150 | Mushabian | 1994 |
| Shluhat Qeren II | Negev | 6,740+-100* | Mushabian | 1994 |
| Shunera XXI | Negev | 12,100+-140* | Mushabian | 1994 |
| Shunera IV | Negev | 11,000+-140*<br>11,700+-140* | Mushabian | 1987 |
| Shunera II | Negev | 6,860+-250* | Mushabian | 1987 |
| Mushabi V | Sinai | 12,990+-110<br>12,700+-90 | Mushabian | 1977 |
| Mushabi XIV/1 | Sinai | 12,900+-235<br>13,260+-200<br>13,800+-130<br>13,800+-150<br>13,900+-400 | Mushabian | 1977 |
| Nahal Zin D101B | Negev | 13,530+-144 | Mushabian | 1983 |
| Nahal Zin D5 | Negev | 13,170+-230<br>15,820+-1730*<br>18,840+-680* | Geometric Kebaran | 1976 |
| J504 | Hisma | 11,985+-110* | Early Hamran | 1989 |
| J202 | Hisma | 5,810+-220* | Late/Final Hamran | 1989 |
| Mushabi XIV/2 | Sinai | 13,690+-150<br>13,750+-285<br>13,830+-490<br>14,200+-100<br>14,330+-120<br>14,500+-100 | Geometric Kebaran | 1977 |

| | | | | |
|---|---|---|---|---|
| Neve David | N. Israel | 12,610+-130<br>13,400+-180 | Geometric Kebaran | |
| Arabi I | Negev | 14,500+-190 | Geometric Kebaran | 1994 |
| Azariq XVI | Negev | 160+-80* | Geometric Kebaran | 1994 |
| Lagama North VIII | Sinai | 12,900+-500* | Geometric Kebaran | 1987 |
| Mushabi XVI | Sinai | 13,060+-220 | Geometric Kebaran | 1977 |
| Mushabi XVII | Sinai | 14,170+-480 | Geometric Kebaran | 1987 |
| Mushabi XVIII | Sinai | 4,620+-180* | Geometric Kebaran | |
| Qadesh Barnea | Sinai | 13,930+-120<br>14,130+-160 | Geometric Kebaran | 1981 |
| Shunera III | Negev | 5,210+-70* | Geometric Kebaran | 1987 |

Figure 2:13 Middle Epipalaeolithic radiocarbon determinations from the southern Levant

*considered unreliable by excavator and/or Byrd 1994

## 2.5 Palaeoclimate

Evidence for the palaeoclimate of the region for the period from about 19,000-11,000bp is not entirely straightforward. One problem in interpretation is the dating of evidence. Pollen samples from three cores of lake sediments from the Huleh Basin have been studied (Horowitz 1979, Bottema and van Zeist 1981, Baruch and Bottema 1991). The K-Jam borehole (Horowitz 1979) had weak chronology with only one radiocarbon date for the whole sequence. The Tsukada core and the third, most recent, core have only been partially published, but have, respectively, 1 and 3 dates falling within the Epipalaeolithic.

Researchers broadly agree on the early Epipalaeolithic as a cool and dry phase, based on identification of 25-40% arboreal pollen, mainly *Quercus*, with *Graminaea* and *Chenopodiceae* common. For the middle Epipalaeolithic, arboreal pollen increases to 75% by the end of the period. This is still mainly *Quercus*, with *Gramineae* dropping. Tsukada interprets this as a wet and cool phase, while Baruch and Bottema see it as wet and warm. The later Epipalaeolithic is more finely distinguished, with radiocarbon dates in the newer core. 11,500-10,500bp sees arboreal pollen drop to 20%, mainly comprising *Quercus* and *Pistacia*, with an increase in *Gramineae*. Baruch and Bottema see this as a dry and cool phase.

The exact dating of these climate shifts, and how far they can be extrapolated to the entire Levant, remain open questions. There is a tendency to align climate shifts with perceived culture change. So while the evidence suggests some kind of amelioration of climate with increasing precipitation (although temperature remains a matter of debate) between 17,000-15,000bp, some researchers suggest the change happened around 15,000bp at the start of the Geometric Kebaran. As in discussions of radiocarbon data, the assumed cultural/typological divisions often appear to influence the interpretation of environmental data.

While broad climate trends can be seen within the early, middle and late Epipalaeolithic, there are many fluctuations within these phases which may have had at least as much impact on those living through them as overall trends at a geological timescale. Tsukada's core shows fluctuations in arboreal pollen throughout the early and middle Epipalaeolithic, with the middle Epipalaeolithic showing especially large shifts. In addition, the start and finish of large climatic trends remains difficult to place temporally.

The beginning of the climate amelioration of the middle Epipalaeolithic is dated to around 15,000bp in the newest pollen core. However, pollen from Wadi Fazael (Goring-Morris 1980) may suggest that it began before 16,000bp, and geomorphology supports this earlier date. The Early Hamran site J26 in Jordan has pollen suggesting a dry and cold climate, while J504 shows a warmer, more humid climate (Emery-Barbier 1995). This humid phase, it is widely believed, ended around 11,500bp, to be followed by a much dryer phase contemporaneous with the Younger Dryas in Europe. Both the Tsukada and newer pollen cores support this, as does pollen evidence from some sites, such as Abu Hureyra in Syria, and evidence from steppic gazelle species found increasingly in faunal assemblages (Davis 1981). Some sites have contradictory evidence, such as the early Natufian site J2 in Jordan, which has evidence from pollen of a dry and arid environment (Emery-Barbier 1995), and geomorphological evidence showing an early (14,000bp) end to the humid phase. Lack of radiocarbon dates makes it difficult to put all this conflicting evidence together to understand climate change over this period, and how different microclimates were affected by it.

Overall, the evidence on the details of the environments of the Epipalaeolithic is often contradictory. This may be in part because varying climates allowed quite different environments in different parts of the region. This view is supported by evidence of differing north and south Levantine climates at this time, possibly due to different storm circulation patterns. In addition, elevation, relationship to mountain ranges and prevailing winds, proximity to coast or large inland bodies of water may all affect microclimates in a complex manner, resulting in more variability at a smaller scale than our broad-brush reconstructions can account for. Climate evidence is not yet refined or well-dated enough to be confidently linked to cultural developments in the Epipalaeolithic, or used as an exclusive explanation for changes identified within typological frameworks. This leaves open the investigation of other reasons for changes in Epipalaeolithic material culture.

## *2.6 Conclusions*

Study of the Epipalaeolithic began with a typology-based scheme based on excavations and collections in the coastal plain and northern Mount Carmel area of what is now Israel. Created without the benefit of independent dating control at the time, this scheme was subsequently elaborated and refined as research moved south into the Sinai and Negev and then eastwards into Jordan. Radiocarbon dates, as they have become available, appear to raise questions about our current picture of the period, as have some recent field projects. While some have used climate data to explain the successive typological stages, the evidence is, as yet, uncertain. It may be that, rather than finding a processual, climate/based explanation for the observed typological units, we may need to re-examine the very basis of the units themselves. This approach is examined in the following chapters.

# 3. Microlith classification in the Levant

This chapter examines the microlith and its use in characterising the cultures of the Southern Levantine Epipalaeolithic. The first section defines the microlith and describes its manufacture, use, and general archaeological study, while the second section examines the basic parameters of microlith analysis in the Epipalaeolithic. The third section looks in more detail at our current understanding of the microlithic assemblages of the Sinai/Negev and southern Jordan. The fourth section outlines problems with the current approach.

## 3.1 *Microliths*

Microliths were identified during the last part of the $19^{th}$ century (e.g. de Mortillet 1896) as 'pygmy flints' (Cartailhac 1905), and later were identified with Mesolithic, Epipalaeolithic, and Upper Palaeolithic assemblages. Widely represented throughout the world, their earliest appearance to date is at 60,000-40,000BP in Howieson's Poort assemblages, South Africa (Parkington 1990).

Microliths have been variously defined based on size, technology, shape of artefact or type of retouch. Definitions include tools which

- Are made on blades, bladelets or chips/flakelets
- Are sometimes further segmented by snapping, retouching or use of the microburin technique (see below)
- And are further modified through being marginally retouched and/or abruptly backed
- Have final dimensions when complete of less than 50mm long and 9mm wide

Following Barriere (1956), a broad view is taken here as to the final forms of microliths. They may be formed into a very wide range of shapes, ranging from long bladelet-like pieces, to those with one or more extremity modified to a point, to those which have been abruptly backed along one or more edges, perhaps into a geometric shape such as a rectangle or triangle.

## The use of microliths

It is widely accepted that microliths were parts of composite tools, hafted together in various arrangements in bone, antler or wood. There are several examples of microliths or unretouched bladelets from archaeological contexts with their hafts preserved (e.g. Fris-Haasen 1990, Clark 1976, Larsson 1983). Finds from the Near East include a bone haft with a bladelet set in bitumen from Shanidar in Iraq (Solecki 1963) and a bone haft with microliths at El Wad, Israel (Garrod 1932).

Microliths are believed to be an extremely efficient technology (e.g. Clarke 1976, Zvelebil 1986). They are seen as the first modular technology, with each microlithic component easily replaced on breaking. Each composite tool is maintainable (Myers 1989), with repairs or changes to the tool easily accomplished with previously-prepared component parts.

Methods of hafting remain a matter for speculation. Clarke (1976) published a number of possibilities (see figure 3.1). Tools may have been affixed to the haft through the use of a mastic (resin, beeswax, plaster or bitumen), tied with twine or hide, or simply stuck in, relying on friction to hold them (Kukan 1978).

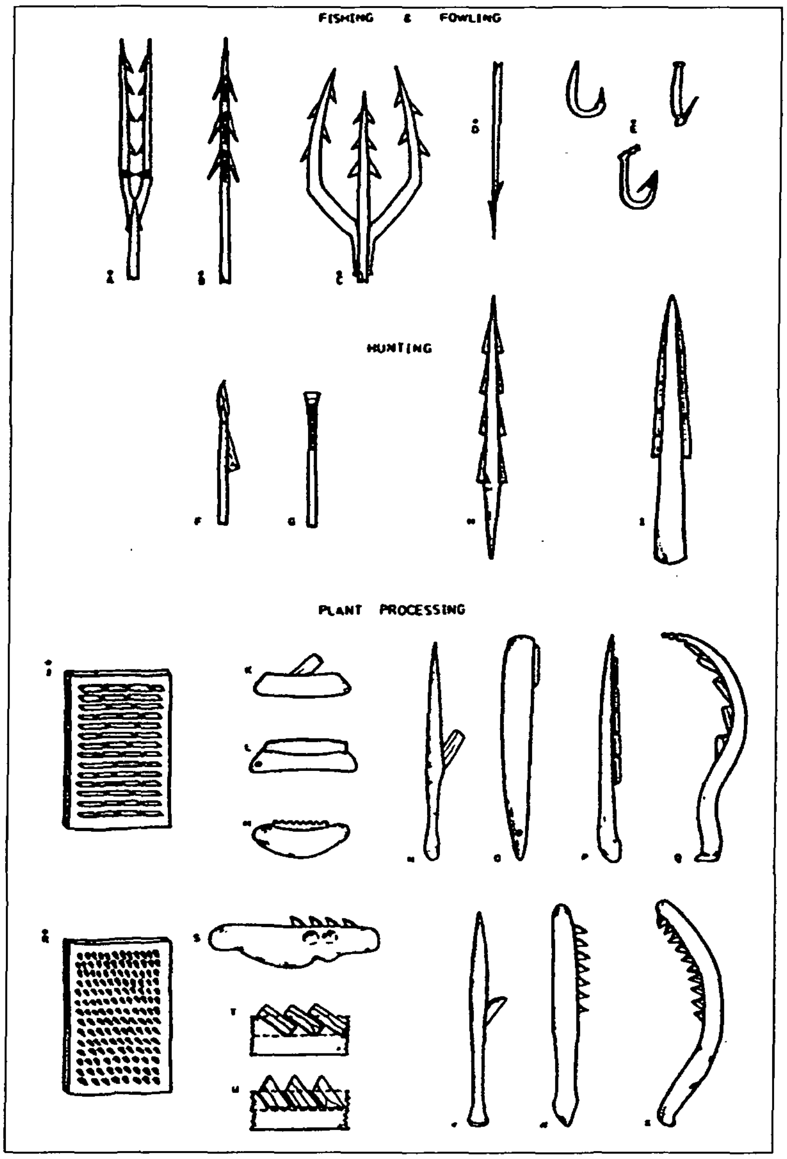



Figure 3:1 Suggested methods of hafting microliths (from Clarke 1976)

Despite Clarke's wide range of hafting possibilities, the underlying belief about microlith function amongst researchers over the last 40 years has been that they were hafted as arrowheads and used in hunting. However, it has been pointed out that they could have been used in a wide variety of functions such as "plant gathering, harvesting, slicing, grating, plant-fibre processing for lines, snares, nets and traps, shell-openers, bow-drill points and awls" (Clarke 1976:452).

Microwear research may provide more information on how microliths were used. However, very little microwear has been carried out on Near Eastern material. The work that has been done focused on Natufian microliths and showed that they may have been used as sickle elements (Anderson-Gerfaud 1988, Tomenchuk 1983, Unger-Hamilton 1989). At Abu Hureyra in Syria, for example, lustre has been found on microliths suggesting plant harvesting activities (Anderson-Gerfaud 1983).

Amongst earlier assemblages, Buller (1983) carried out microwear on microliths from the Early Epipalaeolithic sites of Urkan e-Rub. He found evidence of using microliths to cut hide, possibly with ochre impregnation for preservation. Blades were often used for a secondary task such as sawing bone.

Evidence for the use of microliths as arrowheads also exists. Studies of Egyptian and Nubian lunates (Clark, Phillips and Staley 1974) suggest they have been used as chisel ended or transverse arrowheads, or as regular and reversed barbs. Based on impact damage found, Bergman (1987) has suggested bladelets from the Upper Palaeolithic site of Ksar Akil in Lebanon were used as points. At Mureybit in Syria, Natufian microliths were hafted as transverse arrowheads, set slightly obliquely from the shaft, with traces of adhesive found on the backed edge. Smaller microliths were also thought to be arrowheads used on animal tissue, with haft damage suggesting use as barbs (Anderson-Gerfaud 1983). No traces of adhesive or of damage associated with binding were found on smaller microliths, suggesting they were hafted using friction.

Kukan (1978) studied hafting methods used with microliths from Levantine assemblages, developing a theory of energy input in relation to flint fracture mechanics and the properties of friction and impact. From this, he extrapolated possible hafting positions and orientations in relation to the haft. Hafting without mastics or ties requires the use of friction between the haft and hafted surfaces to hold the microlith in place. The contact between the planes of the tool and the planes of the haft must be close: the surfaces must be flat, and slightly rough to create the friction. The force of the impact should go through the thickest part of the tool to minimise breakages – with bladelet tools, the thickest parts are the arrises which run along the length of the tool.

Adhesives offer another way of hafting, with far less implications for the shape/design of a tool. Direct evidence for use of adhesives comes from the Sinai Geometric Kebaran sites of Lagama North VIII. Remains of a calcareous adhesive have been found covering half to two-thirds of each artefact along the long axis. Tomenchuk (1983) briefly reports on this, suggesting microliths were hafted as knives using limestone based mastic.

## Microliths and typology

While work on microlith use remains in its infancy, microlith variability has long been seen as a way of studying ethnic groups in the Mesolithic and Epipalaeolithic. Work in the late 1970s and the 1980s used attribute analyses to investigate territoriality or ethnic group boundaries. Using Weissner's work on San projectiles (1983), stylistic variability is interpreted as emblemic style, or an expression of group identity. Close (1978, 1989) studied North African Epipalaeolithic assemblages and concluded that lateralisation of backed edges was an expression of socio-cultural tradition. Farther afield, Gendel (1984, 1987) studied Mesolithic assemblages of the Low Countries and France. He found that lateralisation of point forms did suggest a major divide, which he interpreted as based on territorial boundaries. However, he also found that many traits varied in a less clear cut way: randomly, clinally and in various clusters. Other studies have similarly tried to identify territorial boundaries through stylistic preferences in microlith morphology (e.g. Jacobi 1979, Blankholm 1990).

However, in the Levant detailed attribute studies of this kind are rare. Work attempting to identify territorial boundaries is generally based on differing proportions of tool types. Classifications of European microlith variability into 'types' has been rife since microliths were first written about (e.g., de Mortillet 1896), and early microlithic study in the Levant had its roots firmly in European prehistory (see chapter 2). A classical typological approach has portrayed distinct tool types, creating a patterned variability representation of cultural-historical traditions. Broad cultures based on dominant tool forms have been defined (see below), with regional or temporal variants within these based on particular tool variants.

## 3.2 Basic parameters for classification of microliths in the Southern Levantine Epipalaeolithic

The distinct types have retained their analytical importance in work on the Epipalaeolithic. The research emphasis has been on the classification of microlith morphology into 'types', and on variations in frequencies of these types through the use of typelists. The proportions of various tool types present in an assemblage have been used to define major cultural entities, as well as various regional, temporal or other subdivisions. These have been built up through the major pieces of work in the 1970's/1980's.

### Typelists – the history and definition of types

Typelists have drawn on various aspects of microliths - blank type; retouch type, location and shape; tool morphology; segmentation method and differing applications of that method. Different typologies have relied to different extents on these attributes. However, overall tool shape, especially of the edge created by backing, has been central to all Epipalaeolithic microlith classifications.

The major typelist for the period was created by Ofer Bar-Yosef (1970), building on work carried out in other regions (e.g. Sonneville -Bordes and Perrot 1955, Tixier 1963) to develop a regionally specific type-list. He emphasised microliths as the defining tool class of the period, and the trend towards geometric forms (see below) over time. Another approach was taken by Hours (1974), emphasising choice of retouch rather than overall shape in defining tool types for the Upper and Epipalaeolithic.

Other researchers augmented or modified this typelist to fit the particular assemblages they were working on. Henry (1973) built on Bar-Yosef's typelist, with more emphasis on characteristically Natufian tools, such as geometric microliths and notches. Goring-Morris' (1987) work on the Negev and Sinai added more arched and pointed tools found in arid zones. Henry's (1995) typelist added various straight-backed bladelets, as well as arched or pointed tool forms found in Jordan.

The basic parameters and goals of type-definition have remained fairly constant, however. Tool morphology, types of retouch and location remain the basis for tool types.

## Geometric/non-geometric divide – meaning and definitions

A primary division in Epipalaeolithic microlith classification is between geometric and non-geometric microliths. Tixier (1963), in his influential work on microlith classification in North Africa, defined geometrics as those microliths which had no trace of the butt of the bladelet remaining. Geometrics are further defined by the arrangement of backed edges to each other. The overall shape of the tool is paramount in geometric classification (see figure 3.2). The three main types of geometrics are:

- Trapeze/rectangles – which are backed along one long edge of the bladelet, and have 2 roughly parallel truncations at either end, creating a rectangular shape
- Triangles – which have two truncations which meet forming a triangular shape with the unretouched edge
- Lunates – which have a curved back forming a half-circle.

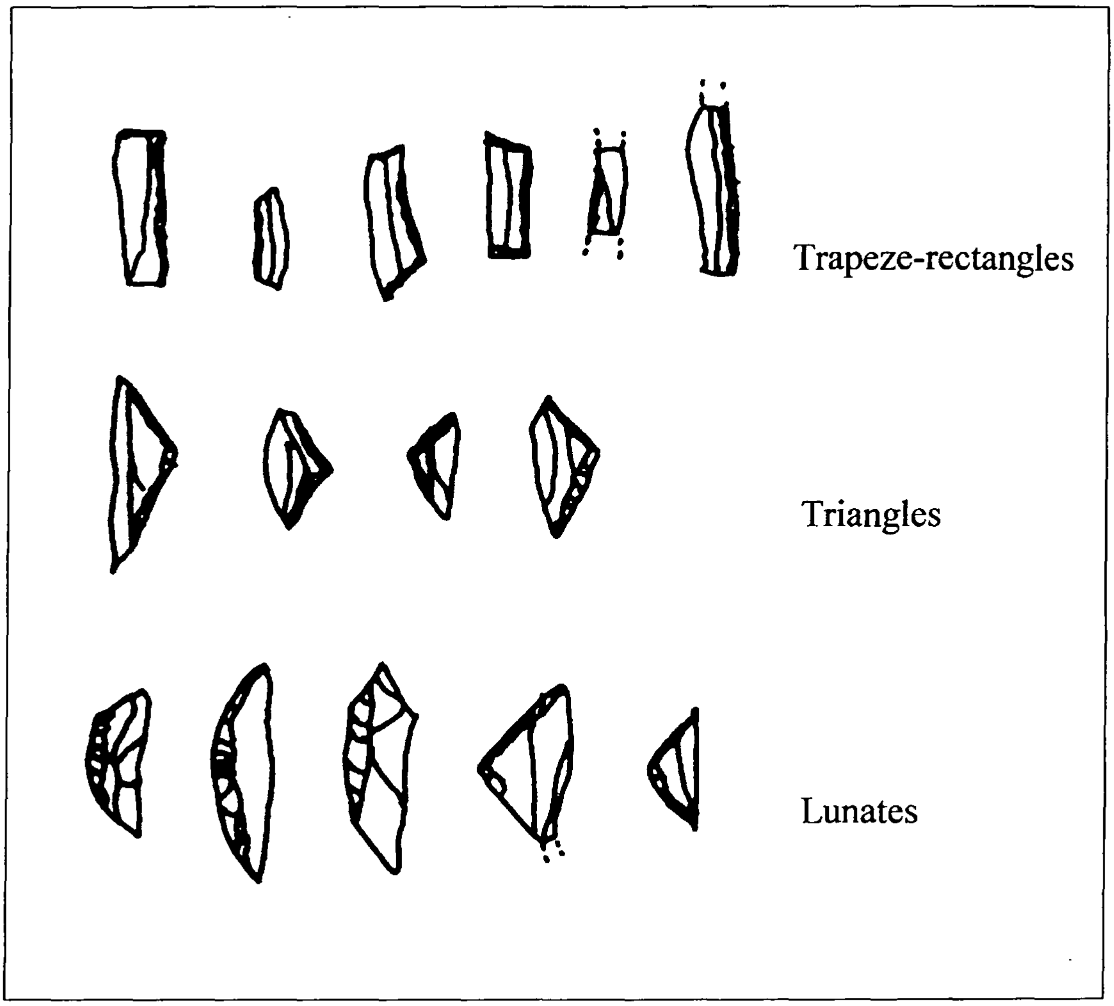



Figure 3:2 Three major geometric microlith forms

Non-geometrics may or may not still have the butt of the bladelet intact, and tend to be more elongated than geometrics. They have a greater range of retouch types and may indeed not always be backed, but may have fine or marginal retouch along one or more edges. Classically, the classification of non-geometrics has tended to emphasise types of retouch, the angle that retouch forms with the face of the tool (from fine to abrupt), the face of the tool that is retouched (either dorsal or ventral). Bar-Yosef's (1970) typelist classified non-geometrics into types based on

- Curved or straight back
- Treatment of extremity – oblique truncation, pointed
- Type of retouch
- Position of retouch

Earlier assemblages (pre 15,000BP) have been said to consist of non-geometrics, while some later ones (Geometric Kebaran, Natufian) are dominated by geometrics. Bar-Yosef's typelist created 'prototype' categories prefiguring all geometric types, which he included in the geometric category. These were tools which still had their butts, but had the general (although elongated) form of one or other geometric tool. The proportions of geometrics to non-geometrics remain an important comparative statistic widely used to 'place' an assemblage culturally. For example, Geometric Kebaran assemblages are said to contain over 40% geometric microliths, while Kebaran assemblages are dominated by non-geometrics. The regional and other dynamics of this temporal trend towards geometrics is not clear, however. Many later industries such as the Mushabian do not contain many geometrics, and some apparently earlier assemblages (such as the Nizzanan) do contain them. The temporal progression from non-geometric to geometric, while accurate in some areas and for some assemblages, may not completely describe the patterning of these tools.

## Microburin technique

Henri Breuil (1921:350) gave the microburin its name, calling it " un petit objet trés special". They have retained their status as 'very special little objects' in Levantine Epipalaeolithic classification. The microburin technique is a method of segmenting bladelets in a controlled manner, snapping the blank obliquely across its face. It involves notching the bladelet blank and, possibly using an anvil for support, striking the bladelet to snap it at the notch (see Figure 3.3). One part of bladelet becomes a microburin. The other, usually distal, part becomes a Piquant triedre, which is often the part to be retouched into a microlith. The microburin is recognised by its distinctive fracture facet, which is doubly oblique fracture scar with have a small bulb of percussion at the striking point.

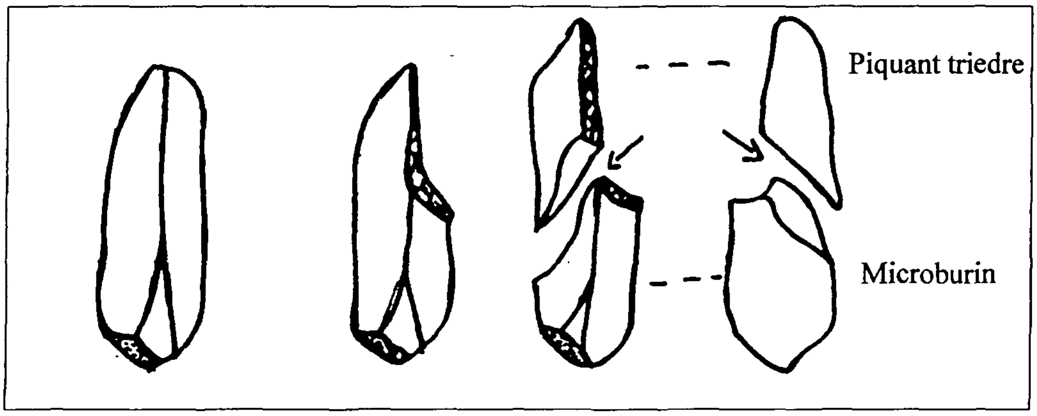



Figure 3:3 Microburin formation, showing the initial blank, which is then notched and snapped at the notch, creating a microburin and a piquant triedre

The presence and quantity of these pieces have become a way of measuring if the microburin technique was used as part of the technological repertoire at the site, and how intensively. The index of microburins for an assemblage is calculated either as a percentage of the retouched tools in the assemblage, or as a percentage of the microlithic component of the assemblage.

The microburin technique was very widely used throughout the Epipalaeolithic of the Southern Levant. However, it seems that not all cultures used the technique. It is not as common at most Early Epipalaeolithic sites, although more recently many Eastern Levantine assemblages from before 15,000BP have been shown to use the technique (Garrard and Byrd 1992). From 15,000BP, assemblages containing arched backed tools or lunates tend to have microburins in varying proportions. Microburins are not found in any quantity in Geometric Kebaran assemblages.

It is widely accepted that a fundamental technological and cultural divide exists between those groups using the microburin technique and those not. The technique would seem to be most relevant for making arched or pointed tools, because of the pointed shape blank it creates. Thus it has come to be associated with the arched, pointed and triangular industries of the arid zones throughout the Epipalaeolithic, while the Kebaran and Geometric Kebaran, associated with the Mediterranean zone, do not seem to use the technique. The microburin index, like the geometric: non-geometric ratio, is one of the primary classifying devices of Epipalaeolithic microlithic analysis.

## 3.3 Problems with microlith classification in the Levant

While the basic paradigm and methodology of microlith studies in the Levant has remained one of typologies made up of distinct tool types, various researchers have recently been identifying specific ways in which this approach or its application does not work.

### Identification/consistency

Byrd (1989) has found that variation in the classification of tools by individual researchers has made it difficult to compare between studies, and between sites. Variation includes:

- different emphases on morphology or on retouch in distinguishing tool types
- role of debitage blanks in distinguishing tool types
- how fragments are classified.

Microlith types are defined by the relation of pieces of backing: each type is a conglomeration of a number of traits relating to this. Further types are defined intuitively using other criteria: length:width ratio, presence of microburin scar/retouch, breakage, type of retouch. These traits do not co-vary, and all states of each attribute are not recorded - some are seen as more important/diagnostic for the purpose of the typology than others. So, amongst retouch types, only Helwan (low angle bipolar retouch) is recorded. Microburins, when not further retouched, are considered a debitage category. However, piquant triedres (the other part of the blank after segmentations through the microburin process) become either a separate tool category (Lamouillah Point), or, if partially retouched, are placed in any of a number of tool categories with their technological status unmentioned. Some non-geometrics and proto-geometrics are considered longer/thinner than their geometric equivalents, although this is usually a matter of personal judgement rather than defined parameters, and with other tool types, there can be as much or more metric variation within tool type - such as trapeze/rectangles, which can be either very wide or very thin.

## Variability within culture

There has been little work explicitly examining different levels of variability, and different patterns of variation, within cultural blocks. Various researchers, especially those working east of the Rift Valley are identifying ways in which existing typologies do not adequately describe assemblages, and are adding types, or discussing further characterisations based on retouch, morphology or metrics (e.g. Byrd 1989, Byrd 1994, Olszewski *et al.* 1994, Edwards *et al.* 1996, Muheisen and Wada 1995). Much of this work is focused on the Natufian, rather than earlier periods.

For example, the Natufian is widely considered to be technologically homogenous (e.g. Henry 1989) despite certain differences between east, west and northern Levant such as flake:blade ratios, multiple /single platform cores, use of microburin technique and choice of retouch all vary. The use of lunates, and their decrease in length over time, seems to be the only Levant-wide trait. How these traits vary is not clear: use of the microburin technique may vary clinally from the south until it is almost unknown in Syria; as does the use of Helwan retouch (Olszewski 1986). In western Levant multiplatform cores are used, but in the North, east and extreme south single platform cores are more common. Henry (1989) has pointed out that use of geometrics varies inversely with rainfall levels. However, Olszewski points out that research and excavation history of different areas of the southern Levant has affected reported levels of geometrics at different sites.

Backing retouch type (position and angle)

Helwan, or bifacial, backing has long been seen as an important Natufian trait used on lunates. It has also been identified as a useful time indicator - by 11,000 BP, it had been largely replaced by abrupt backing. However Byrd (1989) has pointed out that at Beidha, in Early Natufian layers, bifacial backing makes up only 50% of the lunates. 23% of the lunates are backed with semi-steep interior retouch, sometimes together with bifacial retouch. This sets Beidha apart from the traditional parameters of Early

Natufian lithics, but seems similar to, although probably not the same as, retouch identified at Wadi Judayid in the Northern Hisma (Henry 1995). There, many lunates are backed with an alternate semi-steep retouch, and many others with bifacial backing. At the 'Final Hamran' site, lunates are mainly backed with this alternate semi-step retouch which he suggests may be the precursor to the true bifacial backing. As at other Natufian sites, Wadi Judayid shows bifacial backing replaced by abrupt backing in Late Natufian levels. So this suggests that East Levantine Early Natufian backing may show differences from the West Levant, and that possibly there may also be differences between Beidha and Wadi Judayid within Jordan.

Shaping of retouch

This is one of the most fundamental aspects of Levantine classification. However, more subtle gradations of differences in e.g. 'lunates' or 'trapeze-rectangles' are seldom carefully characterised. Discussions focus on whether these are discrete types or continuously variable (e.g. Neeley and Barton 1994, Goring-Morris *et al.* 1996). It would be difficult from much of the published material to carry this debate beyond its current rather polarised level. Closer characterisation of shape of backed edge and retouched ends is required. For example, Byrd has closely characterised the lunates at Beidha as either with uniform arch, or with slightly convex backing on the lateral edge and sharper angled end retouch making lunates with a much less smooth arch. Goring-Morris (1987) called the latter atypical Helwan lunates - suggesting that they were in the minority in his study area. At Beidha, these 'atypical lunates' comprised the majority of lunates. This suggests that a more careful characterisation of backed edges and retouched ends may reveal differences within overall large cultural taxa and within classes of microliths from different areas.

Sequence of shaping methods

Henry (1995) has identified that lunates at Wadi Judayid were partially retouched before sectioning with microburin technique, which he suggests is a process a unique to the Natufian. Byrd has pointed out that at Beidha, backing, truncation and retouching of ends were separate steps in the manufacturing process, and that different types of retouch were on occasion used for these different stages. He identified one area and level at Beidha where lunates were manufactured in a particular way: the bladelets were truncated at the distal end by microburin technique. Semi-steep interior retouch was executed on the left lateral edge, starting at the proximal end. This end was then truncated, possibly by snapping on an anvil, creating a Beidha Krukowski microburin. Semi-steep exterior retouch was used to create the final appearance of bifacial backing, and the ends were either further modified, or not. Clearly methods of making microlithic tools varied, both within and between sites.

For earlier periods, the work is even more limited. Olszewski *et al.* (1994) noted the presence of 'tangs' across various classes of microliths at Wadi Hasa, formed by notches/concave retouch - suggesting certain similarities of retouch across classes, rather than differences within them. Some work on technique in blank segmenting has also been carried out. Henry (1995) has identified that at Qalkhan sites, proximal left edge microburins were produced; while at the Madamaghan site of Tor Hamar, microburins are proximal right edge. Goring-Morris (1987) has also identified differences in the orientation of microburin technique in the Negev. Edwards (1996) has shown that in the Wadi Hammeh area, truncation varies - at WH 26, truncations are oblique while at WH 31 they are straight.

This work tends to support the suspicion that there may be a great deal more patterned variability within culture than is commonly discussed, and perhaps more similarity between certain sites across cultural boundaries as well. There may well be other aspects of retouch that show variability in certain circumstances. The work of Olszewski *et al.* (1994) and Byrd (1989) strongly suggest that attribute analyses of actual variability within or between assemblages may reveal more than type-based studies do.

## Types vs. other forms of variability

Recently, questions have been asked about some of the most fundamental understandings of Epipalaeolithic lithics. Work has suggested that much variation can be explained within a technological continuum of manufacturing, rather than as discrete predetermined types. Microlithic tools have been central to the perception of variability and interpretations within the period. Neeley and Barton (1994) have questioned various aspects of Epipalaeolithic microlithic definitions. They examine microlith typologies from a viewpoint of production sequences. They point out that the various backed bladelets characteristic of Epipalaeolithic assemblages could actually be seen as stages in the manufacture of other types of bladelets and geometrics. Thus sites with high frequencies of straight backed bladelets would represent areas in which initial residues of microlith manufacture predominate; high frequencies of scalene or arched backed bladelets would result from the discard of end products, or the production of geometrics. Neeley and Barton suggest thus that site function and distance from raw material sources are more relevant to understanding lithic variability than ethnicity, or tool functions. Questions have also been raised occasionally (Phillips and Mintz 1977, Neeley and Barton 1994) about how distinct different microlith types are from each other. Neeley and Barton hypothesise that the shape of backing (which is the primary morphological characteristic differentiating microliths) was determined by the need to fit them into pre-existing hafts - microliths were expediently altered to fit various haft configurations. Neeley and Barton's work has been heavily criticised (Goring-Morris *et al.* 1996) by most researchers active in Near Eastern Epipalaeolithic lithics. Neeley and Barton's work raised many interesting and fundamental questions about interpretations of microlithic forms. However, it seems likely on the basis of both details published in the extensive rebuttals to their work, as well as personal observation of the material in question, that their broad-brush hypotheses, based mainly on re-working of statistics from other researchers' publications, was not well-supported by data, and could better have been investigated with more in-depth quantified work with actual assemblages.

Olszewski *et al.* (1994) have also investigated the continuous variability of microlithic types: points showing a range of forms from curved to arched types, lunate-type bladelets that could be called curved arched forms, different categorisations of microlithic points. In addition, they point out that many different microlithic types have a 'tang'. The fact that so many different types all have the same feature suggests to the authors that they may have served the same functions despite their different forms.

Byrd (1989) also questions the usefulness of existing lithic categories. He points out that the reliance solely on normative definitions, such as those of blades and flakes, is inadequate for characterising the assemblage at Beidha, and for understanding its technology. Blades and flakes are arbitrarily defined categories which do not reflect the continuous reduction sequence from long narrow pieces to shorter narrow pieces to short wide pieces. Without a clear understanding of the way the two categories are defined, how fragments are classified and whether tools were classified by blank categories and then added to the blank totals, the wide variation between sites and characterisation of industries as blade or flake dominant is fairly meaningless.

### *3.4 Epipalaeolithic classification: Goring-Morris and Henry*

While these dissident voices have identified the above problems with typelists, the main paradigm for the period continues to be one of a typological approach. Two researchers have been foremost in defining our picture of the Epipalaeolithic in the arid zones of the south Levant: Nigel Goring-Morris in the Negev and Don Henry in Southern Jordan. Both used a typological approach to identifying previously defined cultures amongst those newly-found sites in their research areas. They also defined new cultures and related them to existing ones taxonomically, temporally and socially.

While these researchers do publish general counts of technological categories such as numbers of flakes and blades, or core types used, these are only peripherally used in the description and interpretation of sites or cultures (see chapter 5). Crucially, this information remains at the level of counts, proportions and ratios, and is not integrated into an investigation of the process of manufacture.

The following section takes a close look at how typelists and diagnostic types or groups of types are used to characterise the lithic assemblages in the work of Goring-Morris (1987) and Henry (1995). Cultures examined include the Qalkhan, the Early Hamran, the Madamaghan, the Geometric Kebaran and the Mushabian/Ramonian.

While both researchers use typelists and typology to assign assemblages to cultures, and to describe new cultures, there are differences in the details of their lithic definitions and analysis which make direct comparisons more complex. All tool data used below is taken from Henry (1995) and Goring-Morris (1987).

## Typelists and their use

Goring-Morris used an adapted version of Bar-Yosef's typelist (1970) to classify sites into cultures. There were three categories of microlithic tools – geometric (14 types), non-geometric (31 types) and projectile points (6 types). All these contain tools made on bladelets, distinguished from each other by a variety of combinations of types of retouch, tool shapes, location of retouch, and manufacture methods. Because he was working with assemblages that displayed a range of tool types not described by Bar-Yosef's original work, he added a number of arched backed tools and points to the typelist.

Henry used a different typelist, with no explanation or illustrations of types, so it is difficult to compare with Goring-Morris' work on the basis of publications alone. Like Goring-Morris, he uses three main classes containing microliths – geometric microliths (10 types), non-geometric microliths (20 types) and points (6 types). However, three further tool classes contain some tools which are microlithic – truncations (2 out of the three types), retouched pieces (8 out of the 21 types) and notches (1 out of 5 types). These additional classes containing microliths arise because Henry emphasises type of retouch over blank form in his primary divisions of tool classes. For Goring-Morris, all microlithic tools are placed in his microlith categories. For Henry, however, only abruptly backed microliths are placed in the microlith categories. Other microlithic tools are placed with larger tools on flakes or blades that are retouched in a similar manner. For example, retouched bladelets are classified with retouched blades and flakes, rather than with microliths, as is the case with Goring-Morris' work. Similarly, truncated bladelets (pieces that are abruptly retouched on the distal or proximal end, or both) are separated out from the microlith category and included with truncated blades. It is possible, although not explicit, that Goring-Morris also places truncated bladelets with other truncations rather than in the microlith category.

Henry's typelist also differs from Goring-Morris in how straight-backed tools are classified. He has fewer geometric straight-backed categories, identifying trapeze/rectangles as the only main one, where Goring-Morris has 6. However, Henry has more *non-geometric* straight backed categories – 6 types based on the manner of snapping or retouching at the distal/proximal ends. These do not correspond at all closely to Goring-Morris' category. In his scheme these would sometimes be classified into obliquely truncated and backed bladelets, or into fragments, or into one of his geometric categories.

The arched tools fare no better. While both researchers have arched backed and arched backed with basal modification categories, there the resemblance ends. Goring Morris has a variety of arched categories – micropoint (with or without basal modification), pointed (with or without basal modification), obliquely truncated and backed, Ramon point – none of which really have clear parallels in Henry's scheme. Henry, in addition, has a category of narrow arched, and one of arched with microburin technique, which have no parallels in Goring-Morris' work.

In some cases, the lack of correspondence between the two typelists is because indeed there are no tools that are comparable in the two research areas. For example, the narrow arched tools in Henry's area have no real parallel in the Negev. Typelists have been formulated on the basis of the particular assemblages each researchers is working with, and thus certain types proliferate in one typelist, whilst being lumped into one, or not used at all, in another.

In addition, terminological confusion in some arched tool categories is a function of categorising practice rather than assemblage differences. Henry (1995:302) refers to scalene bladelets as being the same as Goring-Morris' Ramon Points. However, Goring-Morris also has a scalene bladelet category distinct from his Ramon Point category.

This illustrates the difficulty of replicating Goring-Morris' arched categories by other researchers. His 19 categories that could be considered arched or pointed non-geometrics (leaving aside the 9 geometric categories) are distinguished from each other on the basis of

- Abruptness of truncation – is it a smooth curve or a noticeable corner?
- Location of the join between the two pieces of backing – sited far down the bladelet with the pieces of retouch being almost equal in length, or high up the bladelet
- Treatment of end opposite the point – basal of modification, numbers of truncations, presence of microburin technique
- Type of retouch used
- Concavity or convexity of long back

These are not explicit or quantified, and the various parameters are not always used for each tool. La Mouillah Points are defined solely by the presence of an unretouched *piquant triedre* scar, and could have any angle of truncation, or basal modification. A scalene bladelet is distinguished from an obliquely truncated bladelet by the location of the angle creating the point, with the scalene having a lower join of the two sides, and the oblique truncation having a higher join of these two sides. An arched-backed bladelet, however, is distinguished from an oblique truncation by the smoothness of its truncation – an obliquely truncated bladelet has a more abrupt join between the two sides. These distinctions can be very difficult to replicate in practice (see figure 3.4).

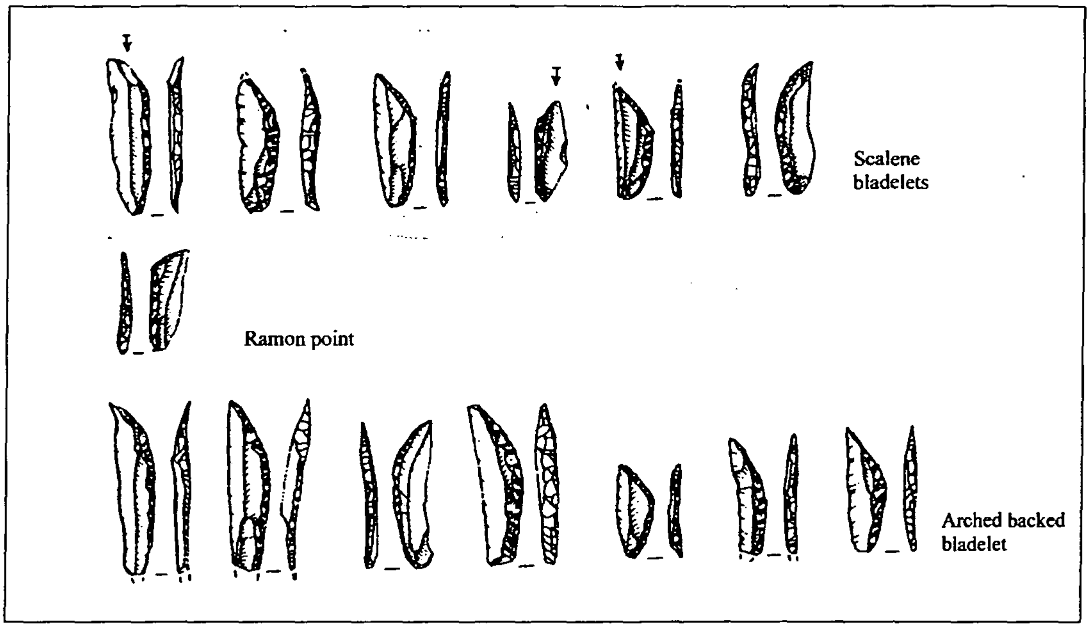



Figure 3:4 Indistinct arched-backed tool types from Nahal Rut 7, after Goring-Morris 1987

Henry deals with snapped tools, that is microliths with one or two ends snapped, differently than other analysts. He sees them as tool types, intentionally snapped. Analytically, he does not really accept the proposition that tools break - there is only one piece classed as a fragment in all the Qalkhan assemblages. Tools that Goring-Morris would consider broken form Henry's two numerically largest categories. Goring-Morris variously either classes these as broken/fragmented tools, or with the tool type that he infers it once was. So, a straight-backed bladelet with one truncated end and one retouched end would for Henry be a specific tool type, while for Goring-Morris it would be either a trapeze/rectangle, or, in a largely arched assemblage, it might be a fragment or included in the main arched backed category in the assemblage (see figure 3.5). Henry does have two 'fragment' categories – one for geometrics, and one for non-geometrics. It is hard to know how these two could be distinguished from each other.

| Arrangement of retouch | Goring-Morris | Henry |
|---|---|---|
|  | Trapeze/rectangle (Geometric) | Trapeze/rectangle (geometric) or bitruncated backed bladelet (non-geometric) |
|  | Trapeze rectangle (Geometric) or Fragment (non-geometric) | Straight backed bladelet with a truncation opposite a snap (non-geometric) |
|  | Fragment (non-geometric) | Medial backed bladelet (non-geometric) |

Figure 3:5 Classification of straight-backed microliths

## 3.5 Henry and Goring-Morris: typological descriptions of cultures

### 3.5.1. The Qalkhan and the Early Hamran

Henry has defined the Early Hamran and the Qalkhan as two separate cultural occurrences, possibly of the Early Epipalaeolithic. The Early Hamran is said to be an Eastern Levantine variant of the Kebaran culture, while the Qalkhan is said to occur solely in the Eastern Levant (Henry 1988a). These two cultures are defined as separate long standing cultural traditions with different typology and technology. However, a closer examination of Henry's data suggests some problems with how they are characterised.

The Qalkhan was first defined on the basis of several small (<50 pieces) assemblages in the Wadi Humeima, then additional excavations there and at Tor Hamar. Henry reports the lithic characteristics of Qalkhan assemblages as:

- Dominated by non-geometric microliths that are narrow arched backed and pointed, straight backed bladelets with truncation opposite snaps, medial segments of straight backed bladelets, and La Mouillah points
- containing large triangular Qalkhan Points, diagnostic of the industry

- Containing non-microlithic tools including scrapers, notches, denticulates and perforators in small proportions. Burins are poorly represented. Retouched pieces (which include retouched microliths, which are not backed, as well as retouched blades and flakes) are prominent in all assemblages
- Rarely containing geometrics, which are in the form of trapeze/rectangles
- Showing technological characteristics such as relatively wide bladelets (2.6:1), single platform subpyramidal cores, and use of microburin technique.
- Containing high frequencies of cores and primary elements; cores often (60-80%) with less than 50% of the platform circumference used.

The Early Hamran is said to be the precursor of Henry's Middle Hamran, a Geometric Kebaran variant in the Eastern Levant. He reports characteristics of the assemblages as:

- Dominated by non-geometric microliths that are straight backed bladelets with truncations opposite snaps, and medial segments of straight backed bladelets
- Containing non-microlithic tools, including moderate frequencies of scrapers, notches and burins. Retouched pieces sometimes are the largest class.
- Showing technological characteristics including relatively wide bladelets, and multiple platform subpyramidal cores which are exhausted.

## Dominant non-geometrics

Individual sites classified as Early Hamran vary quite a lot in terms of the proportions of non-geometric microliths in their assemblages. Three assemblages contain less than Bar-Yosef's 30% microliths for the Kebaran (28%, 19% and 13%). Two of the other three assemblages contain high proportions of nongeometric microliths when one adds in the retouched (but not backed) bladelets (contra Henry)(32%, 64%, and 54%).

The Qalkhan is said to be dominated by narrow arched backed bladelets (range 4.4%-12.9%), but in reality other types have similar ranges - arched backed bladelet (2.1%-14%), straight backed bladelets (4%-7.5%) and medial segments (3.4%-8.6%). The assemblages do not seem to be dominated any one of Henry's types. In addition, the retouched bladelets, which he includes in a separate, non-microlithic category, are sometimes the largest single microlith type, e.g. up to between 17-52% at J405, J406b and J407, although only 2.4-3.5% in the Tor Hamar levels. The Early Hamran is said to be dominated by straight-backed bladelets with one truncation opposite a snap (actual proportions 1.8-12.8%), and medial segments of straight backed bladelets (actual proportions 3.6-26%). Arched backed bladelets, however, vary from 0-6.1%. With the exception of the narrow arched-backed forms, these seem similar ranges to the microlith types of the Qalkhan.

## Broken microliths

Two of Henry's main microlith types are defined by having a snap at one or both ends rather than retouch, microburin scar or extremity of blank. Henry says that, because the length dimensions of these two types are the same, these snaps were an intentional part of tool manufacture process, rather than accidental snaps from use, trampling, or other post depositional process. However, the lengths of both of these types, while similar to each other, are shorter than the other microlithic tools - suggesting that the snaps may instead be accidental. Edwards points out that tools may snap accidentally in a patterned way, and that trampling of tools resulting in snapping is very likely to occur in camp (1987). If these two types are actually broken, then, not too surprisingly, sites have high proportions of broken tools (Early Hamran 19.6%, 13%, 19%, 24.9%, 44.2%, 25.8%; and Qalkhan 7.4%, 9.6/16.1/10.6%). In the Early Hamran sites, which have higher proportions of these possibly broken types, there are also higher proportions of the category 'fragments' - so possibly these sites are just more trampled than those called Qalkhan. At Early Hamran <u>and</u> Qalkhan sites, then, of the tools which would usually be considered complete, arched backed are more frequent than straight backed forms.

## Qalkhan points

The type fossil of the Qalkhan, 42 Qalkhan points have been identified. These points are central to defining the Qalkhan culture, but only half clearly came from non-mixed Qalkhan contexts. There are between 1-6 of these very large, wide points found in each Qalkhan assemblage. In morphology, they are very like some scalene bladelets or asymmetric trapeze B as defined by Ofer Bar-Yosef, which is also non-microlithic in scale.

## Non-microlithic tools

Non microlithic tools show very similar profiles at Qalkhan and Early Hamran sites.

## Technological attributes

Both Qalkhan and Early Hamran assemblages are very similar in technology. Both have a predominance of single platform subpyramidal cores. Raw material, bladelet dimensions, and technique related attributes are all similar.

## Microburin technique

The technique is said to be used systematically in the Qalkhan but not in the Early Hamran. However, three Early Hamran sites do have some microburins. The microburins found in the Qalkhan are of dimensions that suggest they were created while manufacturing the La Mouillah Points and Qalkhan Points - all very much larger than any of the arched backed forms found in both Qalkhan and Early Hamran sites. Yet Henry points out that the arched backed forms in the Qalkhan were made using the microburin technique, because one can see the remnant scars on the tools. Yet *smaller* microburins have not been found at Qalkhan sites to account for these scars. Clearly the actual microburins, debris from using the microburin technique, are not always found, possibly due to recovery techniques, or to a different location of manufacture. If that is the case, then simple microburin counts from both Qalkhan and Early Hamran sites might not fully describe the level at which the technique was used.

## Overall differences

Overall the Qalkhan and the Early Hamran show a similar technology despite being assigned to different complexes. The typology has many similarities, with differences based on subtle proportions of microlith types. The limited number of assemblages, some with small tool counts, mean that differences are not supported by substantial statistical data. Some tool types could be differently interpreted and the bulk of tools in both industries would usually be classified as broken. In general tool classes appear similar in both cultures and the use of microburin technique is not shown convincingly to be different.

### 3.5.2 Middle Epipalaeolithic straight backed industries

Researchers have classified assemblages into two cultures, said to be part of the same industry. Sites in the Negev/Sinai have been classified as Geometric Kebaran (Goring-Morris 1987) while assemblages in Southern Jordan have been classified as a regional variant, the Middle Hamran (Henry 1995). Direct comparisons between the two are difficult because of varying classificatory practice. However, they seem very similar in many ways. These cultures are both defined by high proportions of geometric microliths, which is what differentiates them from earlier assemblages.

## Geometrics vs. Non-geometrics

The presence of geometrics has been emphasised as a characteristic distinguishing Geometric Kebaran and later Epipalaeolithic industries from early Epipalaeolithic assemblages. However, the actual definition of what a geometric is, and what tool types fall within the category, seems to be fairly undefined and definitions loosely applied, often without specifying in publication how terms are used. For example, Valla (1984:23) wrote of problems comparing Hours and Bar-Yosef because backed bladelets with transverse truncations are counted with the geometrics by Bar Yosef and as truncated backed bladelets by Hours. One of the differences of interpretation relates to 'proto-geometrics'. Some tools were called (originally by Bar-Yosef 1970, but followed by Goring-Morris 1987) proto-geometric and used to enlarge the 'geometric' category and further differentiate Geometric and Kebaran assemblages. Microliths with a higher length:width ratio were seen as earlier and thus proto; Goring Morris specifies that these tools must have one truncation opposite a natural distal or proximal end. These proto-geometrics are included in the counts of geometric tools in Goring-Morris' work, but Henry's equivalent (the straight backed bladelet with one truncation) is considered a non-geometric.

A number of microlith types impinge on geometric/non-geometric definitions and ratios. Each of these types has been classified differently either as either geometric or non-geometric, and in addition sometimes classified with other tools in different tool types, by different researchers. Clearly the overall proportions of both particular tool types, and of the geometric: non-geometric ratio of an assemblage will be substantially affected by these differences in classification practice. Based on Bar-Yosef's definitions, these are:

- **Obliquely truncated backed bladelets** - retouched or backed with parallel edges truncated obliquely at one end (distal or proximal) (Bar-Yosef 1970:214). These are considered non-geometric by both Bar-Yosef and Goring-Morris. However, they were first described by Turville-Petre (1932) as 'an elongated triangle' and classed as a geometric. Henry considers these scalene bladelets, and classes them as non-geometrics.
- **Broken backed bladelet** - broken microliths, including fragments with bulb intact and medial fragments, that are otherwise unclassified were classed by Bar-Yosef as non-geometric. Sometimes they comprise 50% or more of microliths. (Bar-Yosef 1970:217). This corresponds to Henry's straight backed medial bladelets, or straight backed bladelets with one truncation opposite a snap, or straight backed bladelet with one truncation (all non-geometrics). Goring-Morris sometimes classifies these as fragments, and sometimes includes them in his geometric or non-geometric tool types.
- **Proto-rectangle** - backed bladelet with straight, retouched truncation has bulb, but resembles a rectangle in form (Bar-Yosef 1970:218). Bar-Yosef classifies this as a geometric, although the presence of bulb counters Tixier's (1963) definition of geometrics. Goring-Morris also classifies this as a geometric, despite possible confusion with his straight backed truncated bladelet, which is a non-geometric. Henry does not use this type name, and would consider this a straight backed bladelet with one truncation, and class it as a non-geometric.
- **Rectangle** - backed bladelet or blade with parallel sides and truncations at both ends (Bar Yosef 1970:218). Goring-Morris supports the geometric classification but also includes as rectangles pieces with one truncation and a snap opposite, presuming past existence of a second truncation. Henry would include this latter as a straight backed bladelet with a truncation opposite a snap, and consider it a non-geometric. A full rectangle is classed by Henry as a geometric, but it is not clear how he differentiates between this and his straight backed bladelet with

bitruncation, which is a non-geometric.

- **Broken rectangles** - straight backed and truncated, and broken at either end (Bar Yosef 1970:218). These are included by Goring-Morris in the rectangle category; and by Henry as a separate non-geometric tool category (straight backed bladelet with snap opposite a truncation).
- **Proto-trapeze** - elongated bladelet, obliquely truncated at both ends. Same as obliquely truncated backed bladelet, but with one more truncation, giving it a geometric classification.(Bar-Yosef 1970:218) For Bar-Yosef these are longer and thinner than trapezes, based on his idea of development from narrow to wider bladelets through time. However, many tools with high length:width ratios are considered trapezes or rectangle by both Henry and Goring-Morris. The length issue is largely unquantified and becomes a matter of 'feel'.

Thus the different geometric/nongeometric ratios, which are considered so important in defining the Geometric Kebaran and in describing trends over time within the Epipalaeolithic as a whole, seem difficult to sustain on the basis of current, at least published, practice in typology. An important divide is stressed in the literature between geometric and non-geometric assemblages. However, different classification practices result in different characterisations of the geometric nature of an assemblage. Generally, it seems that straight backed industries are seen as more geometric than arched backed ones, with more long, non-geometric-type straight backed tools being considered geometric than is true for arched backed tools. In comparing Goring-Morris and Henry, differences in what is considered geometric or non geometric considerably affect descriptions of assemblages. Clearly the difference in practice between researchers may be affecting comparisons between the two regions worked in – the Negev and southern Jordan. Differences are difficult to quantify from published data because of a lack of complete definitions of the basis of categorisation, and lumping together tools about which inferences have been made as to their possible original form before being broken. It is not possible to completely disentangle classificatory work from published accounts.

## Geometric Kebaran

Goring-Morris describes Geometric Kebaran assemblages as:

- Dominated by geometrics - at least 40%, often 50% or more. This category includes broken pieces with just one truncation opposite a snap, as well as 'proto-trapezes' which have one truncation opposite a proximal or distal end.
- Containing non-geometrics as well, including 15-45% which are broken retouched or backed bladelets, including many of Henry's medial segments. The frequency of broken backed bladelets is similar to that of other Negev industries. Those sites with higher values often make narrow trapeze/rectangles. These broken pieces could have been used, as they frequently fall within lengths of complete trapeze/rectangles.
- Containing non-microlithic tools including scrapers – variable numbers in different regions, with, for example an abundance at Nahal Zin. Burins are rare. Truncations are mainly on broken blades. Many are interpreted as incomplete trapeze/rectangles, abandoned because of breakage during manufacture, before backing.
- Characterised by the production of bladelets from mostly single platform cores.
- A lack of use of the microburin technique.

Goring Morris analysed trapeze/rectangles as the type fossil of the industry, and determined that there were two main groups based on length and width of tools. Assemblages had either wide tools (7.5+, and length at least 20mm) or narrow ones (less than 6.5mm) which were sometimes long. Retouch also varies. Narrow geometric assemblages tend to more bipolar/mixed backing, although the variability is also regional. Gebel Maghara assemblages all have 20%+ bipolar, whatever their width, while Central Negev narrow assemblages have very little bipolar backing.

The Geometric Kebaran in Negev/Sinai is thus characterised by

- Straight backed tools in both geometric and non-geometric categories
- Many snapped and broken forms in both geometric and non-geometric categories
- Homogeneity within assemblage

- Being very highly microlithic
- Very similar geometric and non-geometric tools.

## Middle Hamran

The Middle Hamran was defined by Henry as an Eastern Levantine variant of the Geometric Kebaran, and recovered from 4 sites. Henry (1995) reports continuity with the Early Hamran in that it is also characterised by nongeometric microliths dominated by straight backed bladelets with truncations opposite snaps and medial segments of straight backed bladelets. Differences from the earlier period includes the presence of geometrics in the form of trapeze/rectangles.

Reported Middle Hamran characteristics (Henry 1995) include:

- Geometric microliths in the form of trapeze/rectangles form moderate proportions of toolkits.
- Non-geometric microliths form 58-73% of toolkits, with straight backed bladelets with one truncation opposite a snap and medial segments of straight backed bladelets standing out
- Truncations occur in moderate proportions as straight/ oblique truncations on bladelets. This may represent an early step in making trapeze/rectangles
- Non-microlithic tools include retouched flakes and blades, scrapers in low numbers, and notches and denticulates in low frequencies, usually on bladelets.
- Microliths are segmented through snaps rather than microburin technique.

The technology is reported as following the pattern of the Early Hamran, with cores extensively exhausted and fairly rare. Henry (1995) sees the industry as strongly resembling the Geometric Kebaran of the southern arid zone in having large numbers of wide trapeze/rectangles.

An examination of Henry's 4 Middle Hamran sites shows that while Henry is broadly accurate in how it is described, his emphasis on the presence of geometrics seems overstated - they are indeed present, but in relatively small proportions (6.7 - 19.6%). The industry is actually characterised by

- Being heavily microlithic 75%+
- These are mainly non-geometrics - nearly 60%
- Of these, the overwhelming majority are straight backed bladelets with truncation opposite a snap and medial segments of the same
- Very many of these are snapped and may be broken (over half of the entire assemblage)
- The presence of <u>some</u> trapeze/rectangles.

Overall, the published description of the Early and the Middle Hamran, which makes the two seem so similar to each other, actually fits the Middle Hamran much better. A comparison of the actual characteristics of sites shows that the Early Hamran:

- Is less microlithic
- Has more variety in microliths, with some arched and some retouched bladelets
- Has far fewer straight backed forms, with less medial segments and straight backed bladelets with truncations opposite snaps (only 19-25%)
- Has many more larger tools - especially retouched blades, and scrapers.

Geometric Kebaran and Middle Hamran characterisations are difficult to compare, because of Goring-Morris lumping broken pieces with complete ones, and Henry not specifying what his tool types are or how fragments are dealt with. However, proportions of tool types between the two industries seem quite different.

Non-geometric microlith proportions are apparently different in the two cultures, but this may be a figment of classification practice. If one discounts Henry's straight backed bladelets with one truncation which would have been classified differently by Goring-Morris, Hamran sites have 25-40% non-geometrics, which is quite similar to Geometric Kebaran sites.

Goring-Morris' fragments category seems much higher than that in Henry's sites, but if medial pieces are added to Henry's fragments, the proportion is 18-33%, which is very similar to that in the Geometric Kebaran (13-30%).

There remain some differences, however, which do not seem reducible to classification practice. Geometrics in the Hamran are less than half the proportion of Geometric Kebaran ones - even after halving the number of Geometric Kebaran geometrics to account for the inclusion of snapped pieces, which Henry would not have classified as geometrics. Also, there are fewer retouched bladelets in the Hamran, except at the open air sites.

Overall, the broad characteristics of the two cultures suggest that the Geometric Kebaran and the Middle Hamran are very similar.

- Very microlithic
- Microliths are homogenous
- Straight backed
- Many snapped and broken forms and many with one truncation; a few with two truncations and a few with one or two natural bladelet extremities. So, most are snapped/broken.

### 3.5.3 Middle Epipalaeolithic arched backed industries

## The Mushabian

The Mushabian was defined on the basis of preliminary analysis of 4 assemblages at Gebel Maghara in northern Sinai (Phillips and Mintz 1977). Goring-Morris divided the Mushabian into several temporal and spatial facies based on microlith typology. Classic Mushabian, Ramonian, Qerenian, later Qerenian, and Nizzanan were all suggested cultures within the Mushabian. The Nizzanan was later (Goring-Morris 1995) shifted to the Early Epipalaeolithic, becoming a culture within the Kebaran. These cultures, together with the Madamaghan defined by Henry (1995) as an Eastern Levantine Mushabian group, spring from the large variability within tool typology of the arched assemblages. In addition, they reflect the difficulty of classifying arched forms which incorporate variability in a way that is harder to quantify than that of straight backed forms.

Goring-Morris describes Mushabian assemblages as:

- Overwhelmingly dominated by a small range of microliths and only small numbers of other, larger tools
- With non microlithic tools including small numbers of scrapers, rare burins and retouched and backed blades. Truncations and notches include microlithic forms which may be the unfinished or broken remnants of microlith manufacture.
- With non-geometric microliths dominated by scalene and arch backed bladelets, including La Mouillah Points, with broken backed bladelet fragments a considerable element
- With technology showing rather globular cores and short wide bladelets from a range of core types
- Commonly using microburin technique.

Goring-Morris subdivides the Mushabian into various subgroups in the following way. Classic Mushabian assemblages contain arched backed bladelets and some blunt backed bladelets. Later Mushabian assemblages also contain these, adding some obliquely truncated and backed bladelets. The Ramonian, seen as a late Mushabian entity, is entirely dominated by a specific form of obliquely truncated and backed bladelet called the Ramon Point. The Qerenian contains geometrics, usually in the form of trapezes, produced by microburin technique, as well as arched backed bladelets. The Later Qerenian additionally contains asymmetric trapeze A's. The Nizzanan includes arched backed bladelets, as well as small triangular microliths, again using the microburin technique.

The Madamaghan is defined by Henry as a Mushabian variant in the Eastern Levant, based on excavations at two sites in Jebel Qalkha. The assemblages are characterised by:

- Being dominated by non-geometric microliths (36-65%), made up of straight-backed and arched-backed bladelets, as well as scalene backed bladelets and La Mouillah Points
- Non-microlithic tools, which include small numbers of scrapers, retouched flakes and blades, notches

- Use of the microburin technique
- Wide bladelets made from sub-pyramidal cores with one or more platforms.

Broadly speaking, all Mushabian, later Mushabian, Qerenian and Madamaghan sites seem similar in terms of very general tool classes and more specifically microlithic tool types. The are usually made up of 29-73% arched backed forms, predominantly arched backed bladelets, with 9-35% straight backed and retouched bladelets. Fragments tend to make up 7-19% of the assemblage. For phasing the Mushabian, facies are often defined by fossile directeurs - so, the Ramon Point signals the later Mushabian and Helwan lunates signify the later Ramonian.

The predominant arched forms are arched backed bladelets, arched backed bladelets with basal modification, scalene bladelets with or without basal modification, Ramon Points, atypical Ramon Points, La Mouillah Points, trapeze-rectangles, lunates and triangles and asymmetric trapezes. Looking at general proportions of tool types in assemblages, all Mushabian (sensu lato) assemblages look very similar, but the difficulties of classifying arched tools in a consistent manner across researchers, and of describing variability in a meaningful and consistent manner, make typological description of these assemblages to date less helpful.

The range of variation between sites is large (see figure 3.6). For example, the Asymmetric Trapeze A's of Azariq X are totally different from those at Shluhat Qeren (both ascribed to the Qerenian by Goring-Morris), and arched backed bladelets from Ramat Matred 2 look quite different from those at Mitzpeh Shunera 3. At the same time, within assemblages, there is a lot of homogeneity - across *and* within tool classes. So, at Shluhat Qeren II, the trapezes look much like the arched backed bladelets; and neither of those tool types strongly resembles their counterparts at any other site. The fact that the way that tools are made at a site seems to crosscut typological categories suggests that using types to describe variability in an assemblage may be missing the point – the use of types may be obscuring other patterns of variability and similarity. A detailed attribute analysis of tool morphology might reveal a very different picture of an assemblage and how it was structured, as well as of the relationships between assemblages.

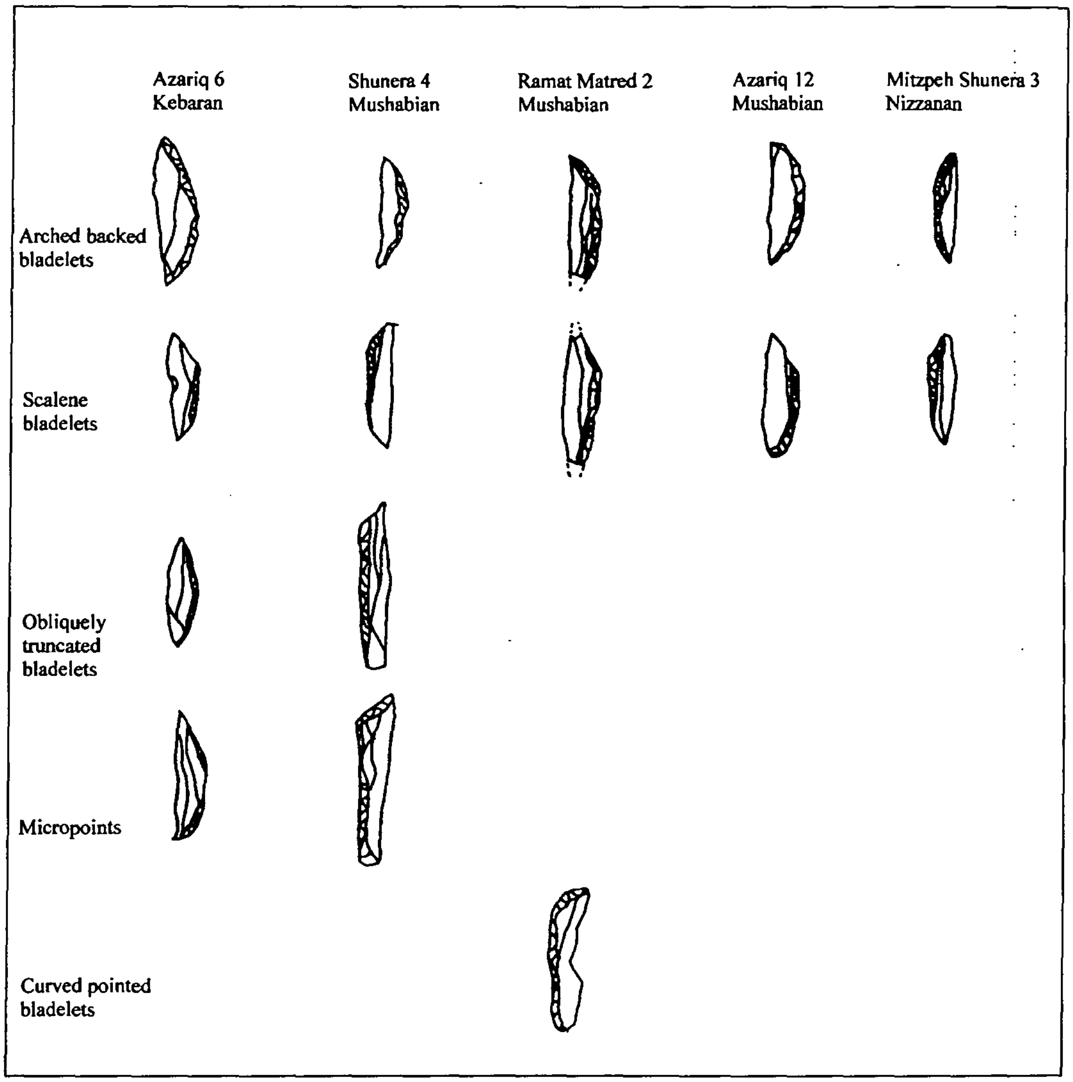



Figure 3:6 Arched-backed tool types from different sites, showing variability within types from different sites, and similarity between different types from within one site.

## 3.6 Summary

Based on examination of classification practices currently used in the Southern Levant, and comments made by other workers mainly working in the Eastern Levant, it is clear that typelists as currently used do not fully describe microlithic assemblage variability. Existing typologies are useful for looking at broad similarity across quite different assemblages and regions through suppressing variability. Types emphasise 'common denominators' between what may be quite different tools in order to define types across assemblages, often in different regions. They also impose a certain order on 'continuous' variability <u>between</u> ' types', and between what, thus, have been defined as industries. However, researchers working to describe variability more fully (e.g. Byrd 1989, Olszewski *et al.* 1994) suggest that these 'types' obscure much variability present in tool morphology and the processes of segmenting and retouching that create it.

Overall, after working through classificatory practice amongst the two researchers, specific comments about the use of type lists for cultural designations can be made.

- The distinction between Qalkhan and Early Hamran assemblages may not be as great as previously thought, based on similarity in technology and in many tool types.
- The continuity between Early Hamran and Middle Hamran may not be great, with the Early Hamran having great variety in microlithic forms, including less emphasis on straight backed tools and a greater emphasis on non-microlithic tools
- The geometricisation which defines the Geometric Kebaran is not very well-defined and suffers from methodological inconsistencies between researchers.
- While the Geometric Kebaran and Middle Hamran do indeed have many similarities, the Middle Hamran seems to have a smaller proportion of geometrics. This is hard to pin down accurately due to differing classification of fragments.
- The characteristic arched tools of Mushabian *et al.* assemblages have not been successfully described in terms of tool morphology, with inconsistent attributes used in defining types and varying use of terminology in describing tools by different researchers.
- The nature of variability within and between sites has not been fully described by the use of type lists.

# 4. Narrative analysis

## *4.1 Introduction*

This chapter investigates the published image of the Epipalaeolithic of the Southern Levant through the work of Ofer Bar-Yosef, Nigel Goring-Morris and Don Henry, spanning the last 30 years of research in the region. These three researchers have published the largest bodies of work to date on the Epipalaeolithic of the southern Levant, and their works have together formed the picture we have of the period.

The aim of this chapter is to identify how our knowledge of the period has been constructed through the major writings and research. This analysis is based on the idea that we structure our accounts of the past with ideas and methodologies drawn from outside the field of study. The post modern movement in social thought has shown how 'reality' is constituted in and through language, and that discursive practices are central to how truth is constructed in many disciplines (e.g. Barthes 1985, Foucault 1970, Ricouer 1984). Nowhere is this more evident than in historiography where much work has been done showing how traditional histories legitimise modernist social agendas (e.g. Baudrillard 1994, Derrida 1979, Foucault 1981, Jameson 1981). This work has suggested some useful strategies for looking at how we create our pictures of the past (e.g. White 1978, Kellner 1980). I believe these ideas can very usefully be applied to archaeological description and explanation. The following discussion will draw heavily on these theories and methodology.

### The language of archaeology

Our accounts of the past can be said to consist of two parts. The various disparate statements and pieces of data form the initial stage of researching a past. These statements can be judged to be accurate or not through comparison with, for example, raw data, maps, independent dating, and so on. However, no published account consists simply of lists of pieces of data. Published accounts are translations of disparate statements and data into a whole picture, through endowing sets of events, data, and so on with meaning beyond what might be suggested by a straightforward list. This is the process that makes an understandable story out of raw data.

We could make many, many true statements about a site or a period – but only certain statements are chosen to be included in each account. Certain statements or facts are given an explanatory force, a greater significance, than other facts. These are seen as causes explaining the structure of whole sets of facts chosen to make up the account, or as symbols of the entire structure of this set.

This overall written picture of the past, with its select set of chosen statements, arranged with certain facts given extra weight, cannot be compared against the past and declared true or false. It is the connections and relationships between statements which gives the picture its explanatory force, rather than solely the individual facts which make it up. It is this process of assembling which is the transformation of a collection of individual statements or facts into a piece of research with some unity of significance.

A verbal account of the past relies on the same linguistic strategies as other verbal accounts, whether prose or poetry, fiction of fact. As Hayden White (1987) says, "the means of making sense" of the real or of the imagined world is the same. White's work has been influential in showing how historical texts gain the authority of objective accounts of the past through manipulation of certain linguistic strategies.

Within archaeology, interest in how we use language to describe, discuss, infer and conclude has been more recent. An early example is Misa Landau's work on the narratives of human evolution (1984), influenced by Vladimir Propp's work (1958) on universal narrative structures of fairy tales. However, there is now growing realisation that the accounts of an archaeological period or site are verbal structures, based only in part of those initial statements of fact. Writing is a central and interpretative part of our discipline (e.g. Bender *et al.* 1997, Tilley 1999, Hodder 2000). Archaeology as a textual endeavour has been discussed by Hodder (1999), who has examined the history and development of the form of site reports, and connected this to a broader shift in the way authority is established in scientific/academic disciplines.

In the social sciences we are dependent on language and linguistic methodologies to a greater extent than those in the physical sciences, where codified formulae have to some degree taken the place of figurative language. In archaeology, our raw data is comprised of material culture, ecofacts, stratigraphy and so on. Hodder (2000:5) points out that "critical reflexivity has to deal not just with writing but also with those aspects of method which involve scientific observation and natural science techniques." Interpretation begins with excavation methods, as Hodder (1999:3) points out. Gero (1996) shows how at one site there were gendered differences amongst excavators in recording and presenting features. The description of the excavation and artefacts was part of the complex social strategies between all those involved in digging, directing and writing about a site. And some researchers are recognising that even excavation methods and what happens on site, socially and archaeologically, fundamentally influences our picture of the past (e.g. Bender *et al.* 1997, Hodder 2000, Hodder 1999, Lucas 2001). There is, in some quarters, a recognition that this is also true of how we deal with data, our methods of observation, description and quantification of artefacts and attributes (Hodder 2000). However, the *specific* links between our methods of describing and analysing data, and our linguistic strategies, are seldom made (but see Shanks 1996, Tilley 1999).

Hayden White's methodology of analysing the use of tropes will be used here to investigate methods of lithic analysis. This method is particularly useful in showing the *mechanics* of how data has been assembled to create powerful and cohesive accounts of the past.

This chapter sets out to examine the ways that data have been described and structured to create the picture we have of the Middle Epipalaeolithic. Tool typologies are fundamental to this picture. Typologies are systems of structuring data, creating a language with the air of scientific codification. The use of typelists, numbered tool types, counts, ratios and proportions all give the impression of a scientific language akin to mathematical formulae. However, the construction of classes and types, the implication of significance to certain types and not to others, the arrangement of types in a meaningful way – this is all a construct more akin to natural language, using the same figurative, linguistic techniques as any other written discourse.

The relationship between these type-constructs and the past is not a straightforward statement that can be judged true or false. These constructs are assembled narratives using linguistic strategies to acquire meaning, plausibility and authority. As such, it is illuminating to analyse these strategies.

## 4.2 Narrative strategies

White has set out a series of narrative strategies used to give meaning to historical accounts (White 1973). Some aspects of these have been used both widely within the field of history, and more sparsely in archaeology and evolution (e.g. Landau 1984, Terrell 1990, Tilley 1999). White argues that the ways we create convincing research accounts, which go beyond simply listing pieces of data, is through structuring the accounts as narrative. This enables our histories to be seen as important and coherent pieces of work that answer questions such as 'What does it mean?' or 'What is the point of all this?'. These narratives are organised through the use of three main types of explanatory device – argument, emplotment and ideology. Each of these forms of explanation can be expressed in various ways. The combinations of the various modes of explanation result in the individual historical styles of different researchers.

Explanation by argument is about the amount of integration or dispersion of the elements making up the narrative. Elements can be integrated tightly by their relationship to causal laws or to general classification categories, or to an underlying principle or spirit of the age. Any explanation can be placed along a spectrum, from dispersed to integrated.

- Least integrated works stress the uniqueness of individual items or events, with few generalisations made. Objects are identified, entities clarified, artefacts classified.
- Somewhat more integration might involve setting events or objects in a context and identifying trends, movements or periods.
- More fully integrated works attempt a synthesis of the field, with various contexts seen as parts of the whole. Each part is seen as mirroring the structure of the whole, or prefiguring the end of the whole process. Events tend to be expressive of an underlying essence.
- A fully integrated work would stress laws, with events seen as manifestations or impersonal causal agencies.

Explanation by emplotment describes the kind of story built. Stories can be chosen from a range of types familiar to us from our general literary/cultural repertoire, creating a familiar form for a narrative. Plot types relate to the degree of choice exercised by the 'main characters'.

- romance invokes a heroic transcendence of situations
- satire is the opposite of romance, with characters seen as captives of a world lacking redemption
- comic plots tell of temporary triumph over situations - things *do* go wrong, but elements are harmonisable with each other
- in a tragedy, things always go wrong, but reconciliations are possible. Limits are set to what may be hoped for and there is resignation to conditions.

Explanation by ideology, the third explanatory device, addresses how change is portrayed in the narrative.

- A conservative attitude to change carries with it a sense of natural, organic rhythm to any change, which may be limited. Evolution or change may involve the progressive elaboration of a prevailing structure and the existing state of affairs is the most desirable one
- A more liberal attitude to change involves evolutionary or piecemeal change, and change through reform
- A radical approach involves cataclysmic change, amounting to significantly different situations and difference.

Underpinning these modes of explanation are a set of what White calls 'conceptual strategies' that relate these modes to each other. These strategies are the figurative devices, or tropes, used to relate different elements of the past/story to each other. White (1973, 1987) shows how the main tropes of metaphor, metonymy, synecdoche and irony have been used to structure data and events in historical accounts. Often a number of such devices are used in one work, to support one dominant trope affirming the structure of the work.

Metaphor involves transferring meaning from one system, level or domain, to another. Metaphor is used in works which classify objects, identifying like with like. Research is involved in naming and identifying objects. Archaeological methods which use metaphor include those involved in setting up a taxonomy of tools, assemblages and sites. Classes are constructed which emphasise similarity between certain objects. A new object is understood in terms of another, existing object or set of objects.

Within metonymy, one *part* of the whole stands in for the whole. This is a reductionist trope, relying on associations built up previously between the parts of a whole to allow the significance of that whole to accrue to one chosen part of it. For example, an individual artefact or site stands in for or represents the general phenomena of a culture. A classic archaeological use of this trope is the *fossile-directeur*, in which one type of object is seen as representative of a whole assemblage, and indeed a whole set of cultural traits, behaviours and subsistence methods.

Synecdoche integrates all individual phenomena into a whole, so that the individuals are understood only in terms of that whole. Individual artefacts or sites contribute to an overarching trajectory or concept. An archaeological example of this would be the emphasis on regional or period patterns, with sites functioning only as parts of an overarching image of the 'spirit of the age'.

Irony emphasises a sceptical awareness of discrepancy between appearance and reality or the distinction between words and their meaning. Archaeological examples would include more recent works investigating the use of language in archaeological understanding (such as the present work).

Figurative modes of thought underpin the meanings of much communication typically considered literal rather than figurative – such as factual or scientific discourse. Works of archaeological research can be shown to be underpinned by tropes in a number of ways. For example, actual methodologies of data analysis are governed by figurative thinking. Lithic assemblages are classified and subject to complex issues of nomenclature. Their complex whole is reduced to one tool class, carrying all the meaning of the assemblage and these are then used to signify overarching trajectories or evolutions.

The devices used in data analysis carry through into the final inferences and conclusions of the work. The use of the various modes of explanation and figurative devices used by Ofer Bar-Yosef, Nigel Goring-Morris and Don Henry in their lithic analyses, and the conclusions drawn from them, are examined below.

## Temporal devices

Another important aspect of any narrative is the use of time. Ricoeur (1980) considers the use of temporality to be central to the construction of a narrative – the bringing together of past, present and future. White speaks of the initial stages of writing history as arranging the events considered significant in a chronological order. In prehistory, the temporal order is even more constructed. Our data only rarely include unambiguous evidence relating to temporal relationships between sites, phases or periods. There is less temporal imperative in how we arrange events and data in our account of the past. Sequencing, and the nature of relationships in time, are a part of our primary inferences (and storytelling). In fact, this sequencing is often a major goal in archaeological work.

Fabian (1982) suggests that in our writing we use time as a device that creates meaning. Time, and its perceived relationships to human events, results in constructed chronologies, periods and stages. One way we use time is through linguistic tropes. Such figurative devices use language to "spatialise time and temporalise space" (Kellner 1980:18). One is collapsed into the other. In archaeology, this relationship has been discussed in terms of Palaeolithic chronology (e.g. Chazan 1995, Bailey 1983). We can see this difficult relationship between space and time in the work under discussion here. Constructed chronologies and spatial relationships are used to bring together the disparate sites spread through the region and the different levels of stratified sites in a unity of significance. The interweaving of temporal and spatial relationships between sites, tool classes and assemblages, through the use of periodisation, group territories and taxonomic ordering structures, is one of the fundamental tools here. The relationships between data and these ordering principles are often accomplished through tropes such as metaphor and metonymy.

Ricoeur (1980) discussed the dichotomy between the chronology of sequence and the a-chronology of models. The chronological aspect characterises the narrative as made out of sequential events, while the a-chronological aspect is that which creates significant wholes out of scattered events "eliciting a pattern from a succession" (Ricoeur 1980:174). In archaeology, this split is often characterised as a divide between an Americanist New Archaeology, searching for nomological patterns of behaviour, and a cultural-historical approach concerned with succession of cultures. The difficulties of a model-based approach in dealing with temporal issues and change has been commented upon (e.g. Bailey 1983). Models tend to be closed systems, with little ability to explain change and especially the origins of dramatic differences. The ways in which work on the Epipalaeolithic of the Southern Levant has struggled with the incorporation of temporal sequence within atemporal models are discussed below.

The important theoretical aspects of how we use time in archaeological accounts has seldom been discussed (but see Bailey 1983, Chazan 1995 and Fabian 1982). Bailey has pointed out that the invention of independent means of making chronological determinations, such as radiocarbon, has left the study of chronology in theoretical limbo. However, the use of temporality as a narrative strategy continues in tandem with the use of radiocarbon determinations.

Pre-radiocarbon typological systems for ordering time are still fundamental to most regional prehistory schemas, and radiocarbon dates are used alongside these structures. When both systems are in use, radiocarbon dates are commonly rejected if they do not 'fit' the typological picture (see chapter 2 for discussion of this practice in the Levantine Epipalaeolithic). When radiocarbon dates are scarce or entirely lacking, typological temporal schemes are invariably used instead.

More fundamentally, even when radiocarbon dates are available, they function in the same way as other 'raw' elements of data in the archaeological account. They are used as part of a narrative. If one considers, for example, the question of how temporal rates of change occur, it becomes clear that radiocarbon dating seldom contributes unequivocally to the picture drawn in an archaeological narrative. A picture of gradually changing groups, versus one of homogenous, almost a-temporal cultures broken by sudden and total change, can and has been constructed with or without radiocarbon dates. It is how these dates and other data elements available are assembled which creates the overall meaning of the narrative.

## Narrative in the Southern Levantine Epipalaeolithic

This chapter will investigate the main synthetic works on the Southern Levantine Epipalaeolithic, giving a close reading of the ways the lithic and other data has been structured and used to create a 'unity of significance' in each of these works. I will do this through examining the use of narrative methods of explanation such as ideology, emplotment and argument in describing and understanding lithic and other data. The underlying tropes each researcher has used to bring meaning and coherence to the whole picture will be explored. The use of temporal devices and how they contribute to meaning will be explained.

This examination of the construction of meaning in the work of these researchers is not intended to negate their work in any way. I believe similar analyses could be carried out on most archaeological work. If, as White suggests (1987), narrating is fundamental to our way of understanding the world, then it is not surprising to find that narrative devices are used in those works dedicated to furthering that understanding. But it seems necessary to open these methodologies up to critical enquiry, in the same way as other aspects of archaeological methodology.

## 4.3 Bar-Yosef

### Background

Bar-Yosef came to work on the Epipalaeolithic at a time in Israeli archaeology when almost nothing had been done on prehistoric periods since the end of the British Mandate. The prehistory he inherited had largely been structured by, and was still understood in terms of, the work of Garrod and Neuville (see chapter 2). Work had been done on cave sites, with excavated levels being meters thick. Lithic assemblages reflected this, with cultures seen as large chunks of static time, interspersed with sudden, dramatic change. Change was conceived of as externally driven – migrations of peoples bringing their material culture with them. Culture change was universal, with the same cultures and tool types found in the Near East and in Western Europe.

In the post Mandate period, archaeology in Israel focused on later prehistory (see chapter 2). Archaeology had played a central role in developing a sense of local, Jewish history and rootedness in the land. The assignation of material culture traits to certain identifiable ethnic groups, which could be traced to modern groups, was commonplace.

So, Bar-Yosef was to focus on the problem of creating a truly local prehistory, with its roots in the Levant, and an identifiable local development from the beginning of the Epipalaeolithic through to later prehistory and historic periods. He also was concerned with the relations between different prehistoric groups of people in the region – how they differently developed and related to later populations and economic developments. These interests drive his analysis at all levels.

The dataset comprised:

- Previous work of the 1930s-40s in cave sites, and
- Assemblages collected, and sometimes excavated, in Israel during the post-Mandate period.

These assemblages were located in the Israel of 1949-1966 (see figure 4.1), which mainly comprised what he referred to in his work as the Mediterranean Zone, together with the northern Negev. The rest of the Negev and the Sinai were in Egypt until 1967; the West Bank and east of the Jordan Valley were part of Jordan. Many of these areas were arid or semi-arid. Syria and Lebanon, to the north of Israel, comprised a range of ecological zones.

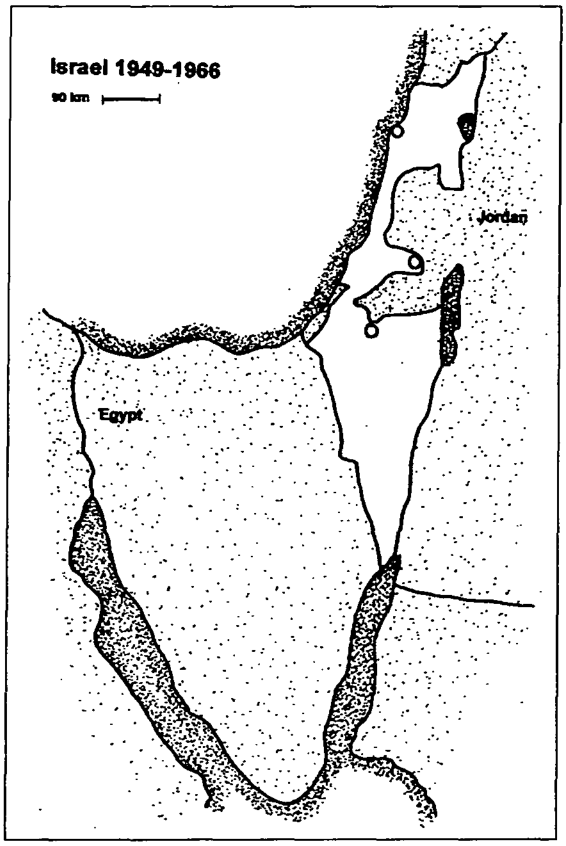



Figure 4:1 Israel in 1949-1960

## Naming

Bar-Yosef is most famous for systematising the Levantine Epipalaeolithic. He set out to clarify what lithic traits made up each culture within the region, and to assign each site or assemblage in his sample to a culture. "..to delineate correlations, similarities and dissimilarities...compiling the similar typological and technological characteristics of these sites" (Bar-Yosef 1970: 152). This would provide an overall picture of the succession of cultures in the Levant over the period, where they were based and for how long they existed.

He would set out the definitive names to be used for the period as a whole, which cultures would go within it and which names should be used for them. There had been a lot of confusion over nomenclature previously, with, for example, the period as a whole being variously called the Mesolithic, the Epipalaeolithic, and the Upper Palaeolithic Stage VI by different researchers (see chapter 2). The beginning and the end of the period was shrouded in mystery, because of

- A lack of radiocarbon dates to give chronological clarity
- A lack of clearly agreed criteria for what defined the period, and
- Gaps in the archaeological record of cave sites, with discontinuous stratigraphy and 'missing' cultures.

There was also confusion over cultural designations within the period. Earlier researchers had set up cultural designations on an almost site by site basis, with, for example, the Khiamian I, Kebaran III, II and I, and Atlitian of El Khiam (Neuville 1951), the Gravettian of Ksar Akil (Ewing 1947), the Falitian, Nebekian and Late Capsian of Jabrud (Rust 1950).

Bar-Yosef set out to instil order and comparability between these sites within a clear framework of period and culture designations based on measurable differences and similarities. He had to relate the cave stratigraphy of earlier sites, as the basis of assigned chronology, to the new set of single-occurrence, mainly surface, assemblages that he was working with.

His method was to first place individual assemblages in cultures ordered with reference to cross-referenced cave stratigraphies. He then developed the first internally coherent/congruent system which could be used as a key to the period. He devised a typelist of tool morphology based on the work of Bordes, Tixier and others, which allowed him to assign certain microlith type percentages to each culture. Any site could be assigned to a culture on the basis of the percentages of various microlith types. The relative chronology of these different cultures was based on analogy to the succession of assemblages in cave sites. This was thus based on a synthesis of the earlier work of Garrod and Neuville, and a typelist which allowed sites to be assigned to a defined number of cultures in an 'objective' way.

Bar-Yosef's work thus has the appearance of one dedicated simply to naming and identifying, classification based on counting up of tool types.

### Hierarchies of significance

While the apparent goal of Bar-Yosef's work is to name or identify pre-existing entities, which 'fill up' the Epipalaeolithic space in a value-free way, once we look more closely at how he actually describes his work, another goal becomes apparent. Bar-Yosef sees the Natufian, immediate predecessor of the Neolithic, as a period of very great significance, pivotal in world history. "Certain groups die out....the survivors lay the foundations for early states and Western Civilisation" (Bar-Yosef 1970: 394). Faced with the existing understanding of these breakthroughs as the result of groups migrating from elsewhere (e.g. Garrod 1932), Bar-Yosef was determined to show a cultural or ethnic continuity from the Upper Palaeolithic through the Neolithic and beyond. "Urbanization was not a uniform process throughout western Asia, and evidently not all contemporaneous west Asians and northeast Africans participated directly in this major episode of cultural and political change. ..it was *clearly the history of particular groups*, such as the Natufians or the Halafians, who changed the face of the Near East" (Bar-Yosef 1991:383 my emphasis). In order to demonstrate this continuity within the Epipalaeolithic, Bar-Yosef included the Natufian within the Epipalaeolithic, and put Natufian 'characteristic tools' in his typelist "in order to compare Natufian and Kebaran assemblages" (Bar-Yosef 1970: 17). One of his initial assumptions was a "technological continuity which concludes with the Natufian as an integral element" (Bar-Yosef 1970: P).

In order to show this continuity, he needed not only to include Natufian tool types such as lunates, but also to define tool types found in earlier sites in such a way as to foreshadow later tool morphologies. "Proto-tool types", such as proto-lunates or proto-rectangles, were defined and presented as the predecessors of lunates and rectangles. Changes in tool morphology were seen as gradual and incremental. Slight changes over time accomplished the transformation of one tool type into another. "The lunate can originate typologically from either the curved pointed bladelet, the broad micropoint or the triangle" (Bar-Yosef 1970:164). (see figure 4:2. There was "a tendency towards curved edges....exhibited by some specimens in anticipation of the future lunate" (Bar-Yosef 1970:218).

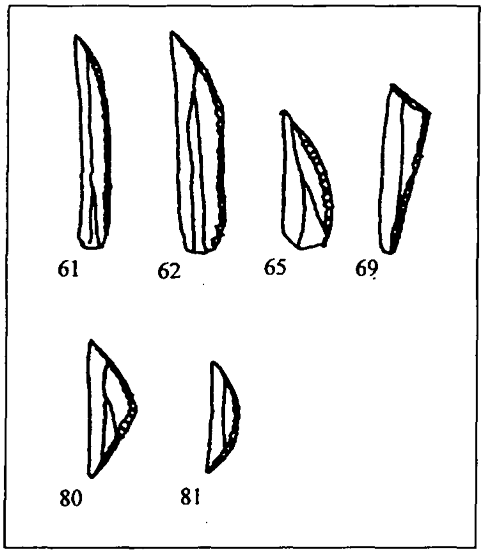



Figure 4: 2 Tool types from Bar-Yosef's (1970) type list.
Types 61, 62, 65 and 69 develop over time into lunates (types 80, 81)

So this is part of Bar-Yosef's temporal creation, linking the future with the past in a way that <u>prefigures</u> later developments. Tools in earlier sites came to have within them the potential for later period tools. These significant types thus represented the implicit future fulfilment of a trend of tool morphology and associated cultural development.

### Continuous data

A picture of gradual, incremental change is drawn through the use of continuous variables. This happens at the level of individual tool types 'morphing' into other tool types over time, as we have seen above. The emphasis is on 'proto' tools and other forms as transitional, with types placed chronologically in relation to each other, based on an image of incremental change.

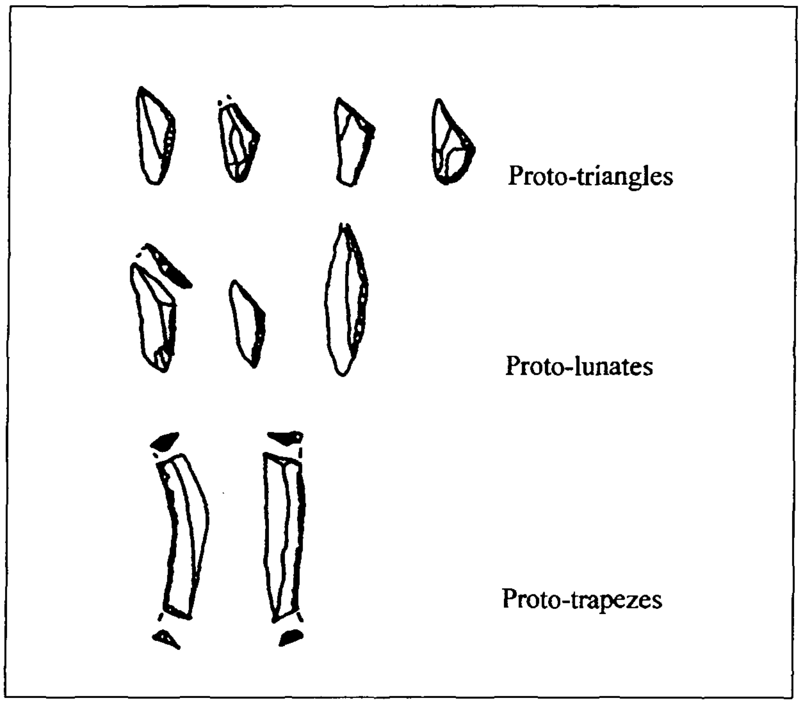



Figure 4:3 Proto-tools (after Bar-Yosef 1970)

Individual tool types are also ordered through continuous variables of width and length. Tools are seen as getting wider over time, with for example narrow trapezes becoming wide rectangles, and narrow micropoints becoming wide micropoints.

However, it is at the level of assemblage composition that typology is marshalled most decisively into an image of continuity. Bar-Yosef stressed the presence in an assemblage of those microliths considered 'geometric' as representative of the latter parts of the Epipalaeolithic. The trend of lithic assemblages throughout the period was towards 'geometricization'. This was the way that the trajectory towards the Natufian was represented in lithic terms. The proportions of non-geometrics and geometrics (including proto-geometrics) in each assemblage was measured. Bar-Yosef defined a new culture, the Geometric Kebaran, to emphasise this process of geometricization. Assemblages dominated by rectangles were assigned to the Geometric Kebaran; those dominated by lunates to the Natufian. Previously, the Kebaran had broadly encompassed all non-Natufian forms. The Geometric Kebaran, with its increase in proportion of geometrics, showed an intermediate stage between the non-geometric dominated earlier Kebaran, and the lunate dominated Natufian (see figure 4.4).

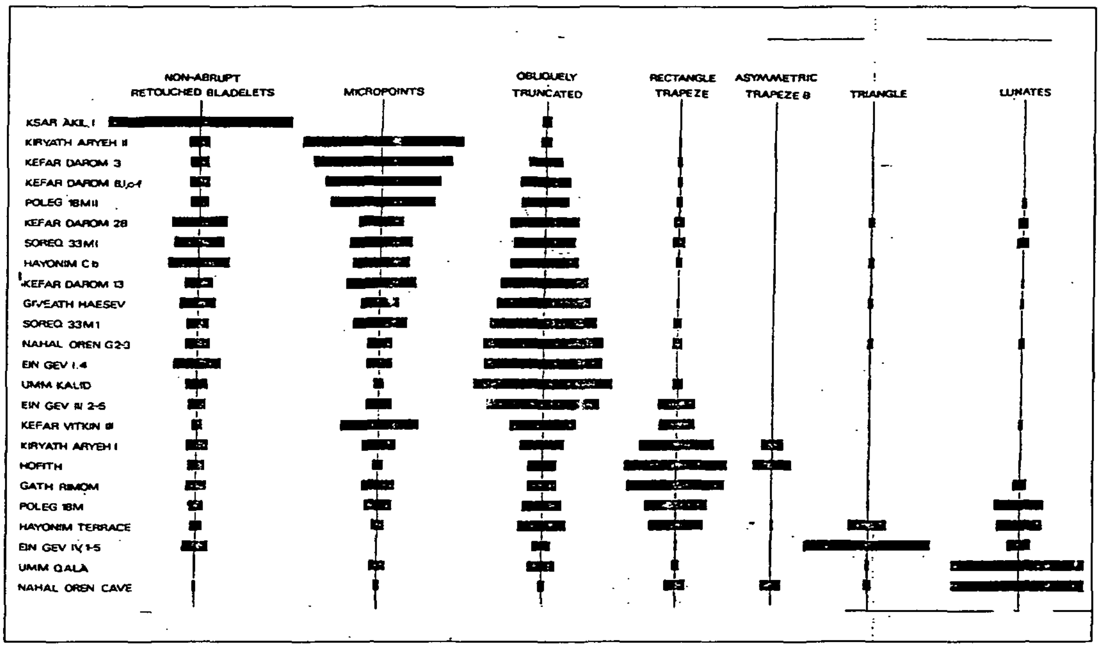



Figure 4:4 Sites arranged to reflect gradually changing frequencies of tool types. Taken from Bar-Yosef 1970

## Time

Continuous variability thus became a 'temporal device' in Bar-Yosef's ordering of data. Measurements of, for example, width, assemblage composition in terms of proportions of certain 'types', and indeed tool morphology itself were ordered to show incremental change over time. Continuity of tradition over the entire period was thus assured.

The methods of Garrod, Neuville and Rust had created large blocks of time, each block representing a synchronous period within which time stood still. Change between these blocks represented great ruptures of technology, migration and ethnicity. Bar-Yosef took the succession of cultures derived from this work, and created continuity between the periods, and incremental change towards the succeeding period with each cultural unit. He did this through the use of naturally continuous variables such as width measurements, and imposed continuity on non-continuous variables through the idea of tool types 'morphing' into each other, and through the use of proportions of these types in assemblages and in cultures.

In Bar-Yosef's work, the basis of charting time was shifted from cave stratigraphy to tool forms. The nature of that time changed also, from static periods followed by rupture, to a smooth incremental trajectory.

## Discontinuity

Discontinuity, however, did have a place in Bar-Yosef's work. Discontinuous variables used included which end of tool was truncated, and presence/absence of microburin technique. While the number of microburins present in an assemblage varies along a continuum, Bar-Yosef has classified sites as either intentional or accidental use of microburin technique, based on the frequencies of microburins in the assemblage. Of course, tool types, as well, are discontinuous. However, as discussed above, certain tool types are portrayed as 'morphing' into each other, becoming quasi-continuous variables that contribute to Bar-Yosef's evolutionary progress. This is done in terms of both the trajectory towards the lunate, and, more generally, the development of geometrics from proto- and non-geometrics.

However, outside the developmental trajectory paradigm, tool types remain discontinuous entities. Each type is seen as distinct and separate. The elements which go into defining these types are cast as discontinuous. For example, retouch is classed as different types, amount of retouch as either partial or complete, endshape as either curve or truncation, and location of retouch as either dorsal or ventral. Geometrics are defined by the absence of the bulb of percussion, together with the overall shape of tool. So whatever transformations certain types are said to go through over time, there is nevertheless a distinctiveness of each type, an ideal type *to transform from* – or, more likely, *towards,* in the case of the lunate.

## Ethnicity

All of these discontinuities are seen as representations of ethnic differences, which by extension are themselves seen as bounded and discontinuous. Overall, Bar-Yosef assigns a direct 1:1 relationship between material culture and ethnicity in the Epipalaeolithic. Tool types represent boundaries between social groups. By the Neolithic, he claims there was a different, more complex, relationship with tool types, involving exchange and relationships between different groups of hunters. However, he often calls on later prehistoric methods of assigning ethnicity to certain classes of artifacts for justification in doing this for this earlier period. "It is also worth noting that local Levantine archaeologists find support for their approach in the works of colleagues who study the Near Eastern Bronze and Iron ages. Written documents favour tentative correlations between archaeological assemblages and specific peoples" (Bar-Yosef and Vogel 1987:221).

There is an original ethnicity in each group – a pristine state from which they may have fallen through acculturation or contacts, but which is discernible in material culture nevertheless, if all known contact-effects are discounted. The use of the figure of discontinuity in defining these groups contrasts strongly with the continuity that characterises the developmental trajectory through time.

Ethnicity and its discontinuities are seen in spatial relationships, described through 'ecological zones'. The regions under discussion, and the sites within them, are divided into broad ecozones: mountainous areas (Mount Carmel and Syria/Lebanon), the coastal plain (of Israel); the Jordan Valley; and the arid zones (Negev and the Judean Desert). These areas are linked to social/ethnic boundaries. "Epipalaeolithic cultures [are] independent units…[which] offer a pattern for distinguishing the differing tool traditions emanating from Neolithic sites which are so closely related to their well-defined ecology" (Bar-Yosef 1970:186). Thus we see similarity across time (with the Neolithic) and dissimilarity across space (with sharply defined ecological zones that define social boundaries).

The definition between ecozones comes to be simplified into the idea of a heartland and a periphery. The heartland, or Mediterranean zone, is located in the Coastal plain and Mount Carmel regions, while the periphery is the arid zones of the Negev and Judean Desert together with Jordan, Syria and Lebanon. The arid zone assemblages are not portrayed as having the same relationship with Natufian assemblages as those from the Mediterranean Zone. "The description of the sites, within the context of geographical limits, indicate distributions which disclose *levels of technological development*" (Bar-Yosef 1970:199, my emphasis). The assemblages from peripheral areas were seen as non-geometric, and this cast them as not taking part in the developmental trajectory towards the Natufian.

The divide between Mediterranean zone and arid zone sites is generally portrayed in certain tool forms. 'Gravettoid' forms are found in non-Mediterranean zones – these are seen as distinctly different from, and not 'morphing' into, any other later too forms. The microgravette point, furthermore, is generally seen as a tool form characteristic of the Upper Palaeolithic (Western Europe). Its terminological use here suggests a distancing in time of these assemblages, where time is equated with a developmental ladder from Upper Palaeolithic forms to Natufian geometrics. In addition, these assemblages are seen as having fewer tool types than other sites. "Such an ...elimination...of types may give an archaic appearance to an industry" (Bar-Yosef 1970:196).

The tool forms characterising these assemblages are not seen as a direct response to environment in any direct or functional way. "Gravettoid forms...were used in a vast area extending from the Lebanon Coast to the Syrian Plateau and in Transjordan as well....these forms had no relation to environment....but rather a technological tradition of ethnological source" (Bar-Yosef 1970:197).

It is not tool differences but space itself that becomes the definer of ethnic boundaries. Having set up differences between these ecozones, the ecozones themselves describe social boundaries. In the case of Bar-Yosef's Geometric Kebaran B culture, the archaeological culture is seen as two different ethnic phenomena based on a division between heartland and periphery. Where other cultures are seen as being ethnically unitary, the Geometric Kebaran B is not. In the Mediterranean Zone, these sites are seen as part of the Natufian, representing small hunting camps, while Geometric Kebaran B sites in peripheral areas are seen as a different ethnic group altogether with no relationship in space or time to the Natufian. No tool forms or other lithic differences are called upon explicitly to make this difference: it is solely created the location of the sites in different environments.

## Overview of narrative strategies

Bar-Yosef takes metaphor and metonymy as his initial methodologies of constituting his field of study – first describing and classifying his assemblages (metaphor), then reducing his mass of data to manageable, meaningful parts of the whole (metonymy). These elements are then brought back together using synecdoche to give overall meaning to the period: a smooth continuous flow towards the Natufian, in opposition to arid zone occupants and their dead-end tool types.

His initial methodology is to sort, classify and register the lithic assemblages he is working with. Tools are classified by type, and entire assemblages are classified by culture. This is carried out by emphasising the similarities between tools and between assemblages. The levels of different cave sites are correlated, with similar assemblages compared. This stage of Bar-Yosef's work sets out the nomenclature he will be using for the period and its constituent parts. He discusses the name of the period, or the constituent cultures. He enumerates tool types which make up the assemblages, and describes them. He does not at this stage attempt to pull together any directional flow or to integrate the data in any way: his task here is to enumerate the full field of study in all its particularities.

Having done this, Bar-Yosef then *dissassembles* his assemblages. He takes a reductive approach in constituting his data for analysis. For example, one tool type comes to stand in for a culture or a period of time, metonymically. For the Kebaran, this is the micropoint, with the lunate representing the Natufian. He compares the proportions of micropoints (Kebaran), trapeze rectangles (Geometric Kebaran) and lunates (Natufian) in assemblages as a way of demonstrating how each tool type is related to, or stands in for, each cultural period. Various proportions and indices of tool types (index of microburin technique, geometric: non geometric, percentage of microliths) are used as parts which signify the whole (the Epipalaeolithic range of cultures). The indices and measurements of an assemblage determine which part of the Epipalaeolithic it belongs to. The full, detailed description of Bar-Yosef's earlier catalogue is gone, to be replaced by a more integrated vision of complementary indices, counts and proportions that create a symmetrical *grammar* for the period. This is used to temporalise space: the logic of types and indices is used to give a temporal order to sites that are actually distributed in space. Thus neighbouring sites with a high percentage of geometric microliths and a low index of microburin technique are placed in the Geometric Kebaran, while those with low percentages of geometric microliths are placed in the Kebaran.

Bar-Yosef's final analytical movement is to bring all the dispersed and reduced particular elements of his catalogue and analysis together synecdochically in a synthetic process. This is the trajectory seen from the earliest Epipalaeolithic towards the Natufian. Each part of this trajectory contains within itself its own relationship to the final stage of the Epipalaeolithic (and to farming, urbanisation and all future human developments), either as lunate 'potential' in an earlier tool type, or as 'archaic' assemblages with no geometrics. The nomenclature and identifications, similarities and correlations of Bar-Yosef's initial lexical stage, together with his disassembling into reductive parts or the whole, are arranged and mobilised to create an integrated picture in which each part is understood in terms of the overarching trajectory towards 'civilisation'.

This trajectory has a 'natural' pace of change, with each change happening through the gradually changing shapes of major tool types. Metaphors of natural, biological change are used to describe the advent of the Natufian. "In the central area....the Natufian culture was born" (Bar-Yosef 1970:201). Also development in the period more generally is subject to verbs of biological life , for example "Epipalaeolithic cultures, fermented from earlier manifestations…." (Bar-Yosef 1970:186). The progressive elaboration of incremental changes in an organic rhythm epitomises a conservative ideology, in which abrupt change is regarded with suspicion and agential control over history is limited.

It is within the synecdochical mode of understanding each part in relation to an overarching whole that Bar-Yosef utilises the chronic device of temporalising space. Here the parts of the region, cast as ecological zones, come to take on different relations to time. And in a parallel movement, time's trajectory becomes a developmental ladder.

Outside of this development, the arid zones are considered 'archaic'. Outside of such areas as Mount Carmel, it is necessary for "man to wander in search of sustenance" (Bar-Yosef 1970: 5). Even individuals in groups thus lacked a personal trajectory. Space has been co-opted into the developmental trajectory. Each element of Bar-Yosef's Epipalaeolithic is expressive of an underlying essence – its relationship to the *end* of the period and beyond.

## 4.4 Nigel Goring-Morris

### Background

Goring-Morris' main published work was from research carried out as a PhD under Bar-Yosef's supervision. Bar-Yosef's work had focused on the Mediterranean zone assemblages, distributions and tool types. Goring-Morris focused on the Negev and Sinai, which had only become available for Israeli investigation in the 1970s, following the aftermath of the Six Days' War. He sought to add the arid zone assemblages, discovered mainly in the 1970s and 80s, to the then current picture of the Epipalaeolithic cultural distributions.

The picture of the Epipalaeolithic that Goring-Morris inherited was Bar-Yosef's, which had become widely accepted and influential. Since Bar-Yosef's work, during the 1970s, the US had come to have greater influence in Israel, and this was reflected in Israeli prehistory. Several American-led or joint projects were undertaken, such as the Gebel Maghara project in the Sinai and the Avdat project in the Negev. The American New Archaeology was influencing the goals and methods of prehistorians in Israel. There was a growing interest in subsistence and settlement, as well as the accompanying search for nomological laws of behaviour. Archaeology of the 1970s (throughout the western world) was witnessing a growing interest in the dimension of space. Techniques such as site catchment analysis, spatial analysis and investigation of regional territories and settlement patterns were borrowed from the discipline of geography (Bailey 1983). Archaeological survey was an increasingly important methodology.

In a sense, archaeological survey had always been important in Israel – as early as the Mandate period, the concept of *yediat ha'aretz* was an important Zionist concept to settlers in the area (Shavit 1997). Roughly translated as 'knowledge of the land', or of the homeland, the concept was an important force in educating young people about their new land, and in the project of identifying modern Arab villages with hitherto unknown Biblical locations. By the post-Six Days' War period, the marking out of territory became politically important in Israel. The cult of West Bank holy places helped to mark ownership of the newly acquired West Bank (Elon 1997). In the deserts of the Sinai and the Negev, also newly acquired, settlements and new towns were extending throughout the area.

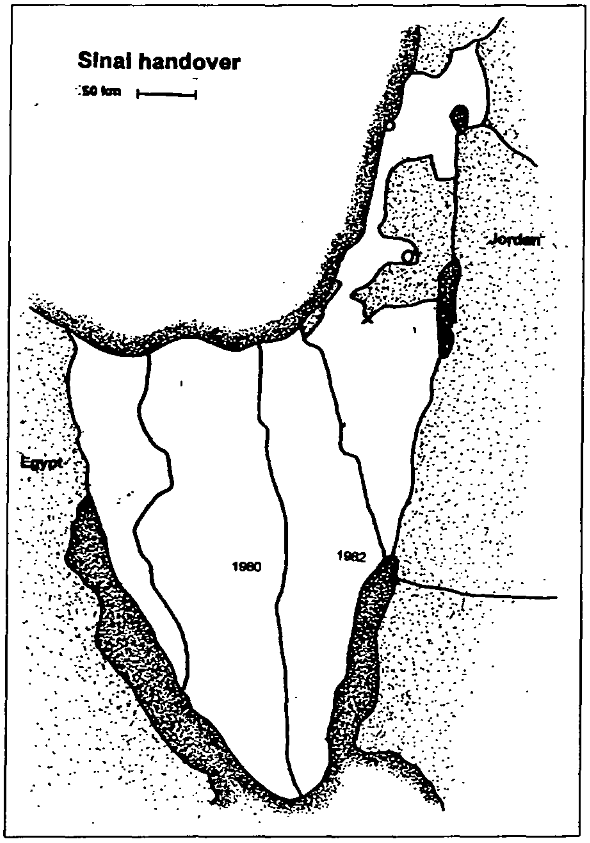



Figure 4: 5 Boundaries of Israel at their greatest extent after the 6 Days' War, shown with boundaries agreed in the Camp David Accord

The taming of arid zones had been an important image since the 1950s in Israel, but the recently increased desert territory of Israel made it particularly important in the late 1960s and 1970s. The idea of 'making the desert bloom' was a national goal, which the desert settlers were making concrete – and there was a concomitant interest in earlier settlers of the desert. Excavations were often commissioned by the new town planners, as a way of linking the new settlers to the history of their land. These usually centred on a large, highly visible monument or town. But the exhibitions and presentations of the history of the sites, such as Arad, a Bronze Age site and new town, often described an earlier hunter gatherer presence. The continuous occupation of the desert, from earliest hominids through the Iron Age, was an important educative goal. Much research effort went into the archaeology of, for example, late Iron Age run-off farms in the Negev.

During the 1970s, the Israel Antiquities Authority carried out extensive surveys in the Negev Desert. In 1979, the Camp David Accord had negotiated the return of the Sinai to Egypt, staged over several years (figure 4.5). Israeli archaeologists were concerned to map out the spread of prehistoric cultures across this region before the area was once again lost to them. The Negev, although not being handed over to Egypt, was to become the new border with Egypt. Israel's substantial armed forces were to occupy it, possibly damaging archaeological sites and making parts of the region inaccessible.

Goring-Morris worked on the Epipalaeolithic element of the Negev Emergency Survey. Questions of time and the sequencing of periods were seen to have been settled with Garrod and more specifically Bar-Yosef's work, using tool typology. Goring-Morris' concern was the exploration and explanation of space – and this new concern can be seen to structure the narrative of his analysis.

## Cultures

Cultures form an a priori classification system in Goring-Morris' work. He broadly followed Bar-Yosef's method of defining cultures through the proportions of tool classes and types, adding in certain new arid zone tool types and cultures. He sees sites as the smallest unit of material remains and uses them as "building blocks" to construct cultures (Goring-Morris 1995). Goring-Morris sees the process of assigning sites to a culture as the lowest rung of a hierarchy of information to be obtained from a site, and as information that can be acquired from even the most post-depositionally degraded sites (e.g. deflated, eroded, mixed, etc). However, the chipped stone analysis which forms the body of the work is based on cultural divisions to such an extent that individual assemblages from each site are not described as a unit. They are disassembled into their constituent tool classes and reassembled into composite 'culture-assemblages'. So, for example, all the burins from sites classified as Geometric Kebaran are described together, and all microliths from these sites are then described together, and so on. Goring-Morris' illustrations (Goring-Morris 1995) show these 'culture-assemblages' with tools drawn from many sites to create a composite assemblage representing each culture. There is very little discussion of this phase of analysis – how each site is assigned to its culture is a 'black box'.

The concept of assemblage composition as representing ethnic divisions is carried over from Bar-Yosef but, simultaneously, Goring-Morris also wants to use these same tool types to discuss subsistence and settlement issues. The range of each tool type within the culture as a whole is described, in terms of different proportions within each assemblage, or technological indices. Parts of these ranges will come to represent 'site types' in terms of settlement and subsistence patterns. For example, sites with high proportions of tools to debitage are considered special activity sites, such as hunting sites. However, these comparisons remain within the original cultural classifications, presented as a 'given' at the beginning of the analysis.

In addition, Goring-Morris seeks to use tool types to represent functional differences in tool use. To do this, he amalgamates certain very similar tool types in order to emphasise variability between sites. Within the microlith class, all tools are reduced to 5 'functional types':

| Functional types | Included tool types | Culture |
|---|---|---|
| Finely retouched bladelets | I1-2 | Kebaran |
| Blunt backed bladelets | I9 | Mushabian |
| Pointed backed bladelets | I10-27 | Mushabian |
| Rectangles | J1-8 | Geometric Kebaran |
| Lunates/triangles | J9-14 | Natufian |

Figure 4: 6 Microliths divided into functional tool types (after Goring-Morris 1987)

The category of pointed backed bladelets, for example, includes a range of 17 tool types that are arched and pointed in slightly different ways – tools originally called scalenes, arched backed bladelets, obliquely truncated bladelets, and micropoints, amongst others. Having amalgamated tool types together to create greater variability in the tool proportion profile of each site, Goring-Morris then used the statistical method of Smallest Space Analysis on the proportions of these functional tool types in each assemblage, in order to investigate how similar sites were to each other in terms of toolkit compositions. However, " the overwhelming impression from this analysis is that the postulated functional microlith forms still primarily reflect emblemic stylistic criteria" (Goring-Morris 1987:393) – in other words, cultural divisions rather than functional differences. This is not surprising when one remembers that the cultural divisions and assignation of sites to those cultures has been done on the basis on proportions of these tool types. For example, the eight tool types included in Goring-Morris' functional category of rectangles are all used to define the Geometric Kebaran. So sites with high proportions of these 'functional types' will by definition be Geometric Kebaran.

The small proportions of non-microlithic tool classes present, such as scrapers, were also used to show variability within cultures, interpreted as showing the range of tasks carried out as a site.

Consistency of tool type within culture is an important part of the picture drawn of cultures. For example, sites have been shifted from one culture or time frame to another, usually without any discussion of the process involved. Goring-Morris has shifted some sites described in Bar-Yosef's 1970 work, which had time-anomalous tool types – such as sites considered to be Later Epipalaeolithic, which had been described as having Early Epipalaeolithic tools. For example, Poleg 18M was classified as a Geometric Kebaran site by Bar-Yosef, but was reclassified as a Kebaran site by Goring-Morris. Ein Gev IV was shifted back in time by Goring-Morris from the Geometric Kebaran to the Nizzanan on the basis of its microgravettes, an 'early' tool. Sometimes the typological designation of the dominant tool at a site is changed so that a site can be moved from one culture to another, with the effect of lessening morphological variability within the first culture. So, Azariq 1 was classified originally as transitional to Middle Epipalaeolithic (Goring-Morris 1987) with arched backed bladelets and geometrics predominating in the assemblage, while later (Goring-Morris 1995) it was classified as Early Epipalaeolithic, with arched backed bladelets becoming micropoints, an 'earlier' tool type (see figure 4.7). None of the shifts here are based on independent dating evidence.

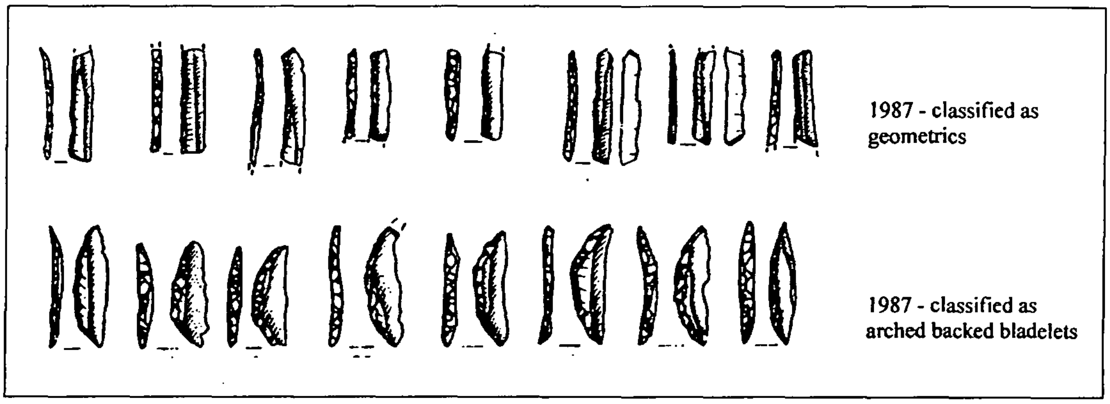



Figure 4:7 Microliths from Azariq 1 (taken from Goring-Morris 1987). Lower row was later reclassified as micropoints

## Punctuated equilibrium

As in Bar-Yosef's work, the passage of time is seen through the succession of cultures – but Goring-Morris sees cultures as timeless and essentially stable constructs. "Adaptations and stylistic variables demonstrated relatively stable conditions bounded by rapid transitions" (Goring-Morris 1987:443). A culture is defined by its typological characteristics, as represented by a suite of *fossile directeurs*, which stays the same throughout the duration of a culture. Each distinct set of *fossile directeurs* represents a different culture, a different 'block' of stable time. The composite culture-assemblage represents this block, and variability within it represents not the passage of time, but the different parts of a stable, interlocking system.

These different components are largely signalled through technological indices such as tool:debitage ratio, or tool:core ratio, as well as site size/elevation. Changes in size of tool or retouch type are seen as regional differences. Typological change signals different cultures and is seen as abrupt: Bar-Yosef's emphasis on transitionals is lost. When there are types representative of more than one culture in an assemblage, this is seen as signalling contact between two ethnic groups, possibly with a temporal element added. For example, assemblages with obliquely truncated backed bladelets are called Ramonian; if there are lunates in the assemblage as well, it is considered a terminal Ramonian site, overlapping with the Natufian in time, possibly with direct contact between the 2 cultures. However, the Ramonian is not seen as *changing into* the Natufian through this process. Change from one culture to another in time is seen as abrupt and differences between cultures are absolute.

Interestingly, this is not unlike Garrod's view of culture change, and the pace of that change, in her work during the 30s at Mount Carmel (see chapter 2). The lumping together of many levels of excavation in these cave sites can be mirrored in Goring-Morris' analytical strategy of lumping together many sites to create a culture-assemblage, homogenous and unchanging until a radical change brings on a new culture.

### Spatial relationships

While time remains stable for the duration of a culture, Goring-Morris uses the construct of the culture to map out spatial relationships. There is a concern to show the spread of each culture through dots on maps. He describes a concertina effect of cultures moving in and out of the arid zone as circumstances allow. Within a culture, the variability in assemblages is analysed as the seasonal round of site locations. Groups move from one location to another depending on season: in relation to climate, group size/aggregation, and seasonal subsistence tasks. Certain ranges of assemblage composition represent certain 'site types' in relation to their location in space and inferred seasonal, cyclical time. Each culture thus becomes a closed spatial system, with sites distributed in relation to each other in a schematic cyclical time and space equation. Within this system, variability is shown through continuous variables, with proportions and indices making up the variability. However, sites are then classed as particular types, discontinuous from other site types. This is reflected in the picture of the behaviour that created the sites. Whole cultures are seen to have particular, unchanging adaptations, persisting over several thousand years of summers and winters, group relationships, stone knapping and hunting episodes.

### Climate as prime mover

Abrupt cultural changes, as well as cyclical spatial relationships, are seen as caused by one factor external to the systems. In Goring-Morris' work, it is the environment which is the cause of all change. "...the available data indicates that environmental variables constituted a prime mover in terms of the nature...of human adaptations in the region" (Goring-Morris 1987:442).

At every scale, environmental determinism dictates human behaviour, as constructed through stone tool/microlith classification. A major cultural change from, for example, the Kebaran or Nizzanan to the Geometric Kebaran, is instigated by climate amelioration "...a high degree of correlation between environmental and cultural development is apparent." For his 1987 work, Goring-Morris inferred climate from geomorphology studies in and out of the region. He also inferred climate from numbers of sites assigned to different periods. Thus, because there were many Geometric Kebaran sites, he inferred improved climate for the Middle Epipalaeolithic.

In more recent publications, Goring-Morris uses pollen cores from the Hula Basin in the north of Israel (Baruch and Bottema 1991). He sets the progression of cultures against two pollen core diagrams (Goring-Morris 1995) to show correlation of culture change with climate change (see figure 4.8). The divisions between the major culture shifts used are the traditional Mediterranean zone ones – Late Kebaran to Geometric Kebaran; Geometric Kebaran to Natufian. However, in the body of his work, the described cultural variability does not actually correspond to this pattern. In the Mediterranean Zone there is a progression, and a major shift, from Geometric Kebaran to Early Natufian, while, at the same time, in the Negev, Goring-Morris describes continuity between the Mushabian/Ramonian to Terminal Ramonian. And similarly, the Late Kebaran to Geometric Kebaran culture shift in the Mediterranean Zone is less clear in desert regions. Goring-Morris himself suggests 'residual' populations (of Kebaran groups, presumably) and radiocarbon dates also suggest very 'late' Kebaran sites (Hovers and Marder 1991). So, the major divisions set out visually in diagrams, and confirmed in the text, are constructs to show correlations with peaks in pollen diagrams. In addition, the pollen diagrams themselves do not always confirm these shifts. "About 15000 BP there are indications of a sudden shift, followed by a steady, incremental process of climatic amelioration" (Goring-Morris 1998:77). However, the Tsukada diagram presented in this article clearly shows a substantial sharp downward fluctuation of arboreal pollen in the Geometric Kebaran, followed by equally sudden amelioration, and then another drop. Climate in the Geometric Kebaran does not appear to be either stable, or universally better.

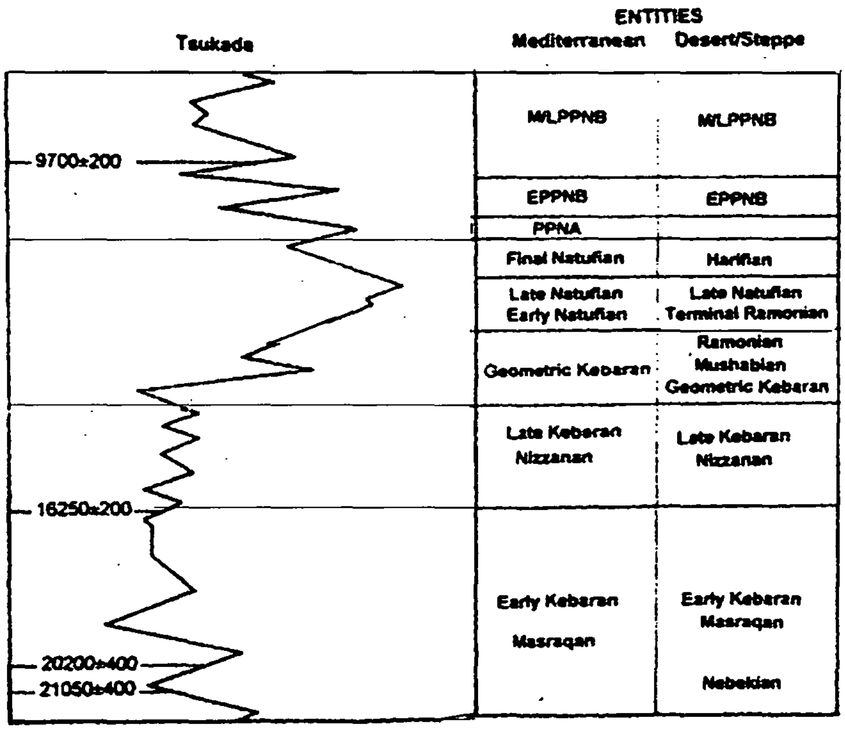



Figure 4: 8 Aligning of cultures with climatic shifts (taken from Goring-Morris 1998)

The pace and quality of time is seen to reflect the nature of the presented picture of paleaoclimatic change. The only passage of time delineated here is that of rapid, sudden and unforeseen change. This is the 'motor' for the change seen from one culture to another. With each culture portrayed as stable and unchanging over its duration, a mechanism for abrupt change is found in the image of climate catastrophe. "Environmental change in many instances appears to be a mechanism causing instability and stress to adaptive systems" (Goring-Morris 1987:443). Time has thus become figured by large scale environmental change – much like Garrod's view of geological time split by abrupt changes.

## Ethnicity

In this close alliance between 'culture' and large scale environmental change, ethnicity is closely tied to adaptive settlement patterns. Goring-Morris creates an interlocking pattern of 'site types', with the whole range and location of these types presenting a unique adaptation for each culture. Using ratios of different technical categories, together with site sizes and elevation, he assigns sites to certain types: base camps, hunting sites, seasonal aggregation sites, and so on. It is the overall pattern of these types which creates a picture of the adaptive system unique to each culture (see figure 4.9).

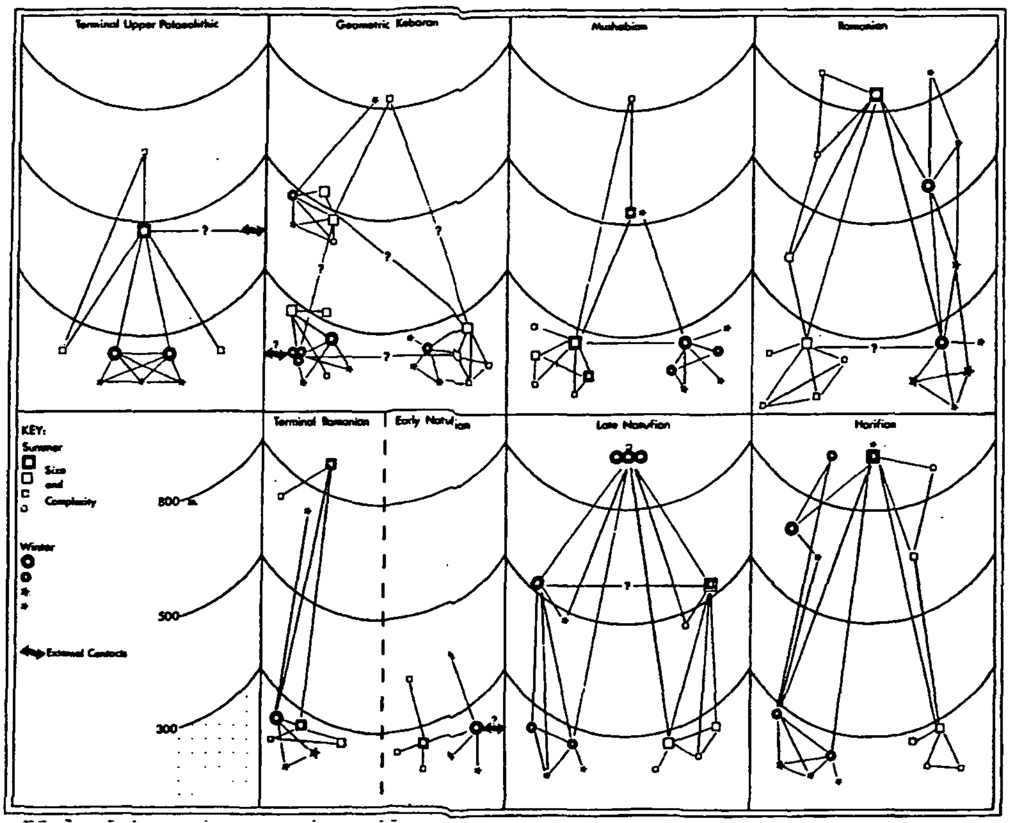



Figure 4:9 Settlement patterns of various cultures. Taken from Goring-Morris 1987.

Sometimes the differences between these types, or between the patterns of each culture, have to be forced. For example, Goring-Morris presents the Ramonian pattern of tools:site size ratio as significantly different from preceding cultures, saying that there are bimodal peaks in distributions. In fact, distributions of tools across the six categories of toolkit sizes are fairly uniform for the Ramonian (see figure 4.10), especially considering that the total sample for this statistic is 12 Ramonian sites.

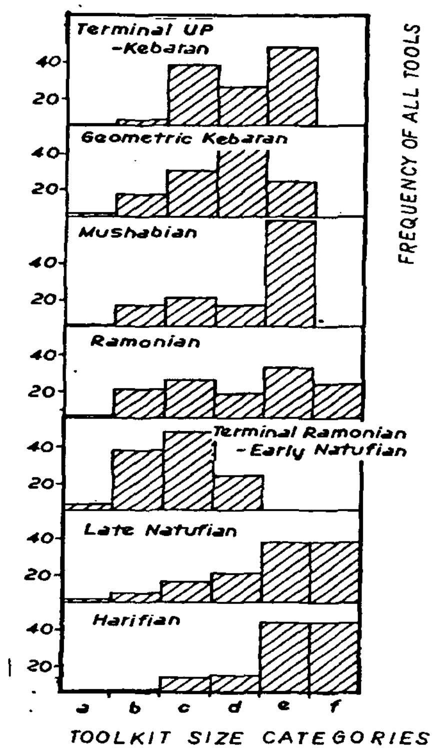



Figure 4: 10 Numbers of tools in toolkits of various sizes, by culture (taken from Goring-Morris)

Site distributions of cultures are also sometimes forced into distinct groups. The Mushabian is said to be a 'desert-adapted' group, based in part on having sites farther away from water sources. Yet the vast majority of Mushabian and Geometric Kebaran sites in the Negev are in the same locations. The impression of one culture 'tethered' to water and another culture with a completely different rational for site location is created through emphasis on a very few Mushabian sites further away from inferred water sources.

Adaptive patterns are portrayed as being as stable as cultural entities. Indeed, a culture cannot shake off its adaptation. The Geometric Kebaran is seen as a Mediterranean Zone phenomenon (Bar-Yosef 1970, Goring-Morris 1987, 1998) which expands into the Negev with Mediterranean Zone climate during a so-called amelioration. As the climate then becomes more arid, the Geometric Kebarans must go North again because their adaptation no longer works. As there are almost no radiocarbon dates from Geometric Kebaran sites outside the Negev, movements over time are not independently verified.

Just as adaptational patterns are linked to cultures, cultures in turn are represented to us by different microlith styles. While the overwhelming picture is one of environments and adaptations to them causing cultural change, the nature of the change, as represented to us in lithics, is not 'functional' in nature – there is no suggestion of the tools themselves being used in different ways. Their variability is the expression of ethnic identity, which has somehow changed in response to climate change. "Technological, typological and stylistic proclivities of assemblages are considered to reflect the identity...of the occupants of the sites" (Goring-Morris 1987:45). And of course, the a priori definition of these cultures (which later are allied to distinct adaptational patterns) is stylistic microlith variability. "Secondary technological traditions, typological characteristics and stylistics are much more sensitive indicators for the definition and isolation of the various industries representing social groups" (Goring-Morris 1987).

## Causality and change

Cause and effect are important to Goring-Morris' narrative. The nature of the relationship between the two main elements, culture and environment, is seen as causal, in a mechanistic mode. "A number of crises or 'bottle-neck' situations, most resulting from environmental changes, are described which caused radical realignments in social and subsistence systems" (Goring-Morris 1998: 71). The changes in lithic assemblages over time are caused by environmental changes – culture and climate are necessarily in lock-step. Climate is seen as an overarching impersonal force that visits change on unsuspecting human groups.

However, the kind of change engendered is not, as might have been suspected, of an entirely or even primarily functional or subsistence nature. Change in lithic forms are not seen as suggesting different hunting or other practices. In addition, there is no suggestion that assemblage composition, which *is* seen as signifying functional variability, changes with major culture change. The full range of assemblage compositions occurs within each culture. Instead, the fundamental changes that occur in response to major environmental shifts take place in the realm of tool morphology (distinct tool types).

Having composed cultures on the basis of tool morphology, and correlated shifts from one culture to another with climatic shifts, there is a 'post hoc' creation of adaptive systems within each culture. There is an emphasis on elements creating *difference* between cultures to suggest adaptive difference between cultures, bringing the argument full circle back to climate change. The linkage between a culture and its adaptation and environment is cast iron, as seen in the relationship between the Geometric Kebaran and the Mediterranean Zone, and the Mushabian and the arid zone. "The Geometric Kebarans in common with the Mushabians appear to have lacked the technological means to rearrange their subsistence strategies..." (Goring-Morris 1987:430).

The power given to non-social mechanisms in this system is reinforced by the use of impersonal, non-human and scientific terminology, such as parallel phyla, amplitude, oscillations or favourable niches, as metaphors for groups and their relationships. Words usually used to describe animals and their behaviour, or to measure physical phenomena, give the impression of an authoritative 'hard science'. Concepts generally associated with a cultural-historical analysis, such as culture, ethnicity and movements of people, are discussed in a language used by processualists.

In Goring Morris's work, the general sequence of events and the particular relationship between the cause (climate) and the effect (culture) is arranged in a way that Hayden White would characterise as a 'tragedy'. Climatic changes are experienced as difficult and causing stress. Culture change is unwelcome and forced by external circumstances. While cultures achieve a kind of stability, (seen in the 'classic' form of their fossile directeur), this is only to be dashed by the climate change which inevitably comes, causing 'disequilibrium'.

Goring-Morris believes that the very few radiocarbon dates and even rarer stratigraphy related to the Geometric Kebaran and the Mushabian suggest that these two entities co-existed in the same area of the Negev for 1000 years. Goring Morris suggests that these are clues to an Epipalaeolithic struggle for turf that may have happened around 14,000 years ago. He suggests that the desert adapted Mushabians came from North Africa, and settled the Negev. The Geometric Kebarans, from their heartland in the more lush Mediterranean zone, also settled the Negev and for a period they competed for the same land and resources. The Mushabians won in the end and the Geometric Kebarans retreated North, later to develop into the settled Natufians, precursors to domestication and the Neolithic – us, in fact. The Mushabians, left in the desert, continued for a time, developing into the similar Ramonian. When increased aridity struck, they eventually abandoned the desert or died out.

The parallels with the modern political situation are striking – Goring Morris' research was carried out in the desert during the aftermath of the Six Days' War, when Israel had militarily moved into, and settled, the Negev and Sinai. By the time his work was published, Egypt once again owned the Sinai. The Emergency Survey of the Sinai and the Negev that he was working for was commissioned by the government in reaction to the imminent loss of sites/land. The analogy is obvious with Epipalaeolithic ethnic groups who competed for the deserts of Israel, with the Mediterranean zone group losing out, and returning back to its heartland to continue its development into farming cultures and beyond.

### Overview of narrative strategies

The analytical movement in Goring-Morris' work starts with a set of already-constituted archaeological cultures, comprised of sites and tool types, which are then transformed into a set of cultures representing adaptational responses to climate. The nature of the entity described is reinforced – at the end of the work, cultures are more bounded, more inevitable; change from one culture to another in time is more abrupt and catastrophic, uncontrollable. The representation of activities and subsistence methods is even more externally determined, and individual sites are more firmly subsumed into the culture as a whole.

This is done through dealing with each culture spatially. Within a culture, sites are arranged into a notional representation of a seasonal round, using continuous variables. This is seen as a stable system. At the same time, the distribution across actual regional space is mapped using discontinuous variables – these represent culture-boundaries, and changes between them are abrupt, representing disequilibrium forced on stable systems.

Differences between cultures are then emphasised by linking them to different adaptations/environments, and by the relationships between cultures. There is no emphasis on transitionality. Cultures are thus reinforced as bounded. This is explained through aligning these changes with climate changes.

Each part/site is understood in relation to the whole culture. It is first presented in its most 'raw' form as one example of its (already present) culture. The next phase of analysis integrates all sites and their assemblages further as the culture-assemblage. Finally, each site is seen as a 'type' in relation to the other types within that culture, an example of a certain adaptational pose within the integrated adaptational system which is what the already-existing culture becomes. Sites never have their own 'identity', from start to finish.

This synecdoche of meaningful and bounded archaeological cultures already existed at the start of the work, invisible through its taken-for-granted, pre-existing status. It continues in the guise of adaptational systems which are also bounded and meaningfully-closed systems. And it is given credibility, within the developing thinking of the 1970s, through alignment with climate change as the explanatory device. Through its invisible status, the concept of culture has gained *more* power.

Within this overall trope of synecdoche, the relationships between different elements are spatial, proximate and horizontal. The sites as 'site-types' have a notional spatial relationship to each other (quite different from their original spatial relationship) in terms of the stylised seasonal movements of people. When sites representing cultures are not separated spatially or temporally, such as the Geometric Kebaran and the Mushabian, they relate to each other through spatial disputes. Even temporal change is explained as a relationship of *contiguity* between climate patterns and culture patterns.

Goring-Morris takes as his starting point Bar-Yosef's methods, broadly using his cultural divisions and methods for achieving them. His raw elements are mainly from different sites, but involve similar types of evidence, such as percentage of tool types or microburin indices. However, Goring-Morris creates quite a different picture from that of Bar-Yosef through a different use of narrative structures.

While both have an outside moving force far removed from the particularity of any given site, the picture Goring-Morris constructs is different. He unites narrative elements horizontally in their relationship to climate, or to cyclic patterns, or to land disputes. Time becomes 'spatialised'. The problem to be solved has become how to make sense of lithics over space. However, the conflation of this with Bar-Yosef's temporal cultures creates a problem for how change from one culture to another can occur. Cultures are stable systems, and time is relegated to the 'gaps' in between these entities. Temporal change is abrupt and unexpected, unlike Bar-Yosef's gradualism. Cause and effect in the form of environmental determinism has taken the place of spirit of age.

## 4.5 Donald Henry

### Background

Don Henry's earlier research in the Levant (e.g. 1973) was in Israel but, by 1978, he was setting up fieldwork in Jordan. This area had not been widely investigated by prehistorians since early work by Kirkbride. The state of play when he began was thus similar to that Goring-Morris found when starting his survey work in the Negev. Henry's Northern Hisma Survey also continued later than Goring-Morris' work, with synthetic publications in the context of his theoretical stance published in 1983 and 1989. Other fieldwork in Jordan was meanwhile being carried out by Geoff Clark in Wadi Hasa and by Andy Garrard in the Azraq Basin. The final publication of Henry's fieldwork was not until 1995.

Henry, as an American, was to some extent operating in the influence of both previous American fieldwork and theorising in the region. The processualist paradigm is important to his work and is frequently cited in his 1995 publication. He places himself within an 'Americanist' intellectual tradition from Julian Steward and Leslie White to Lewis Binford. Tony Marks, who carried out fieldwork in the Negev, and Bar-Yosef's work in the Sinai and Galilee, may have given Henry the dual interest in functionalist and cultural-historical paradigms that drives his analysis.

### Culture-history

In extensive theoretical discussions in both his 1989 and 1995 publications, Henry emphasises the importance of his cultural-historical framework for understanding prehistory. He sees the methods of culture-history as providing a crucial *base* for processual interpretations. The method is useful, Henry suggests, in " describing materials and their organisation in time-space dimensions without explaining them" (Henry 1995:3). "This study incorporates a descriptive, cultural-historic component and an explanatory, processual one" (Henry 1995:417).

Culture-history is thus a method that forms the basis for further research. The first stage of work following an excavation or survey was to classify sites: "the great majority of archaeological occupations were seriated on the basis of artifactual attributes....although stratigraphic and chronometric evidence assisted in sorting out cultural systems in time and space, the patterned variability in those attributes of lithic assemblages...proved the most useful" (Henry 1995:421).

Henry places great emphasis on the overall *structure* of the classificatory framework. Modelled on Clarke (1968), Henry presents a hierarchical structure for classifying lithic assemblages which allows the positioning of new entities into existing Epipalaeolithic systematics, "whereby differences and similarities between assemblages can be expressed at different scales" (Henry 1989:84). This structure codifies in a formal framework the types of relationships between assemblages that other researchers had been using, but within a set of nested hierarchies. In order of increasing specificity/levels of similarity, the categories are complexes, industries and phases/facies (see figure 4.4).

| Archaeological taxon | Socioeconomic scale | Scale of similarity within taxon |
|---|---|---|
| Complex | Technocomplex | Broad temporal and spatial distribution<br>Broad macroenvironmental setting<br>Generally similar economy<br>General settlement and demographic patterns |
| Industry | Culture group | Temporal/spatial distribution is large and may be discontinuous<br>General environmental setting<br>Generally similar economy<br>General settlement and demographic patterns |
| Phase or facies | Culture | Limited and continuous temporal and spatial distribution<br>Similar environmental setting<br>Similar economy<br>Similar settlement and demographic patterns |

Figure 4: 11 Correlation of archaeological taxons and socioeconomic scales in Henry's work

The levels of similarity to be expected at each level are specified. Types of lithic similarities specified at complex level include similarities in percentages of major tool classes and microburin technique indices; industrial similarities are seen in geometric microlith types, backed bladelet types and bladelet dimensions; and phases or facies of an industry are seen in specific retouch type or the presence of certain tool types (e.g. Henry 1989:85) (see figure 4.12).

| Phyla | Arid zone | | Mediterranean zone | | |
|---|---|---|---|---|---|
| Complex | Qalkhan | Mushabian | Kebaran | Geometric Kebaran | Natufian |
| Industry | Qalkhan | Madamaghan<br>Negev Mushabian or Ramonian<br>Sinai Mushabian | Hamran<br>Various Kebaran | Hamran<br>Geometric Kebaran | Natufian |
| Phase or facies | | | Early Hamran | Middle Hamran; Late/Final Hamran | Early Natufian; Late Natufian |

Figure 4: 1 Henry's phyla

So, the Early and Middle Hamran are taxonomically linked and distinct from the Qalkhan, which is placed in a different technocomplex. In order to show similarities between Early and Middle Hamran assemblages, Henry stresses similar technological strategies, indicated by similar core percentages in assemblages. Early Hamran cores are present in small numbers and “single platforms are rare” (Henry 1995: 257), unlike Qalkhan assemblages, where single platforms are common. However, on investigating Henry’s published data, Early Hamran, Middle Hamran and Qalkhan assemblages all have similarly small core percentages, and Early Hamran and Qalkhan assemblages have nearly identical percentages of single platform cores (69%) (Henry 1995: 228 & 257). There is no data on core types for Middle Hamran assemblages. So what is intended to be a purely descriptive technique is already being used as an analytical device to create order and meaning.

## Ethnicity

Henry does not only use this cultural-historical method to describe materials and their organisation. “Perhaps an even more important contribution of culture-history as a foundation for processual inquiry rests in the framework it provides for defining specific social or ethnic groups" (Henry 1995:2). Henry sees a very clear correspondence between ethnicity and the groups defined by cultural-historical method. "It is clear that the material cultural classification used in the definition of the complex and its industries is truly detecting patterned variability in prehistoric ethnicity and not merely functional variability" (Henry 1989:170). This then forms the basis for identifying boundaries between groups; "...classificatory units differ from other units of the same scale because of the differences in the identity of prehistoric interest groups as opposed to functional differences *within* such interest groups" (Henry 1989:170).

Henry links his lithic assemblage taxonomy with a taxonomy of cultural/ socioeconomic data. Other types of data are used to 'flesh out' a picture of variability in environment, settlement and subsistence, which are said to correlate with levels of variability in assemblages. A lithic complex represents a 'technocomplex', an industry is a 'culture group' and a phase or facie is a 'culture'.

### Hierarchy and Structure

The levels of variability outlined allow the incorporation of Jordanian assemblages into the classification framework which embraces Israeli ones. "...new 'industry level' labels (i.e. Early Hamran, Middle Hamran, etc.) are employed. In order to convey the affinities of the Hamran industries to those of the Kebaran and Geometric Kebaran, I have elevated these labels to taxa of a higher order, that of 'complex'" (Henry 1995:243). The hierarchical, taxonomic structure of relationships created demands that each 'box' at every level be 'filled' with an archaeological entity. Thus, the arid zone cultures (see below) must have predecessors. "...the Qalkhan appears to fill the void immediately preceding the Mushabian" (Henry 1995:215). The socio-economic/cultural picture is thus, like lithic assemblage variability, hierarchical in its structure, and non-overlapping in similarities with neighbouring 'taxa'. Henry's taxonomical predecessors are biologists and a biological motif is reflected throughout "From an adaptive perspective, cultures do in many ways resemble species" (Henry 1995:418).

The taxonomy itself has come to take on meaning in the 'description' of behaviour. He presents his taxonomy as having two major 'branches' or 'phyla'. One encompassed the Geometric Kebaran and leads to the Natufian, while the other links the Mushabian/Madamaghan, with the Qalkhan as its predecessor. These two traditions coexist across the entire Epipaleolithic.

## Transhumance

Henry sees cultural-historical typology as a base, a preliminary, for the explanatory or processual analysis. The form his processual analysis takes is the attribution of transhumant settlement patterns within each cultural entity. He sees a long term patterned exploitation of the different elevational levels within Southern Jordan.

In order to delineate these patterns within a culture, he sets up categories of sites – lowland rockshelter sites, with evidence of longer term occupations, and upland open sites, more ephemeral in nature (see figure 4.13). These categories are used to create and to explain variability within culture.

| | Lowland | | | Upland | | |
|---|---|---|---|---|---|---|
| Survey area | Jebel Hamra | | | Wadi Judayid | | |
| Sites | J201 | 830masl | Early & Middle Hamran | J21 | 1080masl | Early Hamran |
| | | | | J22 | “ | Early Hamran |
| | J203 | “ | Middle & Late Hamran | J31 | 1080masl | Middle Hamran |
| | | | | J26 | 1080masl | Middle Hamran |
| | J202 | “ | Late Hamran | | | |
| Survey area | Jebel Mishraq | | | Jebel Humeima | | |
| Sites | J504 | 860 masl | Early Hamran | J431 | 950-1020masl | Qalkhan, Madamaghan |
| | J520 | 870 masl | Early Hamran | | | |
| | | | | J405 | “ | Qalkhan |
| | | | | J406b | 1020 masl | Qalkhan, Early Hamran |
| | | | | J407 | 950-1020masl | Qalkhan |
| | | | | J436 | “ | Madamaghan |

Figure 4: 13 Categories of lowland and upland sites

Each culture has a seasonal round which involves different parts of the survey area. "The distribution, settings and artifact content of Hamran sites point to a transhumanant pattern of settlement and procurement in which groups coalesced in the lowlands during the winter and dispersed into the uplands during the warm season" (Henry 1995:279).

Henry also places Madamaghan groups in the lowlands of the same valley as the Hamran groups, in the winter months, but surmounts this by pointing out that they were in different parts of the valley. Hamran groups were around lakes at the lower end of drainages from the uplands, while Madamaghan groups were near the upper end of drainages to the Rift Valley. Madamaghan groups were only found in Wadi Humeima, but Henry hypothesises a summer destination at coastal Red Sea locations. Qalkhan groups, too, are found only in Wadi Humeima. Henry first suggested that certain smaller sites in Wadi Humeima are summer locations, with the rockshelter Tor Hamar representing winter sites. However, later in the publication he suggests that, like the Madamaghan, Qalkhan groups have summer locations, in as yet undiscovered Red Sea coastal locations.

Some of the site categories Henry uses are not as clear cut as they may at first appear. He has emphasised elevations and site size/artifact density that set up a lowland/highland dichotomy. The actual elevations of the sites do not always fall into 2 categories so easily. For example, while the sites in Jebel Hamra and Jebel Mishraq do have similar elevations (830-870masl), those in Jebel Humeima fall midway between his two categories, mostly below 1000masl. The Wadi Judayid upland sites are found at around 1080 masl. It should also be noted, as Henry himself points out, that there is little actual difference in these elevations (at most 250m). There is only 80m difference between the upland Jebel Hamra sites and the lowland Jebel Mishraq sites.

Other differences between sites within upland and lowland categories are artefact densities, size and depth of deposit. Site J406b, an upland sites in Wadi Humeima, does not fit this dichotomy as it has thick deposits and high artefact densities. Henry suggests this is because of its location near a spring. However, other upland sites were also well situated for water. Hassan (1995) points out that Wadi Judayid sites during the Epipalaeolithic would have been located on the same level as the wadi, which had not been subject to deep erosion at that point, and would have created a large, marshy, riverine area. Overall, the environmental categorisation of the sites may not be straightforward – changing environment, different geomorphology and plant habitats have all been documented for these sites, creating a picture of complex and shifting environments not reflected in the categories. In addition, some of the differences between sites in depth and density of deposits may have been created by their different depositional contexts. The sites with thick deposits are usually rockshelters, where habitation may have been concentrated, while the thinner deposits are in open air settings, where habitation is not constrained and which would have been subject to erosion and sheetwash.

## Seasonality

A key element of Henry's patterns of transhumance is seasonality of occupations of sites. As has been pointed out by Baird (1996), this assertion is damaged by a lack of direct evidence. Henry relies on inferred exposure of sites to prevailing winds or likely cold temperatures in uplands to suggest they must have been occupied in the summer. For example, the upland site of J504 is suggested as a summer site because it would have been cold and open during a period of depressed temperatures (1995:279). However, Emery-Barbier's pollen diagram from this site (1995) shows a very high arboreal content (oak), and a warm humid environment. Much of Henry's seasonality is based on personal experience of existing in this region now. The warmth of stored heat from rock faces, and the hour when a site loses the sun in the afternoon, are reported as supporting evidence for seasonality.

The seasonal round for Madamaghan and Qalkhan sites is reliant on the hypothesis that summer sites will be found on the coast. In addition the elevation of the 'winter' sites is actually midway between his two categories of lowland and upland sites. The lack of any different subsistence relating to a different environment also makes the separation of Hamran and Qalkhan-Madamaghan settlement rounds unconvincing.

Comparisons of Geometric Kebaran and Madamaghan chipped stone tool kits reveal "...no real functional differences between the complexes" (Henry 1995:313).

## Tool provisioning

One of the reported elements of this transhumant lifestyle is the need for importing tool blanks to lowland Hamran sites. 25-30km from sources of *in situ* raw material, some lowland sites have blank:core ratios three times as high as those of the upland sites. Henry sees groups as bringing blanks to lowland sites as the most efficient way of transporting raw material long distances. This links lowland, chert-poor sites with upland chert-rich sites within a seasonal provisioning round. However, he makes no explanation of the numbers of lowland sites which actually have slightly higher core proportions than the upland sites (Henry 1995:282). He also does not point out that some of this variability between low and high core proportions in the lowlands actually happens between different levels at a single site (see figure 4.14).

| Site | Level | High core ratios | Low core ratios |
|---|---|---|---|
| J201 | MHA | 1:47 | |
| | MHB | | 1:132 |
| | EH | | 1:119 |
| J207 | L/FH | | 1:107 |
| | LH | | 1:137 |
| | MH | 1:48 | |

Figure 4: 14 Lowland sites from Henry's survey with differing core:debitage ratios (data from Henry 1995)

And information from Hassan's geomorphology report in Henry's 1995 publication suggests strongly that occupants of lowland sites did not go to upland sites to acquire raw materials for tools. Henry points out that wadi cobbles are often used in all the assemblages analysed. Hassan reports, "Chert derived from *in situ* sources also appears in the lag deposits on the pediments of the escarpment, and in stream cobbles found in the beds of wadis" (Hassan 1995:31). Thus, the majority of raw materials used are likely to come from wadi cobbles found in lowland or upland locations.

In this case, analysis of transhumant site-categories obscured evidence available from looking at each site as a whole, through its various stratigraphic levels. A different explanation of varying blank:core ratios might have included different technological choices at sites all classified as Hamran. However, continuity in knapping strategies between Hamran occurrences/phases is central to Henry's argument. Transhumance through the ages is not a developmental trajectory. Henry sees this mode of settlement as time-transgressive over 70,000 years in this region. This is the cyclical, within-culture site patterning that he sees in different site elevations.

### The role of environment

Henry creates a dichotomy in his lithic assemblages, cultural progressions and environments. "..the Qalkhan contributes to the evidence for a dichotomy between steppe-desert and woodland adaptations that stretched over much of the Epipalaeolithic" (Henry 1995:215). Meanwhile, "The ...evolution of the Hamran follows a very similar path to that recognised within the Epipalaeolithic of the core Mediterranean zone west of the Rift Valley" (Henry 1995:243). These two developmental trajectories are thus seen as inextricably linked to 'their' particular environment over thousands of years. "As an expression of a mobile foraging population adapted to exploitation of the arid zone, the Mushabian persisted on the fringes of the Mediterranean woodland from ca. 14-12,000 BP" (Henry:1995). Each level of Henry's taxonomical hierarchy is linked to more and more specific environments – a technocomplex shares a 'broad macroenvironmental setting', while a culture group shares a "general environmental setting". The two broad technocomplexes - one including Early, Middle and late Hamran and Natufian sites and found in the Mediterranean zone, the other including Madamaghan and Qalkhan sites and found in the arid zone - are distinguished from each other in terms of broad microlith classes, use of the microburin technique, and environmental setting. These longstanding relationships with environment are seen as linked not just to tool forms, but to ethnicity. "...within the Levant over the last 70,000 years or so, variability in cultural ecology appears to offer the best explanation for the region's marked ethnic diversity" (Henry 1995: 437).

Every opportunity is taken to stress links between cultures of the arid zone. Thus, a stratigraphic relationship between the Qalkhan and the Madamaghan occurrences at Tor Hamar is stressed, although site plans show a picture which is much less certain. At the same time, the presentation of cultures rather than sites obscures the undoubted stratigraphic relationship of the Qalkhan and Early Hamran levels at J406b. Links with other parts of the arid zone are also stressed by Henry, with occurrences in Petra and Azraq being called Qalkhan. However, other sites, such as Hofith and Kiryeth Aryah (Bar-Yosef 1970), that have been linked (Fellenr 1995) to these sites at Petra and Azraq but which are not themselves in arid zones, are not mentioned.

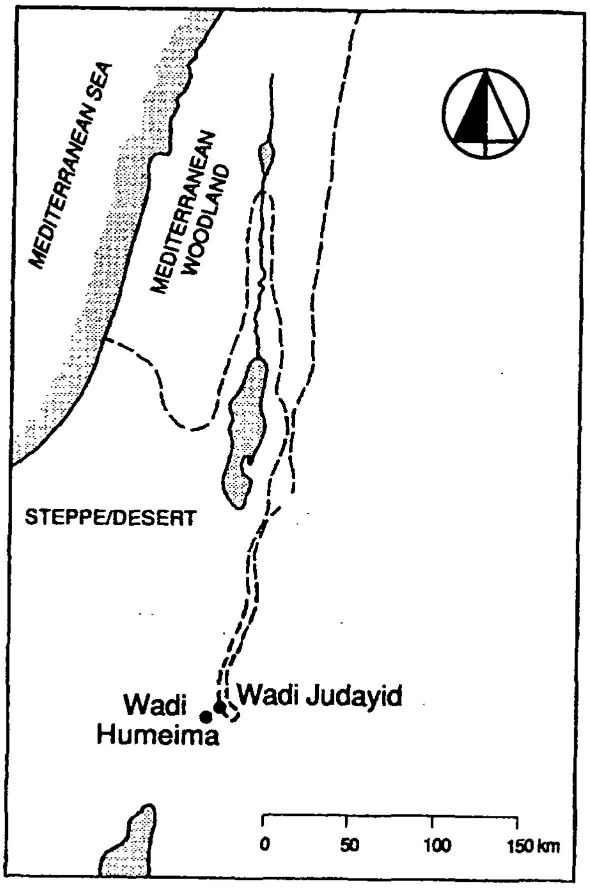



Figure 4: 15 Henry's arid and Mediterranean zones (taken from Henry 1995)

Within the Hisma region, sites assigned to these two technocomplexes are all very close to each other, and the two parallel phyla are said to be coeval. "What is so interesting here is the evidence for cultural interaction with neighbouring populations centred in the Mediterranean woodlands. Although such interaction between these arid zone and woodland foraging populations appears to have persisted for some 1500-2000 years (i.e. ca. 14-12/12,500 BP) these populations retained their distinctive cultural signatures" (Henry 1995:312). He suggests a reason why groups might relate for thousands of years whilst maintaining distinct cultures. "...the contact took place along a fringe area where interaction was not prolonged or intense, especially when compared to the social interaction that was maintained with the parent populations of the respective core areas" (Henry 1995:343). As a result, Henry concludes, "Environmental similarities were more important that geographic proximity in determining archaeological (and presumably behavioural) affinities" (Henry 1995:20).

## Environmental complexities

More broad brush pictures of the environment at a regional scale drawn from pollen cores from the Huleh Basin, in the north of Israel, have suggested a cold dry Early Epipalaeolithic, followed by a rapidly and smoothly ameliorating Middle Epipalaeolithic - and an optimal Early Natufian, followed by a suddenly arid Late Natufian. The Late Epipalaeolithic opens with a climatic amelioration, followed by a sudden arid phase at its end. It is this broad brush picture that has formed the picture we have of the large scale environmental trends of the period at this time, and which Henry draws on extensively for his picture of dichotomised cultures centred on one environment.

Henry's own data suggest the picture may well be more complex (see figure 4.16). For example, the Geometric Kebaran has been said to originate in the improved climate of a post 14,000BP amelioration (e.g., Henry 1995, Goring-Morris 1987). However, pollen from J26 Middle Hamran site shows an initial arid period, which later improves. The Early Hamran site J504, which should predate the ameliorations in the late Pleistocene, shows instead a warm, humid oak-dominated woodland. And pollen from the earliest levels of Madamaghan Tor Hamar shows a moist period at the inception of this supposed "arid zone" occurrence. The Early Natufian site in Henry's survey, Wadi Judayid J2, shows a very dry and arid environment based on pollen evidence. However, the Early Natufian culture is said to originate because of sudden climate optimality and availability of certain resources in the Mediterranean woodland setting.

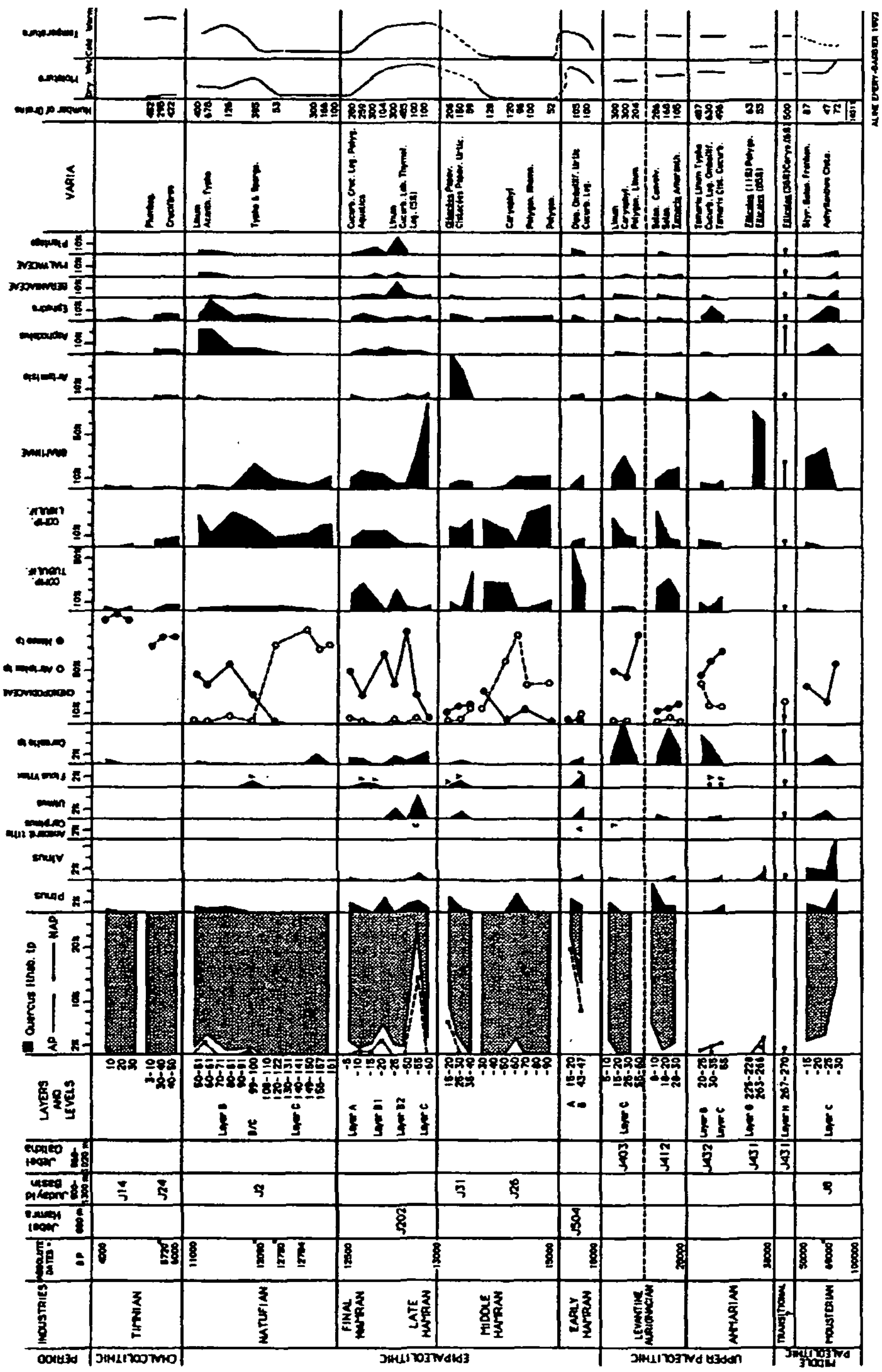


Figure 4: 16 Emery-Barbier's pollen diagram from various Hisma sites (taken from Henry 1995)

Henry thus makes little use of pollen evidence from the sites within his project, which would have given a more detailed 'snapshot' of actual micro-environments inhabited, rather than the broad trends of, for example, amelioration during the 15 to 12,000 BP period. These detailed site pictures do not always confirm the broad trend Henry portrays for the period. Data may suggest people living with complex microenvironments and climate shifts that are resistant to sweeping generalisations.

Again calling on prior understanding of the natural distributions of plants in the region, Henry emphasises the developmental trajectory leading to agriculture, through the Mediterranean zone Natufians. "By inhabiting an environment outside of the natural distributions of wild cereals and nuts, the triggering resources of complex foraging, Mushabian populations persisted as simple foragers, never developing sedentary lifeways" (Henry 1995:295). However, the natural distribution of cereals and the locus of plant domestication has been questioned (e.g. Olszewski 1986). In addition, one of the earliest dated Natufian sites in the Levant, Wadi Judayid in Henry's survey, had an arid environment which is presumably shared with the apparently coeval Madamaghan people, making this dichotomy less likely.

And his own discussion of the local palaeoenvironment, when not assessing it in terms of relationships to ethnic groups, is much more complex and subtle showing "...regions of marked relief, such as the Negev and Southern Jordan, where woodland, steppe and desert are tightly packed into narrow elevational belts. The close proximity and episodic shifts in distribution of the zones would have acted to inter-finger the habitats of steppe-desert and woodland adapted communities" (Henry 1995:312).

The nature of the relationship between an environment and its culture, as portrayed by Henry, is somewhat mystical. While cultures are often referred to as "steppe-desert and woodland adaptations" (Henry 1995:215), the evidence of different *adaptations* as such is non-existent. Evidence from Tor Hamar, for example, "indicates a subsistence strategy differing little from the other simple foraging populations of the

Levant" (Henry 1995:313). So, without having any apparent differences in subsistence, resource base or technology, groups remain aligned for thousands of years, through major and rapid climate changes, to one environment.

### Continuity of culture

Henry's 'big picture' is made up of very gradual change through time within culture. Each culture is seen to be internally homogeneous, with all variability representing either seasonal transhumance, or gradual temporal change. For example, the Hamran evolution extends from around 16,000 BP through to around 12,500BP.

To foster this image of continuity, the Early Hamran is portrayed as very like the Middle/Late Hamran and unlike the Qalkhan. For example, the fact that the Early Hamran usually has only a small percentage of microliths, making it unlike the Kebaran and the Middle/Late Hamran, is not mentioned outside the detailed typelists. Technologically it is said to be like the Hamran – so, for example, cores are usually not single platform, unlike the Qalkhan and like the Hamran. However, the data shows Early Hamran single platform cores are actually 69% of the core assemblages, much like the Qalkhan cores.

Henry suggests a gradual trend in typological change through the various Hamran phases. The trend in type replacement shows, he suggests, a trend in increasing edge modification. However, detailed examination of these trends suggests they do not follow the smooth trajectory given us to us by Henry. He tells us that straight backed bladelets and medial backed bladelets decrease from Early Hamran to Middle Hamran assemblages. In fact, medials do not decrease in the Middle or even Late Hamran, where they comprise up to 26% of assemblages. These tools, with less edge modification, continue through the period (see figure 4.17).

| Cultures | Medial bladelets | Straight backed bladelets | Backed and truncated bladelets | Pointed and arched backed bladelets |
|---|---|---|---|---|
| Early Hamran | 0-26% | 0-2.7% | 1.8-14.4% | 0-11.7% |
| Middle Hamran | 5.7-26.7% | 0-9.5% | 22.7-38.7% | .6-3.4% |
| Late Hamran | 6.5-26% | 0-.3% | 16.8-43.4% | 0-1.5% |

Figure 4: 17 Proportions of microlith types said to show a trend through the Hamran (data from Henry 1995)

Henry's data show a change from arched and pointed forms in the Early Hamran to more straight backed forms in the Middle Hamran. It may be that this is not drawn out in his text because it suggests that arched and straight backed forms are not only found in 'separate phyla.' Both Early Hamran and Qalkhan/Madamaghan sites contain pointed and arched forms.

Similarly, the Madamaghan is classified into 3 phases showing typological trends signifying gradual change over time. However, the lumping together of levels to create phases is what creates this trend. For example, the lowest phase is said to have the highest percentage of microliths, which decrease in the late phases. However, the lowest level at J431 in fact has very few microliths – almost the lowest of any Madamaghan level. It also has no 'Ramon Points' (or scalene bladelets), also said to characterise the earliest Madamaghan phase. It is only through lumping levels from different sites together that a smooth, phased trend is created (see figure 4.18).

| Phases | Levels/sites | Total microliths | Scalene bladelets |
|---|---|---|---|
| Phase 3 | Layer A Tor Hamar | 44.% | 1% |
| Phase 2 | Layer B Tor Hamar | 58.4% | .9% |
| Phase 1 | Layer C Tor Hamar | 77% | 1.9% |
| | Layer D Tor Hamar | 71.8% | 3.7% |
| | Layer E1 Tor Hamar | 55.6% | 0 |
| | J436 | 80.6% | .7% |

Figure 4:18 Madamaghan phasing showing frequencies of the two defining characteristics of phases (data from Henry 1995)

Henry sees this long smooth continuity as the result of conservative cultural traditions. Change is brought about through external stimuli in the form of environmental change. This is why Henry needs a picture of clear cut, environmental change to play the role of 'trigger' across the entire region. It is here at the 'interface' between his cultural-historical categories - long-standing archaeological cultures – and his processualist leanings towards environmental triggers that Dunnell (1997) criticises Henry's methodology. He points out that cultural units as classes are antithetical to evolution. "Because evolution is a transmission theory, it requires continuity". The 'gaps' between successive cultures are difficult to account for in an evolutionary schema.

We can see 'transitional' assemblages in late Madamaghan and Final Hamran phases. The presence of a fossile directeur, the lunate, in small percentages in these assemblages suggests to Henry that these are later in time. However, the lunate varies in the type of relationship with the Natufian that it suggests. In the Final Hamran, Henry sees the presence of the lunate as showing that the Hamran is developing into the Natufian, while lunates in the Madamaghan are said to show a parallel cultural group with some social contact with the Natufian. This difference seems to be based more on an a priori perceived difference in taxonomic divide between Mediterranean zone cultures (Natufian and Hamran) and arid zone ones (Madamaghan).

### Overview of narrative strategies

Henry's analytical strategy is to take a series of sites as dispersed elements and classify them into a taxonomic framework of cultures, cultural groups and technocomplexes. Sites are explained by the relationships to other sites in terms of a branching hierarchy. Two main phyla are created, with each site labelled as to level and branch. The taxonomy is presented as a total system in which the branching hierarchy contains all variability and relates each part to all others. Sites are classified by similarity and dissimilarity of tool types in a metaphoric relationship of like with like. Henry then downplays the role of individual sites, in a synedochic move towards integrating elements, with each subset mirroring the whole. There are 2 main synthesising ideas. One of ethnicity is figured in two 'parallel phyla', which show continuity of biology and tool morphology and environmental adaptation, specifically through the period of study but by inference continuing into modern times. Throughout the study, each phyla is seen to be mutually exclusive, with strong traditions. Each site is seen in terms of this divide, being placed into one phyla or the other.

The other synthesising idea is that of transhumance. Each site becomes integrated into a certain type of site in terms of transhumance – upland summer or lowland winter. This division is seen across the entire study period and all variability within a classification category is used to create this division. Each site is thus, by the end of the study, seen solely as a type of, for example, arid zone summer upland site or Mediterranean zone winter lowland site. This synedochical phase of analysis integrates spatial variability (for example different stratigraphic levels and different sites) into a continuous temporal phasing. Equally, different sites/levels are integrated in a parallel movement into different, disjunct 'phyla'. And they are always balanced in time. Where there is a Mediterranean Zone culture, its opposite number, in the form of an arid zone culture, is also there.

The sequence of events described within Henry's narrative suggests an equilibrium which is always within reach, between people and their environment. Never completely overcome by changing environmental conditions, the various environments are 'managed' within the text by transhumance within 2 environmentally specific taxa. The cycle of climates, adaptations and elevational transhumance is sustainable through time. The natural rhythm of, for example, 'summer' sites moving higher elevationally in synch with increasingly warm temperatures has no room for radical change. The emphasis is on cyclical movements, with progressive elaborations of what turns out to be contemporary patterns of transhumance and of ethnicity. Modern "marked ethnic diversity" is mirrored back in time, as is "Bedouin transhumance". The picture is one of a conservative attitude to change.

## 4.6 Discussion

This examination of published accounts of the period has shown that data is described and structured in ways that contribute to an overall narrative using certain figurative devices to create a meaningful unity from disparate pieces of information. Certain parts of these narratives have become unassailable features of our archaeological knowledge of the period, with new pieces of information fitted into the picture. At the same time, there are differences in how researchers have assembled their data.

### Narrative

Overall, we can see that, between the three researchers, the type of data used is very similar. In some cases, even the same data from the same sites is used. Particularly for Don Henry and Nigel Goring-Morris, access to data, in terms of climate evaluation and other published projects, is the same. Yet there are significant differences in the story told by these researchers. How the elements are put together into a narrative substantially affects the presented picture of the Epipalaeolithic. Differences are mainly in the plotting and ideology, as well as the argument. Where Bar-Yosef paints a picture of increasing control over environments and gradual evolution upwards, Goring-Morris emphasises conflicts and imbalances, with change coming as cataclysmic and unwelcome. Henry paints a very static picture emphasising balance between groups and environments.

Time and temporal devices are major points of difference. Gradualism and continuous variability is a hallmark of Bar-Yosef's work, while Goring Morris emphasises similarity and timelessness within culture but massive and punctuated temporal change, owing to climatic upheaval. Henry presents very little change at all, with a static taxonomic framework operating with a timeless present of ethnicity and transhumance.

One narrative element all these accounts have in common is the close integration of the elements making up the story. All three integrate the elements of their narrative. At the level of organising their data, archaeological cultures are used by all three.

They organise lithic assemblages into homogeneous cultures. While Bar-Yosef makes this a main part of the object of his research, Goring-Morris and Henry both assign sites to culture with little discussion of the actual methodology for doing so. Goring-Morris' concern is to investigate spatial behaviours within cultures, while Henry is concerned to set up hierarchies of difference and similarity between groups of sites. Direct comparisons of sites across cultures, or discussions of sites as individual entities, is, after Bar-Yosef, no longer a focus. The construction of archaeological cultures becomes invisible.

For all three, archaeological cultures represent ethnic groups. And for all three, these ethnic groups are each tied to particular environments. These are broad 'zones' of perceived environmental character, relating to a constructed dichotomy between a Mediterranean zone heartland located in modern day Israel, and an arid zone fringe in the Negev/Sinai and countries surrounding Israel. By discussing ethnic groups in terms of environment, an adaptational, processualist approach <u>seems</u> to take over from, or at least co-exist with, the traditional cultural-historical paradigm. This gives the impression of a 'scientific' approach to ethnic boundaries.

Underlying tropes are also similar. Lithic analysis in its initial stages is accomplished using metaphor and metonymy. Emphasising similar classes and relations between taxonomies is a major part of Bar-Yosef's and Henry's work. Reducing data to elements which 'stand in for' whole cultures is a crucial second step for Bar-Yosef. This metonymical approach is used differently in Goring-Morris and Henry, where assemblages are related to subsistence site-types. These initial approaches seem essential to a final synecdochical 'grouping together' of each element into a 'big idea' or unity of meaning for each account. A temporal/ethnic continuity from the Upper Palaeolithic to the Neolithic and beyond is Bar-Yosef's concern. All data are assembled to show gradual change through time for the Mediterranean zone inhabitants. Goring-Morris turned his attention to spatial relationships in a contested environment, with groups at the mercy of abrupt environmental changes. Henry assembled his data within a picture of unchanging ethnic division and environmental adaptation, extending through time in the region.

How has this narrative gained assent and authority?

All the research accounts reviewed in this study offer interesting and powerful views on the Levantine Epipaleolithic. The question, however, is how certain elements of the narratives that have been used to give meaning to complex and often conflicting data have become matters of unchallengable truth rather than of interpretation. In part the assent of the wider archaeological community has come about through the structures of the discipline – career paths, refereed journals, mentoring and supervision have all contributed to the acceptance of the existing views of major figures working in the field. More than that, additions to the field have largely happened through accretion of ideas, sites and tool types rather than refutation or changing paradigm. Some particular characteristics of Near Eastern archaeology specifically have also contributed to unquestioning acceptance of existing views. Access to materials is limited, both for those in the region and others. Access to material from earlier excavations is made very difficult for everyone by the earlier practice of sharing out assemblages amongst up to 20 different foreign institutions throughout the world. Even recent foreign-run excavations may keep materials for long term or permanent housing. Access to materials from different parts of the region is further complicated by the continuing difficult political situation that makes contact across borders difficult or, for some groups of people, impossible.

These problems have resulted in a burgeoning of synthetic articles that seek to overview whole regions, periods or transitions without the burden of detail in terms of data. Training in Near Eastern prehistory can rely too heavily on these in the absence of access to site reports or actual material.

A second level at which the accepted picture has become entrenched is that of accepted discourse on the period. The idea that a typological, cultural-historical approach is the primary descriptive stage in data analysis has become 'written into' the methodologies used. It is hard to make a meaningful statement within the period without taking the metonymical a priori position of using tool types to locate an assemblage within time. Spatial relationships described as environmental zones have become the framework and language of ethnic difference within the period. The 'Mediterranean zone' has become the core area to the 'arid zone' periphery in terms of developmental trajectory.

The degree to which some of these ideas have become 'hard-wired' into the discipline can obscure interesting diversity and inhibit new interpretations and approaches. Thus, the remainder of this study goes back to the lithic assemblages behind the research narratives to explore the alternative pictures offered by a different approach to analysis of microlithic variability.

# 5. Methodology

Previous chapters have outlined the way the discipline of prehistory has developed in the region (chapter 2) and more specifically how chipped stone analysis has formed our picture of the Epipalaeolithic (chapter 3) and gained its authority (chapter 4). Problems associated with chipped stone analysis have been discussed. It is clear that the nature of variability in microliths may not have been fully described. The implications of this for our understanding of the period are profound, given the very central role that microlith classification has had in forming our picture of the Epipalaeolithic. This has led me to ask whether there are other ways of documenting microlith variability that will describe it more accurately and how will this affect out interpretations.

## *5.1. Data collection and analysis*

### 5.1.1. Microlith variability analysis

A study of the morphology of microliths was carried out, exploring ranges of variability within assemblages and in comparison with other assemblages. These were used to look at the juxtaposition of norms and variability. I carried out an attribute analysis of microliths for more precise and sensitive characterisations of variability between tools, through taking apart the different aspects subsumed within tool types – attributes associated with blank removal, segmentation and retouch – which all combine to create tool morphology.

Continuous data – discrete clusters, overlapping ranges, modality and so on - was used wherever possible to enable full patterns of variability within and between sites to show. Attributes included information on the condition of tools, technological attributes, segmentation of blank, metric dimensions and retouch characteristics. Attributes emphasised secondary technology, that is all those stages of manufacture that happen after the blank has been removed from the core. This is because secondary technology is particularly important in Middle and Later Epipalaeolithic assemblages. Earlier stages of technology, such as core preparation and maintenance and control of blank dimensions, become more ad hoc as the later stages of manufacture (invasive retouch and backing, blank segmentation and truncation) become more significant in shaping tools.

### 5.1.2. Assemblages

The 12 assemblages studied were taken from previously published sites from two major projects of the 1980s in the Negev and southern Jordan. Six assemblages were from the Ras en-Naqb survey, directed by Don Henry, and six from the Emergency Survey of the Negev, directed by Nigel Goring-Morris. These projects together form the main body of sites from southern Jordan and Israel assigned to the Epipalaeolithic. The Negev assemblages are all from a very restricted area in the western lowlands, while the Ras en-Naqb assemblages are from approximately 150km away on the Jordanian plateau east of the Rift Valley (see Figure 5.1).

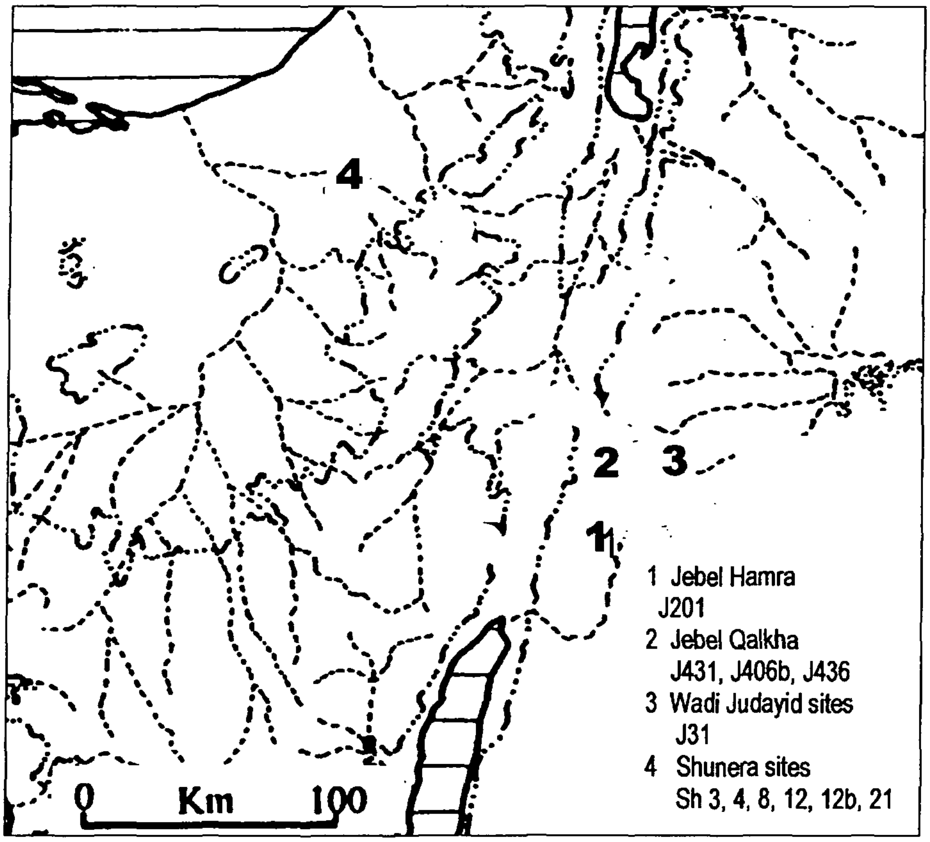



Figure 5:1 Locations of sites used in this study

Assemblages from projects conducted in Jordan and Israel have never been formally compared, and indeed tools from assemblages assigned to different cultures have also not been directly compared. Whilst comments on the similarity or otherwise of assemblages to others in the region or from other projects are commonplace in the literature, this has been done on the basis of published reports, or occasionally brief informal examination of assemblages, rather than direct and detailed contact with the material. Thus this study takes a sample from the two main surveys for material of this period on both sides of the Rift Valley: six assemblages from Jordan and six from Israel.

This study used assemblages from sites classified as from the Middle Epipalaeolithic, or very roughly between 15-12,500 BP. It included assemblages from the complete range of cultures seen as, or sometimes seen as, part of the Middle Epipalaeolithic in the arid zones. Thus the straight-backed Geometric Kebaran and Middle Hamran were examined, alongside the full range of arched-backed cultures, represented by the Ramonian, Mushabian, Madamaghan and Qalkhan (see figure 5.2).

| Name | | Area | Culture |
|---|---|---|---|
| Shunera 12 | SH12 | Negev | Geometric Kebaran |
| Shunera 3 | SH3 | Negev | Geometric Kebaran |
| Shunera 12B | SH12B | Negev | Geometric Kebaran |
| Shunera 4 | SH4 | Negev | Mushabian |
| Shunera 8 | SH8 | Negev | Mushabian |
| Shunera 21 | SH21 | Negev | Ramonian |
| Jebel Hamra J201 | JH | Ras en-Naqb | Middle Hamran |
| Wadi Judayid J31 | WJ | Ras en-Naqb | Middle Hamran |
| Wadi Humeima Lower | WH | Ras en-Naqb | Qalkhan |
| Tor Hamar J431 BLOCK 2 | TH2 | Ras en-Naqb | Qalkhan |
| Tor Hamar J431 BLOCK 1 | TH1 | Ras en-Naqb | Madamaghan |
| Jebel Fatma J436 | JF | Ras en-Naqb | Madamaghan |

Figure 5:2 Sites used in this study

These sites are located in the arid zones of the region and thus give the opportunity of comparing straight-backed Geometric Kebaran and Middle Hamran assemblages with a full range of arched backed assemblage such as Mushabian, Madamaghan, Ramonian or Qalkhan.

*Sampling*
Assemblages from sites chosen for this study are largely microlithic. Assemblage size varied greatly (1083 – 25,986 artefacts). Sample size was minimum 100 microliths from each site (see figure 5.3). An arbitrary selection of microliths from each site was taken, representing examples from each microlithic type previously recorded at that site, and where appropriate, across each Middle Epipalaeolithic level at the site. Samples of greater than 100 were taken from the 2 largest assemblages used (TH1 and TH2).

| Site name | | Total tools | Total microliths | Sample studied | Complete |
|---|---|---|---|---|---|
| Shunera 12 | SH12 | 412 | 362 | 100 | 22 |
| Shunera 3 | SH3 | 970 | 912 | 100 | 6 |
| Shunera 12b | SH12B | 327 | 307 | 100 | 37 |
| Shunera 4 | SH4 | 1685 | 1506 | 100 | 53 |
| Shunera 8 | SH8 | 260 | 235 | 100 | 34 |
| Shunera 21 | SH21 | 1115 | 1055 | 98 | 52 |
| Jebel Hamra J201 | JH | 500 | 385 | 100 | 20 |
| Wadi Judayid J31 | WJ | 149 | 116 | 100 | 24 |
| Wadi Humeima Lower J406b | WH | 377 | 160 | 108 | 26 |
| Tor Hamar J431 Block 2 | TH2 | 475 | 309 | 141 | 86 |
| Tor Hamar J431 Block 1 | TH1 | 1443 | 911 | 155 | 84 |
| Jebel Fatma J436 | JF | 160 | 107 | 107 | 50 |

Figure 5.3 Samples from each assemblage studied

Microliths are prone to breakage, either through use or post-depositional damage. At some sites, high proportions of tools snapped at one or both ends were recorded (see figure 5.3). This affected the total numbers of tools at each site that could be included in analyses of tool end morphology or angle. Certain sites (SH3) were most affected by this – the microlithic assemblages from these sites were very largely composed of tools with one or more snapped ends. This may be because blanks were narrow and thin at these sites, and thus prone to breakage, or it may be that snapping ends was used as a manufacturing technique without additional retouch. However, the tools with snapped ends were noted separately on graphs analysing tool angles.

All of the assemblages are heavily microlith dominated (see figures 5.3) and this, together with the research focus on investigating the existing picture of morphological variability, justified sampling only the microlithic tools.

### 5.1.3. Choice of attributes

The process of shaping microliths relies heavily on all those stages of manufacture which occur after removing the blank from the core. This secondary technology is more influential in shaping microliths than it is for other tools. While the basic blank proportions determined when removing the bladelet from the core do create the outer limits of tool length or width, the later processes of tool segmenting and retouching are more significant in the final tool form. Attributes were chosen to reflect the full range of the secondary technological process.

| Stage of microlith manufacture | Tool attribute |
|---|---|
| 1st stage: Core preparation and striking blanks | Depth of tool<br>Length (not longer than)<br>Width (not wider than) |
| 2nd stage: Segmenting blanks | Truncation angles<br>Symmetry<br>Backed side (in ABB sites)<br>Tool end to be pointed (ABB sites)<br>Length<br>Surface area (in conjunction with backing) |
| 3rd stage: Backing blanks | Backed side (SBB sites)<br>Sequence of retouch<br>Width<br>Amount of retouch and proportion of tool retouched<br>Surface area (in conjunction with segmenting) |

Figure 5:4 Stages of microlith shaping

Attributes reflecting the detail of retouch style, such as morphology, position or extent of retouch, were also recorded, using the definitions set out by Tixier *et al.* (1992). These definitions describe retouch in a series of categories. Morphology, for example, can be regular, irregular, parallel or sub-parallel. It was found in the course of data collection that these categories were difficult to apply accurately and consistently and that they did not always fully describe the variability in retouch morphology. Analysis of these attributes did not prove revealing, in part because certain attribute states were overwhelmingly dominant (whilst, I believe, hiding greater variability than was reflected in my data). Thus they have not been included in further analysis. This confirmed my suspicion that 'types' were not the best way of examining variability. A more detailed approach, sensitive to retouch microstyle, is necessary at this level, using higher magnification and quantification of, for example, retouch scar sizes, as suggested by Prost (1993).

### 5.1.4. Data collection

All examinations of tools were carried out using 10x and 16x hand lens.
Measurements were done using electronic callipers to measure in millimetres to the second decimal point.

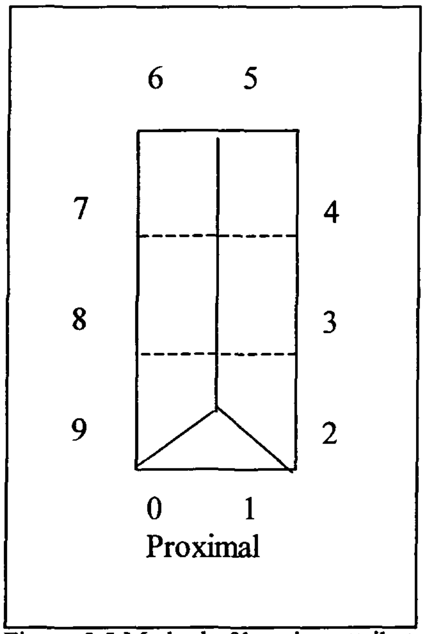
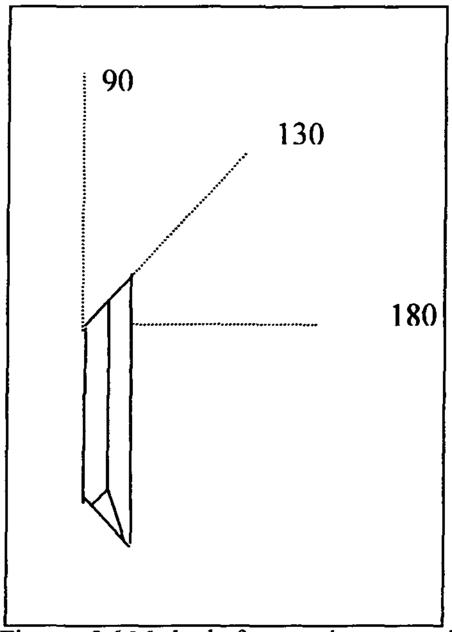


Figure 5.5 Method of locating attributes on tools

A numeric system for locating damage and retouch was used (Wembach Working Group 1995). Each area of damage or of retouch was defined by recording its numeric position (see figure 5.5).

For measurement of angles, tools were placed dorsal face up with the backed edge of the tool at 90 degrees (see figure 5.6).



Figures 5.6 Method of measuring truncation angles

*Database structure*

Microsoft Access 1997 was used to record data collected from assemblages. Each box below represents a table in the database, with unique identifiers for each table and linked fields between tables identified.

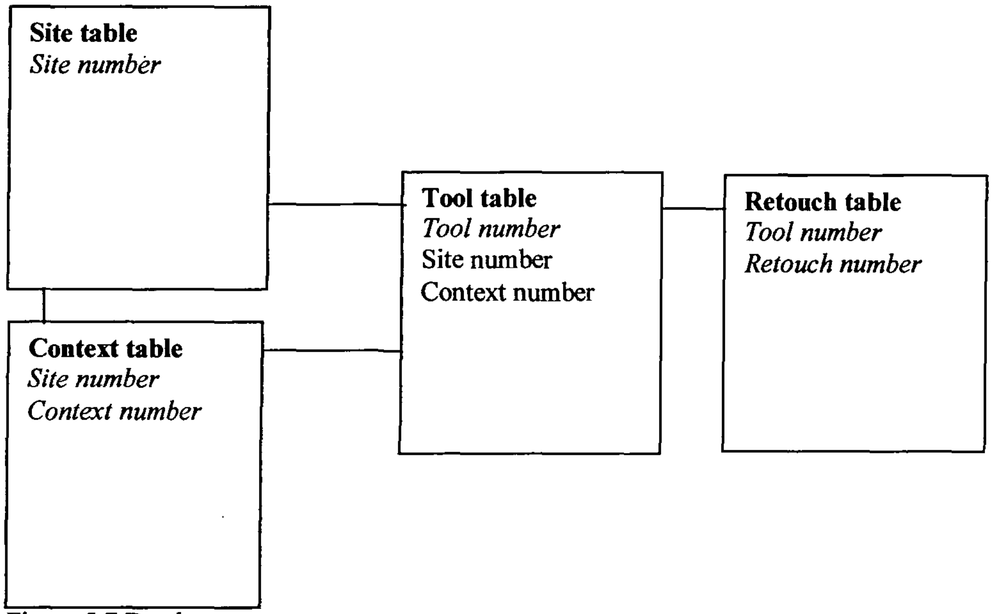


Figure 5.7 Database structure

The total number of fields in each data table is listed below (Figure 5.7)

| Table | Field | Type of data | No. of possible attribute states |
|---|---|---|---|
| Site | **Site Number** | categorical | 16 |
| | Region | categorical | 3 |
| | Assigned culture | categorical | 8 |
| | Comments | text | ---- |
| Context | Site Number | categorical | 16 |
| | **Context Number** | categorical | infinite |
| | Date | text | ---- |
| | Description | text | ---- |
| | Comments | text | ---- |
| Tool | Site Number | categorical | 16 |
| | Context Number | categorical | infinite |
| | **Tool number** | automatic | infinite |
| | Oriented | categorical | 2 |
| | Blank | categorical | 3 |
| | Damage | categorical | 4 |
| | Complete | categorical | 2 |
| | Proximal treatment | categorical | 9 |
| | Proximal angle | numeric discrete | 18 |
| | Distal treatment | categorical | 9 |

| | | | |
|---|---|---|---|
| | Distal angle | numeric discrete | 18 |
| | Length | numeric continuous | infinite |
| | Wide point | numeric continuous | infinite |
| | Width | numeric continuous | infinite |
| | Depth | numeric continuous | infinite |
| | Shape | text | ---- |
| | Original classification | text | ---- |
| | Comments | text | ---- |
| **Retouch** | **Tool Number** | automatic | infinite |
| | **Retouch Number** | numeric discrete | infinite |
| | Edge Proportion | numeric discrete | 10 |
| | Back proportion | numeric discrete | 10 |
| | Continuous | categorical | 2 |
| | Length | numeric continuous | Infinite |
| | Thickness | numeric continuous | Infinite |
| | Location | categorical | 6 |
| | Position | categorical | 3 |
| | Angle | categorical | 3 |
| | Extent | categorical | 3 |
| | Shape | categorical | 5 |
| | Direction | categorical | 4 |

Figure 5.8 Fields in database

The definitions of each attribute, together with all possible attribute states, is in figure 5.9. Retouch attributes such as position and angle of retouch are taken from Tixier *et al.* (1992).

| **Tool table** | | |
|---|---|---|
| **Complete** | A tool was considered complete if both extremities were intact. | Y = yes<br>N = no |
| **Orientation** | Where possible, each tool was oriented technologically, with proximal end at bottom and distal end farther away from the viewer. If this was not possible, the tool was oriented with backing on the left side, and if the tool was not backed, it was oriented with sharpest point in the distal position. | Y = yes<br>N = no |
| **Blank** | Part of blank the tool is on. | M = medial<br>P = proximal<br>D = distal |
| **Extremity treatment** | How the distal and proximal extremities have been treated. | N = natural blank end<br>M = microburin scar<br>P = piquant triedre scar<br>R = retouched<br>S = snapped |

| | | |
|---|---|---|
| | | All states can be combined with 'R', for example RM = retouched microburin scar |
| Extremity angle | The truncation angle of distal and proximal extremities. | Range from 180 degrees to 90 degrees |
| Length | The length measured at the longest extent in the direction of impact. | |
| Depth | The depth measured at the deepest part of tool from ventral to dorsal faces. | |
| Width | The width measured at the widest part of the tool at right angles to the direction of impact. | |
| Wide point | The distance of the widest point from the proximal end. | |
| Tool shape | The shape of tool based on the shape of backed edge and number of acutely pointed ends, if any. If a closely defined point name is appropriate, this is used. | SBB – straight backed bladelet<br>ABB – arched backed bladelet<br>Pt – point<br>Bipt – bipoint<br>Qalkhan point<br>Ramon point<br>Microgravette point |

Figure 5.9 Attribute definitions, tool table

| Retouch table | | |
|---|---|---|
| Position | The position of the application of the retouch with reference to the dorsal and ventral faces of the tool. | D = direct (on the dorsal face)<br>I = inverse (on the ventral face)<br>B = bifacial (on both faces) |
| Shape | The shape of the part of the tool covered with this piece of retouch. Where the shape changes over the length of 1 piece of retouch, each state is entered, starting from the proximal/right. | Irr = irregular<br>R = rectilinear<br>CC = concave<br>CV = convex<br>N = notch |
| Length | Total length of the piece of retouch. | |
| Thickness | The thickness of the piece of retouch, measured at the deepest point. | |
| Location | The piece of retouch is located based on the numbered system (see below), later translated into categorical data. | Right, Left, Right partial, Left partial, Right proximal, Left proximal, Right distal, Left distal, Proximal, Distal |
| Angle | The angle of the piece of retouch in relation to the face of the tool. | A = abrupt<br>SA = semi-abrupt<br>L = low |
| Direction | Where visible, the direction/sequence of retouch application in relation to the proximal, distal, left and right locations. | PD = proximal to distal<br>DP = distal to proximal<br>LR = left to right<br>RL = right to left |

Figure 5.10 Attribute definitions, retouch table

### 5.1.5. Data analysis

The goal of the data analysis was to explore variability, in order to examine patterns within and across sites. Variability was to be used as a way of looking at decision-making within the context of norms or rules. The goal was to use variability patterns to look at the underlying syntax of the relationship between norms and variability at different levels of analysis. Attribute analyses have been used successfully to explore variability and decision-making in the design process within site before (e.g. Dobres 2000, van der Leuw 1993, Lemonnier 1986). Dobres (e.g., 1999a, 1999b) in her work on Magdalenian bone tools suggests that technologies are integrated webs of skill, knowledge, dexterity, values, functional goals, traditions and material constraints, woven together with individual agency, social relations between technicians, power relations.

The first stage was to analyse the data from each assemblage in such a way as to show ranges and patterns of variability in each attribute used at that site. The emphasis was on the assemblage as a unit and the concern was to identify within-site patterns which would reveal the range of decisions taken in creating tool morphology: priorities, concerns with certain attributes or values, design goals, rules followed or broken, attribute values never used, and so on. These pictures of decision-making and norms were then compared on several levels: between sites, within and between cultures and between straight-backed and arched-backed sites.

Methods of analysis chosen involved ways of exploring the data visually through representations that emphasised full variability – ranges, dispersions around a mean, scatterplots of values and correlations of values.

Variability is examined in terms of:

- actual differences in design parameters, for example, the angle of tool truncation. The makers of certain tools, assemblages and sets of assemblages can be shown to have used different, often non-overlapping, sets of design parameters in the creation of individual tools.

- different patterns of variability, such as the amount of spread or of clustering. Within a site, an assemblage is made up of tools falling within a certain range of variation. Some attributes may not vary at all, while others may vary greatly. Some attributes may regularly co-occur on tools in one assemblage and not in another.

The range of microlith variability is described, using the following techniques.

Scatterplots of tool truncation angle combinations are used to show the pattern of tool shape variability at each site (figure 5.11).

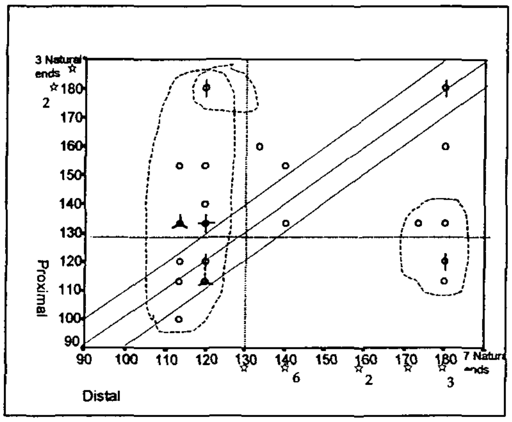



Figure 5.11 Sample truncation angle scatteplot

Complete tools are represented by circles, with multiple tools at one location represented by lines through the circle. Each 'petal' represents a tool. Tools are plotted by their proximal angle (X axis) and distal angle (Y axis). Snapped tools with only one retouched end are represented by stars at the edge of the plot, located along the axis of the complete tool end, at its truncation angle. Tools with one natural end opposite a truncation are shown at the far end of each axis representing the natural proximal or distal end. Diagonal lines across the plot show the area of the plot within which tools are symmetrical.

Diagrammatic representations of tool shape range are shown, each 'type' representing a range of variability in the above scatterplot (see figure 5.12).

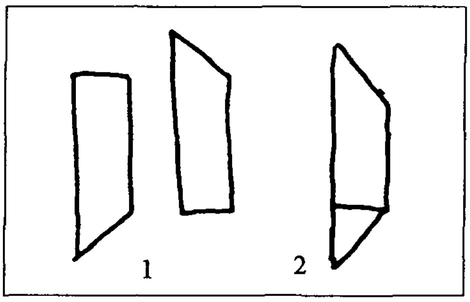



Figure 5.12 Sample tool shapes

The patterns of variability in tool metrics are shown using scatterplots. Width, length and depth are represented, as are composite measurements of tool elongation (L: W), proportion of tool edge retouched and total tool surface area. Each dot represents one complete tool. A table of the strength of significance of these correlations is also presented, with statistically significant correlations (Spearman's rho) highlighted in grey on the table.

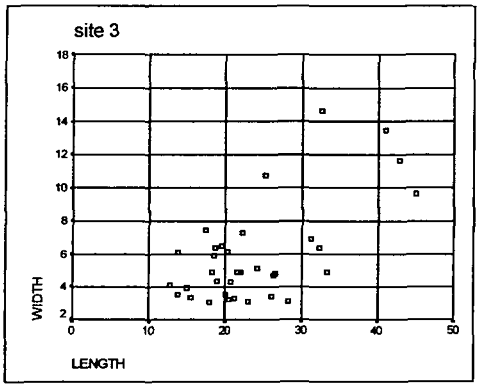



Figure 5.13 Sample tool metrc scatterplots

The design principles used in creating each assemblage are then discussed, based on the parameters outlined above.

Following the description in chapter 6 of each assemblage in this manner, chapter 7 describes each 'culture' in terms of the above data, comparing sites within cultures to each other, using additional plots showing measures of dispersion around each assemblage mean to look at the metric data.

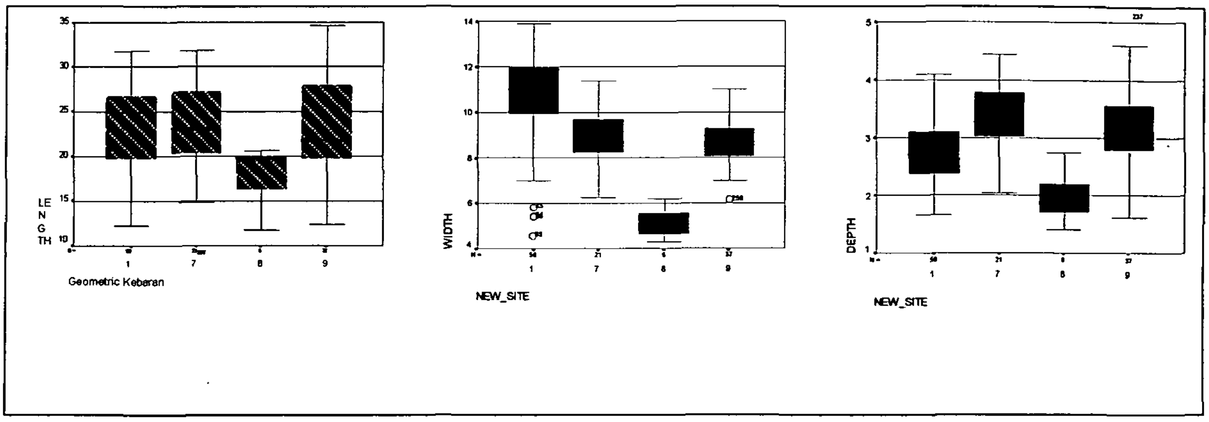



Figure 5.14 Comparisons of site metrics, showing dispersion around a mean

### 5.1.6. Other methods of analysis

Alternative methods of analysing the dataset were initially investigated. I wanted a method that would allow me to compare the patterns of data variability with traditional typologically defined cultural variability, as well as, in an initial exploratory phase of analysis, to investigate what variables co-vary.

There was an initial exploratory phase of data analysis which did not produce any clear-cut results, but served to emphasise the crosscutting nature of the attributes, as well as the different strengths of association between variables, and between certain variable states.

This phase involved multivariate analysis of the data. The dataset has various structural characteristics that are problematic for many multivariate techniques:

- Both categorical and continuous data are included, which means that a coefficient of similarity such as Gower's has to be used, or the continuous data has to be reduced to categorical states, or a programme that handles both types of data is required
- The categorical data is particularly complex, in that each attribute has a number of possible states
- Attributes are not normally distributed
- Some variables have high numbers of missing observations (e.g. direction of retouch)
- There are redundant variables (that is, very highly correlated variables). For example, measurements are often highly correlated.

These various problems limited my choice of methods and I decided to investigate various applications of Correspondance Analysis. SPSS supports a number of programmes developed by the Department of Data Theory at the University of Leiden for analysing categorical data through non-linear variants of classical multivariate techniques. They have developed a number of programmes that are generalisations of Principle Components Analysis and other multivariate techniques. HOMALS appeared to offer potential for this dataset. The name is derived from the analysis of **homo**geneity and **al**ternating **l**east-**s**quares. The method has many names, including multiple correspondance analysis (MCA).

The technique is based on the premise that complicated multivariate data can be made more accessible by displaying in scatterplots. The technique finds a low dimensional space (usually a 2 dimensional plot) in which objects (rows) and categories (columns) are positioned in such a way that as much information as possible is retained from the original data. The plot minimises the total squared length of the edges through alternating least-squares algorithms.

A graph has a multiple correspondance (MC) point for each category that is the centre of gravity of the objects within that category. There are also object points for each object in the dataset, with object scores as their co-ordinates in the graph. A good solution **minimises** the sum of squares of distances between object points and their corresponding MC points. As a corollary, a good solution also **maximises** the sum of squared distances between MC points and the origin of the dimension.

Because a HOMALS solution represents a high-dimensional space in 2 dimensions, sometimes certain points are less well represented than others. A good solution represents most of the categories well. Numerical information is given to help in understanding how successful the graph is.

Analyses were carried out on the dataset using these methods, some of which provided interesting results with solid solutions. However, the structure of the data made some of the analyses difficult, resulting in uninteresting, trivial or over-complex results. Particular problems were:

- HOMALS tends to exaggerate the importance of categories with small overall marginal frequency. It is sensitive to outliers. There may be dimensions on which unique values will obtain extreme quantifications and merge all other categories. This was the case with many attributes in this dataset.

- Difficulty of clear interpretation. As variables used multiply, interpretation of results in MCA is more problematic.
- Lack of full information on results given by SPSS –The results on an MCA omit the contribution to dimension inertia of each variable state, making analysis of the quality of the CA plot difficult.

In addition, the varying importance of different attributes at each site meant that when looking across all sites in an effort to compare with traditional cultural categories, solutions were found which did not represent all sites, or all attributes, well. The extremely varying strengths of associations between different attributes in each site made this a very unwieldy dataset not amenable to these methods.

*Form of results*
MCA results are delivered in the form of a plot that represents a multi-dimensional correlation of attributes included in the analysis. Most simplistically, they can be read by visual interrogation of the plot. Variables are represented by different symbols, and each variable state is a different, labelled, location on the plot. The closer these variable and states are to each other, the more closely correlated they are. Lines on the plot represent he trajectory of continuous variables, such as Length, with the longest tools at one end, and the shortest at the other.

*Initial findings*

The area in which the method was most successful involved the few basic correlations of attribute states, which held true across all or most sites. These were:

- Tool width and proportion of tool retouched are negatively correlated (see figure 5.15). Wider tools (on the left hand side of the plot) have less retouch. This relationship is seen in all sites and assemblages can be divided into those with wider tools and less retouch and those with narrower tools and more retouch. Length of tool has only a minimal effect on the proportion of retouch, with highly retouched sites including those with both short tools (site 8 - SH3) and long ones (site 4 - TH1).

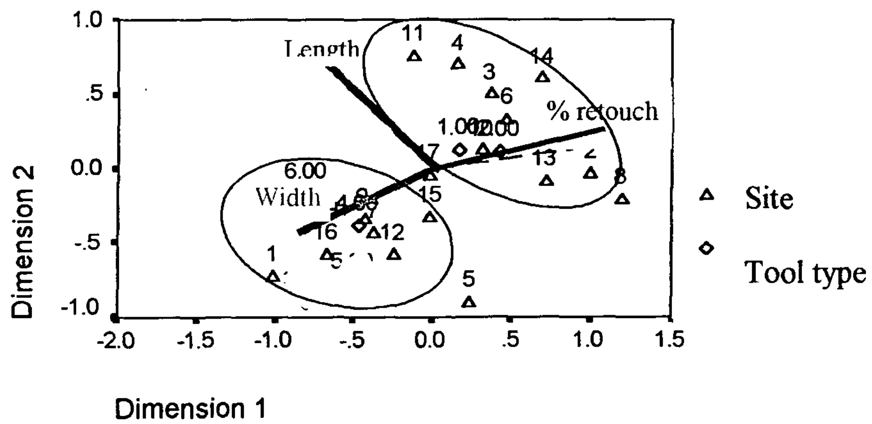



Figure 5.15 Multivariate example 1

- Sites regularly fall into two main groups, governed by their truncation angles (Figure 5.16). Sites with 170/80 degree truncations are divided from all the others (on the left hand side of the plot. Following on from this, the others are then divided into two groups, one with steep angles of 100-130 and the other with mid-angles of 140-150.

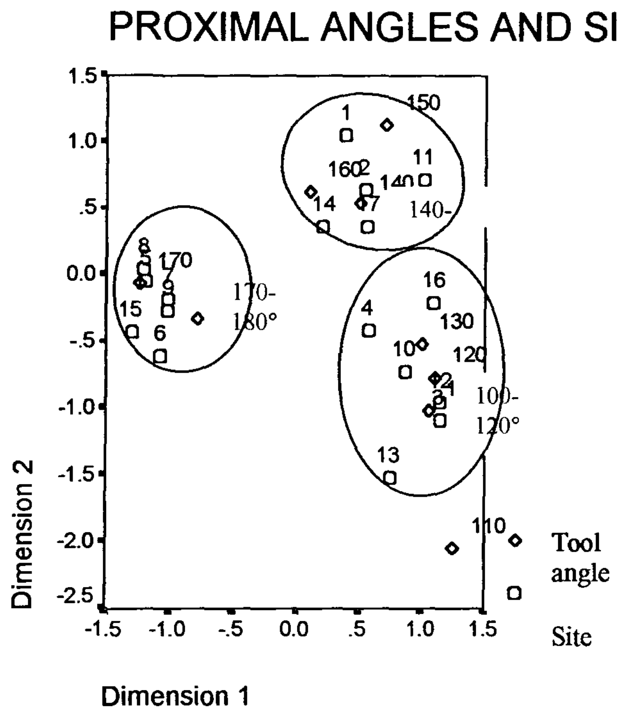
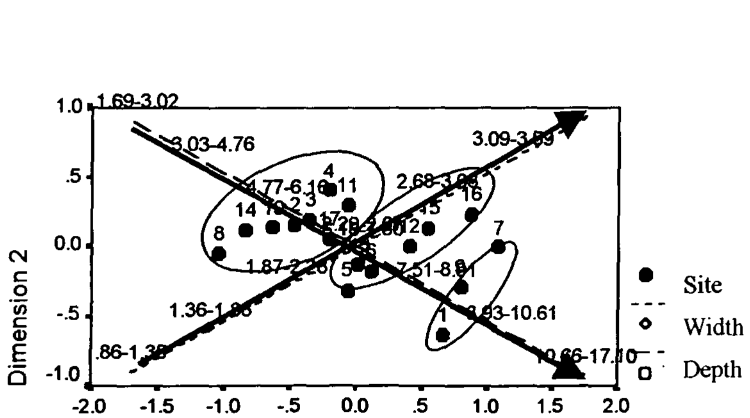



Figure 5.16 Multivariate analysis example 2

- Width of tools divides 170/80 sites from ones with steeper angles as well. All the wider-tooled sites are 170/80 ones (lower right hand side of plot) and all the narrower tooled sites except one have steeper truncation angles (upper left hand side of plot). Width seems to clearly differentiate into three separate groups, with depth of tool varying continuously in each group.



- When truncation angle is left out of the equation, sites are still split up into groups which are reflective of the truncation angle divide seen above (figure 5.18). Sites with tools at 170/80-degree truncation angles (and site 12 – SH8) are less elongated (on the left hand side of the plot) and steeper angled sites are more elongated (on the right hand side of the plot). The amount of retouch varies continuously between 170/80 sites. Sites with steeper-angled tools, however, fall into two distinct groups in terms of amount of retouch.

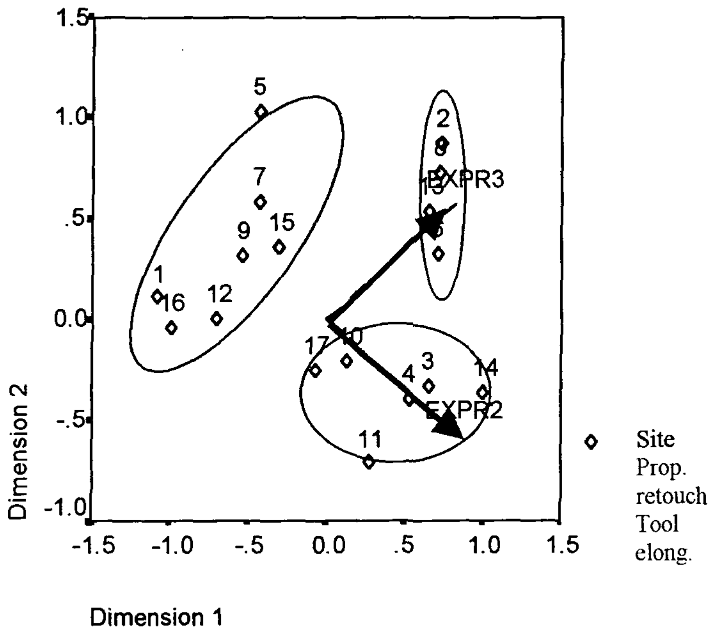



Figure 5.18 Multivariate analysis example 4

*Limitations of the method*

All these attributes exhibited a systematic variability across assemblages. Each assemblage was thus placed along a spectrum of more retouch/less width and elongation. This placement also tended to reflect the general truncation angles used at the site.

However, other attributes did not vary in such a systematic manner. It was clear that this method of analysis was giving a gross generalisation of attributes at each site and their variability. For example, sites were represented as having one basic truncation angle in use. However, the reality was that certain assemblages *did* focus very much on one angle, while others did not. This was true of all attributes examined. In addition, the fine distinctions between certain attribute states was lost. For example, TH2 (site 3) and WH (site 13) clustered together on truncation angle in this analysis because they were more like each other than they were like other sites. However, these two sites in fact use slightly different truncation angles.

Beyond certain basic relationships examined above, few attributes were clustering and every combination of attributes clustered sites in a different way, often with indistinct clusters. The failure to produce clear-cut patterning was due to the great variability of the data. Attributes did not 1) vary along traditional cultural lines, or 2) co-vary in *any* clear groups.

The logic of choices relating to the different design parameters at each site was not well represented by this method. This is because this logic varied from site to site, except for the relationships described above. At one site, truncation angle might be an important variable, and related to metrics, possibly with a bimodal distribution of values for angles. At another site, this might not be the case. Multivariate analysis did not offer a successful method of representing variability *within* site in a way that emphasised the site as a unit, but containing ranges of values, in order to understand design logic at that site and its relationship to other sites.

### *5.2. Site Catalogue*

The site catalogue that follows describes the environment and location of each site studied, as well as the technology and typology of the chipped stone assemblage as reported by the excavator. The terminology used to describe the tool typology at each site is that of the original excavator, so there are differences in terminology used between the Ras en-Naqb and Shunera sites. Typelists and tool data are taken from Goring-Morris (1987) and Henry (1995). Tables are provided showing basic counts of each assemblage (Figures 5.20 and 5.28). Data on tool assemblages is given as published, but this is not always consistent between researchers or sites. Each site description is followed by a brief summary of the sample I examined.

#### 5.2.1. Shunera Dunes

The Shunera Dunes are in the Western Negev lowlands. The dune fields themselves have a Pleistocene origin and many terminal Pleistocene sites are located in the sands. This area is the eastern continuation of the extensive dunefields of the northern Sinai, which cover 10,000km2. The current climate is arid, with variable precipitation of less than 80-100mm during a short winter, followed by a dry summer. Vegetation is sparse Saharo Arabian.

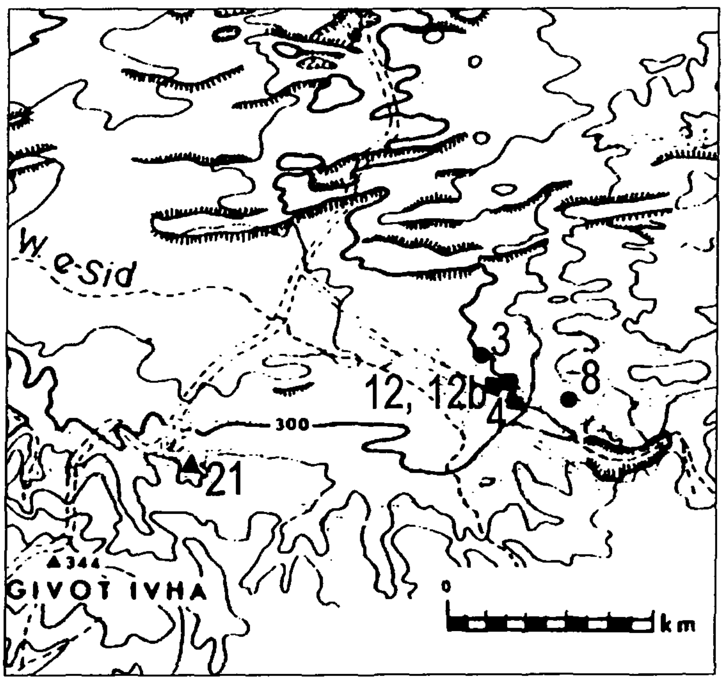



Figure 5.19 Map showing locations of sites in the Shunera Dunes

From 1979-84, a 10km2 area within the dunes was surveyed as part of the Emergency Archaeology Survey of the Negev, directed by Nigel Goring-Morris. Near the southern edge of the dunes, the small drainage of Wadi es Sid drains the low Mitzpeh Shivta hills, at an elevation of 300masl. The sites were located on the banks of this wadi at the edge of the dunes, where they abut the low loess-covered hills.

The Survey located 29 Upper Paleolithic and Epipalaeolithic sites in this area, of which 6 were assigned to the Geometric Kebaran and 10 to Mushabian/Ramonian variants. Most sites comprised 5-10cm thick archaeological horizons. Collections were carried out in quadrats of .25m2. Many of these sites were very close to each other, with, for example, Shunera 12 and 12b only 12m apart. The precise stratigraphic nature of various sites, including Shunera 3, 12 and 12b, was not determined given the sandy nature of the sediments. All six sites studied here were interpreted as fairly ephemeral occurrences, briefly occupied by small groups of people.

| Site name | Total artefacts | Tool % | Deb% | Core% | Tool: core | Deb: core | Flakes: blades | Total tools | Total microliths | Sample studied |
|---|---|---|---|---|---|---|---|---|---|---|
| Shunera 12 SH12 | 2090 | 19.7 | 80.3 | .2 | 82:1 | 336:1 | 2.2:1 | 412 | 362 | 100 |
| Shunera 3 SH3 | 3995 | 24.3 | 75.7 | .4 | 54:1 | 168:1 | 1.3:1 | 970 | 912 | 100 |
| Shunera 12b SH12B | 1542 | 21.2 | 78.8 | .3 | 65:1 | 243:1 | .9:1 | 327 | 307 | 100 |
| Shunera 4 SH4 | 25986 | 6.5 | 93.5 | .9 | 7:1 | 103:1 | 1.7:1 | 1685 | 1506 | 100 |
| Shunera 8 SH8 | 1083 | 24 | 76 | .6 | 37:1 | 123:1 | 1.9:1 | 260 | 235 | 100 |
| Shunera 21 SH21 | 5141 | 21.7 | 78.3 | .5 | 45:1 | 161:1 | .4:1 | 1115 | 1055 | 98 |

Figure 5.20 Assemblage composition of sites from the Shunera Dunes

NB flake:blade ratios calculated on debitage only

### *Shunera 12 (SH12)*

Shunera 12 was a completely deflated lithic scatter close to the bank of Wadi e-Sid, which was systematically collected in 1980. There were no hearths or structures associated with it. Goring-Morris estimates (1987) that the site was probably considerably smaller than 20m$^2$ before deflation. The site is interpreted as a Geometric Kebaran occurrence.

## Chipped stone

A chipped stone assemblage of 2090 pieces, including 412 retouched tools, was retrieved. Only 5 cores were retrieved, of which 4 have 1-2 platforms and 1 has 3-5 platforms. The tool to core ratio is high, as is the debitage: core ratio. There is a high proportion of tools in this assemblage, with lower proportions of debitage. Goring-Morris (1987) suggests that tools were made elsewhere, or that the cores were dumped off-site. The assemblage also has a high proportion of flakes: blades.

| Tool type name | Number | % |
|---|---|---|
| Scraper on bladelet | 2 | .5 |
| Total scrapers | 2 | |
| Backed or retouched blade fragment | 2 | .5 |
| Total | 2 | |
| Straight truncation | 5 | 1.2 |
| Concave truncation | 14 | 3.4 |
| Oblique truncation | 8 | 1.9 |
| Total truncations | 27 | |
| Completely retouched bladelet | 27 | 6.6 |
| Scalene bladelet | 3 | .7 |
| Retouched backed bladelet varia | 4 | 1 |
| Retouched backed fragment | 88 | 21.4 |
| Total backed/retouched bladelets | 122 | |
| Geometric straight truncated & backed | 6 | 1.5 |
| Rectangle | 103 | 25 |
| Trapeze/rectangle | 11 | 2.7 |
| Prototrapeze | 5 | 1.2 |
| Trapeze | 77 | 18.7 |
| Asymmetric trapeze A | 33 | 8 |
| Asymmetric trapeze B | 2 | .5 |
| Trapeze with 1 convex end | 3 | .7 |
| Total geometrics | 240 | |
| Awl | 1 | .2 |
| Retouchednotch | 11 | 2.7 |
| Denticulate | 3 | .7 |
| Total notches | 14 | |

| | | |
|---|---|---|
| Retouched flake<br>Hammerstone<br>Varia | 1<br>1<br>1 | .2<br>.2<br>.2 |
| Unaccounted for in publication | 1 | .2 |
| Grand total | 412 | |

Figure 5.21 Shunera 12 tool type list

Broken retouched or backed bladelets are interpreted as accidental by products of geometric microlith manufacture. There is a high proportion of bladelets truncated at one end and classified as truncations. Goring-Morris considers these to be trapeze rectangles broken whilst being made. He includes broken pieces exhibiting one truncation as geometrics (which otherwise have two truncations). Microliths actually classified as broken are only those with two snaps. Some of the trapeze rectangles here have serration on the working, non-backed edge.

Goring-Morris (1987) measured a sample of trapeze rectangles showing Shunera 12 to have wide geometrics. The average length is 24.1 mm and average width is 9.5 mm. The length/width ratio is 2.6.

## Sample

I have examined 100 microliths, of which 22 were complete and all were oriented. Most were straight-backed bladelets/trapeze-rectangles, with 0-2 truncations.

---

### *Shunera 12b (SH12b)*

Shunera 12b was partly *in situ* but slightly deflated. The site was systematically collected and was less than 20m2 (Goring-Morris 1987) or 25m2 (Goring-Morris *et al.* 1998). The site contained an unlined hearth and an ashy area, each about 50cm in diameter. There were three concentrations of chipped stone and a limestone disc was also retrieved. Shunera 12b was some 12 metres from Shunera 12A. This site is classified by Goring-Morris as a later Geometric Kebaran occurrence.

## Chipped stone

A chipped stone assemblage of 1542 pieces was retrieved, including 327 tools. There is a high proportion of tools in the assemblage, with relatively small numbers of debitage and cores. Goring-Morris (1987) suggests that tools were made elsewhere and brought to the site. Only 5 cores were retrieved, of which 3 have 1-2 platforms, 1 has 3-5 platforms and 1 has 6-7 platforms. The ratio of cores is low compared to tools and to debitage.

| Tool type name | Number | % |
|---|---|---|
| Scraper on bladelet | 1 | .3 |
| Total scrapers | 1 | |
| Backed or retouched blade fragment | 1 | .3 |
| Total | 1 | |
| Straight truncation | 2 | .6 |
| Concave truncation | 7 | 2.1 |
| Oblique truncation | 3 | .9 |
| Total truncations | 12 | |
| Completely retouched bladelet | 29 | 8.9 |
| Scalene bladelet | 1 | .3 |
| Retouched backed bladelet varia | 2 | .6 |
| Retouched backed fragment | 71 | 21.7 |
| Total backed/retouched bladelets | 103 | |
| Geometric straight truncated & backed | 14 | 4.3 |
| Rectangle | 143 | 43.7 |
| Trapeze/rectangle | 7 | 2.1 |
| Prototrapeze | 5 | 1.5 |
| Trapeze | 34 | 10.4 |
| Asymmetric trapeze B | 1 | .3 |
| Total geometrics | 204 | |
| Awl | 1 | .3 |
| Retouched notch | 1 | .3 |
| Denticulate | 1 | .3 |
| Total notches | 2 | .6 |
| Retouched flake | 1 | .3 |
| Hammerstone | 1 | .3 |
| Varia | 1 | .3 |
| Grand total | 327 | |

Figure 5:22 Shunera 12b tool type list

There are fewer truncations at this site than at Shunera 12, but still a high proportion of backed fragments. There is a very high proportion of microlithic tools (93.9), some of which still have some kind of mastic, perhaps plaster, adhering to them. One rectangle has ochre stains.

A sample of trapeze/rectangles was measured, showing that the geometrics at Shunera 12b are wide. The average length is 22.6mm and the average width is 9mm. The length/width ratio is 2.5, making the tools slightly shorter and narrower than those at Shunera 12. In addition, 7% are notched and 2.1 % serrated on the working edge.

### Sample

I have examined 100 microliths, of which 37 were complete. All were oriented. Most of these were straight-backed bladelet but a minority were irregularly backed, or retouched.

---

### *Shunera 3 (SH3)*

Shunera 3 was a deflated site located at the base of a dune. It was systematically collected, containing a hearth, which may be associated with the lithic assemblage. The site is assigned to the later Geometric Kebaran.

### Chipped stone

A chipped stone assemblage totalling 3995 pieces was retrieved, including 970 retouched tools. This makes it one of the larger assemblages assigned to the Geometric Kebaran complex in the Negev. Some tools were seen as intrusive and removed from the assemblage before analysis, including a Harif Point and 2 Pottery Neolithic points.

16 cores were retrieved, of which 68.8% have 1-2 platforms, 6.3 have 3-5 platforms, 12.5 have 3-7 platforms and 12.5 have 8-9 platforms. The ratio of cores is very low compared to tools and to debitage. The ratio of flakes: blades is considered fairly high for a bladelet-based industry.

| Tool type name | | No. | % |
|---|---|---|---|
| Scraper on flake | A1 | 3 | .3 |
| Sidescraper | A6 | 1 | .1 |
| Scraper on bladelet | A7 | 13 | 1.3 |
| Denticulate | A10 | 1 | .1 |
| Double | A11 | 4 | .4 |
| Total scrapers | | 22 | |
| Partially retouched blade | E1 | 3 | .3 |
| Completely retouched blade | E2 | 1 | .1 |
| Retouched both edges | E3 | 1 | .1 |
| Backed or retouched blade fragment | E9 | 2 | .2 |
| Total | | 7 | |
| Concave truncation | G2 | 9 | .9 |
| Total truncations | | 9 | |
| Partially retouched bladelet | I6 | 6 | .6 |
| Completely retouched bladelet | I7 | 26 | 2.7 |
| Bladelet retouched on both edges | I8 | 2 | .2 |
| Blunt backed bladelet | I9 | 1 | .1 |
| Curved pointed bladelet | I12 | 4 | .4 |
| Obliquely truncated & backed | I16 | 1 | .1 |
| La Mouillah point | 122 | 5 | .5 |
| Retouched backed bladelet varia | I30 | 6 | .6 |
| Retouched backed fragment | I31 | 300 | 30.9 |
| Total backed/retouched bladelets | | 351 | |
| Rectangle | J2 | 184 | 19 |
| Trapeze/rectangle | J3 | 7 | .7 |
| Trapeze | J5 | 370 | 38.1 |
| Total geometrics | | 561 | |
| Retouched notch | M1 | 4 | .4 |
| 2 or more notches | M2 | 2 | .2 |
| Total notches | | 6 | |
| Pick/chopping tool | N2 | 1 | .1 |
| Massive denticulate | N3 | 1 | .1 |
| Retouched flake | O1 | 2 | .2 |
| Hammerstone | O4 | 5 | .5 |
| Varia | O5 | 5 | .5 |
| Grand total | | 970 | |

Figure 5:23 Shunera 3 tool type list

A sample of the trapeze-rectangles at this site were measured showing that the geometrics at Shunera 3 are much less wide and long than all but a few other Negev Geometric Kebaran sites (Azariq 1 and 8 and Nahal Sekher 22). The average length is 16.9mm and average width is 4.8mm. The average length/width ratio is 3.6.

Goring-Morris places this site in a subgroup of the Geometric Kebaran emphasising narrow trapezes. Members of this group have been variously considered to be transitional between the Kebaran and the Geometric Kebaran, because of their narrow tools (Goring-Morris 1987), or influenced by the Mushabian (Fellner 1995), based on perceived resemblance of microlith forms to both industries.

Bipolar and mixed backing occurs at this site (33%), as at other narrow trapeze sites. Goring-Morris suggests that this is because of the necessity of supporting the thin pieces while backing them, while wider ones could be backed while holding them in one's hand. However, he also points out that at Gebel Maghara all sites, regardless of width, have bipolar backing and at Nahal Zin sites have narrow trapezes and no bipolar backing.

### Sample

I have examined 100 microliths, of which only 6 were complete and 91 were oriented. Most were straight-backed bladelets (95%).

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### ***Shunera 4 (Sh4)***

Shunera 4 was located at the foot of a large dune close to the edge of the terrace of Wadi es Sid. It was a large *in situ* site, covering some 80m2 and containing at least 2 hearths, with diameters of ca. 50cm, one accompanied by quantities of burnt stones. Occupation was up to 30cm thick and was very dense, but no internal stratigraphy was found. Large quantities of marine molluscs, mainly *Dentalia* as well as a Red Sea specimen, *Anachis miser*, were retrieved. Several of the marine gastropods are ochre smeared.

A block was found with angular edges showing signs of battering – it is suggested this was an anvil for use in microburin production. A shallow cupmark was found on a piece of limestone, as well as a limestone disc.

Goring-Morris suggests this site is a later development of the Mushabian. Two radiocarbon determinations on charcoal from the hearths gave dates of 9050 +-140 (PTA 3003) and 9750+-140BP (PTA 3690). He questions the reliability of these determinations, as they do not overlap and are too recent by 1000-1500 years for their expected, Mushabian date. Fellner (1995) assigns this site, along with Shunera 8 (below) to one cluster including other 'classic Mushabian' sites.

### Chipped stone

A large lithic assemblage of 25986 pieces was retrieved, including 1685 tools. The lithic assemblage is very similar to that of neighbouring Shunera 2. 239 cores were recovered from the site, 66.9% of which have 1-2 platforms, 10.9% have 3-5 platforms, 5.9% have 6-7 platforms and 6.7% have 8-9 platforms.

Shunera 4 has a high proportion of cores and a low proportion of retouched tools. In addition, 511 microburins were recovered from the site, making a microburin index of 23.3, or a restricted microburin index of 57.2, higher than most of the other Mushabian sites. Shunera 4 is more heavily microlithic than other Mushabian assemblages and includes a range of microlithic forms, including arched backed bladelets, backed and obliquely truncated bladelets, triangular microliths and rectangles. The arched backs and pointed ends were created in a number of ways – backing, retouch, points, oblique, smooth, rough. The broken microliths category (67% of the assemblage) includes many straight backed bladelets with two snaps, or small spikes with one snap.

Goring-Morris suggests that knapping was an important activity here, on the basis of the high proportions of debitage, but the presence of a full range of tools points to other activities being carried out as well.

| Tool type name | | No. | % |
|---|---|---|---|
| Scraper on flake | A1 | 4 | .2 |
| Sidescraper | A6 | 1 | .1 |
| Scraper on bladelet | A7 | 29 | 1.7 |
| Scraper on retouched blade/let | A8 | 1 | .1 |
| Double | A11 | 10 | .6 |
| Total scrapers | | 45 | |
| Burin on break/natural surface | C3 | 2 | .1 |
| Partially retouched blade | E1 | 2 | .1 |
| Retouched both edges | E3 | 1 | .1 |
| Retouched backed varia | E8 | 2 | .1 |
| Backed or retouched blade fragment | E9 | 2 | .1 |
| Total | | 7 | |
| Unretouched sickle blade | F1 | 1 | .1 |
| Concave truncation | G2 | 1 | .1 |
| Oblique truncation | G3 | 17 | 1.7 |
| Total truncations | | 18 | |
| Bladelet with complete/fine retouch | I2 | 1 | .1 |
| Alternately retouched bladelet | I5 | 1 | .1 |
| Partially retouched bladelet | I6 | 9 | .5 |
| Completely retouched bladelet | I7 | 16 | .9 |
| Scalene bladelet | I8 | 3 | .2 |
| Blunt backed bladelet | I9 | 3 | .2 |
| Pointed backed bladelet | I10 | 1 | .1 |
| Curved pointed bladelet | I12 | 4 | .2 |
| Obliquely truncated bladelet | I15 | 1 | .1 |
| Obliquely truncated & backed bladelet | I16 | 2 | .1 |
| Scalene bladelet | I18 | 85 | 5 |
| Scalene bladelet with basal modifi'ns | I19 | 10 | .6 |
| Arched backed bladelet | I20 | 128 | 7.6 |
| La Mouillah point | I22 | 9 | .5 |
| Ramon point | I24 | 3 | .2 |
| Ramon point with basal modifi'ns | I25 | 1 | .1 |
| Retouched backed bladelet varia | I30 | 32 | 1.9 |
| Retouched backed fragment | I31 | 1142 | 67.8 |
| Total backed/retouched bladelets | | 1451 | |
| Geometric straight truncated & backed | J1 | 2 | .1 |
| Rectangle | J2 | 38 | 2.3 |
| Trapeze/rectangle | J3 | 1 | .1 |
| Trapeze | J5 | 6 | .4 |
| Lunate | J11 | 4 | .2 |
| Atypical lunate | J12 | 3 | .2 |
| Atypical triangle | J14 | 1 | .1 |
| Total geometrics | | 55 | |
| Awl | L1 | 1 | .1 |
| Retouched notch | M1 | 49 | 2 |
| 2 or more notches | M2 | 7 | .4 |
| Denticulate | M3 | 3 | .2 |

| | | | |
|---|---|---|---|
| Total notches | | 59 | |
| Chisel/retoucher | N1 | 3 | .2 |
| Pick/chopping tool | N2 | 4 | .2 |
| Massive denticulate | N3 | 3 | .2 |
| Massive battered piece | N4 | 8 | .5 |
| Massive scraper | N5 | 2 | .1 |
| Retouched flake | O1 | 6 | .4 |
| Limestone disc | O3 | 2 | .1 |
| Hammerstone | O4 | 8 | .5 |
| Varia | O5 | 10 | .6 |
| Grand total | | 1685 | |

Figure 5:24 Shunera 4 tool type list

A sample of points were measured, with an average length of 20.4mm and an average width of 5.7mm. The length/width ratio is 3.6.

## Sample

I examined 100 microliths, of which 53 were complete and 98 were oriented. A variety of forms were examined, from the obliquely truncated Ramon-Point-like forms to more smoothly arched forms, irregularly backed microliths and very small, snapped backed, spiky points.

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### *Shunera 8 (Sh8)*

Shunera 8 was located 80m east of Shunera 2. It was collected from a deflated surface partially covered by recent sand dunes. It is inferred that the site did not exceed 25m2. It is designated a 'classic' Mushabian site

## Chipped stone

An assemblage of 1083 pieces was retrieved, including 260 retouched tools, in systematic sampling. 7 cores were retrieved from the site, of which 71.4% have 1-2 platforms.

102 microburins were recovered, giving a microburin ratio of 28, or a restricted microburin ratio of 48.3, which is high.

| Tool type name | | No. | % |
|---|---|---|---|
| Scraper on bladelet | A7 | 1 | .4 |
| Total scrapers | | 1 | |
| Backed or retouched blade fragment | E9 | 4 | 1.5 |
| Total | | 4 | |
| Straight truncation | G1 | 1 | .4 |
| Concave truncation | G2 | 2 | .8 |
| Oblique truncation | G3 | 5 | 1.9 |
| Backed and truncated | G4 | 2 | .8 |
| Total truncations | | 10 | |
| Partially retouched bladelet | I6 | 1 | .4 |
| Completely retouched bladelet | I7 | 9 | 3.4 |
| Blunt backed bladelet | I9 | 6 | 2.3 |
| Curved pointed bladelet | I12 | 8 | 3.1 |
| Scalene bladelet | I18 | 23 | 8.8 |
| Arch backed bladelet | I20 | 16 | 6.1 |
| Arch backed bladelet with basal mod'n | I21 | 11 | 4.2 |
| La mouillah point | I22 | 3 | 1.1 |
| Ramon point | I24 | 1 | .4 |
| Retouched backed bladelet varia | I30 | 11 | 4.2 |
| Retouched backed fragment | I31 | 134 | 51.1 |
| Total backed/retouched bladelets | | 223 | |
| Trapeze | J5 | 1 | .4 |
| Atypical lunate | J12 | 6 | 2.3 |
| Atypical triangle | J14 | 5 | 1.9 |
| Total geometrics | | 12 | |
| Retouched notch | M1 | 7 | 2.7 |
| 2 or more notches | M2 | 2 | .8 |
| Total notches | | 9 | |
| Retouched flake | O1 | 1 | .4 |
| Varia | O5 | 2 | .8 |
| Grand total | | 262 | |

Figure 5:25 Shunera 8 tool type list

Goring-Morris measured a sample of arched backed bladelets, focusing only on those he considered points. The average length is 20.9mm and the average width is 7.4mm. The length/width ratio is 2.8.

## Sample

I examined a total 100 microliths, of which 34 were complete and 98 were oriented. A range of arched backed and obliquely truncated forms were included.

### *Shunera 21 (Sh21)*

Shunera 21 was found eroding from a dune surface with a view overlooking Wadi es Sid and the Shunera dunes, in a lowland location. The site was partially excavated and contained 4 hearths, one with burnt stones. At 80m2, this is considered to be a large site for the area. The site contained two main hearths three metres apart and 2 smaller ones about 2 metres away from these. This is considered to be an Early Ramonian assemblage.

#### Chipped stone

An assemblage of 5141 pieces, including 1115 retouched tools, was retrieved. 25 cores were found. The assemblage has a very high proportion of blades. The microburin technique was used heavily. With 604 microburins retrieved, the assemblage has a restricted microburin index of 62.2, higher than most other Ramonian sites. Goring-Morris suggests that the very high numbers of microburins compared to tools may mean that tools made here were taken elsewhere.

Bladelets often have small punctiform platforms, with dorsal edge grinding, which can still be seen on the tools.

| Tool type name | | No. | % |
|---|---|---|---|
| Scraper on bladelet | A8 | 2 | .2 |
| Ogival | A9 | 1 | .1 |
| Total scrapers | | 3 | |
| Partially retouched | E1 | 2 | .2 |
| Completely retouched | E2 | 1 | .1 |
| Backed or retouched blade fragment | E9 | 1 | .1 |
| Total | | 4 | |
| Straight truncation | G1 | 1 | .1 |
| Concave truncation | G2 | 2 | .2 |
| Oblique truncation | G3 | 19 | 1.7 |
| Total truncations | | 22 | |
| Inversely retouched bladelet | I4 | 1 | .1 |
| Partially retouched bladelet | I6 | 4 | .4 |
| Completely retouched bladelet | I7 | 202 | 18.1 |
| Obliquely truncated bladelet | I15 | 8 | .7 |
| La mouillah point | I22 | 13 | 1.2 |
| Ramon point | I24 | 622 | 55.8 |
| Ramon point with basal modif'ns | I25 | 95 | 8.5 |
| Retouched backed bladelet varia | I30 | 4 | .4 |

| | | | |
|---|---|---|---|
| Retouched backed fragment<br><br>Total backed/retouched bladelets | I31 | 106<br><br>1055 | 1.5 |
| Retouched notch<br><br>Total notches | M1 | 27<br>27 | 2.4 |
| Chisel/retoucher<br>Massive denticulate<br>Massive battered piece<br>Massive scraper | N1<br>N3<br>N4<br>N5 | 1<br>1<br>1<br>1 | .1<br>.1<br>.1<br>.1 |
| Grand total | | 1115 | |

Figure 5:26 Shunera 21 tool type list

The range of tool types is limited, with very rare scrapers. Broken backed bladelets are common and are mainly medial and proximal. The assemblage is dominated by the Ramon Point, leading Goring-Morris to suggest that this was a hunting site.

### Sample

I examined a total of 98 microliths, of which 52 were complete and 96 oriented. The vast majority of tools were scalene bladelets or Ramon Points.

### 5.2.2. Wadi Hisma

The area is in the western part of the Jordanian plateau and contains a variety of landforms. The limestone plateau contains rolling hills. To its south, the sandstone inselbergs front the plateau, while to the west, granite mountains fall away steeply to the Rift Valley.

Elevations within the area range from 800-1700masl. The main features and drainages of the area predate the final Pleistocene. Aggradation of sand sediments blocked drainages, forming lakes during the Pleistocene.

The modern climate is similar to that of the Negev, with short wet winters and long dry summers. However, the variability in elevations results in differential precipitation and temperature patterns across the area. Rainfall ranges from an average of less than 50mm in the lowland areas, up to 300mm in the uplands.

Vegetation also varies from modern remnants of Mediterranean woodlands in the uplands, to Saharo Arabian vegetation in the more arid lowland.

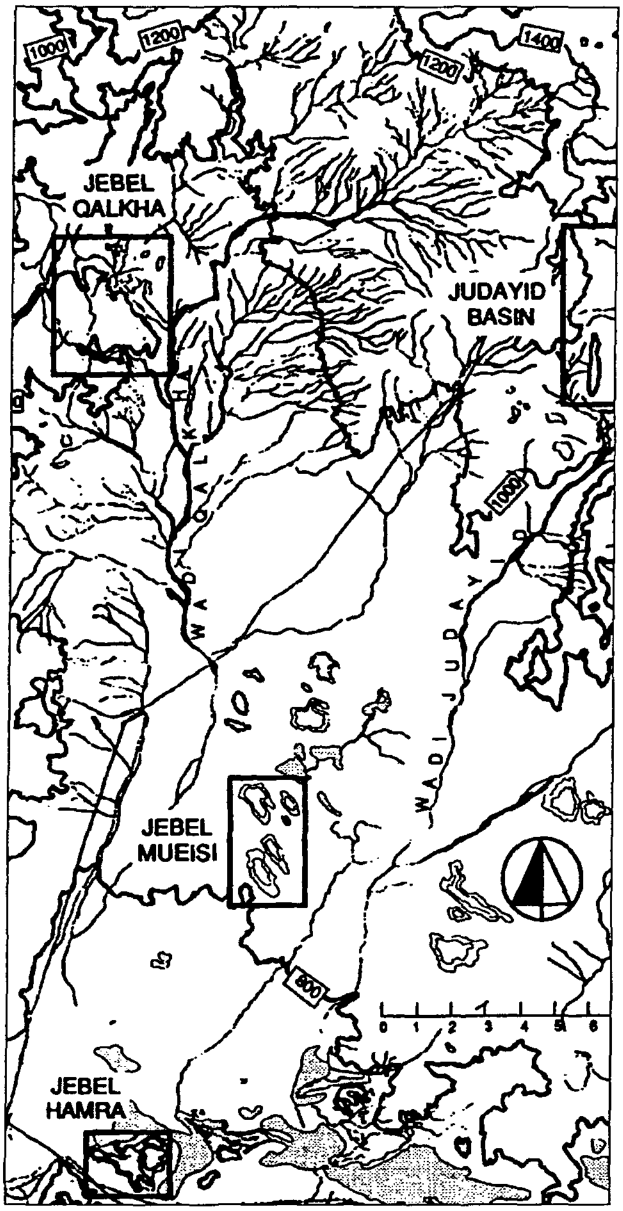


Figure 5:27 Locations of site areas in the Ras en-Naqb

The Ras en Naqb project began in 1979 under the direction of Don Henry. It continued for 5 further seasons until 1988, carrying out systematic surveys of four areas within the Ras en Naqb region of southern Jordan. 32km2 were surveyed and 109 sites discovered. Of these, 35 were mapped and systematically surveyed.

| Site name | | Total lithics | Tool % | Deb % | Core % | Tool: core | Deb: core | Flakes: blades | Total tools | Total micr-oliths | Sample studied |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jebel Hamra J201 | JH | 3333 | 15 | 85 | 1.1 | 13:1 | 91:1 | .3:1 | 500 | 385 | 100 |
| Wadi Judayid J31 | WJ | 1319 | 11.3 | 88.7 | .7 | 17:1 | 150:1 | .3:1 | 149 | 116 | 100 |
| Wadi Humeima Lower J406b | WH | 3792 | 10 | 90 | .8 | 12:1 | 126:1 | 1.7:1 | 377 | 160 | 108 |
| Tor Hamar J431 Block 2 | TH2 | 10999 | 4.3 | 95.7 | .6 | 7:1 | 157:1 | .6:1 | 475 | 309 | 141 |
| Tor Hamar J431 Block 1 | TH1 | 22743 | 6.3 | 93.7 | .7 | 9:1 | 147:1 | .6:1 | 1443 | 911 | 155 |
| Jebel Fatma J436 | JF | 1546 | 5.9 | 94 | .7 | 9:1 | 68:1 | 1.4:1 | 160 | 107 | 107 |

Figure 5:28 Assemblage composition in the Ras en-Naqb sites

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### *Jebel Hamra J201 (JH)*

Jebel Hamra was at the base of a shallow sandstone rockshelter, at 830masl. An artifact scatter covered 320m2. Rock fall marked the western limit of the site. Test units 1 and 2 were dug in 1979 and a 6m long trench was excavated during 1980.

The lowest level of the site was classified as Early Hamran, with the two upper layers (A and B) as Middle Hamran.

Layer A was 5-10cm deep and comprised of sandy-silt and angular sandstone rubble, while layer B was 20cm deep and comprised of compact sandy-silt sediments. Ash lenses were found in both layers. Other finds include petroglyphs of unknown age. The site is interpreted (Henry 1995) as a winter site used by somewhat larger groups and regularly revisited.

### Chipped stone

The assemblage examined here was that from the Middle Hamran levels, which contained a high proportion of retouched tools. The assemblage contains 3333 pieces, including 500 tools.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 20 | 4.1 |
| Burins | 3 | 0.6 |
| Backed blade flakes | 3 | 0.6 |
| Truncations | 11 | 2.3 |
| Retouched blades flakes | 61 | 12.3 |
| Notches/denticulates | 17 | 3.4 |
| Geometric microliths | | |
| Trapeze rectangles | 98 | 19.6 |
| TOTAL GEOMETRC | 98 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 5 | 1.1 |
| Straight backed, bitruncated | 182 | 36.3 |
| Straight backed bladelet, medial | 64 | 12.8 |
| Irregular or concave | 3 | .6 |
| Fragment | 33 | 6.7 |
| TOTAL NON GEOMETRIC | 287 | |

Figure 5:29 Jebel Hamra tool type list

### Sample

I examined 100 microliths in total, 20 of which were complete and 81 of which were oriented. Most of these were straight-backed bladelets, with varying numbers of truncations.

---

### *Wadi Judayid J31 (WJ)*

Wadi Judayid was an open-air site at 1,080 masl. The site extended over 200 m2, bounded by drainages that defined edges of an alluvial fan. Artefacts were eroding from the alluvial fan. 11 1m2 test units were excavated near the centre of the concentration to a maximum of 1.8m below surface. Artefacts were found to a depth of 70cm. Layer A was 40-50 cm thick, comprising silty-sand with thin steeply bedded lenses that followed the modern slope. It was interpreted as reworked Layer B sediments from upslope deposits. Layer B was comprised of moderate grained red sand and had a much higher artefact density together with near level bedded ash lenses. The two layers were grouped together as one assemblage.

This site is interpreted as briefly occupied in the summer months by a mobile group.

## Chipped stone

An assemblage of 1319 pieces includes a high proportion of tools (11%). The assemblage is overwhelmingly made up of various forms of straight-backed bladelets and geometrics.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 3 | 2.0 |
| Truncations | 17 | 11.4 |
| Retouched blades flakes | 1 | 0.7 |
| Notches/denticulates | 3 | 2.0 |
| Multiple tools | 2 | 1.4 |
| Varia | 1 | 0.3 |
| Unaccounted for in publication | 6 | 4.0 |
| Geometric microliths | | |
| Trapeze rectangles | 15 | 10.10 |
| TOTAL GEOMETRIC | 15 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 10 | 6.7 |
| Straight backed, bitruncated | 30 | 20.1 |
| Straight backed bladelet, medial | 19 | 12.8 |
| Pointed straight backed | 5 | 3.4 |
| Fragment | 2 | 1.3 |
| Various | 27 | 18.1 |
| Retouched bladelet | 1 | 0.7 |
| Microgravette | 7 | 5.0 |
| TOTAL NON GEOMETRIC | 101 | |

Figure 5:30 Wadi Judayid tool type list

## Sample

I examined 100 microliths in total, of which 24 were complete and 77 oriented. These were very largely straight-backed (81.8%), together with some truncations and some irregularly backed bladelets.

### *Wadi Humeima Lower J406b (WH)*

This site was at 1020masl, in an open setting along Wadi Humeima at the foot of a slope falling away from the escarpment of Jebel Humeima. It was approximately 8m downhill from a Late Natufian occupation.

During 1980 an assemblage was surface collected and excavated from 50cm thick red sand deposit. In 1983, two 1 m2 units were excavated to bedrock at 25-30cm (units 1 and 3). The assemblages from these excavations are interpreted as mixed Early Hamran/Qalkhan. These assemblages were not included in Henry's published data, except for the 22 Qalkhan Points recovered.

Units 2 and 4, upslope from 1 and 2, were also excavated, revealing much deeper levels. The upper 50cm was separated from the lower 60cm by a lens of rubble, but no other apparent lithological differences between the layers were identified. The upper level is classified as an Early Hamran assemblage, while the lower level is seen as Qalkhan. Henry (1995) interprets the site as occupied during the summer months.

#### Chipped stone

The assemblage examined in this study was limited to the Qalkhan levels. The assemblage contains 3792 pieces, including 377 tools. Cores are mainly subpyramidal, with 68% single platforms and the remaining opposed or twisted platforms. The microburin technique is common, with a restricted microburin index of 20.3. The proportion of flakes to blades is higher than in other Hisma sites.

The assemblage is characterised by Qalkhan points and narrow arched microliths, but also contains many straight backed tools and some wider arched bladelets.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 36 | 9.5 |
| Burins | 12 | 3.2 |
| Backed blade flakes | 23 | 6.1 |
| Truncations | 18 | 4.8 |
| Retouched blades flakes | 64 | 17 |
| Notches/denticulates | 57 | 15.1 |
| Multiple tools | 1 | .3 |
| Perforators | 4 | 1.1 |
| Utilised piece | 3 | .8 |
| Geometric microliths | | |
| Isosceles triangles | 1 | .3 |
| TOTAL GEOMETRIC | 1 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 5 | 1.2 |
| Straight backed, bitruncated | 15 | 4 |
| Bilateral backed bladelet | 3 | .8 |
| Straight backed bladelet, medial | 13 | 3.4 |
| Arched backed bladelet | 8 | 2.1 |
| Irregular or concave | 6 | 1.6 |
| Narrow arched backed and pointed | 23 | 6.1 |
| Ouchtata bladelet | 6 | 1.6 |
| Various | 4 | 1.1 |
| Retouched bladelet | 64 | 17 |
| Microgravette | 1 | .3 |
| Lamouillah | 2 | .5 |
| Piquant triedre | 1 | .3 |
| Qalkhan | 8 | 2.1 |
| TOTAL NON GEOMETRIC | 159 | |

Figure 5:31 Wadi Humeima tool type list

### Sample

I examined a total of 108 microliths, of which 26 were complete and 106 were oriented. A full range of tool forms was studied. Qalkhan Points (7.4%), straight backed bladelets (50%) and arched and narrow points (26%) were studied

---

## *Tor Hamar J431: Block 1, (TH1) Madamaghan and Block 2, (TH2) (Qalkhan)*

Tor Hamar extended from the back wall of a rockshelter downslope towards Wadi Aghar, covering an area of 300m2. The site elevation was 950masl. The site was discovered in 1983/4, when units 1 and 2 were excavated to 1.3m. 8 more units of 2m2 blocks were excavated in the next season to 2.2m.

Block 1 – in upper levels (A-E1) are designated Madamaghan. Block 2, in level E2, contained a Qalkhan occupation. Below this was an Upper Palaeolithic/Ahmarian occupation (Layers F-G). The site is interpreted (Henry 1995) as a winter-occupied site.

### Block 1, (TH1) Madamaghan

Block 1, upslope, was dug first. It was divided into 8 strata with 22 arbitrary levels. A comprised fine powdery light grey ash. A1 (5-10cm) contained recent organic material, not found in A2. Layers B, C and D were differentiated by proportions of ash & sand. Ash lenses pointed to shallow hearths underlain by fire-reddened sediments. These layers could be identified during excavation, but not once dried, in section. B had more yellow red sand and was more compact than A. B graded into C at 110-120 below datum. C was largely yellow-red sand, grading into D, which was more compact and ashy, at 140 below datum. Layer E1 comprised 20cm thick sandstone rubble with dark grey ash & charcoal, fallen from the ceiling of the rockshelter and associated with a large fire in Layer E.

Block 1 contained a large hearth & possibly part of a stone foundation of a windbreak. These were found near the top of Layer C at between 90-120cm below datum. A fire pit was found. This had been used in at least 2 burnings, as it had 2 different ash strata, surrounded by fire-reddened sand. The Eastern side of pit had 2 concentric rocklines with a slab of bedrock. Burnt bones were found near the centre of the hearth and a sandstone muller between the hearth and the foundation stones. 5 bone points were recovered and some groundstone fragments, as well as a surface find of a conical mortar in a large block. There were large numbers of shells, including *dentalium* among many other sorts. Most were Red Sea specimens, although a few were of Mediterranean origin.

Two radiocarbon determinations on charcoal were made from Layer C - 12,680 +/-320BP (SMU 1399); 12,320 +/-90BP (ETH 806).

Madamaghan chipped stone (TH1)

An assemblage of 22743 pieces was retrieved, including 1443 tools.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 151 | 10.5 |
| Burins | 7 | 0.5 |
| Backed blade flakes | 84 | 5.8 |
| Truncations | 15 | 1.1 |
| Retouched blades flakes | 164 | 11.3 |
| Notches/denticulates | 95 | 6.5 |
| Multiple tools | 2 | 0.1 |
| Perforators | 8 | 0.5 |
| Massive tools | 2 | 0.1 |
| Varia | 2 | 0.1 |
| Not accounted for in publication | 2 | 0.2 |
| Geometric microliths | | |
| Lunates | 4 | 0.3 |
| Helwan lunates | 13 | 0.9 |
| Atypical lunates or incomplete | 1 | 0.1 |
| Isosceles triangles atypical or incomplete | 3 | 0.2 |
| Trapeze rectangles | 4 | 0.3 |
| TOTAL GEOMETRIC | 25 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 139 | 9.6 |
| Straight backed with truncation opposite snap | 2 | 0.1 |
| Straight backed, bitruncated | 6 | 0.4 |
| Straight backed bladelet, medial | 45 | 3.1 |
| Arched backed bladelet | 135 | 9.4 |
| Arched backed with truncation | 52 | 3.6 |
| Pointed straight backed | 58 | 4.0 |
| Pointed straight backed w/ basal truncation | 16 | 1.1 |
| Arched back w/ microburin | 11 | 0.7 |
| Partially backed | 4 | 0.3 |
| Scalene bladelets | 28 | 1.9 |
| Ouchtata bladelet | 10 | 0.7 |
| Fragment | 139 | 9.6 |
| Various | 76 | 5.3 |
| Retouched bladelet | 20 | 1.4 |
| Microgravette | 2 | 0.1 |
| Lamouillah | 135 | 9.4 |
| Piquant triedre | 8 | 0.5 |

| | | |
|---|---|---|
| TOTAL NON GEOMETRIC | 886 | |

Figure 5:32 Tor Hamar 1 tool type list

Madamaghan sample

I examined a total of 155 microliths, of which 84 were complete and all were oriented. These were evenly divided between straight backed and arched backed tools.

## Tor Hamar Block 2, (TH2) (Qalkhan)

Block 2 was in a single layer (E2) underlying Block 1. It comprised a powdery strata of ash and sand. A wedge of compact, burnt sediment was recorded in the upslope areas, thought to be either an extension of the burnt area in Block 1 at E1 or a large hearth.

Qalkhan chipped stone

An assemblage of 10999 pieces was recovered, including 475 tools, a lower percentage than other assemblages in the sample. The toolkit is dominated by nongeometric microliths, largely narrow arched backed and pointed bladelets, as well as straight backed bladelets. Qalkhan points are considered diagnostic of the industry.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 62 | 13 |
| Burins | 13 | 2.7 |
| Backed blade flakes | 18 | 3.8 |
| Truncations | 12 | 2.5 |
| Retouched blades flakes | 37 | 7.8 |
| Notches/denticulates | 21 | 4.4 |
| Perforators | 2 | 0.4 |
| Utilised piece | 1 | 0.2 |
| Geometric microliths | | |
| Trapeze rectangles | 13 | 2.7 |
| TOTAL GEOMETRICS | 13 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 31 | 6.5 |
| Straight backed with truncation opposite snap | 25 | 5.3 |
| Straight backed bladelet, medial | 28 | 5.9 |
| Arched backed bladelet | 24 | 5.0 |
| Arched backed with truncation | 15 | 3.2 |
| Irregular or concave | 22 | 4.6 |
| Narrow arched backed and pointed | 45 | 9.5 |

| | | |
|---|---|---|
| Partially backed | 26 | 5.5 |
| Scalene bladelets | 6 | 1.3 |
| Ouchtata bladelet | 4 | 0.8 |
| Fragment | 8 | 1.7 |
| Various | 2 | 0.4 |
| Retouched bladelets | 14 | 2.9 |
| Microgravette | 5 | 1.0 |
| El Wad | 2 | 0.4 |
| Lamouillah | 28 | 5.9 |
| Piquant triedre | 1 | 0.2 |
| Qalkhan | 10 | 2.1 |
| TOTAL NON GEOMETRIC | 296 | |

Figure 5:33 Tor Hamar 2 tool type list

Qalkhan sample

I examined a total of 141 tools, of which 86 were complete and 136 were oriented. A range of straight-backed and pointed forms were studied.

---

### *Jebel Fatma J436 (JF)*

Jebel Fatma was a rockshelter site, with artefacts extending 214ms from the back wall of the shelter downslope. Two one m2 units were excavated in the shelter to depth of 70cm to bedrock. The deposit was mottled grey-yellow ashy sand. This is a lowland site. The assemblage was classified as an early Madamaghan one, occupied during the winter months.

#### Chipped stone

An assemblage of 160 pieces was retrieved, including 132 tools. The microburin index is 27, which is much lower than at Tor Hamar J431 Block 1, where it is between 70 and 79 across different phases of the site. Microburins make up 3.8 of the assemblage.

| Tool type names | No. | % |
|---|---|---|
| Scrapers | 9 | 6.6 |
| Backed blade flakes | 1 | 0.7 |
| Retouched blades flakes | 6 | 4.4 |
| Notches/denticulates | 7 | 5.2 |
| Utilised piece | 2 | 1.5 |

| | | |
|---|---|---|
| Geometric microliths<br>Trapeze rectangles | 10 | 7.5 |
| TOTAL GEOMETRICS | 10 | |
| Non geometric microliths | | |
| Straight backed bladelet, with basal or distal truncation | 3 | 2.2 |
| Straight backed with truncation opposite snap | 13 | 9.8 |
| Bilateral backed bladelet | 1 | 0.7 |
| Straight backed bladelet, medial | 17 | 12.8 |
| Arched backed bladelet | 20 | 15.1 |
| Arched backed with truncation | 1 | 0.7 |
| Partially backed | 1 | 0.7 |
| Scalene bladelet | 1 | 0.7 |
| Fragment | 2 | 1.5 |
| Various | 1 | 0.7 |
| Retouched bladelet | 4 | 3.0 |
| Microgravette | 15 | 11.3 |
| Lamouillah | 17 | 12.8 |
| Piquant triedre | 1 | 0.7 |
| TOTAL NON GEOMETRIC | 97 | |

Figure 5:34 Jebel Fatma tool type list

## Sample

I examined a total of 107 microliths, of which 50 were complete and 94 were oriented. Most of these were straight-backed bladelets, with a significant number of arched-backed bladelets.

# 6. DATA ANALYSIS

## INTRODUCTION

The results of the study of 12 microlithic assemblages are described below. This chapter reports on the variability within each site studied. The methods used to do this were described in chapter 5.

### Design parameters or values

It is clear from the results of this study that choices in the manufacture of microlith morphology reveal concerns along a number of design parameters. Choices were taken on a site by site basis in relation to these design concerns. I will look at the pattern of variability that these decisions have produced within each site.

This study has revealed that there are several principles of design morphology that microlith manufacturers had to negotiate in the production of tools appropriate to their particular site, situation or context. In addressing these principles, decisions emphasised the qualities sought in the final tool. It is these decisions which give each assemblage its character. Design principles include the following:

#### Symmetry

Bladelet blanks are originally long thin objects, with morphological differences at each end related to fracture mechanics. These blanks can be modified so as to be either symmetrical or asymmetrical along their horizontal axis (see figure 6.1). Symmetrical tools have proximal and distal ends that are mirror images of each other in truncation angle. These are generally classified as geometric microliths, such as trapeze rectangles or lunates. However, there are tools not classified as geometrics which are symmetrical (various bipoints). There are also geometrics which are not strictly symmetrical (some trapezes or triangles). Asymmetrical tools include many tools with points on one end. Assemblages can contain almost entirely asymmetrical tools, entirely symmetrical tools, or a mixture of both. The *degree* of asymmetry can also vary, from slight deviations of 10 degrees from symmetry, to extreme differences of 60 or 70 degrees between ends.

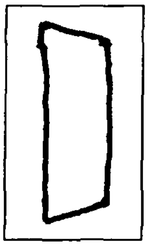


Figure 6:1 Symmetrical tool

## Interchangeability of tool ends

In some assemblages, a certain truncation angle may be prescribed for one of the ends of the blank – either the proximal or distal end. The angle always and only appears on that end. In other assemblages, the tool end is not relevant to the creation of a truncation angle. The preferred truncation angle can be made on either end. These are interchangeable tool ends (see figure 6.2).

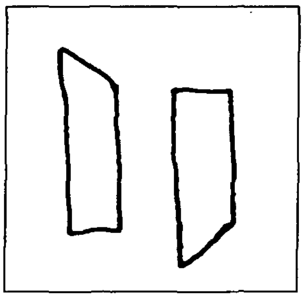


Figure 6:2 Interchangeable tool ends

## Specificity of angles versus relationship of angles

Angles can be either tightly constrained – so that only a certain range of angles is appropriate for tools - or a whole range of angles can be appropriate (see figure 6.3). At sites where the choice of angles is less constrained, it is often the relationship of angles at either end that is determined. They are often symmetrical or vary by a limited number of degrees from each other. Where an end must have one of only a few angles, the other end often varies dramatically in its angle, creating a varying relationship of angles between the tool ends.

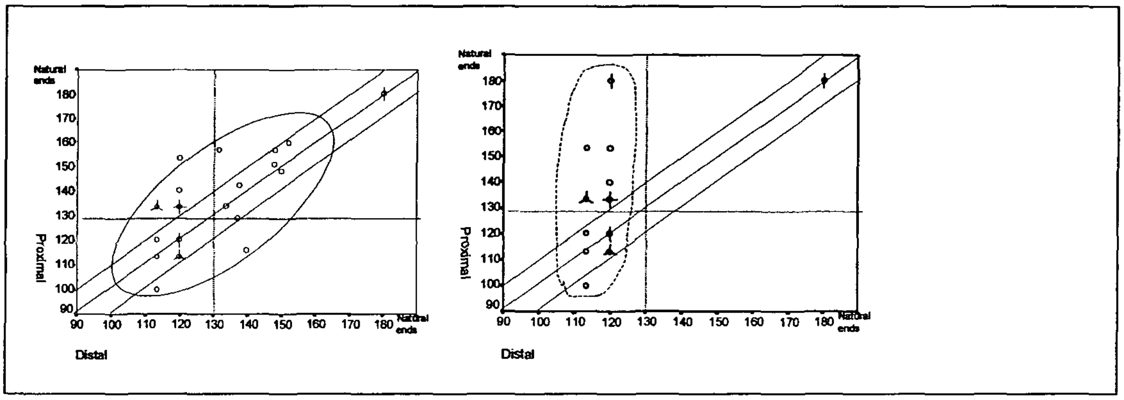



Figure 6:3 Unconstrained and constrained truncation angles

## Discrete or continuous variability

Tool morphologies can be discrete or continuous in their variability patterns (see figure 6.4). Discrete groups of truncation angles are isolated from each by certain angles that are never used at the site. Sites with patterns of continuous variation use a wider range of angles, with fewer prescribed angles. One set of angles can be dominant, with variability taking the form of a fall-off in frequency from that dominant group.

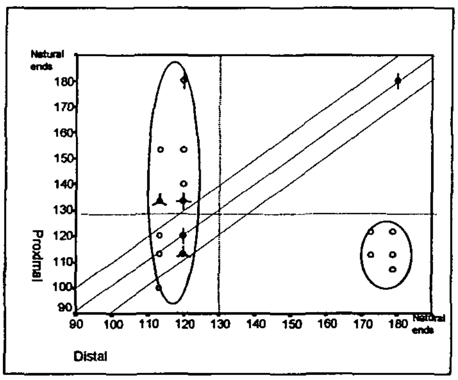



Figure 6:4 Discrete patterns of truncation angle variability

## Techniques of retouch application

Location of backing on a tool can vary, with certain locations relative to the tool blank preferred. The sequence of retouch application can also vary in one direction or another relative to the blank. For example, it can be applied starting at the proximal end and moving up to the distal end, with perhaps the backing on the left side applied first, then the distal end retouch applied next from the left hand side to the right.

### Metrics

Tool dimensions can be more or less variable, and these dimensions can be correlated with truncation angles used, or with other metric dimensions. These correlations can be unimodal or bimodal, and looser or tighter in their correlation.

### Structure of the chapter

This chapter will describe the pattern of variability and use of design principles at each site, as follows:

Middle Hamran
- Jebel Hamra
- Wadi Judayid

Geometric Kebaran
- Shunera12
- Shunera 12b
- Shunera 3

Qalkhan
- Tor Hamar 2
- Wadi Humeima

Madamaghan
- Tor Hamar 1
- Jebel Fatma

Mushabian
- Shunera 4
- Shunera 8
- Shunera 21

Chapter 7 will explore comparisons between these sites at various levels of analysis.

# Assemblage catalogue

## 6.1. Jebel Hamra J201 (JH): Middle Hamran

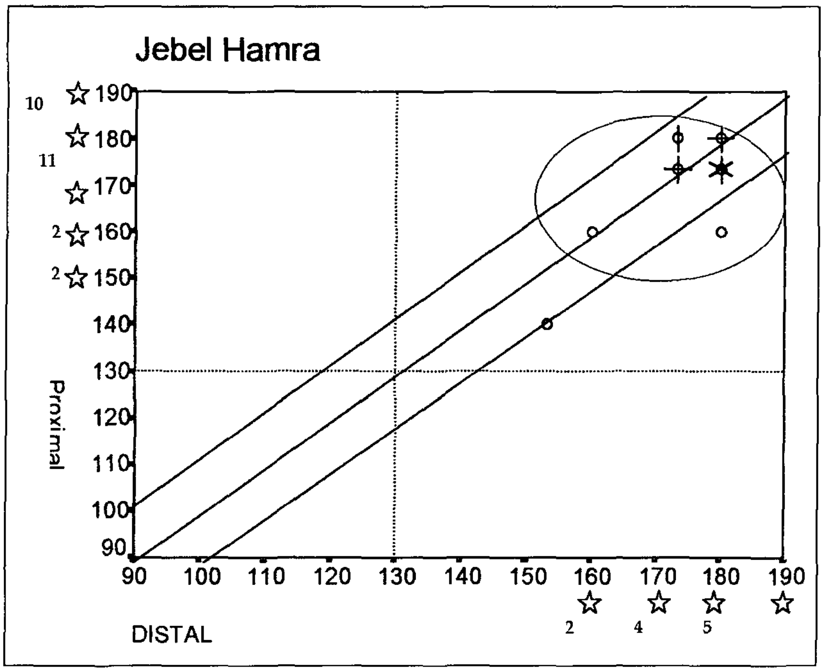



Figure 6:5 Jebel Hamra truncation angles

### Description of tools

The assemblage is made up of tools that are either symmetrical or very nearly symmetrical (10 degrees). Most tools are flat-angled, at either 180 or 170 at both ends.

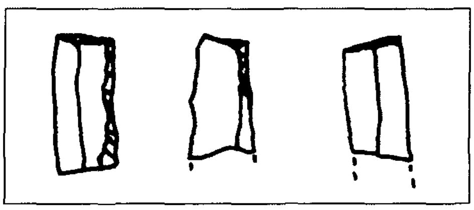


Figure 6:6 Jebel Hamra microliths

### Symmetry and interchangeability

All but one tool falls within 10 degrees of symmetry, so clearly the symmetrical relationship of the tools ends is of paramount importance in this assemblage. The most common tool is 170 opposite 180 degrees, suggesting that a very slight asymmetry is desirable.

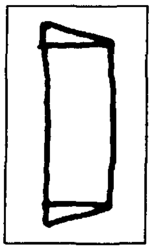


Figure 6:7 Range of variability

## Pattern of variability

Tools are concentrated at 170/180 degree truncations, with a fall-off in frequency as angles move towards a slight point of 160 degrees. This suggests that some variability in actual angle is acceptable, as long as the essential relationship between tool ends is maintained.

## Direction and backing

Backing on the right hand side is preferred, but not very strongly. Direction of retouch shows up as a preference only in distal and proximal locations, where it is clockwise.

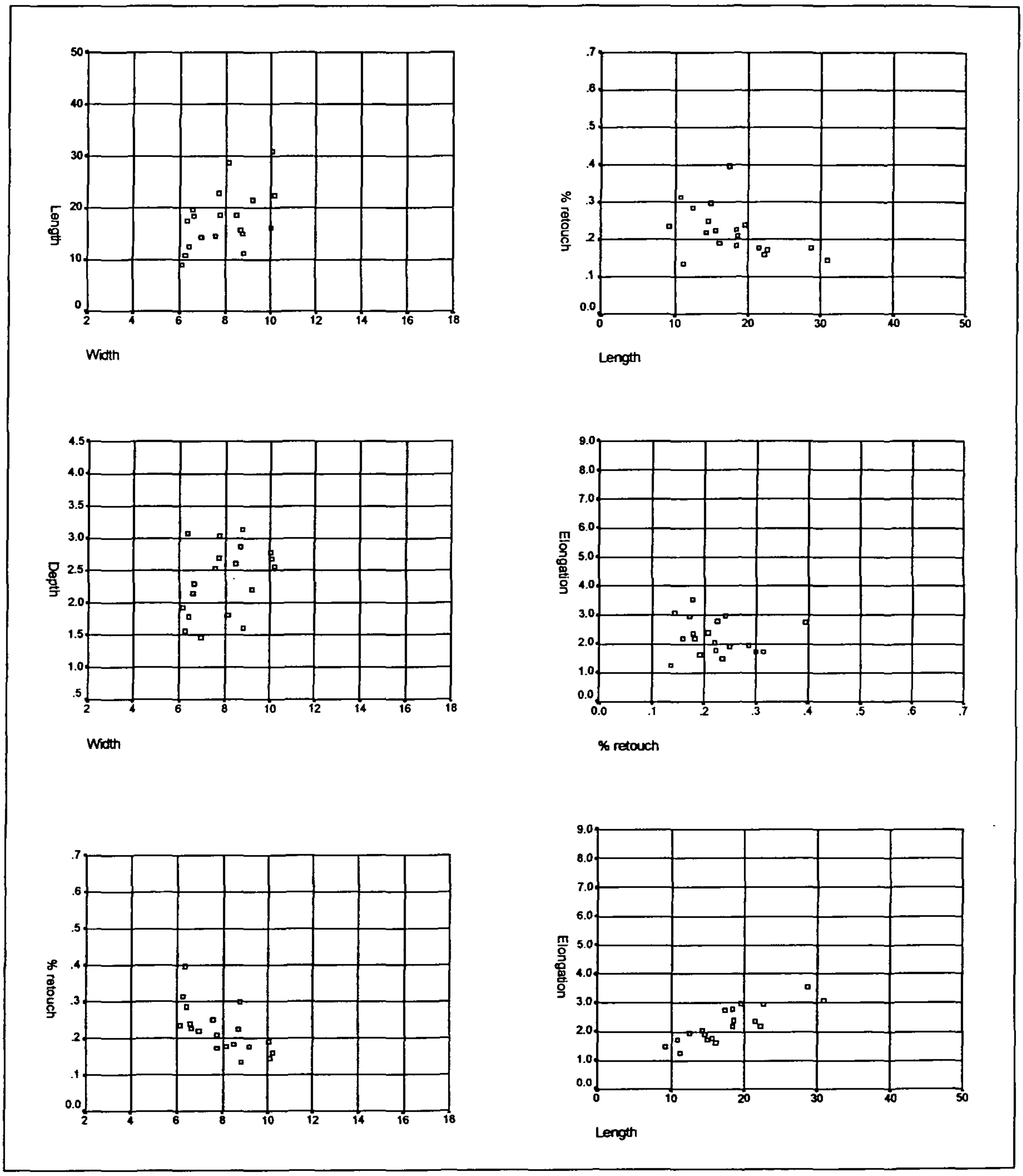
## Metrics

Tools in this assemblage are homogenous in their metrics, with very little metric variability in any dimension except depth. Tools are short with a small surface area.

Correlations between dimensions are weak or non-existent. Length and width are correlated. The only strong correlations are between length and elongation and between width and amount of retouch.

| | | Length | Width | Depth | Elongation | % retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .493 | .388 | .844 | -.547 |
| | Sig. (2-tailed) | . | .032 | .101 | .000 | .015 |
| **Width** | Correlation Coefficient | .493 | 1.000 | .339 | .014 | -.723 |
| | Sig. (2-tailed) | .032 | . | .156 | .955 | .000 |
| **Depth** | Correlation Coefficient | .388 | .339 | 1.000 | .139 | .032 |
| | Sig. (2-tailed) | .101 | .156 | . | .571 | .898 |
| **Elongation** | Correlation Coefficient | .844 | .014 | .139 | 1.000 | -.230 |
| | Sig. (2-tailed) | .000 | .955 | .571 | . | .344 |
| **% retouch** | Correlation Coefficient | -.547 | -.723 | .032 | -.230 | 1.000 |
| | Sig. (2-tailed) | .015 | .000 | .898 | .344 | . |

Figure 6:8 Metric correlations at Jebel Hamra


Length
Width
% retouch
Length
Depth
Width
Elongation
% retouch
% retouch
Width
Elongation
Length

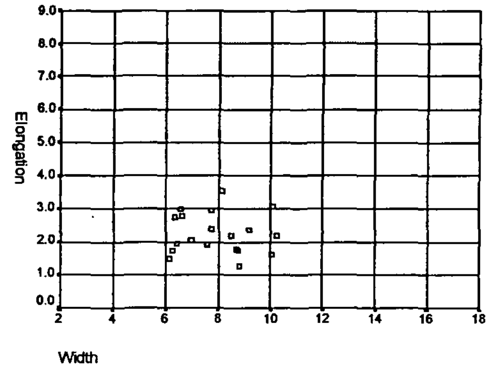



Figure 6:9 Metric correlation scatterplots, Jebel Hamra

## Summary

Overall, tools are very homogenous in dimension and in morphology of truncation angles. Variability in angles seems to show a fall-off in frequency representing latitude in exact angle required. Tool ends are obviously interchangeable as they are symmetrical. Given the lack of metric variation and the concentration of 170 and 180 degree truncations, tools themselves are completely interchangeable with each other. This is also reflected in the lack of a strong preference for side of backed edge.

| **Design principles** | |
|---|---|
| Truncation angles | 170-180 |
| Symmetry | Yes |
| Interchangeable tool ends | Yes |
| Discrete types | Yes |
| Specificity of angle | Within 20 degrees |
| Defined relationship between angles | Yes |
| Side of backing | Right |
| Sequence of retouch application | Partial clockwise |

Figure 6:10 Jebel Hamra design principles

## 6.2. WADI JUDAYID J31 (WJ): MIDDLE HAMRAN

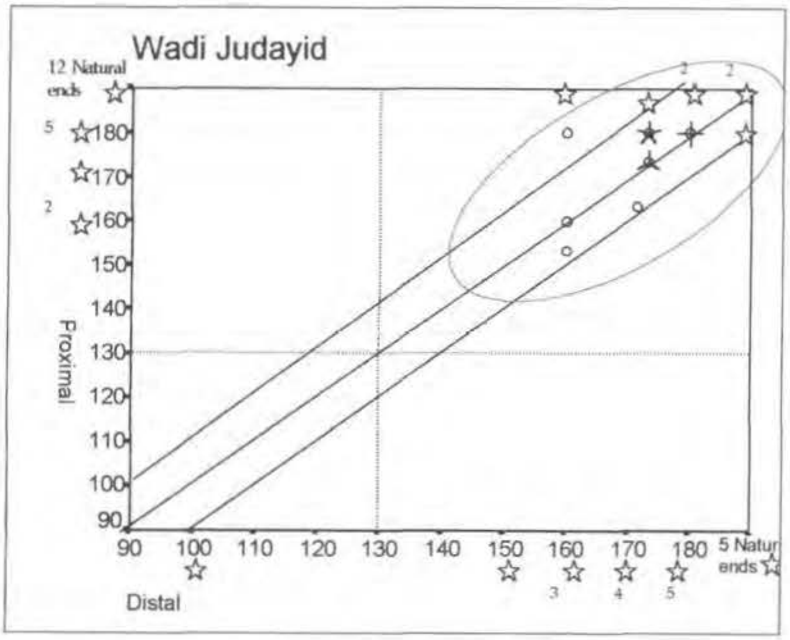



Figure 6:11 Wadi Judayid truncation angles

### Description of tools

The assemblage is made up of tools that are either symmetrical, or very nearly symmetrical (10 degrees). Most tools are flat-angled, at either 180 or 170 at both ends.

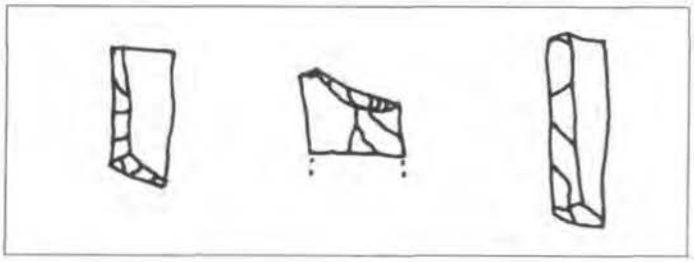


Figure 6:12 Wadi Judayid microliths

### Symmetry and interchangeability

All but one tool falls within 10 degrees of symmetry, so clearly the symmetrical relationship of the tools ends is of paramount importance in this assemblage. The most common tools is 170 opposite 180 degrees, suggesting that a very slight asymmetry is desirable. There are more distal 170 degree angles, and more proximal

180-degree angles, which may suggest a slight preference for certain blank ends at certain angles.

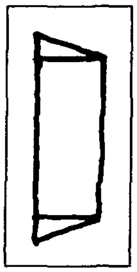


Figure 6:13 Range of variability

### Pattern of variability

Tools are concentrated at 170/180-degree truncations, with a fall-off in frequency as angles move towards a slight point of 160 degrees. This suggests that some variability in actual angle is acceptable, as long as the essential relationship between tool ends is maintained.

### Direction and backing

Backing on the right hand side is preferred. A clockwise direction of retouch shows up as a preference in all except proximal locations.

### Metrics

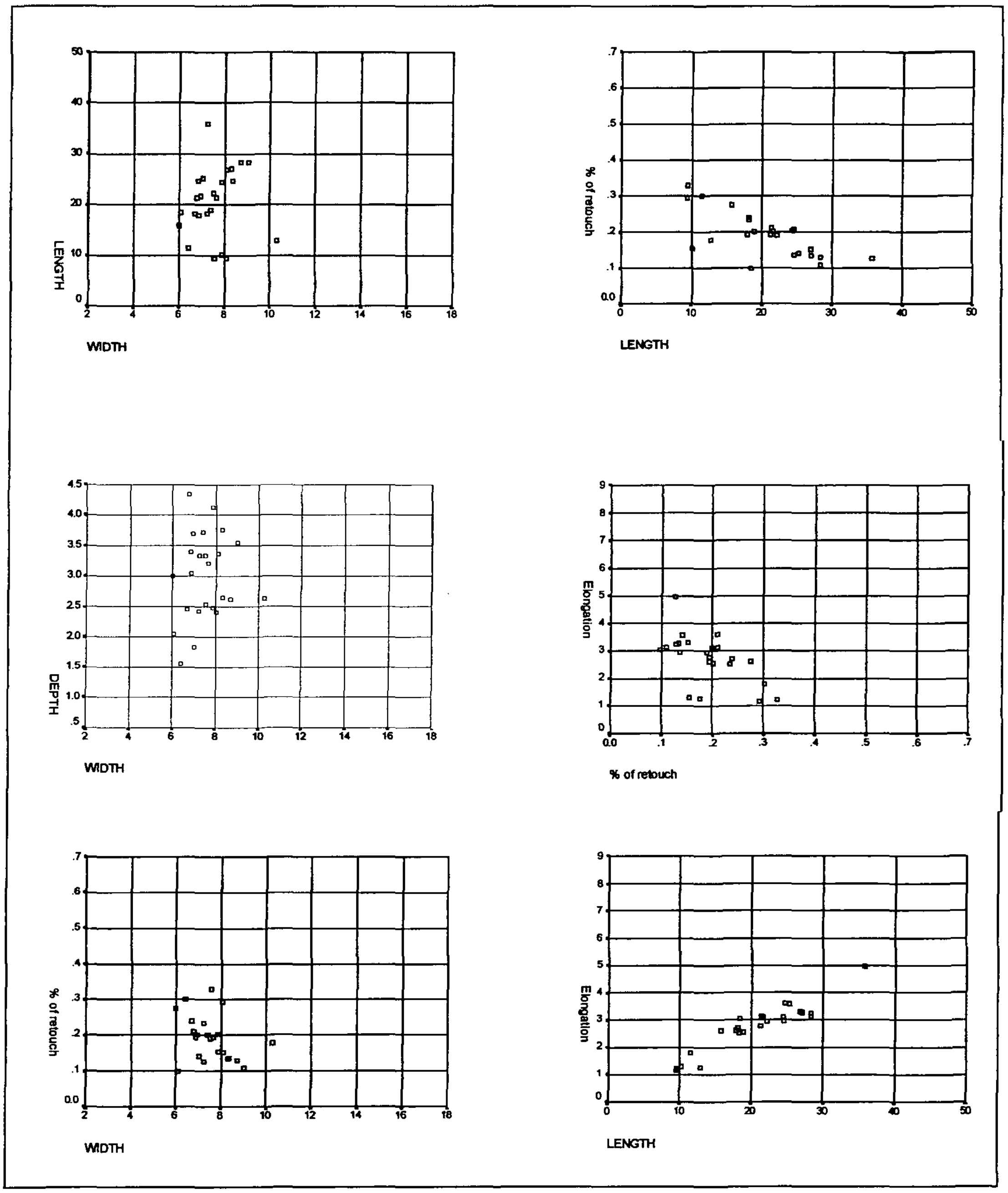
Tools are long with lots of length variability. Depth variability is also large, and tools are deep.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .277 | .501 | .913 | -.681 |
| | Sig. (2-tailed) | . | .191 | .013 | .000 | .000 |
| **Width** | Correlation Coefficient | .277 | 1.000 | .179 | -.026 | -.422 |
| | Sig. (2-tailed) | .191 | . | .403 | .904 | .040 |
| **Depth** | Correlation Coefficient | .501 | .179 | 1.000 | .463 | -.138 |
| | Sig. (2-tailed) | .013 | .403 | . | .023 | .519 |
| **Elongation** | Correlation Coefficient | .913 | -.026 | .463 | 1.000 | -.557 |
| | Sig. (2-tailed) | .000 | .904 | .023 | . | .005 |
| **% of retouch** | Correlation Coefficient | -.681 | -.422 | -.138 | -.557 | 1.000 |
| | Sig. (2-tailed) | .000 | .040 | .519 | .005 | . |

Figure 6:14 Metric correlations at Wadi Judayid

Length and depth are the only two dimensions that are correlated. Length also shows strong correlations with elongation and percentage of retouch. The amount of retouch is well correlated with both width and elongation, showing that tools tend to have the same amount of retouch however large they are.

The most common truncation combination (170 x 180) contains most of the metric variability present in the sample. All of the widest and deepest tools have a proximal angle of 180 degrees.



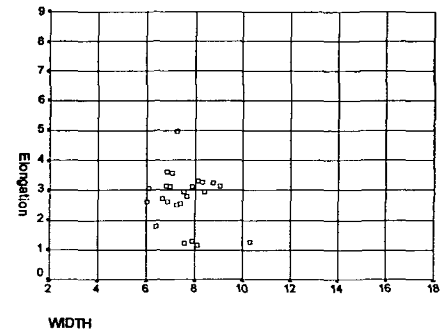



Figure 6:15 Metric correlation scatterplots, Wadi Judayid

## Summary

Tools are very homogenous in metrics, although there is considerable variability in depth. Variability in angles seems to show a fall-off in frequency representing latitude in the exact angle required, while tools are almost always symmetrical. Many tools are completely interchangeable with each other. However, the preference for a right backed side is quite strong, and this, together with metric variability, may suggest that tools are not as completely interchangeable as those at JH. Large numbers of broken proximal ends may suggest unfinished tools. However, the six complete tools with natural proximal ends strongly suggest that at this site at least, tools with natural ends were considered complete.

| Design principles | |
|---|---|
| Truncation angles | 170-80 |
| Symmetry | Yes |
| Interchangeable tool ends | Yes |
| Discrete types | Yes |
| Specificity of angle | Within 20 degrees |
| Defined relationship between angles | Yes |
| Side of backing | Right |
| Sequence of retouch application | Clockwise |

Figure 6:16 Wadi Judayid design principles

## 6.3. SHUNERA 12 (SH12): GEOMETRIC KEBARAN

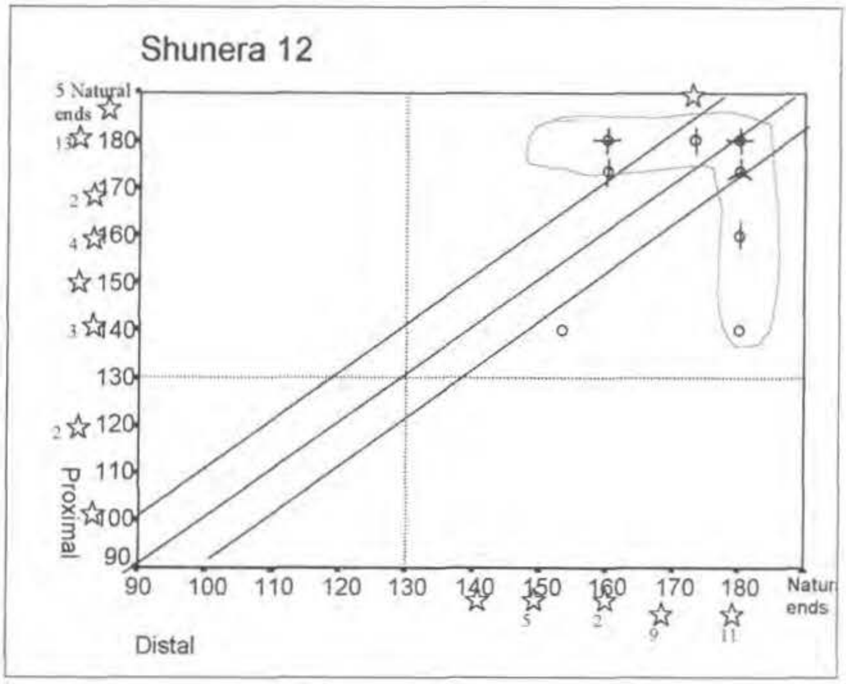



Figure 6:17 Shunera 12 truncation angles

### Description of tools

This site shows many similarities with Shunera 12B (SH12B), described below. The assemblages are dominated by tools with at least one angle at 180 degrees. While many have a second angle at 170/180, there are a number which are less symmetrical with a range of flatish angles to 150 degrees. It seems important to have a flat base on one end, while the other end can vary a certain amount in angle.

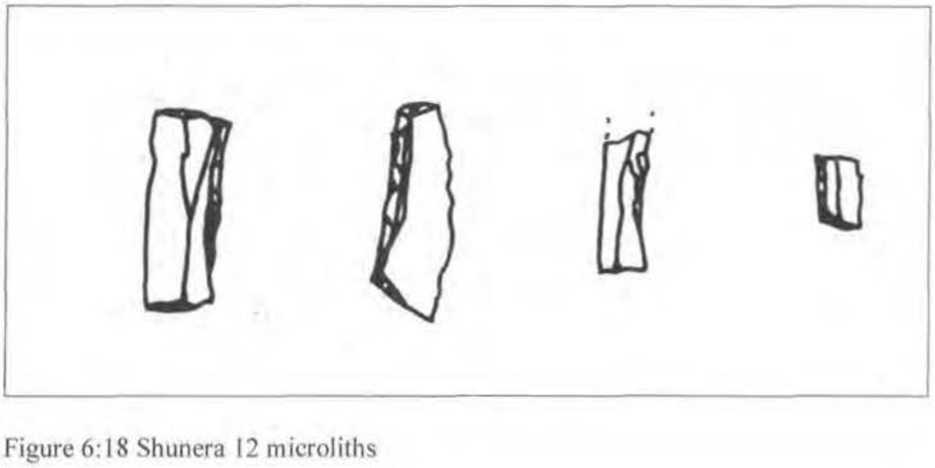


Figure 6:18 Shunera 12 microliths

### Symmetry and interchangeability

Many tools are symmetrical within 10 degrees, but there are also tools with one end at 180 degrees, and the other at 160-40. There are some natural proximal ends.

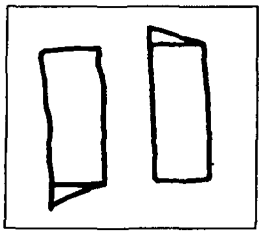


Figure 6:19 Range of variability

### Pattern of variability

The most common angles are 180 at both ends, and a 180 angle opposite 160 degrees. There is a fall-off in frequency from these angles, with tools becoming less symmetrical, while retaining one flat end.

### Direction and backing

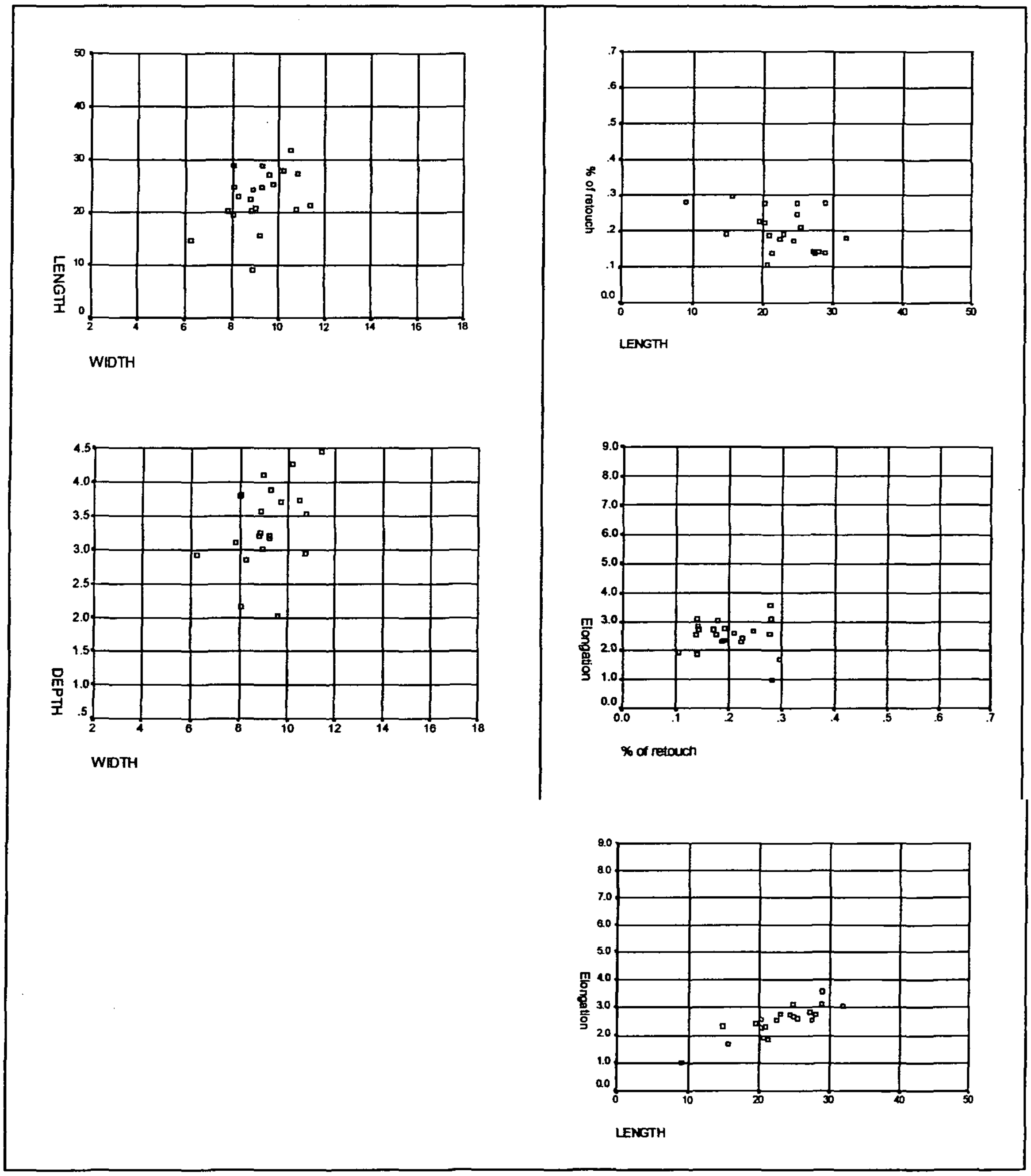
There is a preference for right-backed tools. Retouch is applied in an anticlockwise pattern. This differs from SH12B, where there is a slight preference for left backed tools, and retouch is applied in a clockwise direction.

### Metrics

Tools are large at both SH12 and SH12B and are similar in length, width, depth and surface area. At SH12, there is average metric variability in length and width, and larger variability in depth. Overall, there is very little correlation between dimensions. Length is correlated with depth and with elongation; width with amount of retouch. There is no clear correlation between metrics and truncation angles, with variability distributed randomly at all angles.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .416 | .521 | .820 | -.399 |
| | Sig. (2-tailed) | . | .060 | .015 | .000 | .073 |
| **Width** | Correlation Coefficient | .416 | 1.000 | .355 | -.119 | -.635 |
| | Sig. (2-tailed) | .060 | . | .115 | .606 | .002 |
| **Depth** | Correlation Coefficient | .521 | .355 | 1.000 | .242 | -.183 |
| | Sig. (2-tailed) | .015 | .115 | . | .290 | .427 |
| **Elongation** | Correlation Coefficient | .820 | -.119 | .242 | 1.000 | -.091 |
| | Sig. (2-tailed) | .000 | .606 | .290 | . | .695 |
| **% of retouch** | Correlation Coefficient | -.399 | -.635 | -.183 | -.091 | 1.000 |
| | Sig. (2-tailed) | .073 | .002 | .427 | .695 | . |

Figure 6:20 Metric correlations at Shunera 12



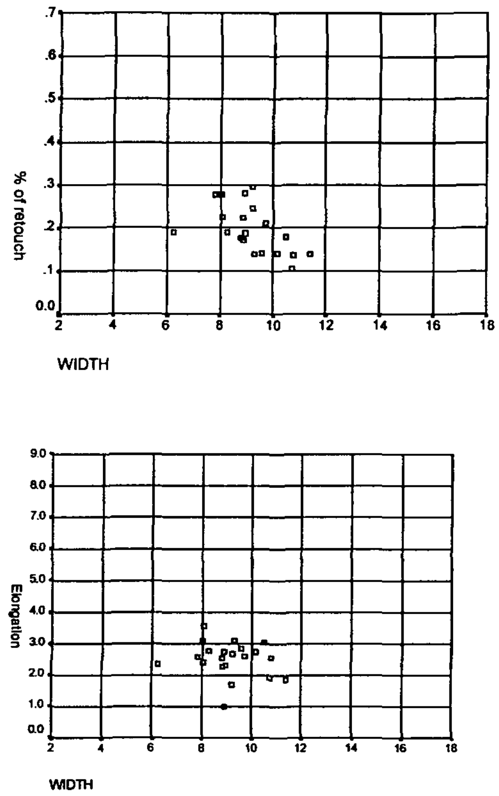



Figure 6:21 Metric correlation scatterplots, Shunera 12

## Summary

The assemblages are comprised of large tools forming one group with a range of variability in terms of truncation angle. One end must always be flat, while the other can vary up to 30 degrees. Tools are large at Shunera 12, with little metric correlation.

| **Design principles** | |
|---|---|
| Truncation angles | 180 x 180/60 or 180/60 x 180 |
| Symmetry | Yes within 30 degrees |
| Interchangeable tool ends | Yes |
| Discrete types | Yes with a fall off in frequency up to 30 degrees |
| Specificity of angle | Yes |
| Defined relationship between angles | Yes |
| Side of backing | Right |
| Sequence of retouch application | Anticlockwise |

Figure 6:22 Shunera 12 design principles

## 6.4. SHUNERA 12B (SH12B): GEOMETRIC KEBARAN

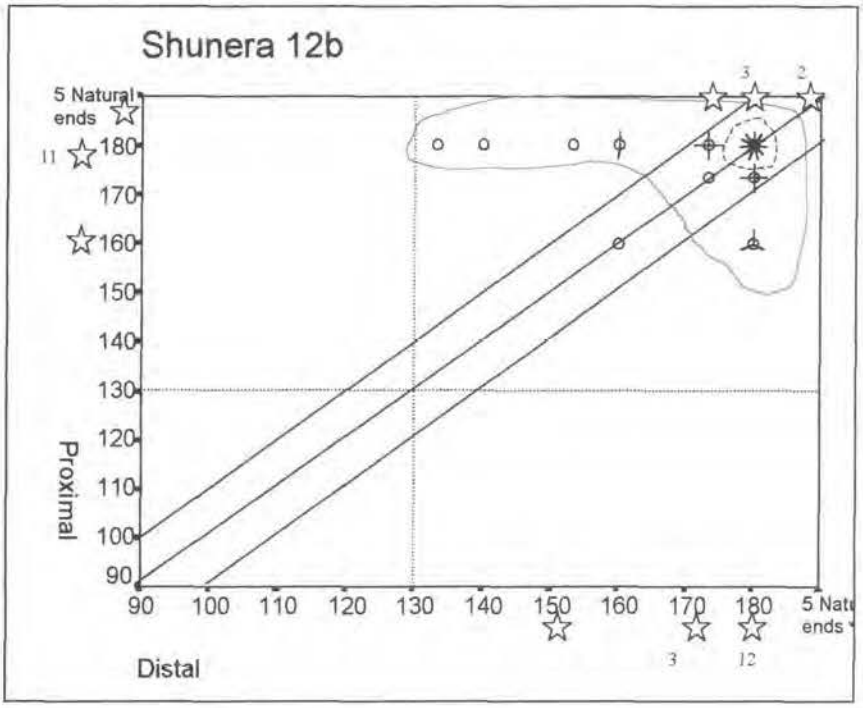



Figure 6:23 Shunera 12b truncation angles

### Description of tools

SH12B shares many features with SH12 described above. The assemblages are dominated by tools with at least one angle at 180 degrees. While many have a second angle at 170/180, there are a number which are less symmetrical with a range of flatish angles to 150 degrees. A flat base on one end seems important, while the other angle can vary a certain amount.

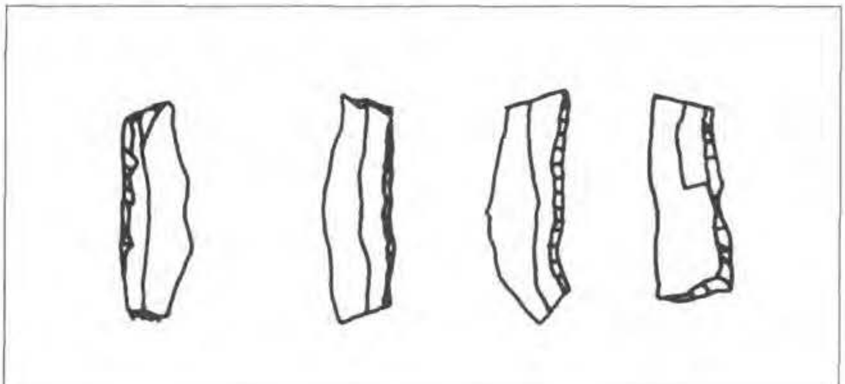


Figure 6:24 Shunera 12b microliths

## Symmetry and interchangeability

Many tools are symmetrical within 10 degrees, but there are also tools with one end at 180 degrees, and the other at 160-40. There are some natural proximal and distal ends, unlike SH12 where the natural ends are proximal.

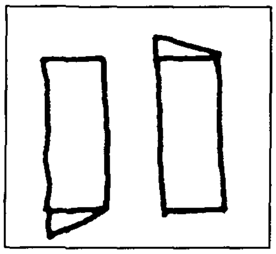


Figure 6:25 Range of variability

## Pattern of variability

The most common angles are 180 at both ends, and a 180 angle opposite 160 degrees. There is a fall-off in frequency from these angles, with tools becoming less symmetrical, while retaining one flat end. The 180 x 180 degree tool is by far the most common.

## Direction and backing

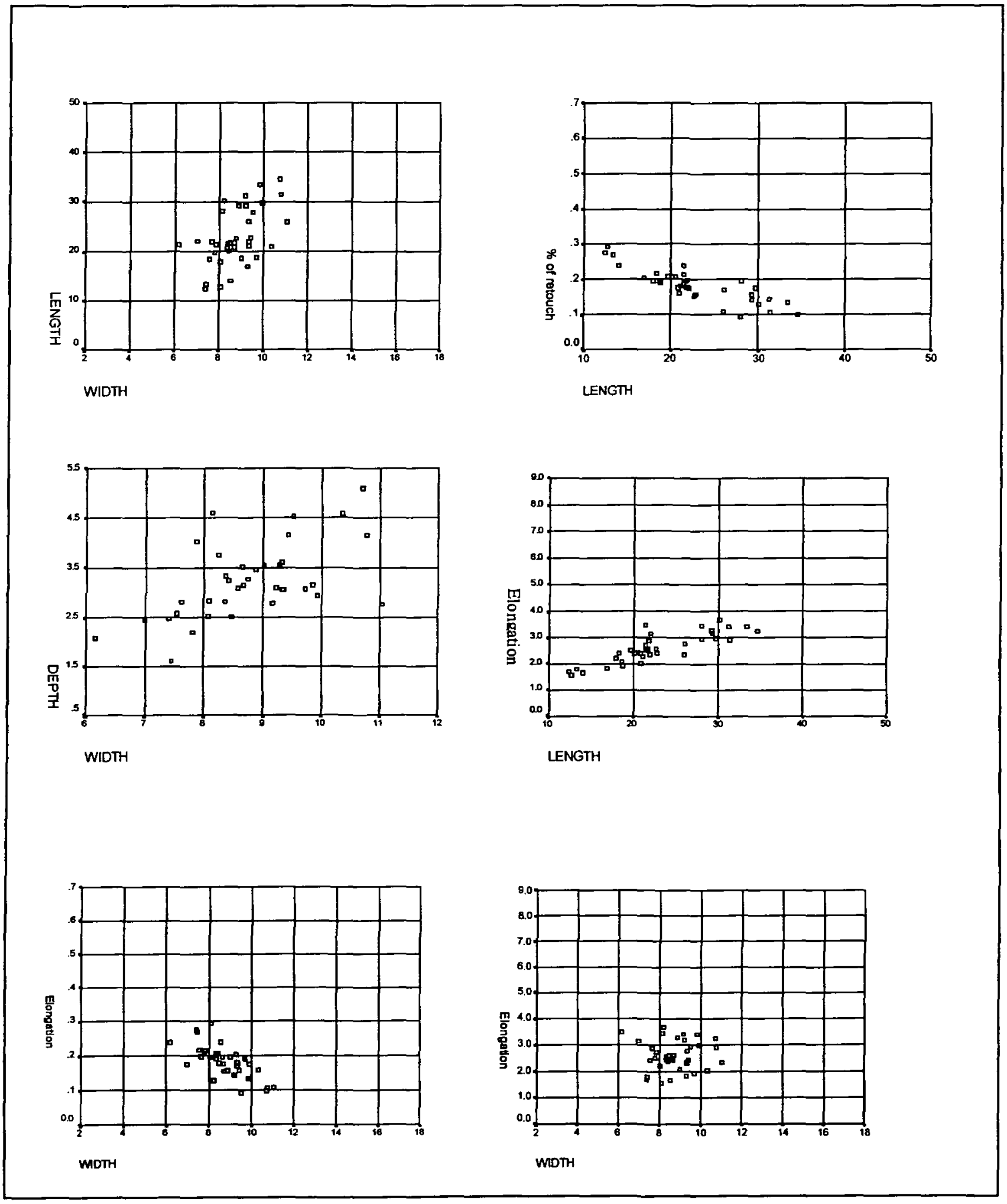
There is a slight preference for left backed tools, and retouch is applied in a clockwise direction. This differs from SH12, where there is a preference for right-backed tools and retouch is applied in an anticlockwise pattern.

## Metrics

Tools are large at both SH12 and SH12B and are similar in length, width, depth and surface area. At SH12B, length and depth vary quite a lot, while width, elongation and amount of retouch do not. All tool dimensions are well correlated except elongation, which is only correlated with length and amount of retouch. There is little correlation with truncation angle. Symmetrical 180-degree tools are slightly shorter, and have little length variation.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| Length | Correlation Coefficient | 1.000 | .508 | .424 | .833 | -.842 |
| | Sig. (2-tailed) | . | .001 | .009 | .000 | .000 |
| Width | Correlation Coefficient | .508 | 1.000 | .535 | .031 | -.721 |
| | Sig. (2-tailed) | .001 | . | .001 | .856 | .000 |
| Depth | Correlation Coefficient | .424 | .535 | 1.000 | .208 | -.478 |
| | Sig. (2-tailed) | .009 | .001 | . | .216 | .003 |
| Elongation | Correlation Coefficient | .833 | .031 | .208 | 1.000 | -.525 |
| | Sig. (2-tailed) | .000 | .856 | .216 | . | .001 |
| % of retouch | Correlation Coefficient | -.842 | -.721 | -.478 | -.525 | 1.000 |
| | Sig. (2-tailed) | .000 | .000 | .003 | .001 | . |

Figure 6:26 Metric correlations at SH12B



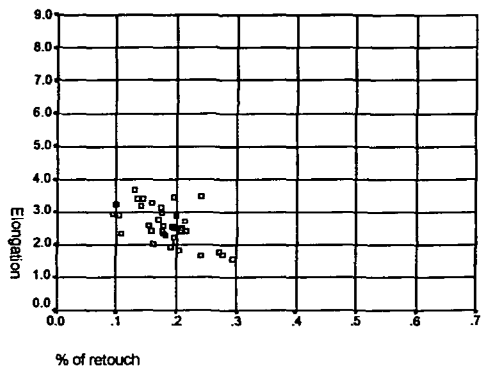



Figure 6:27 Metric correlation scatterplots, Shunera 12b

## Summary

The assemblages are comprised of large tools forming one group with a range of variability in terms of truncation angle. One end must always be flat and there is a preference for symmetrical 180 degree tools.

| **Design principles** | |
|---|---|
| Truncation angles | 180 x 180/60 or 180/60 x 180 |
| Symmetry | Yes within 30 degrees |
| Interchangeable tool ends | Yes |
| Discrete types | Yes with a fall off in frequency up to 30 degrees |
| Specificity of angle | Yes |
| Defined relationship between angles | Yes |
| Side of backing | left |
| Sequence of retouch application | Clockwise |

Figure 6:28 Shunera 12b design principles

## 6.5. Shunera 3 (SH3): Geometric Kebaran

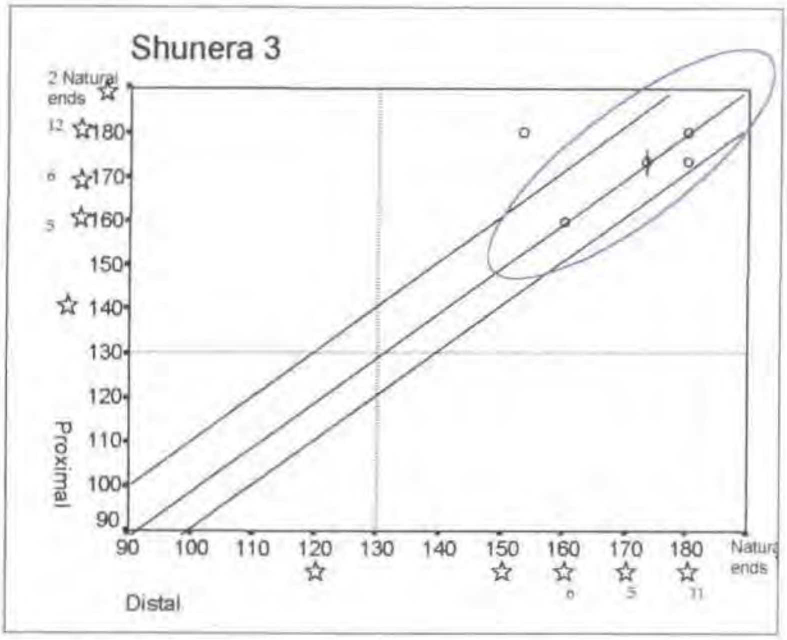



Figure 6:29 Shunera 3 truncation angles

### Description of tools

The assemblage has many snapped tools, so a clear pattern of truncation angles is difficult to see. Existing whole tools are symmetrical from 180-160 degrees. The many snapped tools are mostly 180 degree truncations for both ends, and vary to 150/160 for both ends.

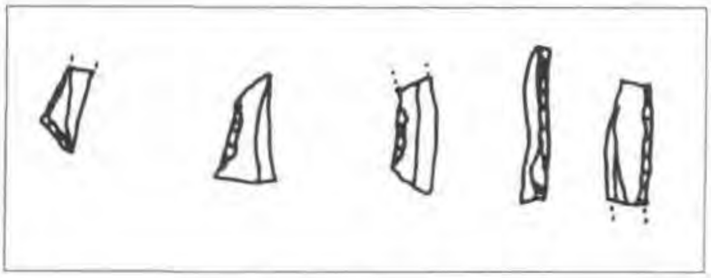


Figure 6:30 Shunera 3 microliths

### Symmetry and interchangeability

Almost all existing complete tools are symmetrical. However, the pattern of snapped tools would suggest either symmetrical tools between those angles, or interchangeable tools with 180-150 opposite a 180 degree angle on either end.

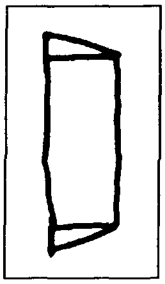


Figure 6:31 Range of variability

### Pattern of variability

There is a cluster of tools around the most common truncation angle, with a fall-off in frequency from that angle.

### Direction and backing

There is a preference for left backing, although not a strong one. Retouch is applied in a non-sequential way, with lateral sides being anticlockwise, proximal being clockwise and distal being very mixed.

### Metrics

Tools are short, narrow and thin at this site. There is very little metric variation in the sample, and no patterning in relation to the truncation angles. There are few metric correlations, with only amount of retouch being correlated with length and width.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .657 | .143 | .029 | -.943 |
| | Sig. (2-tailed) | . | .156 | .787 | .957 | .005 |
| **Width** | Correlation Coefficient | .657 | 1.000 | -.486 | -.657 | -.829 |
| | Sig. (2-tailed) | .156 | . | .329 | .156 | .042 |
| **Depth** | Correlation Coefficient | .143 | -.486 | 1.000 | .657 | .086 |
| | Sig. (2-tailed) | .787 | .329 | . | .156 | .872 |
| **Elongation** | Correlation Coefficient | .029 | -.657 | .657 | 1.000 | .143 |
| | Sig. (2-tailed) | .957 | .156 | .156 | . | .787 |
| **% of retouch** | Correlation Coefficient | -.943 | -.829 | .086 | .143 | 1.000 |
| | Sig. (2-tailed) | .005 | .042 | .872 | .787 | . |

Figure 6:32 Metric correlations at Shunera 3

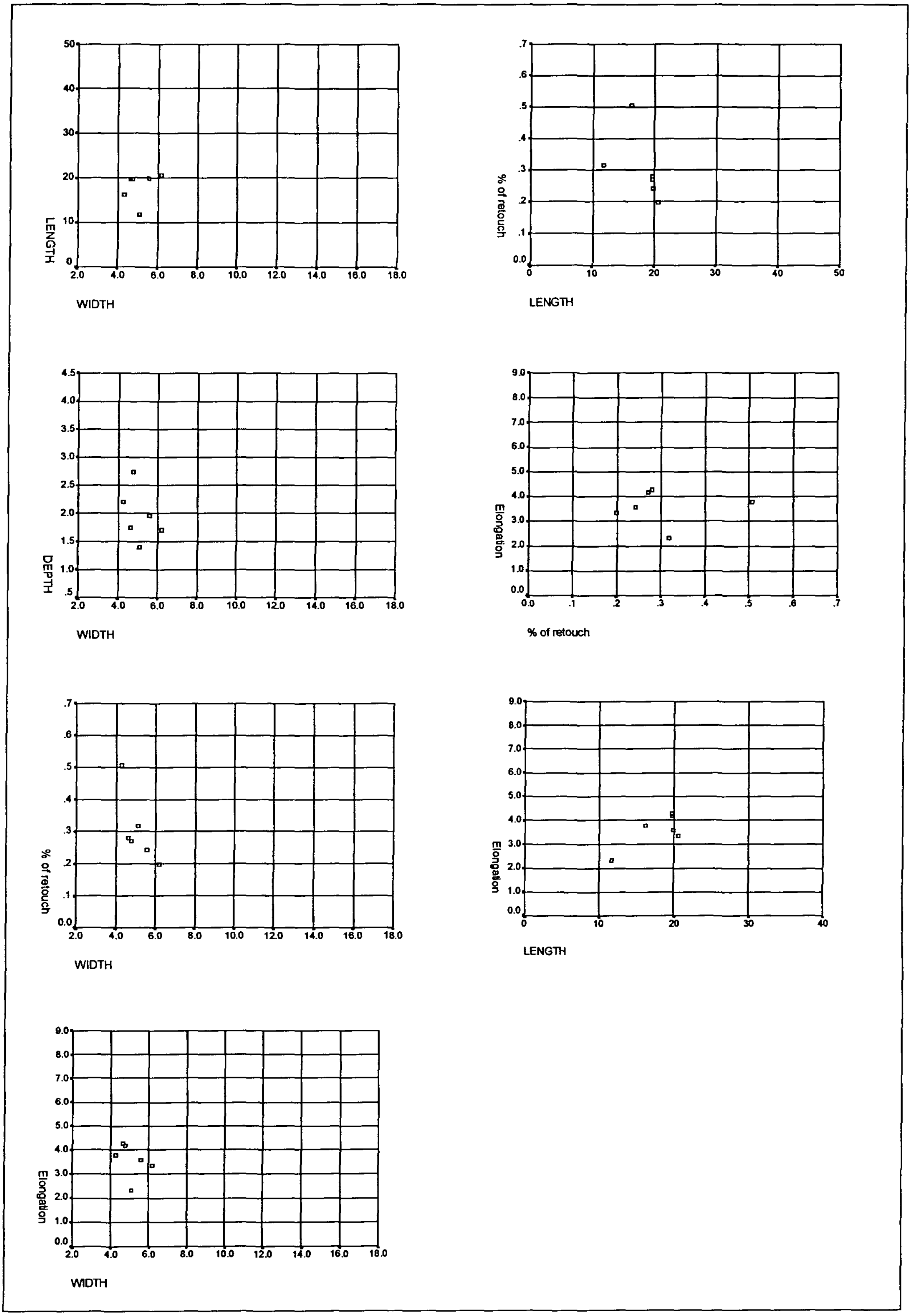



Figure 6:33 Metric correlation scatterplots

## Summary

Shunera 3 contains many snapped, narrow tools. Metric variability is very low, as are metric correlations. Tools are symmetric and vary in angle from 150-180 degrees.

| **Design principles** | |
|---|---|
| Truncation angles | 150-180x150-180 |
| Symmetry | Yes |
| Interchangeable tool ends | Yes |
| Discrete types | Yes |
| Specificity of angle | Yes within 30 degrees |
| Defined relationship between angles | Yes |
| Side of backing | Left |
| Sequence of retouch application | Non - sequential |

Figure 6:34 Shunera 3 design principles

## 6.6. Tor Hamar J431 Block 2 (TH2): Qalkhan

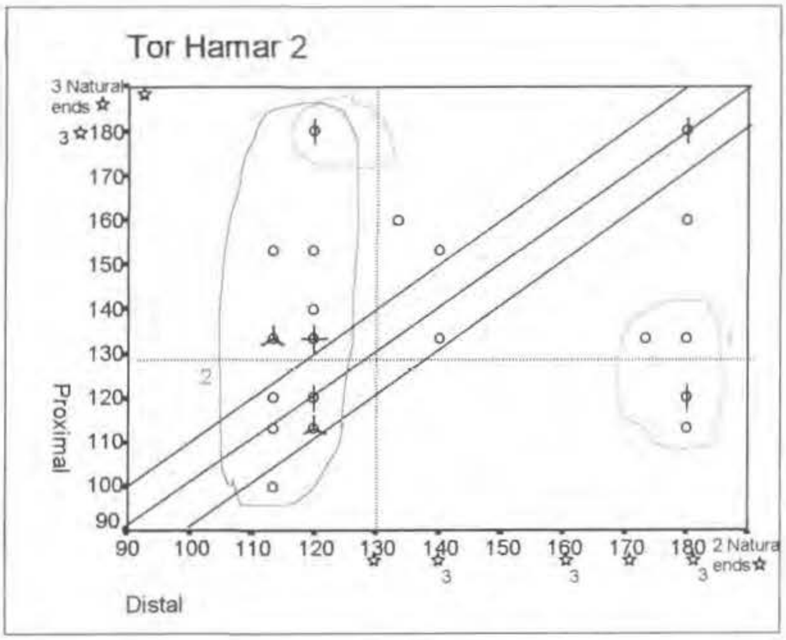



Figure 6:35 Tor Hamar 2 truncation angles

### Description of tools

The assemblage is made up of asymmetric points. There are two clearly defined types of point in terms of overall morphology of truncation angle. One has a distal angle of 180/170 degrees (pink, above). These tools have a proximal angle that ranges from 110-180, although most fall within 110-130. These proximal points are thus slightly less steeply angled than the distal points. Here, it is the distal 'base' which is the least variant end. These tools are short, narrow and deep.

There is another group of tools, with a steep distal point of 110/120 degrees, and a varying proximal end (blue, above). In this group of tools, the distal point angle remains constant, but the 'base' angle varies from point to flat across the range from 90 – 180 degrees. When the proximal is a similarly steep point, the tool is a symmetric bipoint. These include the smallest tools in the assemblage. Overall, this group includes the full range of metric variability present in the assemblage.

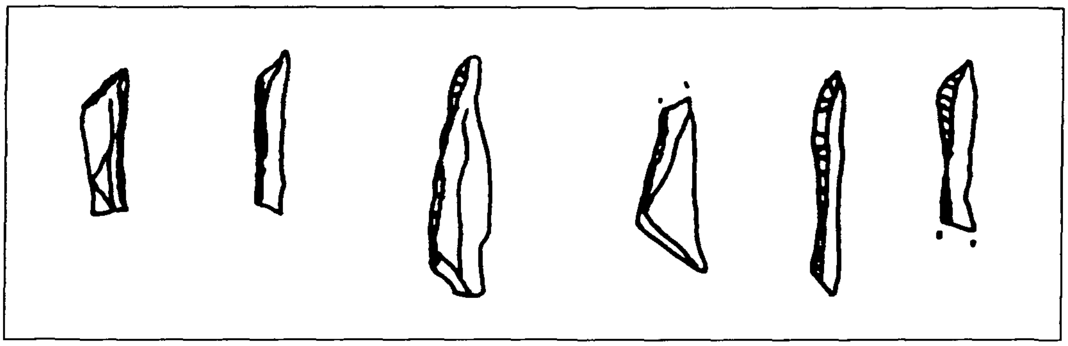


Figure 6:36 Tor Hamar 2 microliths

## Symmetry and interchangeability

The assemblage shows no emphasis on symmetry. However, the distal points, where the proximal is also steeply pointed, form a group of symmetric bipoints at one end of the range of proximal angle variability. The particular angle of each tool end seems heavily determined, with little sign of interchangeability of blank ends.

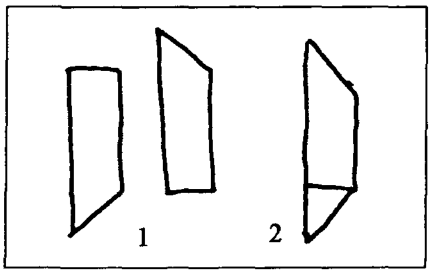



Figure 6:37 Range of variability

## Pattern of variability

The tools in this assemblage have very clearly defined angles that were considered appropriate for use. They fall into clearly separate groups, and neither group encompasses a wide range of variability. Each group of tools has one end which is strictly defined in its angle.

Variability in truncation angle in this assemblage falls into two clear-cut categories. These two groups form distal points, or less steep, flat based proximal points. There are a range of distal mid-angles (140-160) which are very seldom chosen.

## Direction and backing

Tools are largely left-backed. The direction in which retouch is applied is very mixed. Only the left side shows a clear preference for clockwise application of retouch, along with the left proximal location. Most other locations have been retouched in 2 or 3 directions.

## Metrics

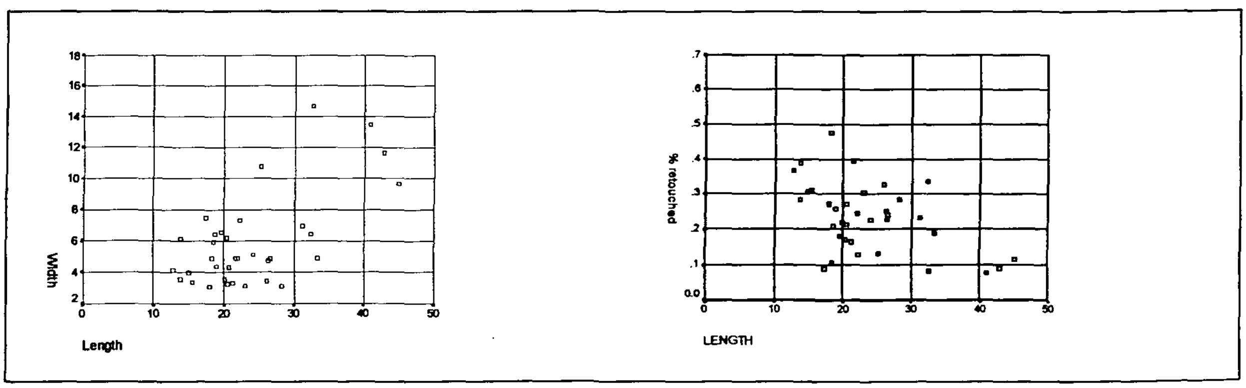
Tools are long at this site, with lots of length variability. Width however is less variable, suggesting set parameters for how wide tools could be.

There are some correlations between metrics and truncation angles, but the two dimensions of tool variability do not co-vary clearly. While the bimodality in metrics shows a separate, larger group of tools, these tools fall randomly within the distal point group. Smallest tools are included in the bipoints, and the distal 180's group are also small. Both of these smaller groups have a proximal angle of 110/120.

There are very strong metric correlations in the assemblage. Width correlates very strongly with depth, while length correlates less tightly with width and depth. Some of the width and length correlation is caused by bimodality : a small group of long and wide tools. Overall, wide tools show less retouch and are less elongated.

| | | Length | Width | Depth | Elongation | % retouched |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .392 | .497 | .288 | -.392 |
| | Sig. (2-tailed) | . | .020 | .002 | .094 | .020 |
| **Width** | Correlation Coefficient | .392 | 1.000 | .723 | -.716 | -.644 |
| | Sig. (2-tailed) | .020 | . | .000 | .000 | .000 |
| **Depth** | Correlation Coefficient | .497 | .723 | 1.000 | -.454 | -.492 |
| | Sig. (2-tailed) | .002 | .000 | . | .006 | .003 |
| **Elongation** | Correlation Coefficient | .288 | -.716 | -.454 | 1.000 | .368 |
| | Sig. (2-tailed) | .094 | .000 | .006 | . | .030 |
| **% of retouch** | Correlation Coefficient | -.392 | -.644 | -.492 | .368 | 1.000 |
| | Sig. (2-tailed) | .020 | .000 | .003 | .030 | . |

Figure 6:38 Metric correlations at Tor Hamar 2



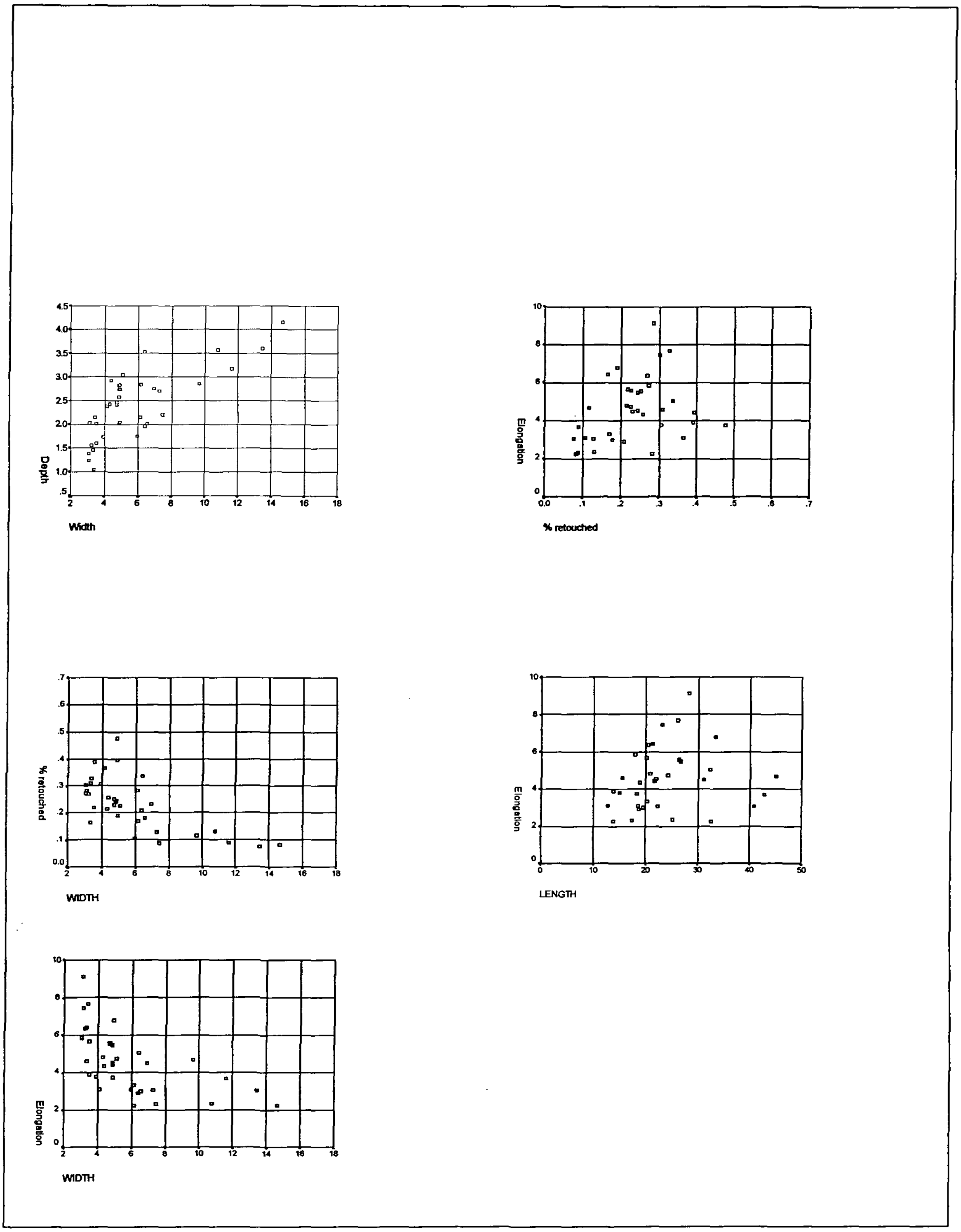



Figure 6:39 Metric correlation scatterplots, Tor Hamar 2

## Summary

This assemblage shows a great deal of precision in morphology of tools and method of manufacture. The angle of tools is very constrained, metric correlations are high, and the size relative to truncation angles is in some cases also determined. Truncation angle relative to blank end is also determined, as are the side of tool to be backed as well as direction of backing retouch. There are two clear types of tool, possibly representing different components of a hafted item. The extreme specificity of tools suggests there are very precise hafting constraints. Tools are not interchangeable.

| | **Overall tool** | **Type 1** | **Type 2** |
|---|---|---|---|
| **Truncation angles** | | 180x120 or 120 x 180 | 110-120 x any |
| **Symmetry** | | no | no |
| **Interchangeable tool ends** | | yes | no |
| **Discrete types** | yes | | |
| **Specificity of angle** | | Distal and proximal | Distal only |
| **Defined relationship between angles** | | yes | no |
| **Side of backing** | left | | |
| **Sequence of retouch application** | mixed | | |

Figure 6:40 Tor Hamar 2 design principles

## 6.7. WADI HUMEIMA LOWER J406B (WH): QALKHAN

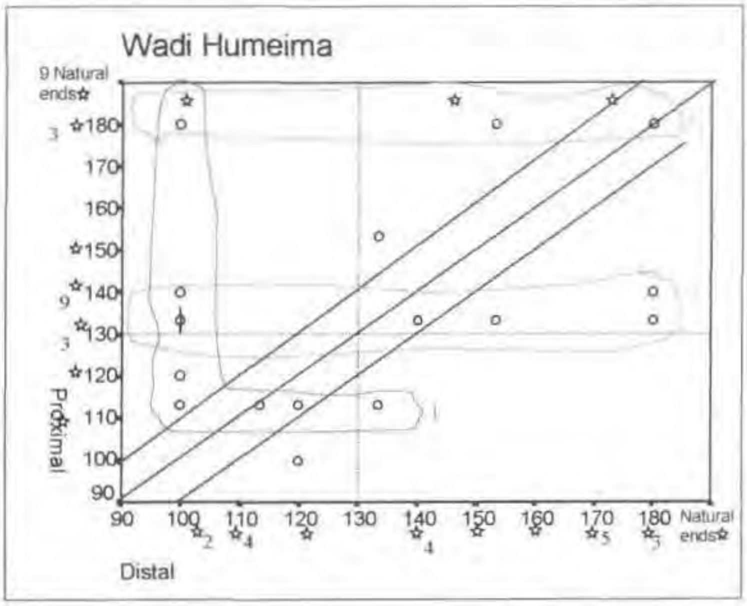



Figure 6:41 Wadi Humeima truncation angles

### Description of tools

The assemblage is mainly made up of asymmetric tools, most of which are points. These include a group with distal angles of 100/110, and proximal angles ranging from 110-180 (blue, above). These tools are short and narrow, and as the proximal angles become steeper, they become less elongated and retouched. These tools have interchangeable ends, with some proximal tools with a 110-degree angle, opposite a distal angle of 100-140.

A second, overlapping group of tools has a proximal angle of 130/40, and a distal angle ranging from 100-180 (pink, above). This group is long and wide and less retouched. It includes some Qalkhan points. These are not interchangeable as to blank end.

The last group also overlaps with the first, with a proximal angle of 180 degrees, and any distal angle (green, above). The 3 complete tools with proximal ends can be included in this group, as they coincide with the group in terms of distal angle. This group is not interchangeable. Tools are long, wide and less retouched.

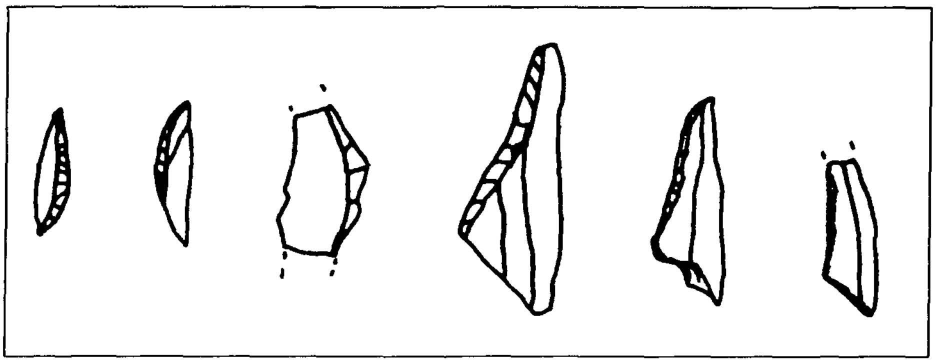


Figure 6:42 Wadi Humeima microliths

## Symmetry and interchangeability

There is no emphasis on symmetry, although there are some symmetrical bipoints. Many tools are within 30 degrees of symmetry, suggesting some relationship between truncations.

While the steepest points may be interchangeable with a few examples on proximal ends, most are distal. The proximal points are all bipoints. Other angle constraints are on the proximal end, and show no signs of being applied to the distal end. There are also a large number of snapped proximal ends.

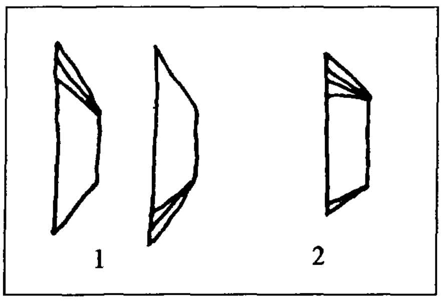



Figure 6:43 Range of variability

## Pattern of variability

The proximal angle is more defined in this assemblage. It falls mainly into three areas: 110, 130/40, and 180/natural proximal. Distal angles are more widespread, with some concentrations. Steep points (<130) are mainly limited to distal ends or are bipoints, while proximal points are generally less steep.

## Direction and backing

Backing on the left is only very slightly more common, and is mainly applied in a clockwise direction. Backing on the right hand side has only a weak preference for clockwise retouch application. Proximal and distal ends are backed in a number of directions, with no preference.

## Metrics

There is very large variability in the width of tools here, with very little variability in length, which is short. There are good correlations between metrics and truncation angles. Steep distal points are short and narrow, becoming less elongated/retouched as the proximal angle gets steeper.

The other proximal angles chosen (at 140 and 180 degrees) are long, wide, less elongated and less retouched. These larger tools have a correlation between their length and their width.

Metric dimensions are correlated at this site. Width is correlated with length in the larger tools, and is strongly correlated with depth, amount of retouch and elongation. Among tools that are not very retouched, there is a negative correlation with length – so as tools get shorter they get less retouched. Elongated tools have a higher proportion of retouch. Length is not well correlated with other dimensions.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .335 | .251 | .126 | -.505 |
| | Sig. (2-tailed) | . | .149 | .285 | .596 | .023 |
| **Width** | Correlation Coefficient | .335 | 1.000 | .816 | -.852 | -.747 |
| | Sig. (2-tailed) | .149 | . | .000 | .000 | .000 |
| **Depth** | Correlation Coefficient | .251 | .816 | 1.000 | -.747 | -.575 |
| | Sig. (2-tailed) | .285 | .000 | . | .000 | .008 |
| **Elongation** | Correlation Coefficient | .126 | -.852 | -.747 | 1.000 | .571 |
| | Sig. (2-tailed) | .596 | .000 | .000 | . | .008 |
| **% of retouch** | Correlation Coefficient | -.505 | -.747 | -.575 | .571 | 1.000 |
| | Sig. (2-tailed) | .023 | .000 | .008 | .008 | . |

Figure 6:44 Metric correlations at Wadi Humeima

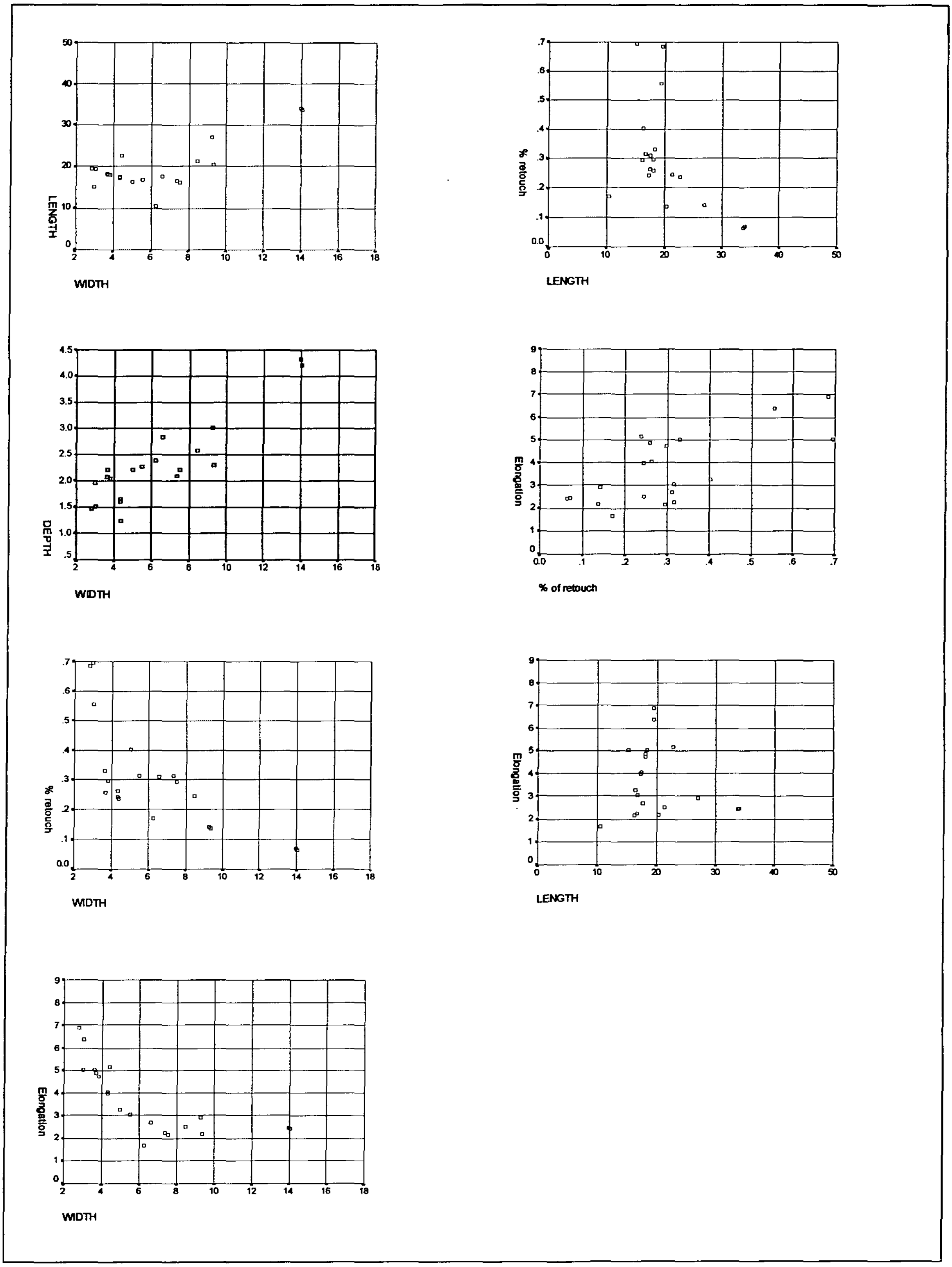



Figure 6:45 Metric correlation scatterplots, Wadi Humeima

## Summary

At this site, certain angles are specified, and there is good correlation between the dimensions of tools and their truncation angles. While the different 'types' overlap in various places, the emphasis is on certain angles, tool ends and dimensions, making the tools in this assemblage very closely determined in their morphology.

| | Overall tool | Type 1 | Type 2 | Type 3 |
|---|---|---|---|---|
| **Truncation angles** | | 100/10x100-140<br>100-140x100/10 | 130/40x130-180 | 100-80x any |
| **Symmetry** | | no | no | No |
| **Interchangeable tool ends** | | yes | no | No |
| **Discrete types** | yes | | | |
| **Specificity of angle** | | Distal or proximal | Proximal | Proximal |
| **Defined relationship between angles** | | no | no | no |
| **Side of backing** | left | | | |
| **Sequence of retouch application** | Weak clockwise | | | |

Figure 6:46 Wadi Humeima design principles

## 6.8. TOR HAMAR J431 BLOCK 1 (TH1): MADAMAGHAN

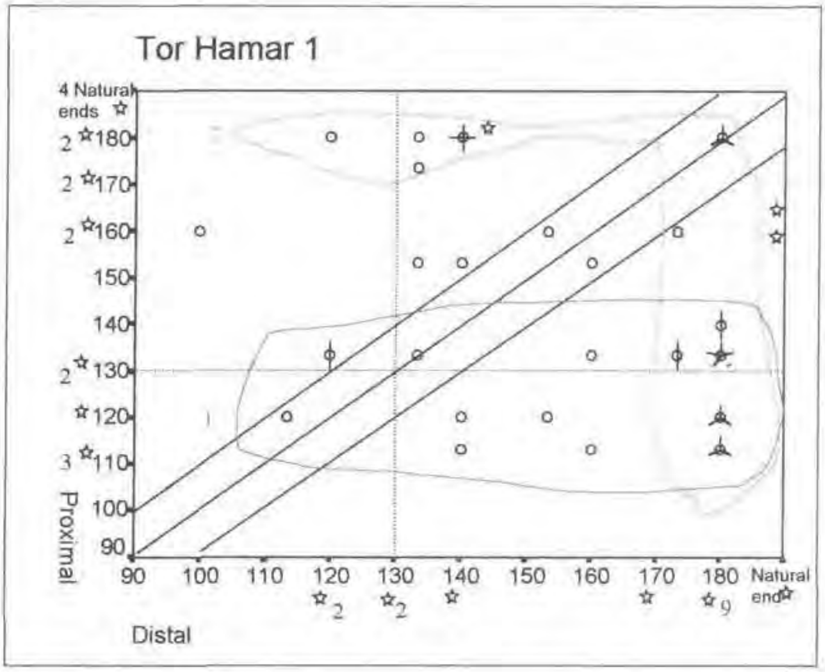



Figure 6: 47 Tor Hamar 1 truncation angles

### Description of tools

Tools are either symmetric or asymmetric, and include both points and flats. Points are asymmetric, opposite a flat base. Flat tools can be either symmetrical or asymmetric. There are preferences for 130 and 180 degree angles. Each end has a range of acceptable truncation values. Distals range from 130-180, with 180 being the most popular. Proximal ends range from 110-180, with 110-130 the most popular angles. There are two types that overlap, and a number of tools which do not fall within their angle parameters. Type 1 (blue) has a range of proximal angles (110-130) against any distal angle, with a concentration at 180 degrees. Type 2 (pink) has one 180-degree end against an end with any angle on it.

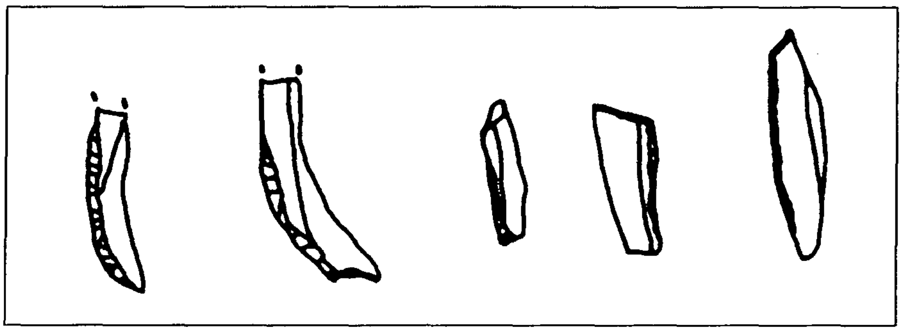


Figure 6:48 Tor Hamar 1 microliths

## Symmetry and interchangeability

Symmetric tools range across all angles, as do asymmetric tools. Asymmetric flat tools are interchangeable as to blank end. Points are proximal and not interchangeable.

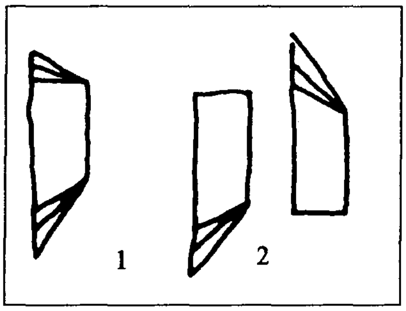



Figure 6:49 Range of variability

## Patterns of variability

There is continuous variability across all acceptable angles. There is a concentration of 180-degree angles, especially on the distal end in both points and flats. Proximals can be either pointed or flat. Distals also vary widely, but concentrate at 180 degrees. The points and flats vary continuously, and have similar preferences in angle and angle relationship.

## Direction and backing

There is a preference for left-backing. Retouch is applied in a clockwise direction in all locations, although only weakly preferred on right sides, and distal/distal left locations. While abrupt and semi abrupt retouch is preferred, there is also some low retouch in most locations.

## Metrics

All metrics have an average to high amount of variability except depth. Width and especially length are variable at this site, and tools are very deep and short. The surface area is thus very variable, but elongation is closely defined.

There is some sign of correlation between metrics and truncation angles. Proximal 180-degree tools are narrower, and somewhat elongated. Distal 180-degree tools have a large amount of retouch. However, metric variability is spread across all angles.

Most metric dimensions are correlated in this assemblage. Length and width are correlated and slightly bimodal, with a group of wider tools. Depth and width are also loosely correlated. Width is negatively correlated with elongation and especially with amount of retouch, while length is loosely negatively correlated only with amount of retouch.

| | | **Length** | **Width** | **Depth** | **Elongation** | **% retouch** |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .585 | .467 | .389 | -.634 |
| | Sig. (2-tailed) | . | .000 | .000 | .004 | .000 |
| **Width** | Correlation Coefficient | .585 | 1.000 | .662 | -.420 | -.856 |
| | Sig. (2-tailed) | .000 | . | .000 | .002 | .000 |
| **Depth** | Correlation Coefficient | .467 | .662 | 1.000 | -.239 | -.659 |
| | Sig. (2-tailed) | .000 | .000 | . | .088 | .000 |
| **Elongation** | Correlation Coefficient | .389 | -.420 | -.239 | 1.000 | .236 |
| | Sig. (2-tailed) | .004 | .002 | .088 | . | .092 |
| **% retouch** | Correlation Coefficient | -.634 | -.856 | -.659 | .236 | 1.000 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .092 | . |

Figure 6:50 Metric correlations at Tor Hamar 1

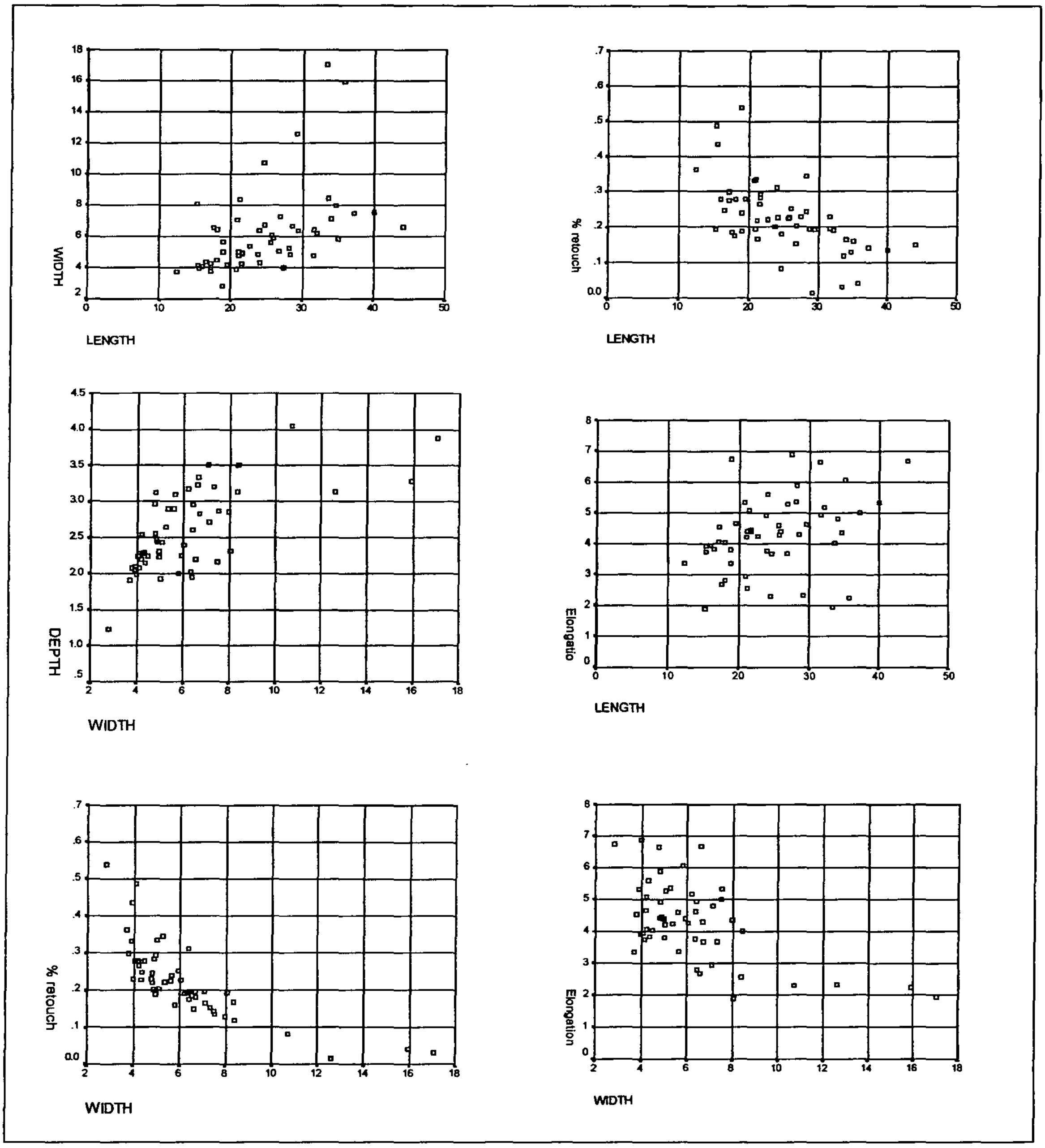



Figure 6:51 Metric correlation scatterplots, Tor Hamar 1

## Summary

There is no clear preference in this assemblage for defined combinations of angles. There is instead continuous variability with a fall off in frequency from preferred angles, which can be on either end. However, the proximal tends to pointedness and the distal to flatness. Metrics are also variable, although elongation is strictly defined.

| | Overall tool | Type 1 | Type 2 |
|---|---|---|---|
| | | | |
| **Truncation angles** | | 110-30xany | 180xany or any x 180 |
| **Symmetry** | sometimes | | |
| **Interchangeable tool ends** | | no | yes |
| **Discrete types** | no | | |
| **Specificity of angle** | | proximal | Distal or proximal |
| **Defined relationship between angles** | | no | no |
| **Side of backing** | left | | |
| **Sequence of retouch application** | clockwise | | |

Figure 6:52 Tor Hamar 1 design principles

## 6.9. Jebel Fatma J436 (JF): Madamaghan

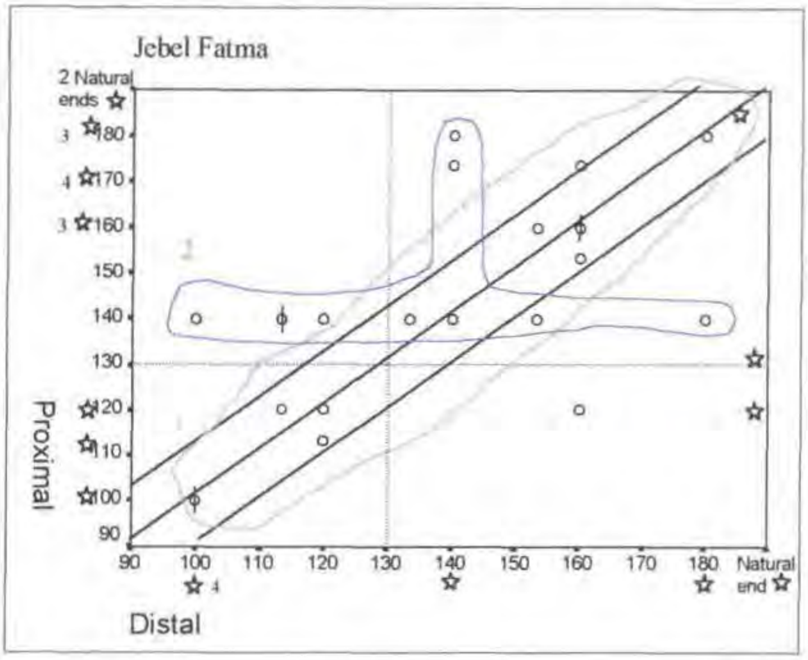



Figure 6:53 Jebel Fatma truncation angles

### Description of tools

Tools are loosely symmetrical at this site, and cover the full range from bipointed to rectangles (pink, above). There are also a smaller number of tools that are 140 degrees at one end (usually proximal) and can be either pointed or flat at the other end (blue, above). This group comprises just under half of both the points and flats.

### Symmetry and interchangeability

Most of the tools are symmetrical within 10 degrees. There are, however, a number of distal points opposite 140-degree ends that are not symmetrical, but may have interchangeable ends. There are only rare points with flat bases, avoiding extreme (>40 degrees) asymmetry.

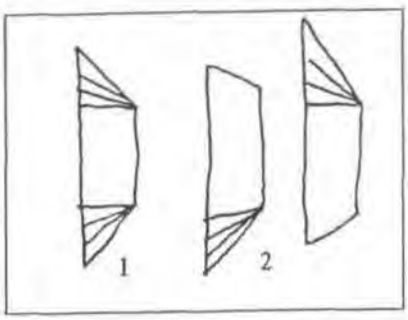



Figure 6:54 Range of variability

## Pattern of variability

There is no one concentration of tools at any particular truncation angle. Variability is fairly constant across the acceptable angles, of which there are many. The two groups are largely overlapping. However, the pointed tools do form two groups – a number of symmetrical bipoints, and another group of distal points with 140-degree proximal ends.

## Direction and backing

Tools are right-backed. Backing is mainly clockwise, especially in laterals and end locations, although a variety of directions are chosen.

## Metrics

Tools are narrow and thin, both dimensions having little variability. Length is much more variable. Surface area is small and narrowly defined, but elongation is high and very variable.

There is some correlation between metrics and truncations. Symmetrical tools tend to be narrower than the asymmetric 140-degree points and flats. The steeper points have greater elongation. 180-degree tools, which fall into both either group, tend to be wider, and all flatter angles tend to stubbiness.

Length, width and depth are not correlated. However, width is negatively correlated with elongation and amount of retouch. Narrower tools have a higher proportion of retouch, and are more elongated. Elongated tools all have a similar amount of retouch, while stubbier tools fall into two groups, one with less retouch.

| | | Length | Width | Depth | Elongation | % retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .121 | .073 | .558 | -.299 |
| | Sig. (2-tailed) | . | .517 | .696 | .001 | .103 |
| **Width** | Correlation Coefficient | .121 | 1.000 | .336 | -.691 | -.628 |
| | Sig. (2-tailed) | .517 | . | .065 | .000 | .000 |
| **Depth** | Correlation Coefficient | .073 | .336 | 1.000 | -.225 | -.196 |
| | Sig. (2-tailed) | .696 | .065 | . | .224 | .290 |
| **Elongation** | Correlation Coefficient | .558 | -.691 | -.225 | 1.000 | .287 |
| | Sig. (2-tailed) | .001 | .000 | .224 | . | .117 |
| **%retouch** | Correlation Coefficient | -.299 | -.628 | -.196 | .287 | 1.000 |
| | Sig. (2-tailed) | .103 | .000 | .290 | .117 | . |

Figure 6:55 Metric correlations at Jebel Fatma

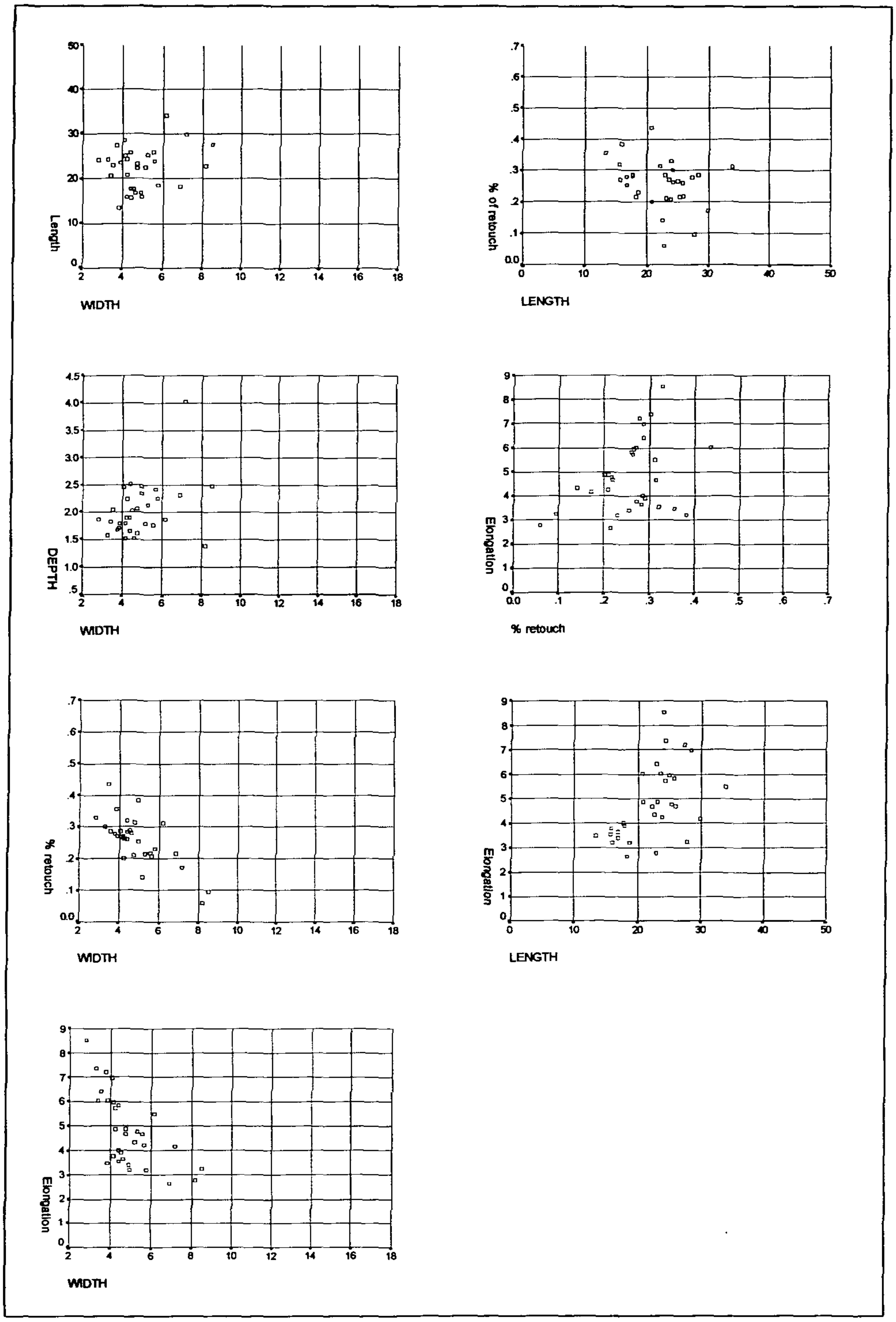



Figure 6:56 Metric correlation scatterplots, Jebel Fatma

## Summary

Overall, the assemblage shows an emphasis on loose symmetry between the two truncation angles, with any angle being used. Tools do not fall into clear angle categories. Metric dimensions are not well correlated.

| Design principles | Overall tool | Type 1 | Type 2 |
|---|---|---|---|
| Truncation angles | | any | 140xany or 140-180x 140 |
| Symmetry | | yes | no |
| Interchangeable tool ends | | yes | yes |
| Discrete types | no | | |
| Specificity of angle | | no | Proximal or distal |
| Defined relationship between angles | | yes | no |
| Side of backing | right | | |
| Sequence of retouch application | clockwise | | |

Figure 6:57 Jebel Fatma design principles

## 6.10. SHUNERA 4 (SH4): MUSHABIAN

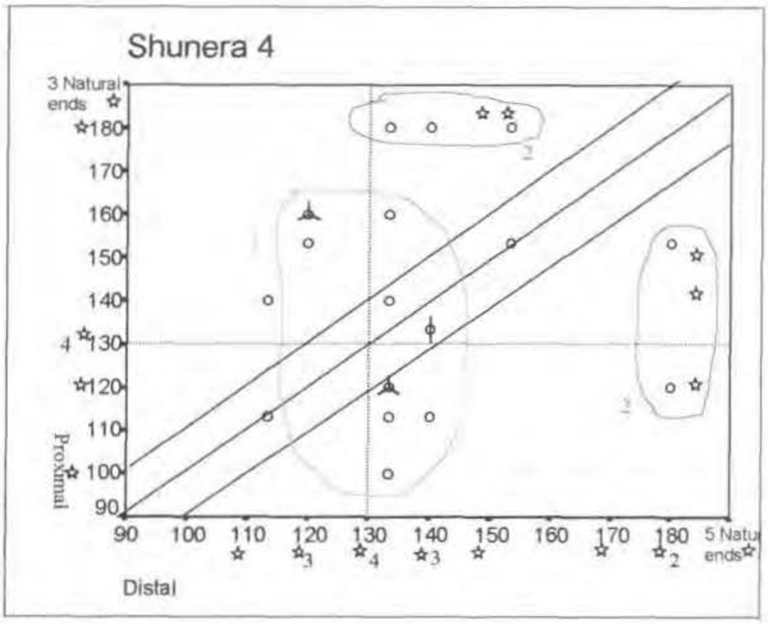



Figure 6:58 Shunera 4 truncation angles

### Description of tools

The assemblage is made up of tools forming distal points with mid to steep angles. Tools are mainly asymmetrical, with a limited range of appropriate angles for the distal end.

One group of tools (pink, above) has a distal angle of 120-140, opposite a proximal angle of 100-160. These distal points thus include some tools that are bipoints, and some that have mid to flat base. These tools are stubby, short, narrow and thin. Steep angled tools are shorter.

Another group of tools has one end that is either 180 degrees, or is natural, opposite a 120-150 degree angle (blue, above). The flat end can be either distal or proximal. Proximal 180's are longer, wider and deeper than other tools.

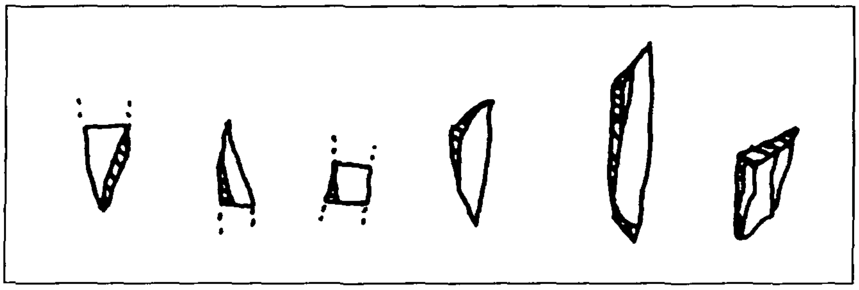


Figure 6:59 Shunera 4 microliths

## Symmetry and interchangeability

There is no sense of symmetry in the assemblage, with the 180-degree tools being particularly asymmetric.

Type 1 tools tend to have one pointed end (110-120) opposite a mid point (130-140). So, where the distal end is 120, the proximal tends to be 130-40, and where the proximal is 120, the distal is 130-40. Within this group, there is some interchangeability, despite a preference for distal 120-130's that is not reflected in the proximal angles. In the type 2 tools, there is interchangeability. Either end can be flat or natural, opposite a 120-160 degree angle.

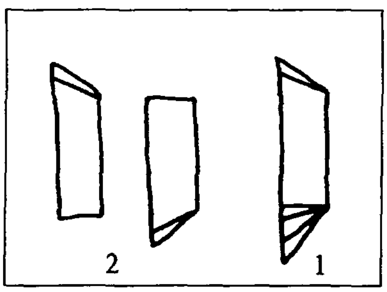



Figure 6:60 Range of variability

## Pattern of variability

Tools fall into two fairly distinct categories, with few mid-angles of 160-70 in between the categories.

While there is clearly a preference for 120-140 degrees on the distal, and indeed throughout the assemblage, there is still a wide spread of angles used, especially on the proximal end.

## Direction and backing

There is no preference for side of backing. Direction of retouch is mixed, with only the lateral edges showing a preference for clockwise retouch, while corner locations are anticlockwise.

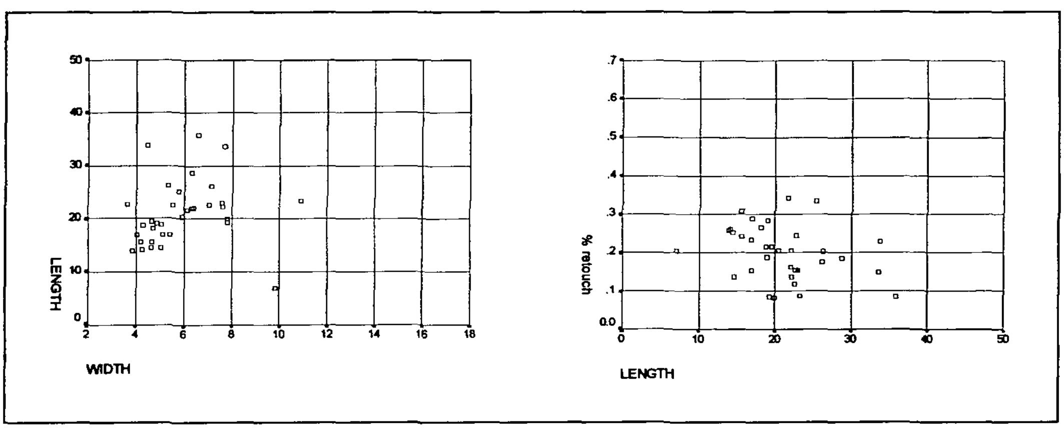
## Metrics

Tools are short and thin at this site, with little variability. Metrics show a number of correlations, with length and depth particularly strongly correlated, as well as amount of retouch with width and depth.

Metrics are correlated to some degree with truncation angles, in that flat based tools (type 2) tend to be larger and more elongated, and type 1 tools tend to be smaller, getting even smaller as the points get steeper.

| | | Length | Width | Depth | Elongation | % retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .436 | .726 | .464 | -.384 |
| | Sig. (2-tailed) | . | .010 | .000 | .006 | .025 |
| **Width** | Correlation Coefficient | .436 | 1.000 | .583 | -.468 | -.694 |
| | Sig. (2-tailed) | .010 | . | .000 | .005 | .000 |
| **Depth** | Correlation Coefficient | .726 | .583 | 1.000 | .096 | -.640 |
| | Sig. (2-tailed) | .000 | .000 | . | .590 | .000 |
| **Elongation** | Correlation Coefficient | .464 | -.468 | .096 | 1.000 | .336 |
| | Sig. (2-tailed) | .006 | .005 | .590 | . | .052 |
| **% retouch** | Correlation Coefficient | -.384 | -.694 | -.640 | .336 | 1.000 |
| | Sig. (2-tailed) | .025 | .000 | .000 | .052 | . |

Figure 6:61 Metric correlations at Shunera 4



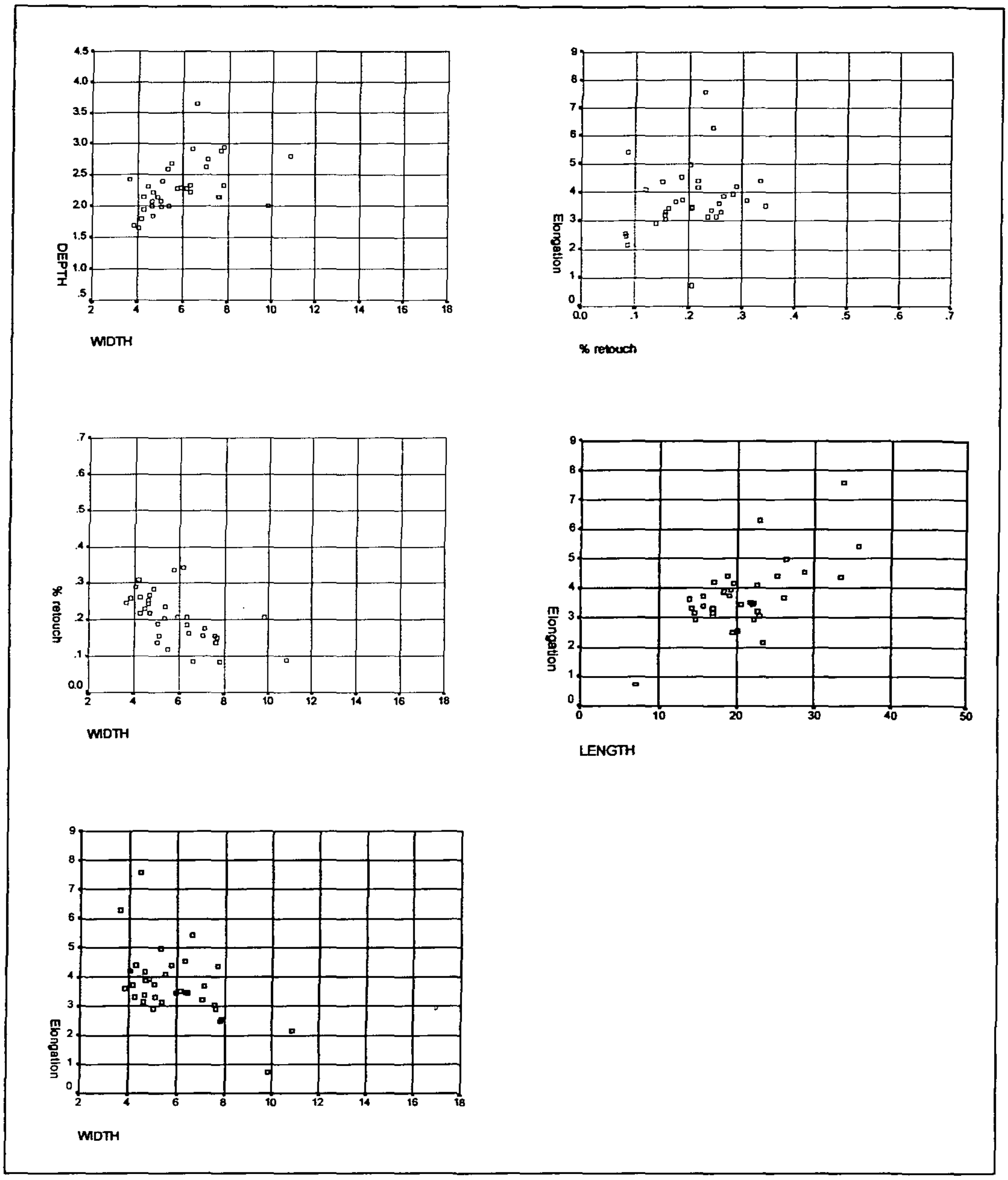



Figure 6:62 Metric correlation scatterplots, Shunera 4

## Summary

There is quite a lot of variability in both sets of tools in this assemblage, including truncation angle, direction and side of backing. In terms of truncation angles, even the pointed end is more variable than usual in other assemblages. However, metric variability is low, and correlated with the clearly different groups of truncation angles, suggesting that metrics are more strictly defined in this assemblage while exact truncation angle is less strictly defined. Despite this, the assemblage shows two clear-cut categories of tool truncation angles.

| | Overall tool | Type 1 | Type 2 |
|---|---|---|---|
| **Truncation angles** | | 100-180 x 120-140 | 180 x 130-50 or 130-50x 180 |
| **Symmetry** | | no | no |
| **Interchangeable tool ends** | | no | yes |
| **Discrete types** | yes | | |
| **Specificity of angle** | | Distal | Distal or proximal |
| **Defined relationship between angles** | | no | yes |
| **Side of backing** | No preference | | |
| **Sequence of retouch application** | Clockwise & mixed | | |

Figure 6:63 Shunera 4 design principles

## 6.11. SHUNERA 8 (SH8): MUSHABIAN

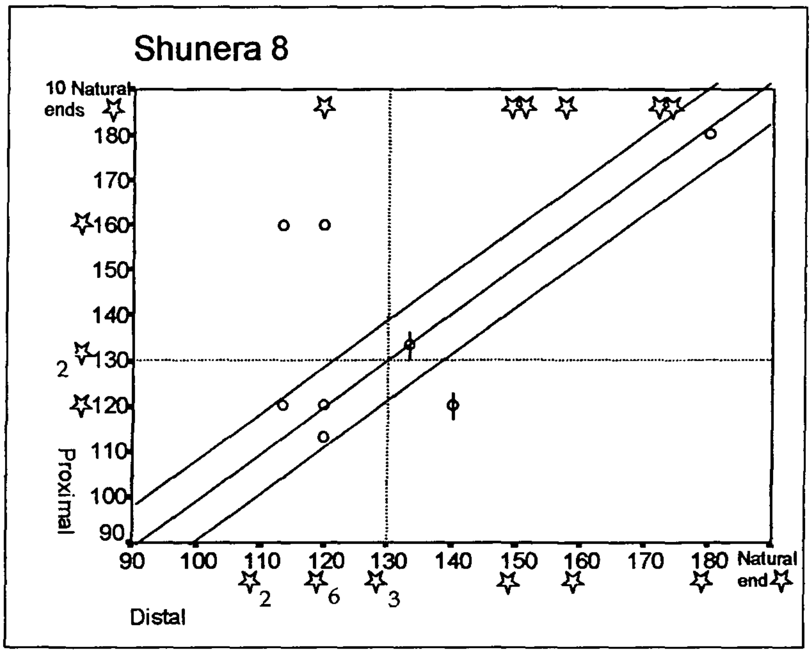



Figure 6:64 Shunera 8 truncation angles

### Description of tools

The small number of complete tools (16) in the sample make it difficult to see clear patterns in the data. There seems to be a concentration of distal angles between 110-140, with proximal angles between 110-160 degrees. A number of these are symmetric. This group include bipoints, as well as both distal and proximal points opposite flatter angles. There are also a number of natural proximal ends, opposite mainly 150-180 degree distal angles.

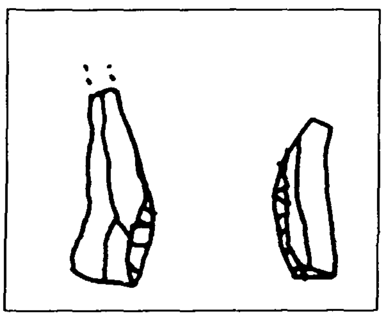


Figure 6:65 Shunera 8 microliths

## Symmetry and interchangeability

While six of the tools are symmetrical, it is hard to determine whether this reflects a preference. As these tools do fall within the same distal and proximal angles as part of the SH4 sample, it may be that they are, as at that site, simply a part of the proximal variability range with the distal 120-140 tools.

Tools do not seem to be interchangeable, with a heavy emphasis on natural proximal ends, and tools with distal angles of 120-140.

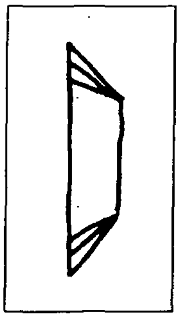


Figure 6:66 Range of variability

## Direction and backing

There is a slight preference for left backing. Retouch is applied in a clockwise direction, except for the proximal locations.

## Metrics

This site has closely specified deep tools with a large surface area. Tools are especially wide, with lots of variability. They are not elongated or heavily retouched.

Tool dimensions are not correlated, although amount of retouch and elongation are correlated with width. There is no correlation between metrics and truncation angle.

| | | Length | Width | Depth | Elongation | % of retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | .253 | .302 | .388 | -.538 |
| | Sig. (2-tailed) | . | .344 | .256 | .137 | .031 |
| **Width** | Correlation Coefficient | .253 | 1.000 | .084 | -.606 | -.687 |
| | Sig. (2-tailed) | .344 | . | .757 | .013 | .003 |
| **Depth** | Correlation Coefficient | .302 | .084 | 1.000 | -.194 | .122 |
| | Sig. (2-tailed) | .256 | .757 | . | .471 | .652 |
| **Elongation** | Correlation Coefficient | .388 | -.606 | -.194 | 1.000 | .218 |
| | Sig. (2-tailed) | .137 | .013 | .471 | . | .418 |
| **% retouch** | Correlation Coefficient | -.538 | -.687 | .122 | .218 | 1.000 |
| | Sig. (2-tailed) | .031 | .003 | .652 | .418 | . |

Figure 6:67 Metric correlations at Shunera 8

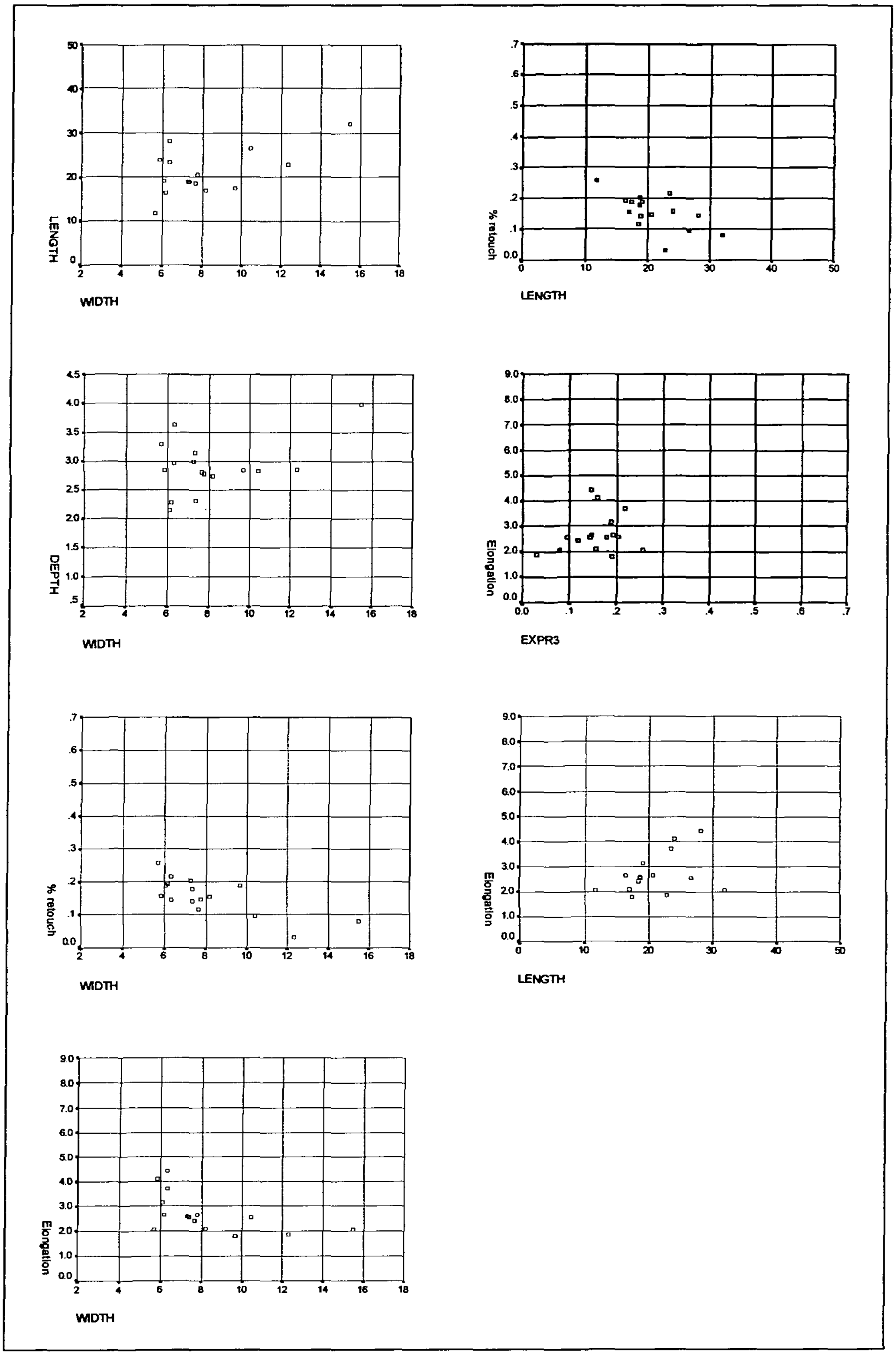


Figure 6:68 Metric correlation scatterplots, Shunera 8

## Summary

With few complete tools, the picture at this site is far from clear. There may be an emphasis on certain angles, with a lack of symmetry. Tools are deep and wide, with few metric correlations.

| **Design principles** | |
|---|---|
| **Truncation angles** | 110-160 x 110-140 |
| **Symmetry** | no |
| **Interchangeable tool ends** | No? |
| **Discrete types** | ? |
| **Specificity of angle** | No |
| **Defined relationship between angles** | ? |
| **Side of backing** | Left |
| **Sequence of retouch application** | clockwise |

Figure 6:69 Shunera 8 design principles

## 6.12. Shunera 21 (SH21): Ramonian

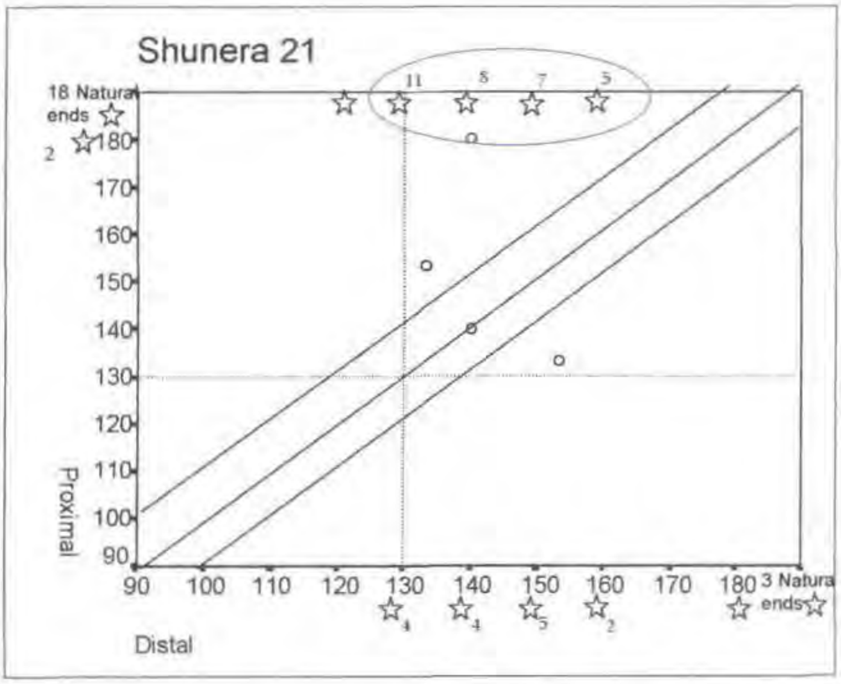



Figure 6:70 Shunera 21 truncation angles

### Description of tools

The assemblage is made up almost entirely of tools with natural proximal ends, opposite distal angles ranging from 130 degrees to 160 degrees.

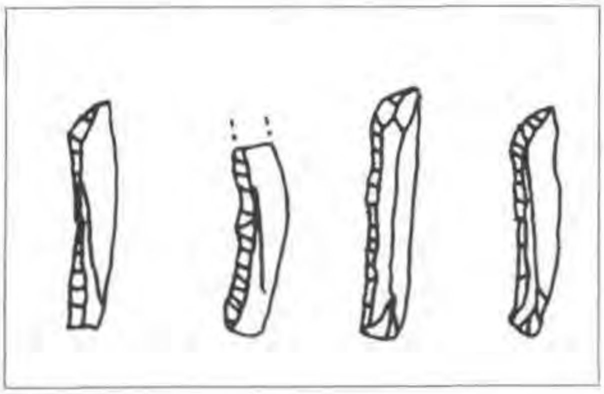


Figure 6:71 Shunera 21 microliths

### Symmetry and interchangeability –

There is no symmetry in the assemblage, and the point is always on the distal end, with no interchangeability of blank ends.

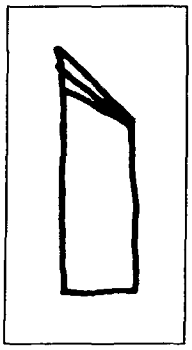


Figure 6:73 Range of variability

## Pattern of variability

There is only one tool type, involving a concentration at several consecutive distal angles and a fall-off in frequency from those angles.

## Direction and backing

Tools are left-backed, and retouch is applied in a clockwise direction. Only proximal locations are anticlockwise.

## Metrics

There is very little variation in width, with a lot of variation in length. Tools are deep with a large surface area, and little variability in this or in amount of retouch, which is low.

Width does not correlate with other dimensions. Length correlates with depth of tool. Elongation correlates well with tool dimensions. The flatter-angled tools tend to be wider and less elongated.

| | | Length | Width | Depth | Elongation | % retouch |
|---|---|---|---|---|---|---|
| **Length** | Correlation Coefficient | 1.000 | -.083 | .405 | .890 | -.059 |
| | Sig. (2-tailed) | . | .620 | .012 | .000 | .726 |
| **Width** | Correlation Coefficient | -.083 | 1.000 | -.055 | -.504 | -.581 |
| | Sig. (2-tailed) | .620 | . | .744 | .001 | .000 |
| **Depth** | Correlation Coefficient | .405 | -.055 | 1.000 | .372 | .051 |
| | Sig. (2-tailed) | .012 | .744 | . | .021 | .762 |
| **Elongation** | Correlation Coefficient | .890 | -.504 | .372 | 1.000 | .201 |
| | Sig. (2-tailed) | .000 | .001 | .021 | . | .226 |
| **% retouch** | Correlation Coefficient | -.059 | -.581 | .051 | .201 | 1.000 |
| | Sig. (2-tailed) | .726 | .000 | .762 | .226 | . |

Figure 6:74 Metric correlations at Shunera 21

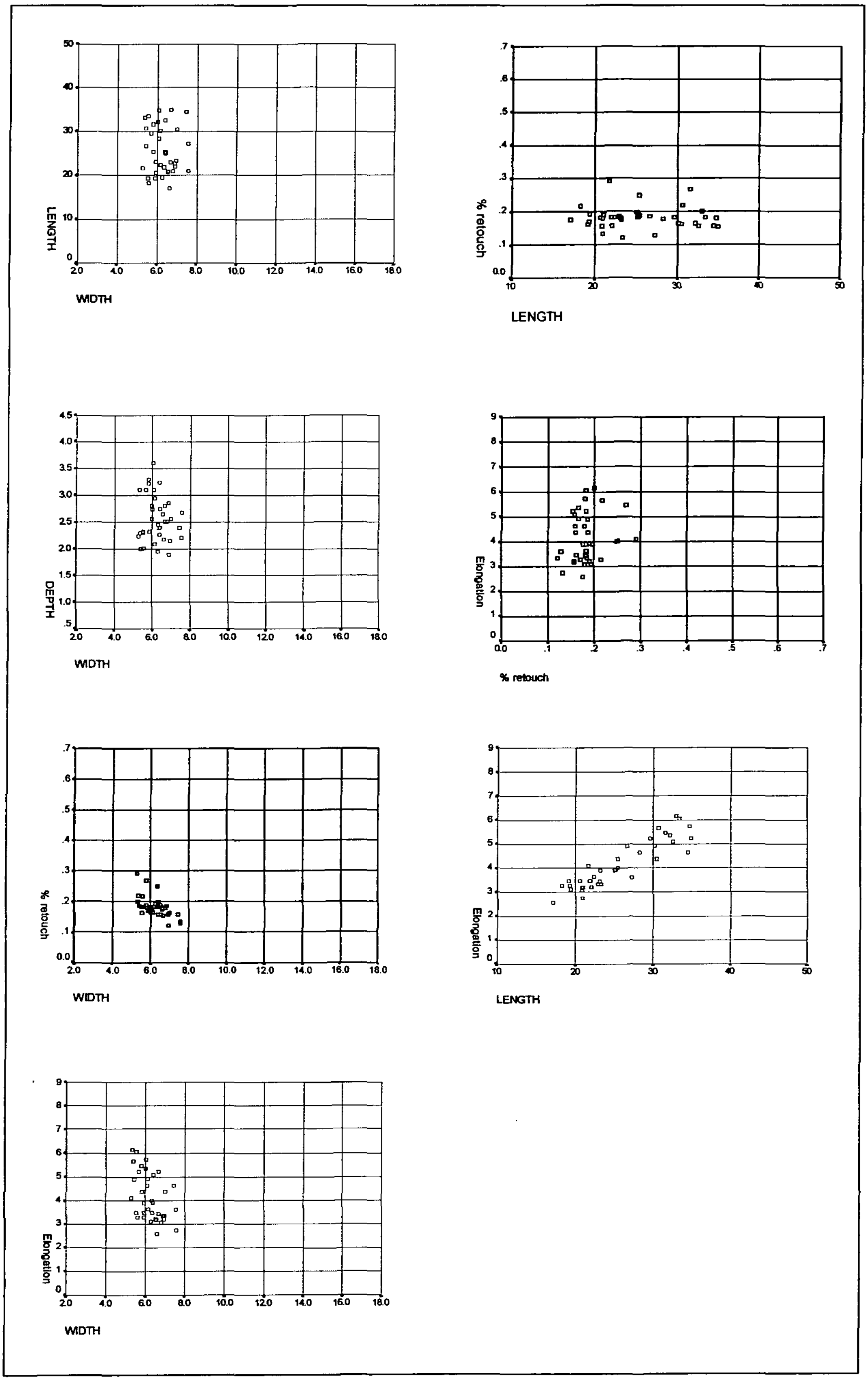



Figure 6:75 Metric correlation scatterplots, Shunera 21

Summary

Tools are very similar in morphology and method of creation, but vary in length and depth, as well as in actual angle chosen.

| **Design principles** | |
|---|---|
| **Truncation angles** | Proximal end x 130-60 |
| **Symmetry** | no |
| **Interchangeable tool ends** | no |
| **Discrete types** | 1 with a fall-off |
| **Specificity of angle** | Proximal |
| **Defined relationship between angles** | no |
| **Side of backing** | left |
| **Sequence of retouch application** | clockwise |

Figure 6:76 Shunera 21 design principles

# 7. COMPARISON OF WITHIN-SITE VARIABILITY

## Introduction

The previous chapter described the nature of within-site morphological variability within 12 assemblages. This chapter will compare the results between sites in the sample. The level/scale at which different axes of normative or variable decisions are taken will be explored in comparisons within and between cultural designations, and between straight-backed (SBB) sites and arched-backed (ABB) sites. This corresponds to the division between straight-backed Mediterranean zone cultures (Geometric Kebaran and Middle Hamran) and arched-backed arid zone ones (Mushabian, Madamaghan, Ramonian, Qalkhan). Then the overall pattern of the variability of the different attributes will be discussed, followed by the pattern of variability characterising three analytical levels: cultures, SBB/ABB divide, and individual sites. This will be followed by a discussion of some of the implications of these patterns.

## 7.1. CULTURES

Sites are compared within their cultural divisions in order to examine what attributes vary at a cultural scale, in what circumstances.

| Name | | Area | Culture |
|---|---|---|---|
| TH2 | Tor Hamar J431 BLOCK 2 | Hisma | Qalkhan |
| TH1 | Tor Hamar J431 BLOCK 1 | Hisma | Madamaghan |
| JH | Jebel Hamra J201 | Hisma | Middle Hamran |
| SH12 | Shunera 12 | Negev | Geometric Kebaran |
| SH3 | Shunera 3 | Negev | Geometric Kebaran |
| SH12b | Shunera 12B | Negev | Geometric Kebaran |
| SH4 | Shunera 4 | Negev | Mushabian |
| SH21 | Shunera 21 | Negev | Ramonian |
| SH8 | Shunera 8 | Negev | Mushabian |
| WH | Wadi Humeima Lower | Hisma | Qalkhan |
| JF | Jebel Fatma J436 | Hisma | Madamaghan |
| WJ | Wadi Judayid J31 | Hisma | Middle Hamran |

Figure 7:1 Sites and cultures

### 7.1.1. Middle Hamran (JH, WJ)

#### Design Principles

##### Truncation angles

180 is the most common truncation angle at both sites. The angles cover a similar range. At JH, the most common tool is distal 180 opposite proximal 170, while at WJ it is distal 170 opposite proximal 180.

##### Symmetry

Tools are symmetrical within 10 degrees at both sites. Symmetry seems a more central concern than actual angles used.

##### Natural blank ends

There are a large number of natural blank ends present at both sites, especially proximal ends.

##### Pattern of variability

At both sites, there is one concentration of tools and a fall off in frequency from this most common angle.

##### Direction and backing

At both sites, pieces of retouch are applied mainly in a clockwise direction. At WJ, proximal locations show no preference in direction, while at JH only proximal and distal locations have this preference. Overall, preferences are not very strong in this respect.

Tools are most often backed on the right in both assemblages, although JH has a fairly weak preference in this respect.

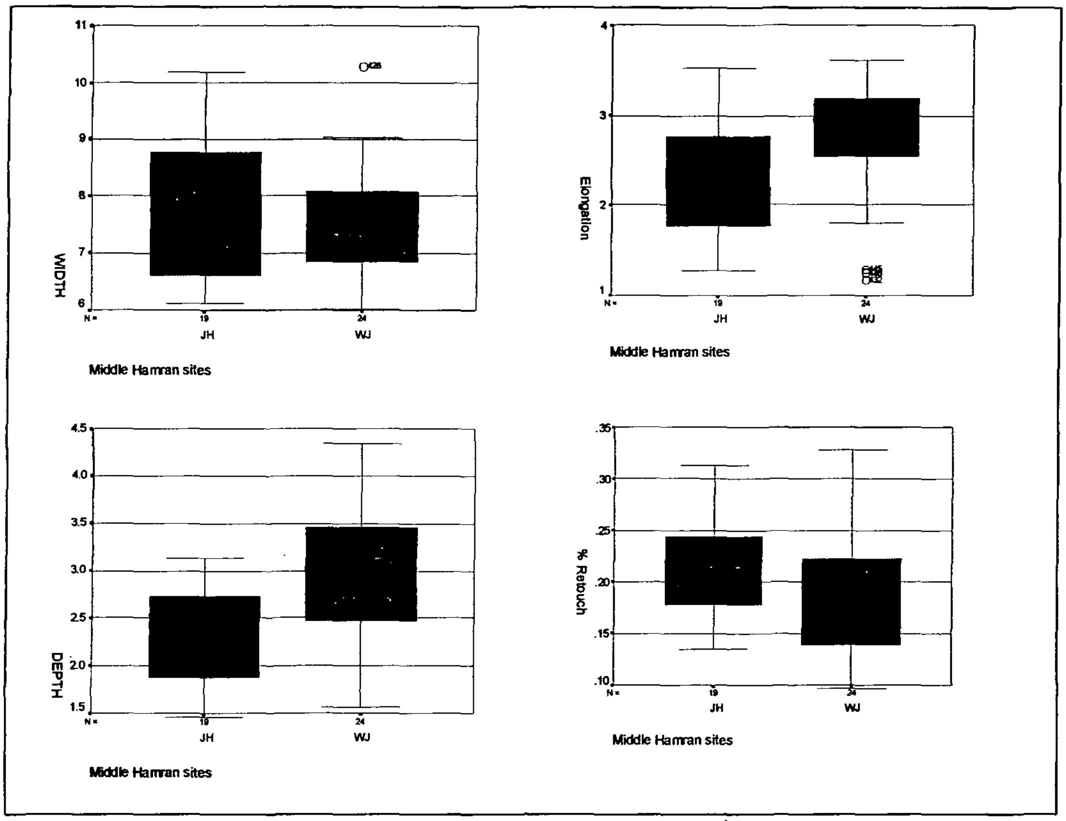



Figure 7:3 Middle Hamran metric comparisons

Overall, both sites have weak correlations, with WJ having slightly stronger ones. At JH, length and width are correlated, but depth is not. At WJ, length and width are not correlated, but depth is. At both sites, length is correlated with elongation, and width with amount of retouch.

| | Correlated | | Not correlated | |
|---|---|---|---|---|
| | JH | WJ | JH | WJ |
| Length | W,E,% | D,E,% | D | W |
| Width | L,% | % | D,E | L,D,E |
| Depth | – | L,E | L,W,E,% | W,% |
| Elongation | L | L,D,% | W,D,% | W |
| % retouched | L,W | L,W,E | D,E | D |

Figure 7:4 Middle Hamran metrc correlations

L = length; W = width; D = depth; E = elongation; % = proportion retouched

Metrics and truncation angle

The most common tools, at 170x180, contain all of the metric variation present in the sample at both sites.

## Summary

Similarities:

- Emphasis on symmetry
- Slight latitude in actual angles
- Fall-off in frequencies from a concentration of tools
- Right backing
- Weak preferences for clockwise directions
- Presence of proximal ends
- Metric variability is random in terms of truncation angle
- Weak metric correlations largely relating to elongation and amount of retouch
- Width similar

Differences:

- Metrics – WJ is deeper, and slightly longer; with a larger surface area
- WJ has more elongated tools
- JH has more highly retouched tools
- locations of clockwise preference
- amount of metric variability is higher at WJ
- length and width correlated at JH, while depth and length are correlated at WJ

These sites are very similar in design principles, producing one tool with a range of variability around it, which is not correlated to any metric differences. Differences relate largely to overall metrics of the assemblages. WJ has larger, more elongated tools with more variability in metrics. Correlations between metric dimensions are similar overall at the two sites in being weak and relating largely to elongation/retouch. However, WJ has tools that are deeper as they get larger in other dimensions, while JH's tools are correlated in length and width only. Other, possibly very personal differences, include direction of retouch in different locations on the tool, and preference for distal or proximal 170-degree angles.

## 7.1.2. Geometric Kebaran (SH12, SH3, SH12B)

### Design principles

#### Truncation angles

At all sites, the most common angle is 180 degrees, with significant numbers at 170 as well.

#### Symmetry

At SH3, tools are symmetrical, but at both SH12 and SH12B some are not, with one end at 180 and the other at 180-140.

#### Natural ends

SH3 has few natural ends, but both SH12 and SH12B have a number of natural proximal ends and SH12B has some distal ends as well.

#### Interchangeability

Overall, most tools are interchangeable. However, at SH12B, the proximal end is almost always either natural or 180, while at SH12 there may be an emphasis on distal 180s.

#### Pattern of variability

At all sites, there is a concentration of tools at 180/170, with a fall off in frequency from these angles. At sites SH12 and SH12B, the fall off consists of tools that are not strictly symmetrical, but retain one end at 180 degrees.

#### Direction and backing

Sites SH3 and SH12B have a slight preference for left backing while SH12 is right-backed. Overall, pieces of retouch are applied in different ways at the three sites. SH3 has retouch that follows no sequential pattern, SH12B retouch is applied in a clockwise manner and, at SH12, retouch is anti-clockwise. Preferences for a particular direction tend to be stronger on the favoured backed edge. SH12B has the strongest preferences for direction of retouch.

| | SH12 | SH12B | SH3 | Similarity |
|---|---|---|---|---|
| **Truncation angles** | 180 x 180/60 or 180/60 x 180 | 180 x 180/60 or 180/60 x 180 | 150-180x150-180 | ✓ |
| **Symmetry** | Yes within 30 degrees | Yes within 30 degrees | Yes | ✓ |
| **Interchangeable tool ends** | Yes | Yes | Yes | ✓ |
| **Discrete types** | Yes with variability up to 30 degrees | Yes variability up to 30 degrees | Yes | ✓ |
| **Specificity of angle** | Yes | Yes | Yes within 30 degrees | ✓ |
| **Defined relationship between angles** | Yes | Yes | Yes | ✓ |
| **Side of backing** | Right | Left | Left | x |
| **Sequence of retouch application** | Anticlockwise | Clockwise | Non - sequential | x |

Figure 7:5 Geometric Kebaran comparison

## Metrics

Dimensions at SH12 and SH12B are very similar; tools at SH3 are smaller, with less variability, while being more elongated and retouched. The width differences between SH3 and the other two are the greatest between any sites within a culture in this study. Sites SH12 and SH12B are more similar than other sites, with even depth in common. Tools at SH12 have much more variability in amount retouched, while those at SH12B have somewhat more variability in elongation.

| | Correlated | | | Not correlated | | |
|---|---|---|---|---|---|---|
| | SH12 | SH12b | SH3 | SH12 | SH12B | SH3 |
| Length | D,E | % | W,D,E, % | W,% | W,D,E | _ |
| Width | % | % | L,D,% | L,D,E | L,D,E | E |
| Depth | L | _ | L,W,% | W,E, % | L,W,E, % | E |
| Elongation | L | _ | L,% | W,D, % | L,W,D, % | W,D |
| % retouched | W | L,W | L,W,D, E | L,D,E | D,E | _ |

Figure 7:6 Geometric Kebaran comparison of metric correlations

L = length; W = width; D = depth; E = elongation; % = proportion retouched

Metric correlations are not strong, except between elongation or amount of retouch and length or width. There are few correlations between actual tool dimensions at SH12 and SH3. SH12B has loose correlations between length, width and depth.

It is only at SH12B that truncation angles show any correlation with metrics. There, the 180/170 degree tools tend to be slightly shorter than other tools.

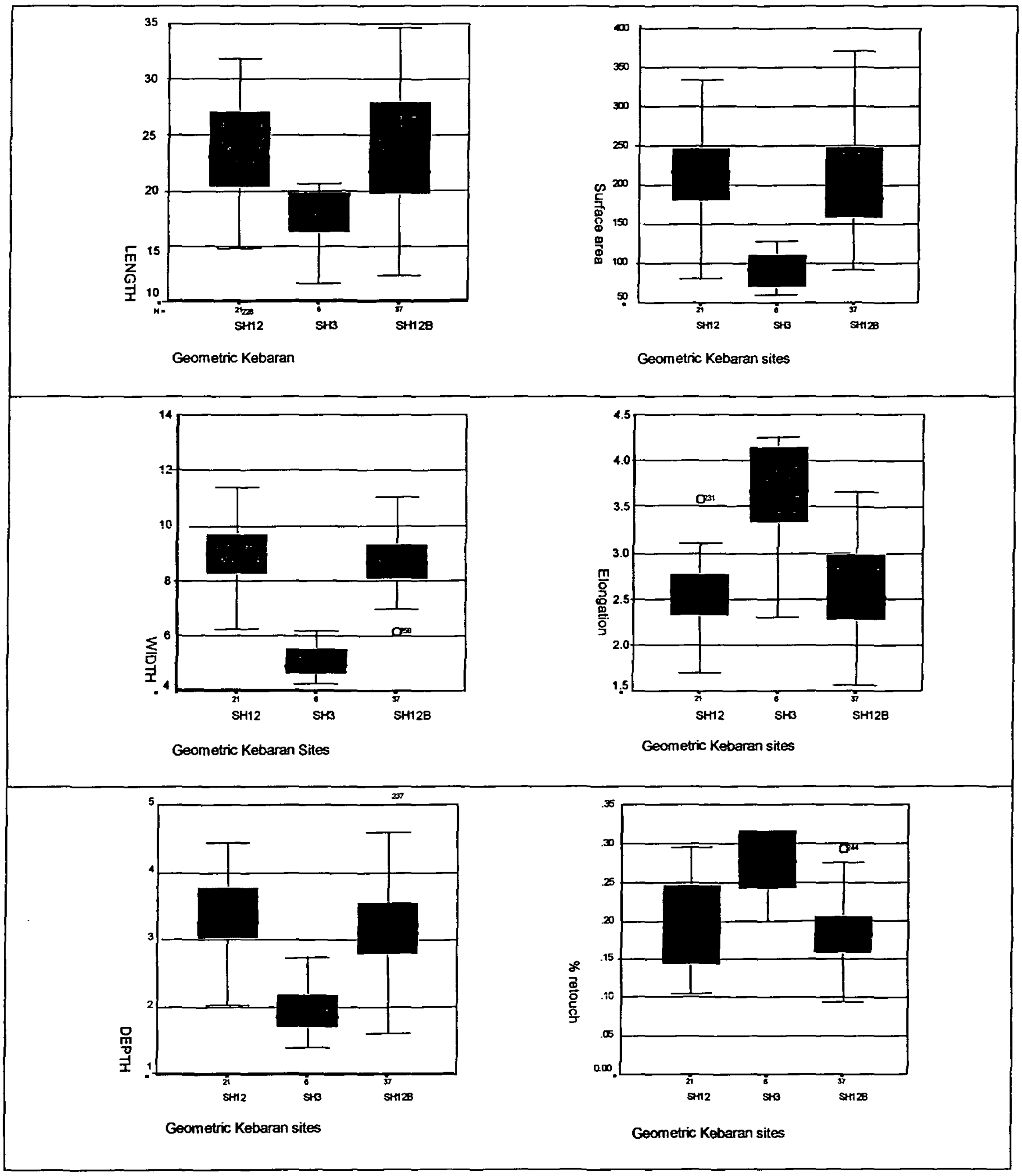



Figure 7:7 Metric comparisons of Geometric Kebaran sites

### Summary

Similarities:

- Overall truncation angles
- Concentration on an angle, with a fall-off in frequency from it
- Any metric correlations are loose
- Width is correlated with retouch, and length with elongation

Differences

- Actual metrics (tools at SH3 are small)
- Metric variability (little variation at SH3)
- Retouch and elongation (common at SH3)
- Only SH12B has many correlations, or metric correlations with truncation angle
- Only SH3 has truly symmetrical tools
- SH12 and SH12B have numerous natural proximal ends
- SH12 is right backed
- direction of retouch

These sites are very similar in decisions relating to design principles. Tools are broadly symmetrical, but also show variability from this in either distal or proximal end, with the opposite end retaining a 180 degrees angle. Any metric correlations are loose.

Differences include metrics between SH3 and the other two sites. SH3 has small tools with little variability, which are elongated and heavily retouched. Sites SH12 and SH12B contrast with this in every respect, and are very similar to each other in metrics. SH12B has more metric correlations than the other two. All sites have differences in backing and direction of retouch, suggestive of individual differences between toolmakers.

## 7.1.3. Qalkhan (TH2, WH)

### Design principles

#### Truncation angles and constraints

Both sites have steep points, although the choice of angles is different. At WH, points are at 100-110 degrees, while at TH2, points are at 110-120 degrees. WH also has concentrations of proximal ends at 130 and 180 degrees, which are reflected at TH2 to a much lesser degree.

Both sites create tools which emphasis certain angles, with usually one tool end determined by that specific angle, and the other much more variable.

#### Pattern of variability

At TH2, tools fall into 2 clearly separate groups defined by their distal angle. At WH there are also clear clusters of tools with a series of very steep points which are, unlike TH2, interchangeable as to which end is pointed. Proximal ends fall into one of three degree ranges. Distal angles seems much less constrained than at TH2.

#### Symmetry and interchangeability

There is little indication of symmetry at either site, although both have a group of symmetrical bipoints. At WH, it seems that the steepest points are interchangeable, although most are distal. TH2 shows no sign of interchangeability of points, although the 180-degree tools have interchangeable ends.

#### Point/flat

Both sites contain very steep points with variable opposite ends, and also less steep points with one flat base.

#### Direction

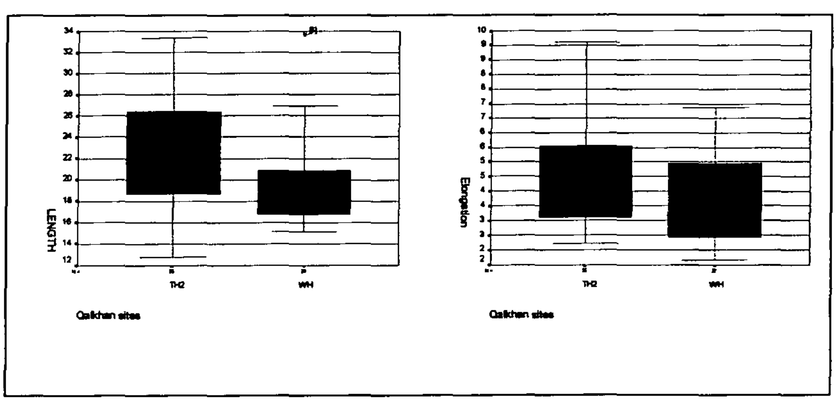
Tools are left backed at both sites, although TH2 has a much stronger preference for side of backing. At TH2, it is only this left side that shows a preference for clockwise retouch. At WH the left side of tools show a strong preference for clockwise direction of retouch, although the right side is also clockwise but more weakly preferred.

| TH2 | | | | WH | | | | Simil-arity |
|---|---|---|---|---|---|---|---|---|
| | | **Type 1** | **Type 2** | | **Type 1** | **Type 2** | **Type 3** | |
| **Truncation angles** | | 180x120 or 120 x 180 | 110-120 x any | | 100/10x100-140 or 100-140x100/10 | 130/40x130-180 | 100-80x any | x |
| **Symmetry** | | no | no | | no | no | no | ✓ |
| **Interchangeable tool ends** | | yes | no | | yes | no | no | x |
| **Discrete types** | yes | | | yes | | | | ✓ |
| **Specificity of angle** | | Distal and proximal | Distal only | | Distal or proximal | Proximal | Proximal | x |
| **Defined relationship between angles** | | yes | no | | no | no | no | ✓ |
| **Side of backing** | left | | | left | | | | ✓ |
| **Sequence of retouch application** | Mixed/ Clock-wise | | | Weak clock wise | | | | ✓ |

Figure 7:8 Comparison of Qalkhan design principles

## Metrics

While overall the sites have very similar tool surface area, there are differences along the various metric dimensions. The sites have similar width and depth, but vary slightly in length, with TH2 having longer tools with greater length variability. This site has less width variability, while WH has the opposite with more width and less length variability. Elongation and amount of retouch are very similar at both sites. TH2 is amongst the longest and most variable of ABB sites, while WH is amongst the widest and most variable of ABB sites. Overall, while the metrics are very variable within site at each site, between sites the surface area, elongation and retouch are nearly identical – suggesting that these are important priorities at this level of conception.



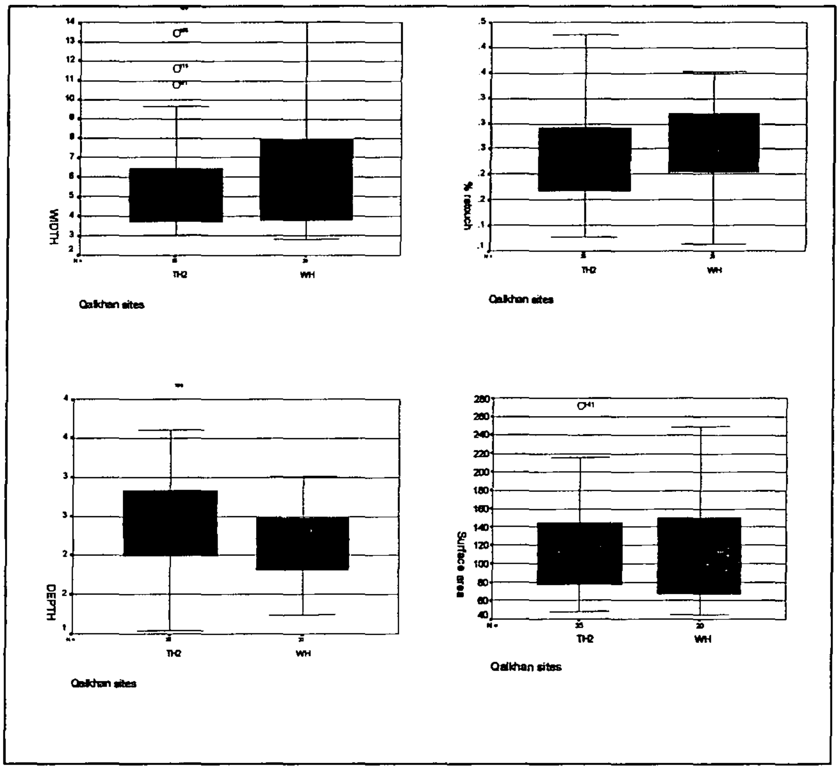


Figure 7:9 Metric comparisons of Qalkhan sites

It is unusual for assemblages assigned to a single culture to vary in length rather than in width and depth. In addition, at TH2 length is well correlated with other dimensions, while at WH length is not well correlated.

However, at both sites, metrics are very well correlated overall. All dimensions are correlated, and width and depth are correlated with both amount of retouch and with elongation. In addition, elongation and amount of retouch are positively correlated. Wider and longer tools are less retouched.

| | Correlated | | Not correlated | |
|---|---|---|---|---|
| | TH2 | WH | TH2 | WH |
| Length | W,D,% | % | E | W,D,E |
| Width | L,D,E,% | D,E,% | _ | L |
| Depth | L,W,E,% | W,E, % | _ | L |
| Elongation | W,D,% | W,D,% | L | L |
| % retouched | L,W,D,E | L,W,D,E | _ | _ |

Figure 7:10 Qalkhan metric correlations

L = length; W = width; D = depth; E = elongation; % = proportion retouched

### Metrics and truncation angles

Differences are seen in the 180 tools. At TH2, these are short, narrow and deep; at WH, they are long, wide, stubby and less retouched.

At both sites, bipoints include the smallest tools. In addition, as ends become steeper at WH, tools become less elongated and retouched.

## Summary

Similarities:

- Width and depth, amount of retouch and elongation, overall surface area
- Amount of within site variability in one of the 3 dimensions
- Emphasis on points
- Steep, and often one-ended, points
- Lack of symmetry
- Very discrete categories
- Left backing
- Importance of particular angles

Differences:

- Actual choice of truncation angles
- Length, and its correlation with other dimensions
- Dimension in which variability is greater (ie length at TH2, width at WH)
- Choice of distal ends for points/flats
- Size of 180-degree tools
- Actual dimensions, with TH2 being longer, deeper and more elongated, and WH being wider and more retouched
- Strength of backing preference

These two sites are in many ways similar, with precise choices of angle at each site, discrete categories of tool angles, and other 'precise' choices, such as side to be backed, and one metric dimension with less variability. Metrics tend to be similar, and correlated. Overall, there is a similar plan of tool making. However, different choices are made in terms of actual angles used, which metric dimension is variable, which blank end is pointed, and the range of tool lengths.

## 7.1.4. Madamaghan (TH1, JF)

### Design principles

#### Truncation angles

There is an emphasis at both sites on the flatter angles of 130-180, although TH1 has many more 180s. Both sites include points at 110/120 degrees. TH1 also has an emphasis on 130 degree angles. JF has an emphasis on 140 degree angles, which is not present at TH1.

#### Symmetry and interchangeability of blank ends

There are a number of tools at both sites following the line of symmetry. At TH1 this is mainly in the flat tools, while at JF it is across the range. Overall, TH1 shows more concentration on particular angles, while JF shows more concern for the symmetrical relationship between blank ends.

At JF, flat tools are either symmetric or interchangeable. At TH1, flat tools are also interchangeable. But other tools at the two sites are quite different, though. At JF they are sometimes bipoints (symmetrical), which are not found at TH1. While both have points that are not interchangeable, they are largely on different ends of the tool.

#### Relationship of points to flats

At both, the points are one end of a range of continuous variability from the flat tools, with no discrete category of pointed tools. At TH1, the proximal points are continuously variable from the flats, with the same range of distal angles as the flatter tools. At JF, the tools are either one end of the truncation range of symmetrical tools, or one end of the distal range on proximal 140-degree tools.

#### Direction of retouch and backing

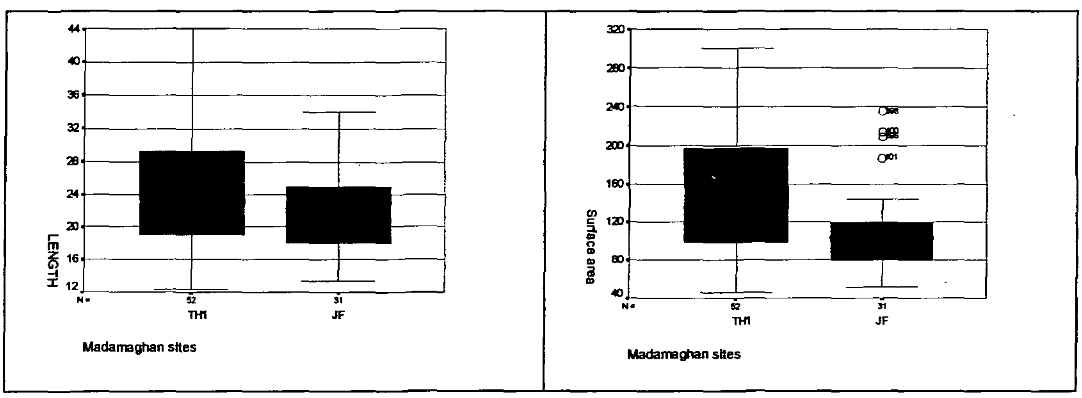
TH1 shows a preference for left-backing, and only the left location shows a strong preference for clockwise retouch application. JF shows a preference for right-backed tools, and preferences on left side and on the proximal end are quite strongly clockwise.

| | TH1 | | | JF | | | Similar-ity |
|---|---|---|---|---|---|---|---|
| | | Type 1 | Type 2 | | Type 1 | Type 2 | |
| **Truncation angles** | | 110-30xany | 180xany or any x 180 | | any | 140xany or 140-180x 140 | x |
| **Symmetry** | sometimes | | | | yes | no | x |
| **Interchangeable tool ends** | | no | yes | | yes | yes | ✓ |
| **Discrete types** | no | | | no | | | ✓ |
| **Specificity of angle** | | proximal | Distal or proximal | | no | Proximal or distal | ✓ |
| **Defined relationship between angles** | | no | no | | yes | no | x |
| **Side of backing** | left | | | right | | | x |
| **Sequence of retouch application** | clockwise | | | clockwise | | | ✓ |

Figure 7:11 Madamaghan comparisons

## Metrics

Overall, tools at JF are smaller with less variability than those at TH1. They are slightly more heavily retouched, and more variable in elongation. Both have a lot of length variability, and less width variability. They are among the longest ABB tools, and have a similar length to each other.



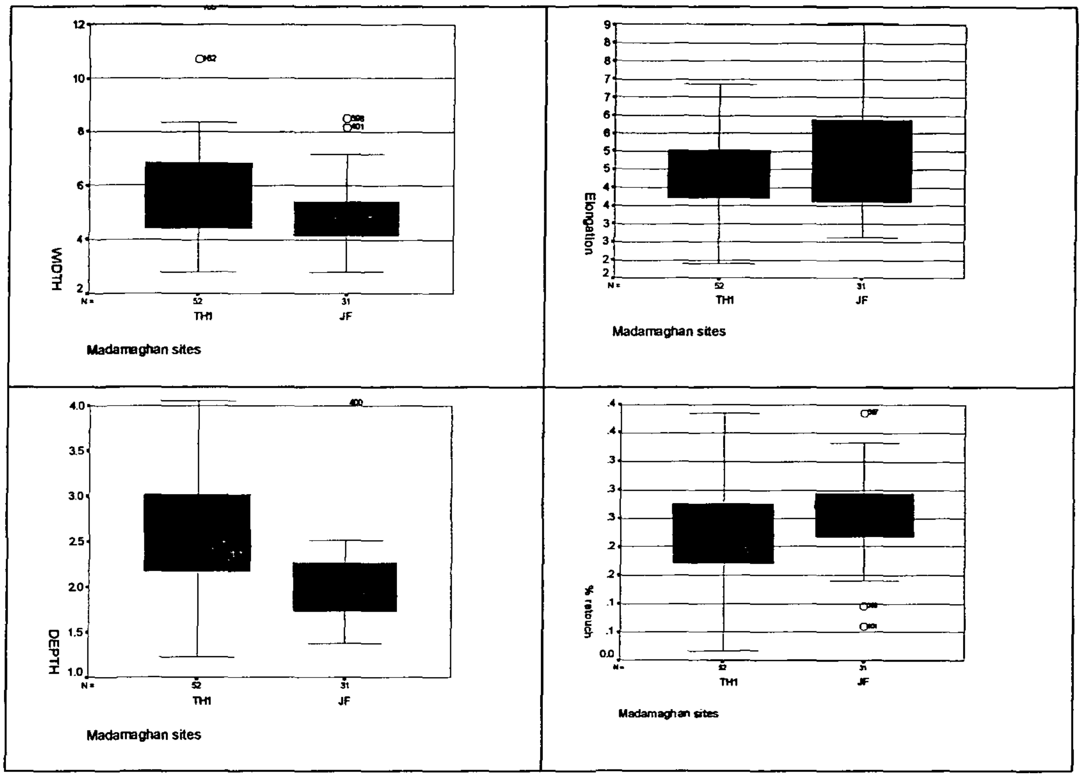



Figure 7:12 Madamaghan metric comparisons

Tool dimensions are correlated at TH1, unlike JF. Width is correlated negatively at both sites with amount of retouch and elongation.

## Truncation angles and metrics

At JF, sharper angles tend to be more elongated, while flatter angles (especially 180-degrees) are stubbier. However, at TH1, the proximal 180s are narrow and elongated, with higher amount of retouch.

| | Correlated | | Not correlated | | Similarity |
|---|---|---|---|---|---|
| | TH1 | JF | TH1 | JF | |
| **Length** | W,D,E,% | E | _ | W,D,% | x |
| **Width** | L,D,E,% | E,% | _ | L,W,D | x |
| **Depth** | L,W,% | _ | E | L,W,E% | x |
| **Elongation** | L,W | L,W | D,% | D,% | ✓ |
| **% retouched** | L,W,D | W | E | L,D,E | x |

Figure 7:13 Madamaghan metric correlations

L = length; W = width; D = depth; E = elongation; % = proportion retouched

## Summary

Similarities between the two sites include:

- Length
- Lots of length variability (more than most ABB), and less variability in width
- Similar amount of retouch and elongation
- Mixture of points and flats, symmetric and asymmetric
- Lack of clearly separate categories of points and flats
- Lack of interchangeability of point ends

Overall these two sites are quite varied in:

- Technique of application
- Emphasis on particular angles
- Attitude to symmetry
- Choice of blank ends for point
- Relationship of metrics to truncation angles
- Metric correlations
- Metric variability
- JF is smaller – in depth and width

These two sites vary in some fundamental ways that other sites assigned to a single culture do not. For example, TH1 has unusual proximal steep points, which JF does not. JF emphasises symmetry more than TH1, with most of its points being symmetrical or nearly so, and most of its flat tools as well. TH1 emphasises certain truncation angles more, although it also has some symmetrical flatter tools. These are all design principles that tend not to vary within culture. Metrics also vary unusually: the amount of variability, and attitude to correlation of metric dimensions, is not the same at these sites.

## 7.1.5. Mushabian (SH4, SH8)

(Ramonian site SH21 included in charts here for comparison, as the culture is generally considered to be either a temporal or regional facies of the Mushabian)

### Design principles

#### Truncation angle

Both sites emphasise 120-140 degree angles. SH4 also has a number of 180-degree angles, both proximal and distal. Overall, at both sites proximal angles are much less constrained and cover a wide range of angles.

#### Symmetry and interchangeability

There seems to be little emphasis on symmetry at either of the sites, although some tools do fall within the area of symmetry at 120-140 degrees. However, given the overwhelming preference for these angles on distal ends, and the complete range of proximal ends, it seems reasonable to assume that this is just one part of that pattern, rather than a desire for symmetrical tools per se.

Both sites have almost entirely distal points, with no sign of interchangeable tool ends. SH4 also has a series of 180s and distal/proximal naturals opposite 130/40 degree angles, which can be seen as forming a group of point-opposite-flat ended tools, with interchangeable point ends.

SH8 also has quite a large number of unretouched proximal ends. SH4, however, while having a few natural proximal ends, has somewhat more natural distal ends, most either snapped or opposite 120-150.

#### Pattern of variability

SH4 seems to have 2 fairly distinct tool types. At neither site are there many 160-170 degree angles. Because of the small number of complete tools at SH8, it is difficult to see if it also has this distinct pattern.

#### Direction of retouch

Neither site shows much preference for a particular backed side, although SH8 has a slight left preference. Both use clockwise retouch in some locations.

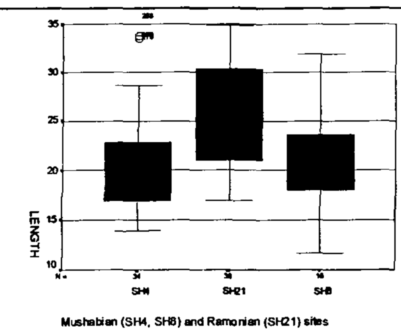
| | SH4 | | | SH8 | Similarity | SH21 |
|---|---|---|---|---|---|---|
| | Overall tool | Type 1 | Type 2 | Type 1 | | |
| Truncation angles | | 100-180 x 120-140 | 180 x 130-50 or 130-50x 180 | 110-160 x 110-140 | ✓? | Proximal end x 130-60 |
| Symmetry | | no | no | no | ✓ | no |
| Interchangeable tool ends | | no | yes | no? | ✓ | no |
| Discrete types | yes | | | ? | ? | 1 with a fall-off |
| Specificity of angle | | Distal | Distal or proximal | No | x | Proximal |
| Defined relationship between angles | | no | yes | ? | ? | no |
| Side of backing | No preference | | | Left | x | left |
| Sequence of retouch application | Clockwise & mixed | | | clockwise | ✓ | clockwise |

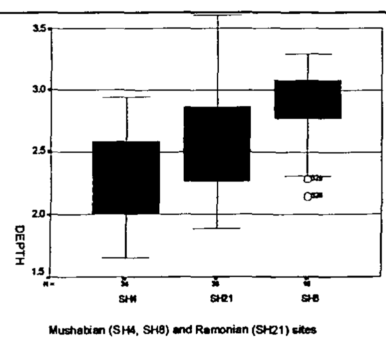
Figure 7:14 Mushabian and Ramonian comparisons

## Metrics

While their short length differentiates them from other ABB sites, other dimensions mark their difference from each other. At SH8, tools are stubby, wide and thick with little variability in any dimension. They have a larger surface area. This site is so stubby that it is more like an SBB site in this respect. SH4 tools are elongated, with a smaller and more variable surface area. Similar in length, tools are narrower, thinner and more heavily retouched.

These sites have a large difference in width. They share this with the Geometric Kebaran sites. They have very little variability in their length, suggesting that it is a crucial dimension to tools at both sites.



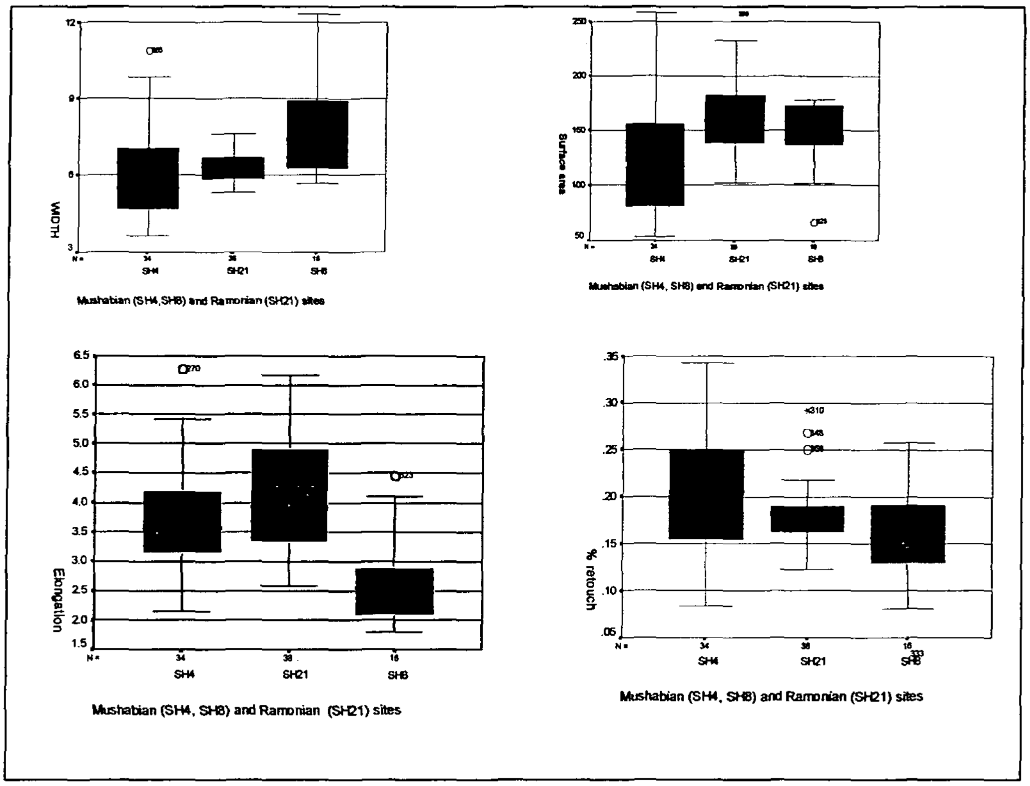



Figure 7:15 Mushabian and Ramonian metric comparisons

Metric correlations at the two sites are quite different. SH4 has very correlated metrics. SH8 is much less correlated. Elongation and amount of retouch are both well correlated with various dimensions, but unlike SH4, the actual tool dimensions are not well correlated.

| | Correlated | | Not correlated | | Mushabian | Corr | Not corr | Ram |
|---|---|---|---|---|---|---|---|---|
| | SH4 | SH8 | SH4 | SH8 | | SH21 | SH21 | |
| Length | W,D,E,% | % | _ | LW,D,E | X | E,D | W,% | x |
| Width | L,D,E,% | E,% | _ | L,D | X | E,% | L,D | x |
| Depth | L,W,% | _ | E | L,W,E,% | X | L,E | W,% | 10 |
| Elongation | L,W | W | D,% | L,D,% | ✓ | L,W,D | % | x |
| % retouched | L,W,D | L,W | E | D,E | ✓ | W | L,D,E | x |

Figure 7:16 Mushabian and Ramonian metric correlations

L = length; W = width; D = depth; E = elongation; % = proportion retouched

## Metrics and truncation angles

At SH4, points are smaller, while flat-based tools tend to be larger and more elongated. SH8 shows no correlations.

## Summary

Similarities

- Use of constrained distal angles
- Choice of angles in points
- Presence of naturals
- Distal points
- Asymmetry
- Short length with little variability

Differences

- Metrics – amount of variability, and actual sizes
- Metric correlations
- Width, depth, elongation, amount of retouch and surface area
- Correlation with truncation angles in flats (SH4)
- Backed side preference (SH8)
- Use of flats (SH4)

In truncation angles, these sites are fairly similar. Both use constrained distal points within a similar range of angle. Tools are asymmetric, with many proximal ends present. Both sites have short tools with little variability.

Differences include metrics (width, depth, elongation, retouch and surface area). Correlation of truncation angle with metrics is different, as is backed side preference. There may be difference in the use of flat-ended tools.

## 7.1.6. Ramonian (SH21)

(see section 7.1.5 for metric and other tables)

### Design principles

#### Truncation angles

SH21 is different from the Mushabian sites in the angles it emphasises, with flatter tool angles on the points. Both ends are fairly closely defined in their treatment, also unlike SH4 and SH8, with the proximal end usually being natural, and the distal falling into one of 2 or 3 angles.

#### Symmetry

There is no symmetry at SH21, as at the Mushabian sites. There is also no interchangeability of blank ends.

#### Pattern of variability

The pattern of variability is like that at the Geometric Kebaran and Middle Hamran sites, with a concentration of tools at a few angles, and a fall-off in frequency from that concentration.

#### Direction of retouch

There is a strong preference for left-backed tools, and most locations have retouch applied in a clockwise manner. The proximal location is anticlockwise. Partial clockwise retouch is shared by the Mushabian, where proximal locations are also often not clockwise.

#### Metrics

In size, the assemblage often falls between the two Mushabian sites (in width, depth, area and amount of retouch). However, in width there is much less variability than in other ABB tools. SH21 tools are longer and more elongated than tools at other ABB sites. The typical emphasis is on one dimension with little variability (width) and another (length) with larger variability. The surface area of tools at this site is large, with very little variability.

Unlike the Mushabian sites, there are fewer metric correlations. This is because of the very small variability in width. Only length and depth correlate with each other. Elongation correlates with all the dimensions.

Truncation angles show some correlation with metrics - the tools with flatter distal angles are less elongated.

### Summary

Ramonian tools are quite different from Mushabian ones, and have some differences from all other ABB sites. Similarities include:

- distal points with non-interchangeable ends,
- no symmetry
- overall dimensions

Differences include:

- flatter truncation angles than other sites,
- all tools on natural proximal ends
- only one range of tools, with a concentration over two angles and a fall-off in frequency from that range, as at SBB sites
- preferences for edge of backing are strong
- width has very little variability
- length has great variability, making this site different from all other ABB sites
- there is an emphasis on long, elongated tools with a large, closely defined surface area.

## 7.2. STRAIGHT BACKED AND ARCHED BACKED SITES

Sites classified as SBB/ABB are compared in order to determine how different these two groups of assemblages are, and what the nature of the difference is.

| **SBB sites** | | | **ABB SITES** | | |
|---|---|---|---|---|---|
| JH | Jebel Hamra J201 | Middle Hamran | TH2 | Tor Hamar J431 bl 2 | Qalkhan |
| SH12 | Shunera 12 | Geometric Kebaran | TH1 | Tor Hamar J431 bl1 | Madamaghan |
| SH3 | Shunera 3 | Geometric Kebaran | SH4 | Shunera 4 | Mushabian |
| SH12b | Shunera 12B | Geometric Kebaran | SH21 | Shunera 21 | Ramonian |
| WJ | Wadi Judayid J31 | Middle Hamran | WH | Wadi Humeima | Qalkhan |
| | | | JF | Jebel Fatma J436 | Madamaghan |
| | | | SH8 | Shunera 8 | Mushabian |

Figure 7:17 SBB and ABB sites

### How cultures vary within ABB or SBB categories

SBB sites are very homogenous, especially within site, but also within 'culture' groups and between such groups. Overall, the main differences between SBB sites are in relation to metrics, backing side and direction of retouch application, and amount of strict symmetry.

ABB sites are less homogenous, both within sites and within and between culture groups. Differences between ABB sites and cultures include actual choice of angle used, blank end preferences, correlations between truncation angle and metrics and backing edge.

### Truncation angles

SBB sites are dominated by one group of truncation angles at 170/180 degrees. ABB sites usually have two groups of tools, which are more or less distinct. One group has a steep angle of less than or equal to 130 degrees at one end, opposite a more variable angle. The other group has one flat end opposite a point. The angle of the points is more or less clearly constrained at each site, with some sites showing variability across 2 or 3 angles, while others restrict points to 1 angle. The Madamaghan sites of TH1 and JF show the division into two types less clearly, with more widespread variability across many truncation angles.

### Symmetry

SBB sites are broadly symmetrical, although the Geometric Kebaran sites show a tendency to have some tools up to 30 degrees off from true symmetry, with one end at 180 degrees, and the other 170-150 degrees.

ABB sites usually show an emphasis on a particular angle at one tool end, with less concern for the relationship between the two tool ends than at SBB sites. The exception to this may be the Madamaghan sites, at which there is a lot of symmetry. Especially at JF, most tools are symmetric.

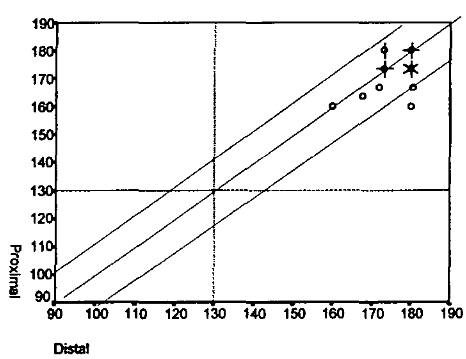
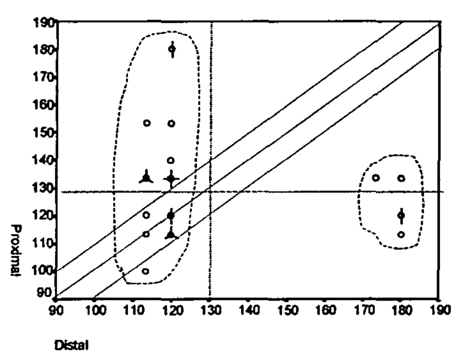
| Straight backed assemblage | Arched backed assemblage |
|---|---|
|  |  |




Figure 7:18 Patterns of variability

### Pattern of variability

SBB sites have a cluster of tools at one or two angle combinations and a fall-off in frequency from that point. ABB sites, however, favour certain angles on particular blank ends, but usually have more variable opposite ends. This results in concentrations of tools along an angle for one end, but a more 'all-over' pattern for the other, usually proximal, end. The Ramonian site is similar to SBB sites in this respect, because it has two predetermined ends. TH1 (Madamaghan) also shows this, but with a much less marked concentration, as well as having two such clusters.

### Blank preferences

While at SBB sites there is no sign of blank end differentiation, most sites have a large number of natural proximal ends (except SH3).

At ABB sites, on the other hand, the truncation angle is chosen in relation to the blank end. A clear preference is often shown for points only on the distal end (JF, SH4, SH21, SH8). TH1, however, had proximal points, TH2 had 2 types of points, including distal and proximal points, and WH had interchangeable point ends – the pointed truncation could be on either end. The tools with a flat (180 degree) base at ABB sites are often interchangeable as to blank end (TH1, SH4 and possibly TH2 and WH).

### Retouch

Retouch at all SBB sites tends towards abrupt. There are weak preferences for backed edge at all sites, with SH12, JH, WJ having backing on the right and SH3 and SH12B having backing on the left.

At ABB sites, preferences for which lateral edge of the tool should be backed vary from site to site. Most favour left-backing (TH2, WH, SH21, TH1); while JF favours right-backing and SH4 and SH8 show no preference. Preferences, where shown, are stronger than those of the SBB sites.

### Metrics

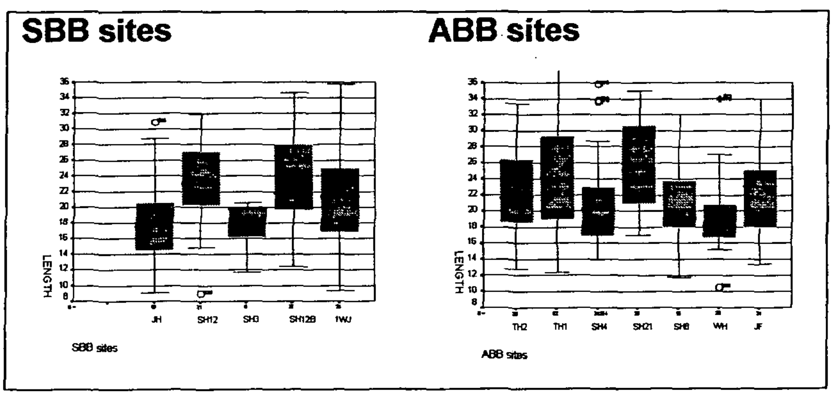
ABB sites have a more complex relationship between metric dimensions in terms of their variability. Often one dimension is much more strictly defined than the other. Sites with shorter tools (SH4, SH8, WH) have less variability in length. The exact length of tools at these sites is more strictly defined. Of these, SH8 and WH have tools that are wider than those at other ABB sites. They show a lot of width variability, while the length is strictly defined. Sites SH21 and JF have much less width variability than the other ABB sites, and greater length variability. So the strictly defined dimension at these sites is width rather than length, a feature more commonly seen in SBB sites. Interestingly, these sites are more like SBB sites in other characteristics as well. TH1 also has a much higher length variability than width.

Overall, while there is no clear difference between ABB and SBB sites as a group in terms of length, ABB sites tend to have tools that are slightly longer. Many of these sites (SH21, TH2, JF, TH1) have more length variability than is found in SBB sites, and again have more width variability as well.

All ABB sites (except SH8) have higher elongation than SBB sites (except SH3) and more variability in elongation. Some have more retouch (TH2, TH1, WH, JF), although there is a lot of overlap in amount of variability between SBB and ABB sites in this respect.

SBB sites have a more straightforward relationship between their metric dimensions. Sites that have long tools also have wide and deep tools. In contrast, at ABB sites tools can be short and wide, or short and narrow or long and narrow. At SBB sites, length and depth have a similar amount of within-site variability (except SH3). SBB sites tend to have less within site width variability than ABB sites (except SH21), and more depth variability (except SH3). There is slightly more difference between SBB sites in width, with SH3 having very little variability, and JH having the most. All except SH3 have wider tools than ABB sites. Depth variability is greater than at ABB sites, and several sites have deep tools (SH12, SH12B, WJ). In all three dimensions, the variability between SBB sites is non-overlapping, with much more distinct difference between sites than that between ABB sites. SBB sites can easily be classed into separate 'small' and 'large' categories.

This continues in surface area of tool, where many SBB sites have tools with larger areas than ABB sites, and bigger variability within site.



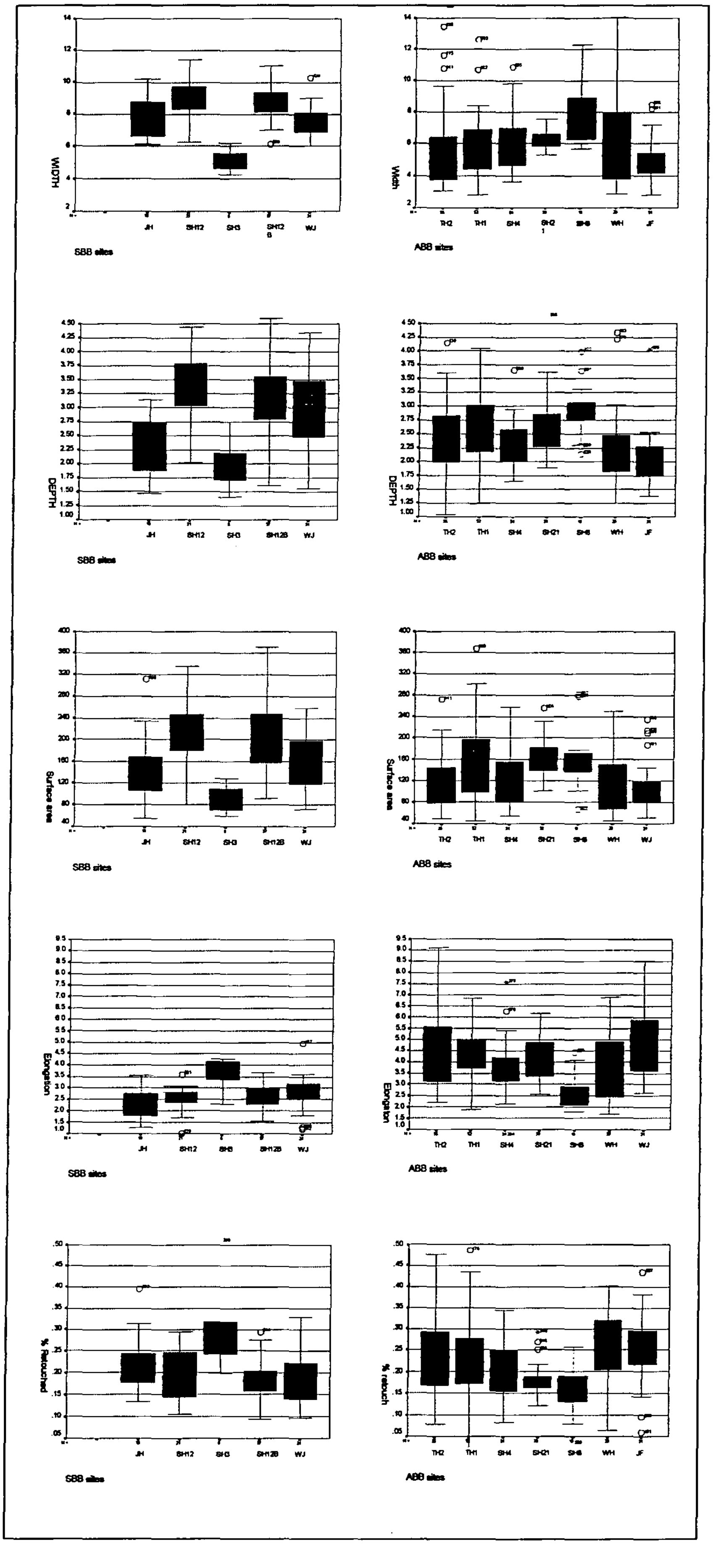

WIDTH
JH
SH12
SH3
SH12 B
WJ
SBB sites
Width
TH2
TH1
SH4
SH2 1
SH8
WH
JF
ABB sites
DEPTH
JH
SH12
SH3
SH12B
WJ
SBB sites
DEPTH
TH2
TH1
SH4
SH21
SH8
WH
JF
ABB sites
Surface area
JH
SH12
SH3
SH12B
WJ
SBB sites
Surface area
TH2
TH1
SH4
SH21
SH8
WH
WJ
ABB sites
Elongation
JH
SH12
SH8
SH12B
WJ
SBB sites
Elongation
TH2
TH1
SH4
SH21
SH8
WH
WJ
ABB sites
% Retouched
JH
SH12
SH3
SH12B
WJ
SBB sites
% retouch
TH2
TH1
SH4
SH21
SH8
WH
JF
ABB sites

Figure 7:19 ABB and SBB metric comparisons

### Metric correlations

At SBB sites, there is little metric correlation. The amount of elongation is correlated with length, and the percentage of tool retouched is negatively correlated with length and/or width. Sites WJ and SH12B are the only SBB sites with length and width correlations, and SH12B and SH12 also have depth and width correlations.

In ABB sites, length and width are correlated as are length and depth. Metric proportions also tend to be correlated. Elongation and length are loosely correlated, while elongation and width are more tightly correlated. Amount of retouch and both length and especially width are negatively correlated. However, sites SH4 and especially JF show much weaker correlations.

### Metrics and truncation angle

At SBB sites, there is little or no sign of any correlation between metrics and the angle of truncation. The entire site variability in metrics is represented within the tools clustered at the most common truncation combinations.

At ABB sites, metrics often relate to truncation angles. There is some patterning between the angle of the point, and the amount of elongation/retouch, but the form this takes varies by site. Points can be elongated (JF), stubby (SH4) or can become less elongated at the point becomes steeper (TH2, WH). Flat angled tools can also be elongated (TH1, SH4), short and narrow (TH2), or stubby (JF, SH21,WH).

### Summary

SBB assemblages

- emphasis on 170/80 tools
- broadly symmetrical
- fall-off in frequency from one main group of truncation angles
- presence of proximal ends
- weak preferences for backed edge
- where there are long tools, these are wide and deep
- similar amounts of variability in any one dimension

- often tools are wider, and deeper
- distinct differences in metric variability between sites
- less metric correlation

ABB sites

- Emphasis on a particular point angle within site (except TH1, JF)
- Emphasis on particular angle on one end of tool with variable opposite end (except SH21, JF)
- Preference for a particular blank end
- Stronger preference for edge to be backed
- One metric dimension more constrained than other
- Tools are often longer, with more length variability
- More elongation
- Patterning of truncation angle with metrics
- Sites include both points and tools with one flat end, showing two distinct ranges of variability (except SH21, JF)
- Assemblages always include many asymmetrical tools (except JF)
- Retouch is clockwise in application
- Elongation and percentage of retouch are correlated negatively with width.

| **Principle** | **SBB** | **ABB** | |
|---|---|---|---|
| | | | **Except** |
| **Symmetry** | Yes | No | JF |
| **Truncation angle** | 170-80 | Variable | |
| **Pattern of variability** | 1 tool cluster | 2 distinct types | TH1, JF, SH21 |
| **Blank end specificity** | N/a | Specific within site | JF |
| **Length** | Slightly shorter | Slightly longer | |
| **Length variability** | Non-overlapping | Overlapping | |
| **Width** | Non-overlapping, wide | Overlapping, narrow | SH8 |
| **Width variability** | Small | Variable | SH21 |
| **Depth** | Often deeper | Thinner | |
| **Depth variability** | Greater; non-overlapping | Less; overlapping | |
| **Elongation** | Less | Greater | SH8 |
| **Surface area** | Greater | Less | SH8 |

Figure 7:20 SBB and ABB comparisons

## 7.3. DISCUSSION

### 7.3.1. Patterns of variability of attributes

This section gives an overview of how design principles vary, summarising differences between individual sites or groups of sites. Each design principle is examined in terms of how it varies – between SBB and ABB assemblages, along cultural divisions, or between sites with no wider patterning. Evidence of pattern of variability – distinct categories, overlapping variability, and co-variance with other attributes – is examined.

#### Metrics

Overall metric variability

Metrics show a complex picture of variability, with no two sites completely identical to each other. At a microscale, metrics vary from site to site. However, some cultures have sites that are broadly similar to each other. For example, the sites within the Qalkhan and the Madamaghan cultures are similar to each other, as are the two Geometric Kebaran sites SH12 and SH12B. However, the Mushabian sites are less similar to each other, and SH3 is very different from the other 2 Geometric Kebaran sites. The Middle Hamran sites are somewhat different from each other.

Each metric dimension seems to play a different role in different contexts, sometimes varying by site, sometimes by culture and sometimes by ABB/SBB. For example, length clearly holds a different role within different sites or groupings of sites. Tool length remains similar at Mushabian sites, where all tools are short. However, at Geometric Kebaran sites there are large differences between some of the sites in the length of the tools. Overall, ABB sites tend to have longer tools with more variability in length within a site, than do SBB sites.

There is no one dimension that separates ABB from SBB, or Madamaghan from Qalkhan, or each site from all others. Each pair of sites is most differentiated from each other by a different dimension. SH3, for example, is different from other SBB sites and especially from other Geometric Kebaran sites in all dimensions. However it is most differentiated by width and elongation. SH21 is different from other ABB sites in its length and elongation. Width and elongation also differentiates the two

Mushabian sites from each other, while they are differentiated from other ABB sites by length. Madamaghan sites are similar to each other in terms of each individual dimension, but overall surface area of tools differentiates the two sites from each other. The Middle Hamran sites are similar to each other as well, but are different in elongation.

Length

While there is no one measurement that always co-varies along cultural divisions, length comes perhaps the closest. Only the Geometric Kebaran sites have clear length differences between SH3 on the one hand, and SH12/SH12B on the other. Sites within the Middle Hamran are not identical in length, but do have overlapping ranges with each other, as do the Qalkhan sites. Mushabian and Madamaghan sites are very similar in length within culture.

Width

While length often varies by culture, width varies most dramatically between ABB and SBB sites, with ABB sites having narrower tools. However, width also varies by site, and shows *some* cultural affiliations as well. Within each culture, width often shows different amounts of within-site variability at each site. This is seen at the Qalkhan, Madamaghan and Middle Hamran sites. It more rarely shows actual significant differences between sites, except within the Geometric Kebaran and Mushabian. Interestingly, sites within a culture *either* have different widths from each other, or different width variability.

Depth

Depth varies most clearly by site, with little sign of variability along cultural lines. Only the Geometric Kebaran SH12 and SH12B are similar and, to a lesser extent, the two Qalkhan sites. Unusually, within the Qalkhan sites, depth is the most similar dimension between the two sites.

Surface area, elongation and proportion of retouch

Surface area of tools can show up some differences within culture not revealed by other metric dimensions. Madamaghan sites, for example, have tools with different surface areas, with JF tools being much smaller and showing little variability in surface area between tools. Qalkhan sites, on the other hand, have tools with almost identical surface areas, despite having different length and width dimensions. Surface area is often closely tied to depth of tool, and varies in a similar way between sites.

Elongation can also emphasise certain differences within culture. The Mushabian culture shows great differences between SH4 and SH8, where tools are much less elongated, despite having similar lengths. And although elongation differences between SBB sites are small, in the Middle Hamran WJ tools are more elongated than those in JH.

As proportion of tool retouched is closely correlated with width, it varies in cultures where width varies most between site. These are the Geometric Kebaran and Mushabian sites.

Metric variability within sites

Within many sites, one metric dimension is much less variable than the others, showing that this dimension was more closely determined. For example, the Qalkhan WH has little variability in terms of length, but a great deal in width. This is in contrast to Qalkhan TH2 which has lots of variability in length, and much less in width. Mushabian SH8 has little length variability, while SH4 has little width variability. At Madamaghan JF, width is closely constrained, but length is variable. Ramonian SH21 has very closely defined tool widths with variable lengths. However, TH2 (Qalkhan) and TH1 (Madamaghan) both have fairly high variability in all dimensions.

SBB sites have less width variability and generally wider tools than ABB sites. Middle Hamran WJ, however, has more length and depth variability than other SBB sites. SH3 has very little variability in any dimension, and sites SH12 and SH12B are very similar to each other in their variability.

Metric correlations

There is a split between SBB and ABB sites in principles of metric correlation. SBB sites vary little in width, and length tends more to correlation with other dimensions.

However, ABB sites have stronger correlations, with width often correlated with elongation and depth.

Correlations between metric dimensions seem to be quite similar within some cultures. The relationships within sites between different tool dimensions, such as length/width, remain constant within the Middle Hamran, Geometric Kebaran and Qalkhan. The Ramonian site is more like the straight-backed sites than it is like the Mushabian, with little width variability creating a horizontal relationship between width and length, and a strong correlation between elongation and other metric dimensions. Qalkhan and Madamaghan sites are similar to each other in having a wide spread of values, loose correlations and some bimodality.

Metric correlations with truncation angle of tool seem to vary by site. For example, Qalkhan TH2 has short narrow 180-degree tools, while WH has long, wide and stubby 180-degree tools. Within the Madamaghan, JF has more elongated sharp points, while TH1 has elongated 180-degree tools. None of the SBB sites have correlations between truncation angle and metric dimensions. All of the metric variability within these sites is contained within each truncation angle.

## Truncation principles

### Actual angles

Variation in truncation angles happens at three levels. There are broad divisions at ABB/SBB level, with more specific blueprints seen at the level of culture. Individual assemblages vary in their interpretation of these blueprints.

At SBB sites, the angle of truncation is extremely constrained, with very little variation allowed. At ABB sites, the truncation angle principles are much less constrained. The steeper point is usually constrained within 20 degrees. The flat-based tool is more variable within and between sites. It can be on either or on both ends, and the sharper angle can be constrained, can cover angles which are consecutive or not, or can be completely undetermined within site.

ABB/SBB

At the ABB/SBB level, there is a major split between SBB sites with flatter angles on both ends of nearly all tools, and ABB sites with many tools with steeper angles on one or both tool end. ABB sites also have a smaller number of tools with one flat end opposite a point.

Cultures

At the level of cultural variability, there is some consistency as well. SBB sites may be either strictly symmetrical, with some variability in angle at both ends (Middle Hamran) or retain a 180-degree angle at one tool end, with slight variability in the opposite end (Geometric Kebaran).

ABB sites also show some cultural patterning. The Qalkhan sites, for example, both have steeper angles than many others. The Ramonian site is distinctive in having flatter angles than others. Madamaghan sites have some mid-angles (140-160 degrees) not seen at other sites.

Sites

However, each site shows an individual interpretation of the general ideas or guidelines, which are seen at the level of ABB/SBB and cultural designation. The actual patterning and precise combination of truncation angles varies from site to site.

| **ABB sites** | **Tool cluster** | | **Tool cluster** | | **Tool cluster** | |
|---|---|---|---|---|---|---|
| | Dist | Prox | Dist | Prox | Dist | Prox |
| **WH** | 100 | any | 180 | 130-40 | | |
| **TH2** | 110-120 | any | 180 | any | | |
| **SH8** | 110-120 | any | any | 180 | | |
| **TH1** | any | 110-130 | 130-140 | 180 | | |
| **JF** | 130-140 | any | 140/180 | 180 | 180 | 140/180 |
| **SH4** | 130-140 | 180 | 180 | 130-140 | | |
| **SH21** | 130-150 | natural | | | | |

Figure 7:21 Truncation angles

### Interchangeability/symmetry

Symmetry varies broadly by ABB/SBB, and, at a more detailed level, by site. SBB sites in general emphasise symmetry, and thus interchangeable tool ends. In contrast, ABB sites are largely asymmetrical. At Ramonian and Mushabian sites, all or most tools are asymmetrical. However, Madamaghan assemblages show some symmetry amongst the less pointed tools.

At some ABB sites, a group of asymmetrical tools may have interchangeable pointed ends – that is, either end of the blank may be made into the point. For example, Qalkhan WH has steep points which are interchangeable to blank ends. It is more common to find interchangeable blank ends in flat-based tools with less steep points. Sites TH2 (Qalkhan), JF (Madamaghan) and SH4 (Mushabian) all have interchangeable flat based tools. However there is no correlation at culture level with this interchangeablility. For example, the Qalkhan has one site with interchangeable steep points, and one site with interchangeable flat based tools. The Mushabian and the Madamaghan have one site each with one interchangeable group of tools, and one site each with no interchangeable tools.

### Blank end used

The blank end used for particular angles varies from site to site, especially in those tools which have one flat end. Steep points can also vary, however. TH1 has proximal steep points, while all of the others have steep points on the distal end.

The flat-based tools at ABB sites are more variable, with many having interchangeable ends, as we saw above. But at WH, they are only on the proximal end, while at SH8 they are only on the distal end.

### Side backed

At all sites, tools were backed on both sides. Some sites show a degree of preference for one side or the other. There is a general preference for tools backed on the right-hand side, and retouch is applied in a clockwise direction.

There is variability along cultural lines in decisions about lateralisation of backing. SH21, for example, has an extremely strong preference for backing on the left hand side. Retouch is applied in a clockwise direction on all parts of the tools except the proximal end, where it is anti-clockwise. Qalkhan sites are both left backed, although only TH2 has a strong preference in this respect. At both these site, it is the left side that has clockwise retouch. At Middle Hamran sites, backing is on the right-hand side, and retouch is clockwise. However, at one site it is clockwise only on end locations, while at the other it is clockwise only on lateral locations. At Mushabian sites, no strong or clear preference is shown for backed side. Retouch is clockwise, in lateral locations.

There are also some variations within culture in choices relating to side of backing and direction of retouch. Geometric Kebaran sites are varied. SH3 and SH12B show a slight preference for left backing, with SH12B having clockwise retouch and SH3 having very mixed directions. SH12 has right backed tools, with anticlockwise retouch. Madamaghan sites also vary in backed side, with TH1 having left-backed tools and JF having right backed tools. In both sites, only left sides show a strong preference for clockwise retouch, with other locations mixed.

### 7.3.2. Variability at three scales of analysis

This section describes the types of variability and similarity seen at the levels of cultures, straight backed/arched backed sites, and individual sites. These patterns are complex and do not often clearly and reliably distinguish between different cultures or other groupings of sites. However, some attributes' variability is more closely associated with one level of classification than another (see Figure 7.22).

In this chart, those attributes which to some degree distinguish between ABB and SBB have a tick in the right hand column. Those attributes which tend to be interpreted in common by individual cultures, have a tick in the middle column, on either the ABB or SBB side. Those sites which receive individual interpretation at most sites have a tick in the left hand column. Many attributes vary simultaneously at different levels.

| Variable | Level of variability | | | |
|---|---|---|---|---|
| | Site | Culture | | ABB/SBB |
| | | ABB | SBB | |
| Surface area | ✓ | | | |
| Amount retouch | ✓ | ✓ | | |
| Elongation | | ✓ | | ✓ |
| Length | ✓ | ✓ | | |
| Width | ✓ | ✓ | | ✓ |
| Width variability | ✓ | | | |
| Depth | ✓ | | | |
| Correlations | ✓ | ✓ | | ✓ |
| Truncation angles | ✓ | | | ✓ |
| Truncation variability | ✓ | | | |
| Blank end | ✓ | | | ✓ |
| Interchangeability | ✓ | | | ✓ |
| Symmetry | | ✓ | ✓ | ✓ |
| Pattern of variability | | ✓ | | ✓ |
| Side backed | ✓ | | | |

Figure 7:22 Levels of analysis most closely associated with attributes

## Cultural variability

Various attributes often seem to be interpreted similarly by sites within a culture, including attitude to symmetry of tools, pattern of variability in tools, metric correlations, length and width.

**Symmetry** details vary by culture. At Middle Hamran sites, strict symmetry is created, while at Geometric Kebaran sites there is a tendency towards a slight asymmetry. Madamaghan sites show a range of symmetrical and asymmetrical tools, while Qalkhan and Mushabian sites have completely asymmetrical tools.

**Pattern of variability** varies by culture in ABB sites. At Madamaghan sites tools are spread across many angles, seemingly randomly, while at Qalkhan and Mushabian sites they fall into two distinct clumps. However, all SBB sites have a similar pattern with a concentration of tools at one combination of truncation angles and a fall off in frequency from that concentration.

**Metric correlations** show a similar picture. SBB sites all show a similar pattern of correlation between different metric dimensions, with little variation in width. At ABB sites, Qalkhan sites show a similar high degree of correlation between dimensions, and Mushabian sites also show some metric correlations. Madamaghan sites are the exception, with tools at the two sites showing different relationships between dimensions from each other.

**Length** may also be said to vary at the level of culture amongst ABB sites, as sites within each culture generally have similar lengths. However, there is overlap between sites and cultures in the range of lengths found. Mushabian and Madamaghan sites are similar within culture, although Qalkhan sites are not. In SBB sites, Middle Hamran sites are similar, while the Geometric Kebaran sites SH12 and SH12B are very similar to each other, with SH3 being very different.

**Width** may also vary at this level. Within each SBB site, width varies little, but is correlated with length. In ABB sites, there is more variability within site, but Madamaghan and Qalkhan sites are similar to each other within culture. Mushabian sites, however, are quite different from each other in width. Amongst ABB sites in general, there is more overlap in width between sites than there is amongst SBB sites, which vary dramatically from site to site in this respect.

**Elongation and % retouch** are sometimes held in common within ABB cultures, although variability between these cultures in this respect is not marked. SBB sites remain largely similar to each other, except for SH3. Mushabian sites have different elongation from each other, however.

In contrast, there are variables that clearly do not vary at the level of culture. The choice of actual angle used, the blank ends used for particular angles, the depth of the tools and their surface area all vary at the level of site and/or ABB/SBB.

## Cultural similarity

Cultures do vary in how many traits correlate (see figure 7.23).

| | Actual angles | Blank end used | Pattern of var | Side backed | Symmetry | Interchange-ability | Length | Width | Depth | Metric correlations | % Retouched | Sur-face area | Elongation | Culture wide similarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Qalkhan | X | X | ✓ | ✓ | ✓ | X | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Med |
| Madamaghan | X | X | ✓ | X | X | X | ✓ | ✓ | X | ✓ | ✓ | X | ✓ | Low |
| Mushabian | ✓ | X | ✓ | ✓ | ✓ | X | ✓ | X | X | ✓ | ✓ | X | X | Low |
| Ramonian | X | ✓ | X | X | ✓ | ✓ | ✓ | ✓ | X | X | ✓ | ✓ | ✓ | Med/low |
| Middle Hamran | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | ✓ | ✓ | ✓ | High |
| Geometric Kebaran | ✓ | ✓ | ✓ | X | ✓ | ✓ | ✓ SH3 =x | ✓ SH3=x | ✓ SH3=x | ✓ | ✓ SH3=x | ✓ SH3=x | ✓ SH3=x | High 7,9 |

Figure 7:23 Similarity within cultural designations

X = difference within culture

✓ = same within culture

Note: Ramonian site is compared to Mushabian sites

In SBB sites, many traits correlate – but, as was seen earlier in this chapter, they do so across *all* SBB sites, not just within each culture. Elongation and amount of retouch, metric correlations, pattern of variability are all similar across all SBB sites. Length varies dramatically across SBB cultures. Only symmetry appears to vary by culture within the category of SBB sites, with the Middle Hamran sites of JH and WJ taking a slightly different approach to symmetry than the Geometric Kebaran sites of SH12, SH3 and SH12B.

The Ramonian site in the sample shares some of these SBB-wide traits (metric correlations and patterns of variability). It also shows some ABB characteristics (lack of symmetry and lack of end-interchangeable tools). As there are no other Ramonian sites in the sample, comparisons within culture cannot be carried out. However, informal examination of Ramonian assemblages suggests they are fairly homogenous. Within site variability is limited in terms of width, surface area and amount of retouch, as is the case with SBB sites.

ABB sites are much less similar to each other than SBB sites. Except in the Ramonian, certain traits are always similar within ABB cultures – pattern of variability, symmetry, metric correlations and amount of retouch. However, the way they are enacted varies from culture to culture, and from site to site.

Mushabian sites are similar in symmetry, pattern of variability, length, metric correlation and amount of retouch, but dissimilar in width and elongation. Wide latitude in choices made at these sites include no preference for one side or the other in backing, and a wide range of suitable truncation angles. Unusually, this latitude is similar across the two sites, and also in the degree of *lack* of preference shown in the two decisions. Mushabian sites are thus dissimilar in metrics and metric relationships, and more similar in the principles of tool shape.

Qalkhan sites are similar in pattern of variability, symmetry, width, metric correlation, amount of retouch and elongation. They are not similar in length. Qalkhan sites are also similar in a number of attributes which usually vary between sites within a culture, notably side of backing, depth and surface area. Qalkhan sites are thus unusually similar in metrics and metric relationships, as well as other traits.

Madamaghan sites are similar in pattern of variability, length, width, metric correlations, amount of retouch and elongation. They are dissimilar to some extent in symmetry, with one site having more symmetric tools, the other having proximal and distal points. They have no other attributes in common. Thus these sites are quite similar in metrics and metric relationships, but not so similar in end relationships, symmetry or interchangeability.

### Variability between ABB and SBB sites

The design principles that distinguish between ABB and SBB assemblages are pattern of variability, symmetry of tools and attitude to blank ends. Many metric principles are also different - metric correlations such as length/width, clumping and bimodality, and relations between metrics and truncation angle vary; some actual metrics such as width, surface area and elongation are different; and the pattern of metric variability between sites is also different.

**Relationship between ABB/SBB and cultures**

The interactions between cultural and, more broadly, ABB/SBB levels of variability are complex. Cultures classified as ABB have a different relationship to variability than SBB sites/cultures. ABB sites vary more by culture and by site than SBB sites. SBB sites tend to be very similar to each other in most design principles, including metric correlations. The greatest difference between SBB sites is in the actual metrics.

**Metrics** – <u>actual</u> metrics vary by culture or by site, but <u>type</u> of variability between site varies by ABB/SBB. Between SBB sites and cultures, the variability is distinct and non-overlapping. Most of the variability between ABB sites is overlapping. SBB sites tend to have wider, shorter, deeper tools than ABB sites. Metric correlations are similar across the board in SBB sites, while they vary at cultural level in ABB sites.

**Pattern of variability** – SBB sites have one tool type, with some variability in truncation angle from that norm. ABB assemblages are usually comprised of two distinct tool types.

**Symmetry** - SBB assemblages are very symmetrical, with only a slight deviation in some cases. The details of how this varies seem to correspond to culture. ABB assemblages are usually not symmetrical, with pointed tools emphasising one or more truncation angles, usually opposite a much more variable end.

**Blank end preference** – SBB tools, being symmetrical, show no end preference. ABB assemblages usually prefer certain angles on one end or the tool or the other.

**Surface area** of tools is similar in most SBB sites, and tends to be greater than that of ABB sites, which are also more variable.

**Elongation** of tools is much greater in ABB sites.

There are certain attributes which do not distinguish between ABB and SBB sites: side backed, length and depth of tool, and amount of retouch.

## Within site variability

Many variables are interpreted differently at each site, often within an overall blueprint of rules that are applied at more than one site. A few variables seem to be entirely determined at site level.

### Metrics

Metric dimensions have a very complex pattern of variability, with some blueprints/guidelines at ABB/SBB or cultural levels, but a lot of variability at site level. Even dimensions that tend to vary at, for example, cultural level, also show variability at site level between sites within a culture. For example, length, which is often broadly similar within culture, varies between Qalkhan sites, and between Middle Hamran sites. Depth varies most clearly by site, but sometimes seems to have cultural significance as well. At Qalkhan sites, depth is held in common between the two sites. Other dimensions also vary from site to site. At Madamaghan and Mushabian sites, width varies within culture. Length varies between Qalkhan sites, and between Geometric Kebaran sites SH3 and SH12/SH12B.

Sites often have one constrained dimension, and one that is more variable (sites WJ, JF, SH4, SH21, SH8, and WH). Either length or width can be the most strictly defined dimension.

### Truncation angles

Within an overall blueprint at ABB/SBB level, sites vary in their preferred truncation angles.

- 100-degree angles = WH
- 110-120 degree angles = TH2, SH8
- 130- degree angles = TH1, SH4
- 130-150- degree angles = SH21
- 140- degree angles = JF
- 170-180-degree angles = JH. WJ, SH12, SH3, SH12B

In addition, exact specificity of truncation angles for steeper points varies. Some sites use only one truncation angle. Others may show up to about 20 degrees variability. Where there are tools with points opposite flatter angles, variability is even greater, ranging from a range of about 30 degrees, to the full range of all angles.

### Interchangeable tools and blank end used

Arched backed sites show considerable variation in interchangeable tools and blank end used. WH, for example, has steep points, which can be interchangeable in terms of blank end used. TH1 has steep proximal points, which are unique amongst the sites studied. Sites TH2, JF, and SH4 have interchangeable flat-based tools. Flat based points at WH are proximal, while at SH8 they are distal.

### Side of tool backed

Many ABB sites show a stronger preference for side of backing than do SBB sites. However, Mushabian sites show no preference at all. At most sites, backing is on the left side of the tool, but right-backed sites include JH, WJ, SH12, and JF.

### Surface area and depth of tool

Both surface area and depth vary by site, and are similar to each other within most sites. The differences in depth are more noteworthy. In SBB sites, there is marked variability in depth between sites, as in other metric dimensions. ABB sites vary in a more complex way. Unusually, Qalkhan sites have a fairly similar depth. Other sites show variability, with mainly overlapping differences in depth.

Overall, only surface area/depth and side of backing seem to vary primarily at the level of site, with no complex interactions with other levels of variability. All other attributes are affected by ABB/SBB and/or cultures, often being interpreted in particular, site-based, ways.

Attributes which vary clearly at the level of groups of sites include the pattern of variability, tool symmetry, width, metric correlations and amount of retouch and elongation. All of these attributes vary at the level of culture and ABB/SBB.

### 7.2.3. Discussion

This study shows that the decisions individuals take in making tools are situated within rules or blueprints for successful manufacture. A tool-maker will use many rules, as well as personal decisions, in making a tool. One rule may be used over only a couple of sites, another may be widespread across many sites. Different rules will have different levels of latitude in their application, depending on the context. Traditionally these commonalities, or wider structures, are seen as cultures and complexes made up of sites and facies. As we have seen, the evidence of this study does not reflect this traditional clear-cut, hierarchical patterning of relations between sites. And yet, there *are* shared traits, techniques and principles between sites. Every individual knapping decision was taken in relation to rules and guidelines shared by other knappers, some off-site.

#### Each site is unique

The perception of Epipalaeolithic 'sameness' over wide areas and long time frames is challenged by the evidence of this study. Each site shows a pattern of design choices and techniques which creates an assemblage of tools which are uniquely characteristic of that site. Each site's fingerprint is individual and immediately identifiable. There were more small-scale, personal decisions in tool making than have hitherto been recognised.

#### Homogeneity of SBB sites

One of these is the major divide between ABB and SBB sites in design principles and in metrics. Straight-backed sites are different from other sites in how each assemblage is structured, and in how the various assemblages are differentiated from each other. Major features include

- Internally homogenous assemblages, with tools totally interchangeable with each other within a site
- Sites showing micro differences of technique (depth and side of backing)
- Sites showing cultural/regional differences in attitude to symmetry
- Sites showing non-overlapping differences in metrics

Overall, the same *principles* of tool design are used at all sites. Extreme differences in metrics also show tools that are *non*-interchangeable between sites.

Differences between the SBB *cultures*, however, are limited to slight differences of symmetry. Other differences between sites, such as metrics or technique, cross these cultural boundaries. In some significant ways, the Ramonian site can be seen as an extension of SBB cultural variability, with internally homogeneity and interchangeable tools. In both Ramonian and in SBB sites, both width and relationship of the angles at both ends are strictly defined. I suggest that these reflect strict hafting requirements in a modular-tool technology. Ramonian sites do still retain some crucial ABB-type characteristics, however, with pointed and elongated tools.

### ABB sites

ABB assemblages are much more diverse, as are the cultures within this classification. These vary considerably in how tightly defined they are, and in how different they are from other cultures, and from SBB sites. We have already seen that Ramonian assemblages share some important characteristics with SBB sites, as does JF (see below).

### Qalkhan

Qalkhan sites represent a quite different technology from that of the SBB sites described above. They show much internal differentiation between microliths in terms of size and retouch characteristics, but are very constrained in choice of truncation angles. There is bimodality in size as well, suggesting distinct clumping of tools into small and large categories, sometimes with correlation with truncation angles. The assemblages are very similar to each other in most respects, with some intriguing differences. At TH2, tools are long, with variability in length. At WH, width is more variable than length and tools are shorter. Surface area at the two sites, however, is nearly identical. Even in attributes where other cultures vary internally, such as surface area and side of backing, Qalkhan sites are similar to each other. This may well relate to very specific hafting requirements for the asymmetrical tools.

These assemblages suggest complex hafting arrangements involving smaller and larger tools possibly in the same haft, and particular arrangements of retouch and truncation angle, creating a very defined tool technology with specific (and different) tools for different hafts and haft locations. Large variability in metrics suggests that each tool was very *individually* made. Tools at each site are quite different in detail from those at other sites. Truncation angles and length/width differences mean that tools are non-interchangeable from site to site. The tools at TH2 would not have 'worked' at WH, despite being made with the same design principles. Sites show identical tool design principles, but are completely different in the choices made about details of tool manufacture.

### Madamaghan and Mushabian

Madamaghan and Mushabian sites have neither the clear focus on a modular tool form of the SBB and Ramonian sites, nor the internal differentiation of Qalkhan sites. These tools are produced within a <u>loose</u> overall blueprint for what constitutes appropriate technology. There is, however, a lot of latitude for individual site-based decisions. Each site produces tools with clearly defined individual styles, more immediately recognisable as from that site than assemblages in other 'cultures'. While all these sites would be considered traditional ABB sites, there are significant differences in design principles at some of them from other ABB sites.

In the Mushabian, there is generally a lot of variability at both sites, as in, for example, the lack of preference for a backed side. Metrics, however, are closely defined and, except for length, different at each site. And truncation angles/side of backing are only loosely defined, and defined in the same way, at both sites. The assemblages are structured like the Qalkhan sites in having two tool types, one of which is pointed. However, SH8 has metrics within the SBB range.

While the two Madamaghan sites are in many ways very different from each other, the main thing they share is a *lack* of clear differentiation of tools in metrics, truncation angles or symmetry. The differences between the two sites include which end is more pointed, how symmetric the tools are, the size of the 180-degree truncations, and emphasis on angles. Both sites have many more symmetric tools than other ABB sites, but the pattern of variability is quite different than in SBB sites – a very wide range of truncation angles is used, with few concentrations at any particular angle. JF especially emphasises symmetry like SBB sites.

Madamaghan sites do not have a category of pointed tools distinct from the other tools, as do other ABB sites. This suggests that they were hafted in such a way that the pointedness of the truncation angle did not affect the pointedness of the tool (or that pointedness was not required, but see Henry 1995).

## Chaine operatoire of secondary technology

Rules informed tool making at each site, with rules applying to different attributes, with varying levels of strictness and specificity, in different combinations. At each site, these rules are combined and interpreted in a unique way. However, these rules do create a *patterned* variability, with various groups of sites having certain similarities of metrics or design principles. These complex interactions between attributes and different levels of similarity and difference are enacted *throughout* the process of shaping microliths (see figure 7.24).

| Stage of microlith manufacture | Tool attribute | Level of variability |
|---|---|---|
| 1st stage: Core preparation and striking blanks | Depth of tool<br>Length (not longer than)<br>Width (not wider than) | Site<br>Culture/site<br>Culture/ABB-SBB |
| 2nd stage: Segmenting blanks | Truncation angles<br>Symmetry<br>Backed side (in ABB sites)<br>Tool end to be pointed (ABB sites)<br>Length<br>Surface area (in conjunction w/ backing) | Culture/site/ABB-SBB<br>Culture/ABB-SBB<br>Site<br>Site<br>Culture/site<br>Site |
| 3rd stage: Backing blanks | Backed side (SBB sites)<br>Sequence of retouch<br>Width<br>Amount of retouch and proportion of tool retouched<br>Surface area (in conjunction w/ segmenting) | Site<br>Site<br>Culture/ABB-SBB<br>Culture/site<br><br>Site |

Figure 7:24 Stages of tool manufacture and design choices

One can see that decisions taken at all stages of the secondary reduction process reflect variability at all levels outlined above. This shows an integration of the microlith shaping process and of the complex layering of choices, habits and rules that result in tool morphology.

For example, the two attributes which most closely correlate with each other at all sites are depth and surface area of tool. These two attributes are largely defined at very different stages of the microlith making process. Depth of tool is mainly determined when the blank is struck off the core. It may be further affected by later decisions on the extent to which the deepest parts of the blank are removed through segmenting. For example, SH21 has relatively deep tools in part because the proximal end of the blank, which will usually be the deepest part, is left on the finished tool.

The outer limits of a tool's length and width, the two dimensions that affect surface area, are set when removing the blank from the core. But final decisions on dimensions are made later in the process. These later decisions have a more significant effect on the tool dimensions. Neeley and Barton (1994) have pointed out that there is often a wide disparity between tool blank lengths and tool lengths in an assemblage, showing that tool length decisions are made later, when segmenting the blank. The decision on the width of the tool is taken in backing, which essentially involves removing a certain amount of the width of the tool blank. Thus the surface area, comprised of tool width and length, are largely defined late in the manufacturing process. The close correlation of surface area with tool depth, an attribute defined at the early stage of removing blanks from the core, shows that the overall process of shaping microliths is, in these assemblages, a very integrated process, with early stages closely related to last ones.

## Conclusion

Integrated sets of decisions, sometimes site-based, sometimes following wider rules for tool-making, are reflected at every level of the manufacturing process. The patterning of shared rules between sites suggest wider connections of some sort between groups of people. The levels on which this operates however is far from simple, with overlapping similarities and differences, showing in fundamental tool principles or in matters of technique or preference. Very different scales of variability in different attributes suggest that different *sources* of variability may be at play. The widespread SBB sites, with great homogeneity as well as absolute metric differentiation, seem to be quite different from the very variable ABB cultures. The Ramonian shares the modularity of the SBB sites, but in a pointed assemblage found only in a very specific area. The Qalkhan seems to represent a particularly clear tool blueprint, with only small and personal differences between sites. The Mushabian and Madamaghan offer only vague tool making rules. It is clear there is a great deal more variability than is accounted for in traditional typology, and that a hierarchy of complexes, cultures, facies and sites does not adequately describe variability and its pattern.

# 8. Conclusions

This thesis has sought to examine how our picture of the Epipalaeolithic of the Southern Levant has been structured, what its evidential base is and how it has gained authority. Another way of looking at material culture attributes was then used to develop a different basis for comparing the microlithic assemblages of the arid zones of the Negev and Southern Jordan.

Chapter 2 summarised the history of research into the Epipalaeolithic in the Levant from its origins during the Mandate period. The context for research was examined, identifying the roots of lithic analysis in early attitudes to the relationships between the Near East and Europe. The way in which paleoclimatic and radiocarbon evidence has been used was critiqued. A brief introduction to the microlith typology of the period set the context for a summary of concerns about the use of typology by researchers in the field.

In chapter 3, the microlith, as the major type-fossil of the period, was examined. Its manufacture, function and role in archaeological studies generally was summarised. An analysis of existing microlith classification methods for the assemblages studied in this thesis was carried out and problems with classification identified. Inconsistencies in the fundamental ideas of homogenous cultures and discrete variability between tool types and between cultures were identified. In addition, problems with descriptions of types and characteristics of assemblages and industries, and of the relationships between them were identified.

In chapter 4, the work of the three main researchers, who have formed the current picture of the Epipalaeolithic of the southern Levant, was examined in a close reading of published texts using narrative analysis. It was shown that narrative structures have been used to describe lithic data and draw it together in a picture of the period relying substantially on ideas 'imported' from researchers' own political, cultural and institutional contexts, and those of past researchers. Certain fundamental parts of our picture of the Epipalaeolithic rest substantially on these 'imported' structures.

Chapter 5 discussed the methodology that was used in this thesis to analyse assemblages in ways that emphasise variability. A catalogue of sites whose assemblages were studied was presented.

Chapter 6 used variability within microlithic form and secondary technology to understand the underlying choices of knappers and the design rules which operate across one or several sites. Comparison of sites and groups of sites in chapter 7 revealed a complex pattern of overlapping variables and individual preferences.

In this final chapter, I will look more broadly at the results of my narrative analysis of published texts on the Epipalaeolithic. I will then examine the implications of my variability analysis of 12 assemblages from the southern Levantine Middle Epipalaeolithic. I will look at the implications of these analyses for the current picture of the Epipalaeolithic, and put forward a new way of looking at morphological variability and its relationship to the culture-concept. Finally, prospects for future research will be discussed.

### *8.1. Narrating the Epipalaeolithic*

In chapter 4, I examined the work that has formed our picture of the Epipalaeolithic, using narrative analysis to look at the linguistic strategies that have been used to structure data. This has shown that narrative strategies are indeed widely employed in archaeological texts, pulling together the disparate, conflicting and enigmatic data we work with into a unity of significance, embodying authority and plausibility.

More specifically, the techniques of lithic analysis – identifying and describing, classifying, and inferring meaning from lithics – are all accomplished through the use of linguistic strategies, by which we relate the part to the whole. In the works examined here, a certain common pattern of the use of such linguistic tropes was discerned. Initial stages of lithic analysis involved a classification using the trope of metaphor, comparing like with like in branching hierarchical taxonomies. Following this, a metonymical reductive approach to significance is taken, with certain tool types standing in for whole assemblages in relation to a 'culture'. These initial stages are then brought together into a whole, in which individual elements such as tools, assemblages and sites are understood only as parts of the whole. This represents use of the strategy of synecdoche. It is clear from this study that the plausibility of these lithic analyses rests in the narrative form of data analysis and final reporting.

Throughout the works examined here, the 'site' or the lithic assemblage gets short shrift. Either portrayed though only one tool type, or understood only as one example of a part of a subsistence round or culture, the assemblage is never allowed its full existence as basic archaeological unit – replete with variability, depositional and post-depositional history, detailed stratigraphy and its interpretation. This has had a fundamental impact on how meaning is ascribed to assemblages.

Much of the debate in archaeology over paradigms of meaning in lithic morphology has rested in the time-honoured divide between the cultural-historical approach and the processualist approach to variability in material culture. However, this divide has taken its own regional direction in the Near East. This study has shown the complex layering and cross-referencing of paradigms and their associated goals, research questions and methodologies. The narrative structures used have employed elements of both approaches, resulting in a text authorised by both the 'scientific' paradigm of processualism *and* by the traditional cultural-historical paradigm.

The cultural-historical approach has come to be demoted in more recent works on the Near East, or taken for granted. It is seen as forming the most basic rung on an analytical ladder, an a priori stage, needing no explanation or justification. Processualist approaches are then tacked on, used within the cultural historical structure already set up.

This layering of different research goals and methodologies, in a non-transparent manner, has resulted in a set of assumptions about the Epipalaeolithic, which are almost impossible to avoid using in research structures or in communicating with others in the field. These are:

- The existence of distinct cultures, with long-lasting ethnic/cultural traditions
- 2 separate ethnic trajectories linked to two separate environmental zones
- Change triggered by climate.

Processualist motivation is used to authorise the fundamental concern with ethnic divides. Climate data, environmental reconstructions and the idea of adaptation to an environment are used to validate what are at heart long-standing ethnic divides constructed with archaeological data through the use of linguistic strategies.

This interpretation has 'grown up' within a local and international set of attitudes to the Middle East and the relations, modern and historical, of people within it. It is this, together with the changing state of political affairs in the region and developing ideas within the discipline of archaeology, which have moulded the view we have constructed of the Epipalaeolithic.

The archaeology conducted during the period of the British Mandate embodied the concept that social change and enlightened progress could only be visited upon the people of the Middle East through European influence and governance. But narrative is used by nationalist as well as by colonial powers (Said 1993), and archaeological stories of the Epipalaeolithic have been moulded by researchers as a reflection of the concerns of their time and their place, within the political situations of the region. Kellner (1980) has argued that areas of formal study are complexes of defences against particular anxieties. During the early years of the state of Israel, archaeology served a useful function for secular nationalists in normalising Jewish existence in Palestine (Shavit 1997). In both creating deep temporal links with the past through continuity, and later also mapping out spatial extent and relationships, the territorial concerns of Israel were reflected in narratives of prehistory. In the work of foreign archaeologists in the region, too, political concerns such as the stability of the region are paramount. The perception of territories with boundaries set by ethnic or religious divides has been an on-going concern of foreign powers in the region (Barakat 1993). Henry's long-standing 60,000 year ethnic traditions are a case in point. Ironically, through all the shifts of archaeological bases and sources of influence in the region, a fundamental picture of the way archaeological cultures work that can be traced back to the Mandate period is still central to our construction of the Epipalaeolithic.

The figure of the 'other', created through temporal and spatial distance in so many ethnographic and other narratives (Fabian 1982, Stahl 1993), incorporated in Epipalaeolithic narratives through the use of ABB sites or 'arid zone cultures' associated with Arab lands and peoples. Local and foreign archaeologists alike have contributed to an incontestable division based on ethnicity – an ethnicity mirroring present day divisions and fears. The contested space of the modern Levant is reworked through the use of stone tools to define the natures of culture, boundary, relationships and social change in the Epipalaeolithic.

## *8.2. Summary of patterns of variability*

In a detailed examination of microlithic assemblages, I found complex variations in the design principles and metrics of tools in the sample. Through comparing this variability with traditional ways of grouping assemblages developed in the narratives described above, I assembled a picture of attributes varying at different levels in a context-dependent manner.

At all sites, assemblages are amalgams of attributes held in common with some other sites and of site-specific interpretations and choices. It is this mix of rules and choices that create the individual fingerprint of an assemblage. Both personal and rule-based behaviour occur at every stage of the knapping process. This results in a complex 'pulling-together' of rules with personal interpretations and habits into an integrated process that results in very specific microlithic forms.

### Site-based decisions

Some variables seem to operate at an entirely site-specific level. While often following the general principles of creating the steepest points at the distal end, in practice the choice of truncation end for various angles frequently varies from site to site. Likewise, tools are most often backed on the left, but a number of sites have chosen right-backed tools. And surface areas, together with depth of tool, seem to vary at site level, with no wider implications at cultural or other levels.

These site-based variations suggest choices very personal to the people knapping the assemblages at a given location. It is clear there are no 'rules' at a wider than site level for exactly how deep a tool should be. This decision is taken by the knappers on-site, producing tools which are usually fairly tightly defined in depth. How we interpret this depends on how we conceive of the site itself being formed. Was it a one-off brief occupation by one or several people, a longer term occupation by a family or other group, or a palimpsest of repeated occupations over a period of time? One would imagine that sites briefly occupied by perhaps only one or a few knappers would produce assemblages in which attributes are very tightly defined at a site level. It is certainly true that Geometric Kebaran sites SH12, SH3 and SH12B show that tight definition at a site level, and most probably were only briefly occupied by small numbers of people. Outside of the SBB sites, the most closely defined assemblages as a whole are from Qalkhan sites TH2 and WH. These sites are from deep occupations, which may well represent somewhat longer-term occupations, perhaps reflecting repeated visits to the rockshelter location. In addition, sites may show tight constraints on one attribute and very little constraint on another one. This suggests that specificity of design within an assemblage reflects more than simply length of occupation or number of people involved in knapping.

Thus some sites show a greater emphasis on specificity of design, with those specific design choices being quite distinct from other sites. At sites TH2 and WH, exact truncation angles are closely determined, and determined differently at each of these sites. At other sites, such as SBB sites, choice of truncation angle is subject to wider rules, or is not an attribute subject to clear choices (JF). So, what constitutes 'technique' varies from group to group.

Depth of tool almost always varies from site to site and is tightly defined at each site, suggesting that even small groups of knappers have technique-related ways of knapping blanks, which produce small but definite site-specific differences. Two exceptions to this are the Qalkhan sites TH2 and WH and Geometric Kebaran sites SH12 and SH12B, where each pair have similar tool depths. This may suggest either that knapping techniques at these sites are subject to wider rules resulting in homogenous tool depths, or that very closely related groups of people knapped the assemblages.

At the Qalkhan sites, tool surface area is also similar between sites, despite wide differences in tool lengths and widths at these sites. This suggests that surface area and depth are closely defined by wider rules for tool production, overriding the usual personal interpretations of these attributes. Other attributes at these sites remain subject to more personal interpretation, such as length of tool and exact truncation angle.

Although there are differences in side of tool backed, Geometric Kebaran sites SH12 and SH12B show extreme similarity of most attributes, including metrics. This suggests that closely related groups of people knapped these assemblages.

### Cultural divisions

An attribute often varies along cultural lines for *some* cultures, but no one attribute always defines cultures from each other. The design principles of Qalkhan and Mushabian sites emphasise having two sets of tools, each with one truncation angle closely defined. The general angles to be used in truncation vary broadly along cultural lines. Madamaghan and Ramonian assemblages, although classed as ABB sites, operate on different principles shared with SBB sites. Often ABB sites, such as Qalkhan and Mushabian sites, show correlations between truncation angle and metrics, again emphasising the distinct differences between tool clusters. Either tool length (Mushabian) or tool width and surface area (Qalkhan, Madamaghan) is similar within cultures, except within the Geometric Kebaran, where in contrast there are distinct differences between some sites in terms of metrics.

Clearly some 'cultures' are much more distinctly defined by similarities in tool design than others: Geometric Kebaran/Middle Hamran, Ramonian and Qalkhan are internally similar. Mushabian sites are similar to each other in ranges of variability except in terms of width and elongation, where they differ – much like Geometric Kebaran sites. However, these have much more latitude within assemblage design in all respects. Mushabian sites are similar in some general principles of design, such as having two groups of tools. But metrics between the two sites, and many specific design decisions, are different. In reality, the two Mushabian sites have almost as much in common with the Qalkhan sites as they do with each other. Madamaghan sites are similar to each other in metrics, but not in design principles.

### SBB and ABB sites

At the level of SBB and ABB sites, significant differences of design principle and metric patterns were found. SBB sites are characterised by having only one, limited range of variability in tool morphology, with very homogenous tools with 180 degree truncations. Tools are symmetrical with fairly large surface areas, stubby, wide and deep. Differences between these sites are few, but involve distinctly *separate* ranges of metric variability within each site. ABB assemblages are a much less homogenous group, with several sites sharing various SBB traits, such as homogeneity (SH21) or symmetricality (TH1, JF). Variability between cultures is more distinct among ABB assemblages, with Qalkhan and Ramonian sites having the clearest fingerprints. In metrics, however, ABB sites largely overlap each other in their ranges of variability. ABB sites usually have two tool types, which each have one closely defined truncation angle on asymmetrical, elongated tools. There are marked preferences for the end of tool to be pointed within ABB sites, which often varies at cultural or site level. However, despite all these difference between SBB and ABB sites, a number of ABB assemblages had SBB design characteristics, without the trapeze-rectangle typology. At all levels, the picture is a complex one, often out of line with the traditional groupings.

### *8.3. The culture-concept*

The underlying image we have been given of cultures, how they have been defined and what they represent in the archaeological record, is of distinct differences between cultures. Each culture is said to exhibit a set of typological traits which co-vary with each other, and which do not overlap with other cultures. Within a culture, we expect largely homogenous lithic typology. The variability analysis I have carried out set out to identify underlying design principles through ranges of variability within and between assemblages. This analysis revealed a quite different picture of lithic morphological variability than that shown by traditional typology.

Variability analysis in this study shows that sites across cultural divides, as currently defined, can share both underlying design principles and metric traits. However, sites are most similar in *principles* rather than in actual implementation of traits, as traits showed a great deal of variability. There were strong similarities of design principles between Middle Hamran, Geometric Kebaran and Ramonian assemblages, with further less marked similarities with one Madamaghan and one Mushabian site. There were similarities between Qalkhan, Mushabian, one Madamaghan site and the Ramonian site. It is this combination of overlapping principles between sites and cultures, and infinite variety in interpretation of these principles that made clumping sites using distinct attribute analysis difficult – groupings of sites always changed depending on which attributes were included.

Furthermore, the picture of homogeneity within cultures was not supported either. No one attribute reliably distinguished cultures from each other, and there were often differences within culture in truncation angle, pointed end of tool, side of backing, tool depth and surface area of tools. With some cultures, only half of the design traits exhibited within culture similarities. Each assemblage exhibited a number of site-based decisions, the *combination* of which sets that assemblage apart from all others. This demonstrates that cultures are in no way homogenous or invariable, nor is any culture distinct from all others in microlith design.

### Nested hierarchies

As can be seen from the above discussion, the patterns of variability within and between sites do not create a picture of clear-cut classifications and clusters. Certain attributes or design principles seem to hold meaning in some contexts, and not in others. Attributes, rules and sites do not combine to form a picture of nested hierarchy, with sites grouping to form facies, facies forming cultures, cultures forming complexes. Attributes do not always reliably differentiate between all sites in a culture, or between cultures and larger groupings. An individual attribute such as, for example, width, might differentiate between two sites in a culture (Geometric Kebaran SH12 and SH3) and also between ABB and SBB sites. At the same time, there might be exceptions to this differentiation – a wide ABB site such as SH8, or a narrow SBB site such as SH3. In addition, there might be a culture where all sites have the same width (e.g. Middle Hamran). While truncation angles broadly vary by culture, the detailed interpretation of the required pointedness at site level means that, for example, a Qalkhan and a Mushabian site have angles of 110/120-degrees, while another Mushabian site, as well as a Madamaghan one, have tools at 130-degrees.

### Lithic webs

The patterns of the assemblages I have studied and their relationships resembles a web. Guidelines, norms, deviations, ranges of variability, individual preferences and habits all create each individual assemblage. Each tool is the seamless result of an individual's enactment of all these forces within the context of his or her own life. This complex pattern of variability reflects the enactment of norms and variability in one part of a complex net of subsistence and tool-making technologies and multiple social organisations. Different values, identities and technological practices are reflected in the varying levels of rule-bound activities and the different locuses of rules.

## *8.4. Subsistence technology*

One reason for the gap between the received picture of Epipalaeolithic lithic variability and the actual morphological variability found in this study can be found in the explanatory practice of downplaying the actual tool function, or technologies of subsistence more generally, within existing scenarios, despite the alleged environmental links of different tool forms. It seems likely that variable patterns within assemblages in part stem from wider technologies and the organisation of subsistence.

In this section, I examine how microliths are part of a wider technological system and how differences in variability of morphology may reflect different systems. Different ways of explaining the Geometric Kebaran phenomenon are discussed, together with ways that hafting methods could affect morphology.

### Technological systems

Microliths and their design are only one part of a wider subsistence technology that involves:

- Tools – microliths and their hafts, other stone tools, and tools in other materials such as net, string, bone and wood.
- People – their organisation in general or age-specific tasks, in groups undertaking certain tasks within the environment to acquire food, water and other resources, in relationships with other groups in their subsistence activities, and in the relationships between individuals and the groups they are a part of.

The nature of variability within and between sites suggests various conclusions relating to subsistence organisation. Ethnographic studies of technology have shown that people can take very diverse approaches to technologies of subsistence, even when relying on the same food source in the same environment (Lemonnier 1993). Faunal and other evidence is scarce for the Middle Epipalaeolithic (see chapter 2). There is little evidence of major differences in animals or plants used in subsistence activities in these and in many other Epipalaeolithic sites to date. However, this does not necessarily mean that subsistence activities were organised in the same way across all these sites.

The particular organisation of microlith assemblages in SBB sites may reflect aspects of this. SBB assemblages represent a modular technology, with each tool within an assemblage completely interchangeable with all others. All assemblages are made following the same design principles and metrics in a way that other, non SBB, assemblages are not. Tools are completely interchangeable in hafts, both with other tools and in their orientation within the haft, as they are symmetrical. This suggests a hunting system in which interchangeability is a prime attribute. Possibly subsistence activities are carried out within a social organisation requiring identical microliths, which can be used by all people, in all hafts (e.g., Bleed 1986). This may suggest an emphasis on massed or team-based subsistence activities, such as netted or herded kills.

The functional role of SBB tools (trapeze-rectangles) has been questioned by Bar-Yosef (1987). If non-SBB sites have assemblages dominated by points used, he assumes, for hunting, then how do Geometric Kebaran groups with their non-pointed trapeze-rectangles carry out hunting activities? Bar-Yosef suggests that the small numbers of triangles found in Geometric Kebaran assemblages fulfil this function. Another possibility is that points were made in a different, perishable material such as wood or bone. However, it is only in the northern area or coastal plain that trapeze-rectangles appear with triangular and arched forms in the same assemblages. Geometric Kebaran assemblages in the southern, arid regions contain no triangular forms, and exhibit the characteristics of extreme homogeneity of tool morphology seen in the assemblages analysed here. The recent evidence of microwear from non-Near Eastern microliths is that microliths with the same morphology may have been put to a variety of uses at each site (see chapter 3), many of these involved with plants rather than hunting. It may be that these homogenous southern Geometric Kebaran tools were made to be hafted in any one of a variety of ways for different subsistence activities. This may be supported by the emphasis on one tool morphology with no patterned differences within site, in contrast to ABB assemblages. However, there is an intriguing difference in the patterning of different types of Geometric Kebaran assemblages. It is interesting to note that it is only in the areas such as the Negev, where Geometric Kebaran assemblages are homogenous, not containing points, triangles or arched forms, that ABB assemblages are found. Could these non trapeze-rectangle assemblages be the residue of hunting activities not represented in southern Geometric Kebaran assemblages? Whatever the case, modular tools are a specific representation of the organisation of technology and of people at Geometric Kebaran and Middle Hamran sites.

The non-overlapping nature of tool metrics *between* some of these sites means that microliths would not be interchangeable with all other sites, although they would be between, for example, Geometric Kebaran sites SH12 and SH12B. Ramonian site SH21 shows many of the important features of SBB sites, but has pointed tools. The interchangeability of tools within site, and probably between sites, suggests that replaceable modular microlith elements were crucial here too. All of these sites (SBB and SH21) have very closely defined tool widths which may have been an important feature of hafting methods that emphasised replaceable microlith elements.

At other sites, the picture is quite different. The range of metric dimensions and truncation angles used at ABB sites is much greater than that at SBB sites. The pattern of variability strongly suggests two tool morphology types, with different point angles, different base angles and often different metric dimensions. There are differences between sites, too, with each exhibiting a very specific tool fingerprint.

For example, Qalkhan sites show a great deal of patterned differentiation between sets of tools in terms of size, retouch characteristics and truncation angles. Metrics fall into a bimodal pattern, with some tools noticeably larger than others. Surface area, depth of tool and side of backing are very closely defined across both sites, while truncation angles are slightly differently defined, and very specific to each site. These characteristics suggest the use of different microliths in a more complex arrangement of microlithic elements in the haft. Different tools were created for different hafts or haft positions, and very specific requirements were in place for all aspects of these tools. Tools were totally non-interchangeable, both within site and between sites, as they were made so specifically for each haft location with, for example, specific metric differences between sites. While width and length varies between sites, the surface area and depth of tools remains strictly defined across both of the sites, suggesting perhaps a desire for a certain weight of tool, possibly for aerodynamic purposes. Sites exhibit quite different choices in details of tool manufacture from each other, but within an overall blueprint, which defined a set of characteristics for each tool for its role within a complex *set* of microlithic elements to be used. Mushabian sites are like less extreme versions of this, with the same principles between the two sites, and two tool groups created within strict requirements for certain metric aspects, and variability between sites on others. Length of tool is the common factor at these sites, rather than surface area as at Qalkhan sites.

### Hafting methods

Kukan (1978) has discussed the constraints placed on microlith morphology due to hafting. When hafting by friction, large flat surface areas are crucial to provide contact with the haft. Some Geometric Kebaran assemblages, with wide tools and increased surface area, may have been friction hafted. Other hafting methods involving, for example, string, hide or sinew ties, may well affect retouch placement and style. Retouched edges on even the working edge may assist hafting with twine, reducing fraying and cutting by a sharp flint edge, as has been found in a microlith from the Dorset culture in North America found hafted with twine (Owen 1987). Goring-Morris has drawn our attention to working edge retouch in some Geometric Kebaran and Mushabian assemblages, suggesting that this was an example of coeval ethnic groups making contact with each other and sharing stylistic traits. However, this may well be explained by hafting methods. Qalkhan sites also have a range of direct and inverse retouch on a number of opposing edges that may suggest hafting with twine, with inverse retouch on working edges used to protect the twine from sharp bladelet edges. Mastics such as lime plaster, bitumen or resin may also have been used, and traces of mastics have been found on a few microliths (Goring-Morris 1987, Henry 1995).

All of these methods suggest different design constraints for microliths. It is possible that the same method was not always used, even by the same group of people. Materials for hafting, such as bitumen or even twine, may not always have been available or convenient to use. It is likely that they would have been much less available, and in some cases much more labour-intensive to produce, than stone suitable for knapping.

In addition, different hafting methods may well have been more suitable in certain contexts. For example, mastics would probably have made microliths less easily replaced in the haft once they had hardened. A broken fragment of microlith embedded in hardened mastic is unlikely to be easily replaced without time, tools and possibly heat. It seems possible that people would have made decisions based on what they were trying to do and the materials they had available to them at the time. Different choices related to hafting method may have substantially affected the retouch, backing and overall morphology of microliths produced for that event.

## 8.5. Ethnicity

The patterns of variability found in this study indicate a variety of sources, ranging from personal and local choices and techniques to varying organisational patterns, composite tool types and hafting methods, as discussed above. This variety of input to variability has, however, traditionally been ignored in favour of an explanation based on ethnicity. The complex and cross-cutting design principles identified here suggest that the role of ethnicity, too, has been misrepresented.

This study has shown that, at the level of site, which in these cases tend to be quite small scale, short-term occurrences, decisions are taken as to a wide range of tool design attributes. Whilst the number of site-based decisions do vary from site to site, these are clearly important factors creating variability. It is hard to say how far this stems from personal or individual techniques of tool manufacture by one knapper and how far traits are shared amongst a group of knappers at one site, comprised of family, peer-group members or task-based group members.

The current picture of the Epipalaeolithic sees the cultures as divided into two separate strands, each representing a long-standing cultural tradition lasting over 10,000 years. Qalkhan, Mushabian and Ramonian sites are generally considered part of a long-standing arid-zone tradition, with Geometric Kebaran and Middle Hamran sites a part of the Mediterranean zone tradition. These two traditions are seen as ethnically distinct from each other, with typologically different traditions springing from this. The analysis of design principles in this study has shown a different picture of similarity and difference between sites. It has also suggested different reasons for that variability. This linking of cultures with environments, it is suggested, has stemmed from modern day political concerns and is not well-supported by available evidence.

The similarities in lithic tradition within the ABB and SBB respectively are also not clear-cut. There are no convincing signs of similarities between the ABB sites suggestive of a long-standing cultural tradition of tool-making kept alive through group contacts over thousands of years. The only similarity across most ABB sites is the emphasis on a constrained pointed tool, and the presence of a second tool with a different end treatment. All other variables show a complex cross-cutting pattern of variability between sites. In addition, I have shown various similarities *across* the ABB/SBB divide, between Ramonian, Madamaghan and Geometric Kebaran /Middle Hamran sites. While clearly there are also distinct differences between the SBB assemblages and some of the ABB assemblages, I have suggested that there may be other reasons for this than long standing ethnic boundaries. The various cultures discussed here have very different kinds of geographic spread with the Geometric Kebaran and the very similar Middle Hamran being distributed from Syria to Sinai and through Israel and Jordan, while the ABB assemblages have much smaller ranges.

Reasons, other than a catch-all idea of ethnic boundaries, for the assemblage and distribution differences include the organisation of technologies of subsistence. These might involve organisation of people, different hunting and gathering methods, changing hafting methods and relationships of tools to each other all contributing to variability. The nature of 'ethnicity', boundaries and relationships between groups, and between individuals and groups, is likely to be a very complex phenomenon, then as it is now. It has been suggested in chapter 5 that modern perceptions and concerns have been central to the way we have structured data. But it would be hard to justify an assumption of similarities between the modern experience of group identity, relationships and boundaries in the Middle East and those of 15,000 years ago, on the basis of current evidence. The different picture of variability drawn in this study may draw our attention to rather different models of group identity and relationship to country than exist now.

Recent ethnographic work (Keen 1995, Myers 1986, Hamilton 1982, Layton 1986, Palmer 1984, Myers 1989) argues that mobile groups have different relationships between identity, territory and land than do settled groups. For example, ties to country in desert regions are not always based on criteria of lineal descent. Myers (1986) has described how mobility in an arid environment can create different ways of interacting between groups, and indeed different ideas of what a 'group' is. Keen (1995) discusses groups' own description of their self-identity in Arnhem Land, North Australia. Individual groups are not visualised as enclosed sets. Connections between people are seen as open strings of connectedness between individuals and between 'groups' and visualised as the lines of journeys taken across modern, historical and religious landscapes. Connections made between people in groups are context dependent and shifting. The level of closeness between groups or identities changes, depending on individual motivation at any given point in time, the types of activity under discussion (for example, hunting, religious practices or marital relationships), and the identity *assumed* by the speaker for that moment, creating a different string of relationships to people in different places, along certain journeys, engaged in shared activities, identities and land-use. Territories are not fixed and contiguous, but overlapping, shared in certain contexts, contested by individuals assuming one identity or another in relationship to that land. Links are articulated in the form of journeys made to or through areas. Our own models of enduring, corporate and co-residing social groups are not appropriate to groups that use patterns of mobility, and the forming and re-forming of groups in the landscape, as a method of living in arid zones.

Until recently, ethnographers have used inappropriate concepts to understand mobile people's relationships to identity and to territory (Keen 1995, Dongoske *et al.* 1997).

Typological concepts such as clan, clan subgroup and language group, have been used to classify relationships between people. A branching hierarchical taxonomy has been used to 'order' groups seen as distinct and externally bounded. These ideas have embodied concepts of spatial boundedness and enclosure, which do not successfully describe all groups and may in fact be more closely associated with sedentary, land owning groups with lineal descent, such as ourselves. Archaeologists have tended to follow ethnographers in this kind of structuring of lithic variability and its perceived relationship to ethnic groups, as we have seen in the previous chapters.

Despite an awareness within the archaeological community of the complex, cross cutting movements of mobile peoples, this has seldom informed our typological classification of hunter-gatherer lithic assemblages. We know that mobile hunter-gatherers use complex networks of relationships between social relations, ideology and subsistence methods to structure their lives and relationships to territory/land (Bender 1978, McBryde 1984, Weissner 1982). We recognise wide-scale interactions between distant groups and over long periods, as well as personal mobility and contacts through marriage patterns, peer groups and ritual activities. We know that groups come together and divide to form new structures and that different patterns mark daily, seasonal and yearly subsistence rounds. All of these need to be better reflected in our understanding of the patterns of technological variability we can see.

The patterns of lithic attributes highlighted in this thesis suggest that work within a framework that accepts variability will reveal the complex factors that feed into lithic or any other technological activity. The 'lithic webs' of these 12 assemblages show the residue of small, mobile groups who make decisions at very local levels, moving about the landscape in small groups or as individuals, as part of a number of overlapping, fluid and contingent groups. The patterns of lithic variability, here described as webs, reflect the cross-cutting links that individual knappers have with others in their world – close kin, far distant relations, marriage partners and their relations, members of religious, age or gender groups, activity groups, and so on. These relationships come together in unique' packages' of influences on each individual, in which different elements of common contact, ideas and identity are shared with individuals probably spread over a wide area. These overlapping groups are likely to be made up of fluid memberships – with decisions to form identity with groups being a contingent decision based on complex motivations of relationship, sociality and personal benefit as well as external factors of environment and resource availability.

The territorially bounded, hierarchically branching archaeological cultures we have been working within do not reflect hunter-gatherer behaviour on the ground.

### 8.6. Future work

This study suggests a potential to uncover a rich picture of technological and social systems in the Levantine Epipaleolithic – a diversity which has been masked by the ethno/cultural framework developed to explain the period. It has shown that a more detailed analysis of full ranges of variability can reveal more about the principles of tool design and create new avenues to explore their possible social and technological role.

A renewed emphasis on variability within sites, using the methodology developed here, can help us address questions of activity areas or different individual or group techniques across horizontal exposures, or indeed relationships between stratified levels at one site. As more detailed reporting across different sites is carried out, comparisons between these sites can become more meaningful. This initial exploration of 12 assemblages from the Negev and Ras en-Naqb suggests that future comparisons with and between other groups of sites, especially in Jordan or other arid zones of the region, would substantially change our view of the structure of archaeological cultures and microlithic variability within and between parts of the Levant, especially the arid and Mediterranean zones.

Of course, comparability of methods, across researchers and research traditions, require contact and meaningful, open debate between scholars. An initiative to discuss and develop accepted standards of reporting, as has been attempted for the Neolithic of the region (Wembach Working Group 1995), could bring considerable benefits. In the absence of typological systems, we would need alternative methods of describing and comparing assemblages. Specifically, I would suggest:

- Amalgamate tool types based on morphology – overall shapes – perhaps based on very broad morphological characteristics such as the arched backed or straight backed designations used here
- Save tool 'types' for those very special forms with particularly closely defined sets of attributes, such as Ramon Points or Qalkhan Points
- Emphasise more quantitative studies of all assemblages using a basic attribute analysis, which would include information on truncation angles, location of retouch, microburin scars, and measurements of dimensions.

This would allow more meaningful comparisons between sites, based on attributes that can be understood as personal technique or habits, group traditions, hafting or subsistence-related traits, and so on. The real similarity/dissimilarity between assemblages would be visible, at whatever scales these occur. This would result in a more rich and detailed description of our assemblages, making us more *lithically literate*.

Other parts of this thesis also suggest that we need to become more literate constructors *and* consumers of archaeological narratives. The exploration in this study of methods of analysis drawn from historiography suggests that the culture of archaeological research in the Levant may benefit from increased examination of the wider contexts of research, the relationships between key texts, and the development and evidential base of basic tenets. Here, narrative analysis has offered a new, and sometimes challenging, method for looking in detail at the ways data are structured and create authoritative accounts of prehistory.

It would be easy to suggest that this identification of narrative strategies within archaeological accounts is *per se* a critique of the use of narratives. However, narratives are the way we make sense of the world (Edelman 1989), and tropes can be considered a useful creative tool wherever they are found (O'Connor 2002). Tropes are the embodiment an essentially human way of thinking - the ability to transport knowledge from one field into another.

However, the question is *how* tropes are being used. They are powerful devices, and it can be hard to see outside the framework of metaphors used. We need to gain sophistication in the appropriate use of tropes in creative and analytical endeavours such as archaeology. We need to learn to use metaphor in a way that stimulates productive thinking without distorting it.

So, what sorts of narratives should we be telling?

- As we construct narratives, we must become more aware of how they relate to past narratives – what we take, what we reject, what we interrogate/question/deconstruct.
- We must become as skilled in analysing the textual strategies used in *materials* analysis as we are becoming in analysing the words used in a narrative. How have archaeological stories acquired that seamless and unquestionable meld between data, analysis and final text?
- We must consider what sorts of narratives are suited to the *nature* of the archaeological record –containing as it does ellipses, elides, obscurities and contradictions. The authoritative voice of grand narrative does not really suit our data.
- Our narratives could address the opportunities and problems of scale so inherent in hunter-gatherer archaeological record, comprised of individual moments, small acts and episodes.

Finally, our narratives must become more transparent in their construction through full reporting of data and honest presentation of inferences, beliefs and personal motivation. As White has commented (1987), history becomes a burden when it claims a privileged weight of truth.

### 8.7. Final reflections

Making a tool requires a sequence of steps, which both embody choices made while engaged in the task and the diverse links and identities, memories and habits, learned sequences and ideas which bind an individual to families, relations, groups, larger communities, in-laws, peer groups and 'foreign' influences. How these are enacted into a tool represents a series of negotiations, habits, memories and rituals, which take the form of an interface between norm and agency at different levels/scales. They come together into a tightly connected series of guidelines, norms, deviations and ranges of variability. Tool making is learnt, imitated, apprenticed, innovatory. Tools are made in families, peer groups and activity groups. It is not surprising then that we would see, reflected in a technology that is situated in the lived world of its makers, the cross-cutting and complex relationships that mobile, arid zone hunter-gatherers often use as an integral part of their subsistence and society.

These ideas offer us the opportunity of a new way of seeing social organisation and its relation to the material culture variability that we work with. If lithic technology is seen as fully integrated with the complex, shifting social organisations, personal relationships, subsistence methods and ritual and other activities that mobile hunter-gatherers carry out, then lithic analysis can be liberated from its existing focus classifying assemblages and the people who made them into discrete categories. With a starting point that accepts messy, complex real world variability, the relationships between people, their technologies and their neighbours can begin to emerge.

| Site | ToolNo | RetNo | ConNo | Tool.Shape | Complete | Orient | Blank | Damage | ProxEx | ProxA | DistEx | DistA | Tool.Length | WidePt | Width | Depth | Ret.Length | Thick | Location cat. | Position | Angle | Ret.Shape | Direction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 305 | 1 | 10B 130 | IRR BB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 21.88 | 4.05 | 9.89 | 2.94 | 21.46 | 2.7 | Right | D | A | IR | PD |
| 3 | 306 | 1 | 10B 130 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 140 | 11.1 | 0 | 4.4 | 2 | 8.99 | 1.55 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 4.02 | 0.17 | Distal | D | SA | R | |
| 3 | 307 | 1 | 9D 130 | SBB | FALSE | TRUE | M | 56 | RM | | S | 180 | 23.3 | 2.8 | 8.36 | 2.74 | 3.92 | 1.64 | Proximal | | | | |
| | | | | | | | | | | | | | | | | | 6.62 | 3.17 | Proximal | D | A | CC | |
| | | | | | | | | | | | | | | | | | 21.59 | 2.95 | Left | | A | RI | |
| 3 | 308 | 1 | 10B 120 | SBB | FALSE | TRUE | M | 01 | S | 180 | PT | 140 | 20.81 | 0 | 4.38 | 2.35 | 16.03 | 2.32 | Left | B | A | R | |
| | | | | | | | | | | | | | | | | | 6.48 | 2.19 | Distal | D | | | |
| 3 | 309 | 1 | 10D 130 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | PT | 120 | 14.99 | 6.25 | 4.62 | 2.16 | 9.4 | 2.29 | Left | D | A | CV | PD |
| | | | | | | | | | | | | | | | | | 10.24 | 2.3 | Distal | D | | | |
| 3 | 310 | 1 | 7D 120 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 50 | 18.43 | 0 | 5.76 | 1.92 | 18.15 | 1.77 | Right | D | A | R | DP |
| 3 | 311 | 1 | 7D 110 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 6.99 | 0 | 7.39 | 2.35 | 6.93 | 2.26 | Left | D | L | R | PD |
| | | | | | | | | | | | | | | | | | 6.31 | 0.97 | Right | D | L | R | |
| 3 | 312 | 1 | 7D 120 | SBB | FALSE | TRUE | M | 56 | R | 10 | S | 180 | 12.43 | 0 | 7 | 2.48 | 6.18 | 2.03 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 10.27 | 1.32 | Left | D | L | R | PD |
| 3 | 313 | 1 | 10A 120 | ARCHED BACKED | TRUE | TRUE | M | | | 50 | R | 180 | 26.59 | 0 | 4.85 | 2.57 | 19.96 | 1.69 | Left | D | A | RCV;R | |
| | | | | | | | | | | | | | | | | | 4.08 | 2.66 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 7.26 | 1.87 | Rt Partial | I | L | NOTCH | |
| 3 | 314 | 1 | 7C 130 | ARCHED BACKED | TRUE | TRUE | M | 234 | | 50 | PT | 140 | 31.16 | 4.5 | 6.93 | 2.75 | 4.72 | 2.48 | Proximal | D | SA | CC | |
| | | | | | | | | | | | | | | | | | 25.98 | 2.08 | Left | D | A;SA | CV;R | |
| | | | | | | | | | | | | | | | | | 4.23 | 2.24 | Distal | D | | | |
| | | | | | | | | | | | | | | | | | 14.9 | 1.25 | Rt Partial | | L | NOTCH;R | |
| 3 | 315 | 1 | 9D 130 | ARCHED BACKED | TRUE | TRUE | M | | R | 180 | RP | 120 | 18.31 | 12.33 | 4.89 | 2.04 | 2.89 | 1.07 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 17.56 | 2.33 | Lt Dist | D | A | CV | PD;DP |
| | | | | | | | | | | | | | | | | | 4.79 | 1.43 | Distal | D | | | |
| | | | | | | | | | | | | | | | | | 17.38 | 2.1 | Right | D | L | RCC | |
| 3 | 316 | 1 | 10A 130 | ARCHED BACKED | TRUE | TRUE | M | | R | 60 | R | 180 | 24.14 | 13.44 | 5.1 | 3.05 | 7.55 | 1.41 | Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 17.5 | 2.85 | Left | B | A | CV | PD;DP |
| | | | | | | | | | | | | | | | | | 2.7 | 1.69 | Distal | D | A | CC | LR |
| 3 | 317 | 1 | 7A 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 180 | 15.26 | 9.18 | 4.9 | 2.3 | 5.52 | 1.49 | Proximal | D | A | RCV | |
| | | | | | | | | | | | | | | | | | 10.66 | 2.39 | Left | B | SA;A | CV | |
| 3 | 318 | 1 | 9C 130 | SBB | FALSE | FALSE | M | 56 | RX | 40 | SX | 140 | 20.45 | 6.12 | 6.64 | 2.03 | 8.89 | 1.54 | | D | A | R | |
| | | | | | | | | | | | | | | | | | 11.24 | 2.14 | | | A | R | |
| 3 | 319 | 1 | 7C 130 | ARCHED BACKED BIPT | TRUE | TRUE | M | | S | 120 | PT | 120 | 26.31 | 0 | 4.73 | 2.41 | 5.28 | 1.39 | Proximal | D | | I | |
| | | | | | | | | | | | | | | | | | 22.74 | 2.35 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 3.33 | 1.2 | Distal | D | | | |
| 3 | 320 | 1 | 7D 120 | QALKHAN PT | TRUE | TRUE | M | | RP | 60 | R | 110 | 42.88 | 18.04 | 11.62 | 3.18 | 17.84 | 2.91 | Lt Prox | D | SA;A | CV;R | |
| | | | | | | | | | | | | | | | | | 27.1 | 2.67 | Lt Dist | D | A | CC;R;CV | PD |
| 3 | 321 | 1 | 10B 130 | QALKHAN PT | TRUE | TRUE | M | | RP | 50 | R | 120 | 22.24 | 8.84 | 7.27 | 2.7 | 5.76 | 3.03 | Lt Prox | D | L | R | PD |
| | | | | | | | | | | | | | | | | | 15.21 | 2.66 | Lt Dist | D | A | R | |
| 3 | 322 | 1 | 9D 150 | MICROGRAVETTE | TRUE | TRUE | M | | R | 30 | R | 120 | 32.38 | 0 | 6.42 | 1.96 | 7.35 | 1.3 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 30.42 | 1.55 | Lt Dist | D | A | CV;CVR | PD |
| | | | | | | | | | | | | | | | | | 32.13 | 1.33 | Right | D | A | RCC | DP |
| 3 | 323 | 1 | 10D 140 | SBB | TRUE | TRUE | M | | R | 180 | PT | 120 | 13.75 | 0 | 3.53 | 2.01 | 2.68 | 0.97 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 10.61 | 2.14 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.62 | 1.97 | Distal | D | | | |
| 3 | 324 | 1 | 10D 140 | SBB | TRUE | TRUE | M | | RP | 30 | R | 110 | 20.33 | 4.02 | 6.15 | 2.84 | 4.1 | 2.42 | Proximal | D | A | CC | |
| | | | | | | | | | | | | | | | | | 17.23 | 2.53 | Left | | A | RI | PD |
| 3 | 325 | 1 | 10A 140 | QALKHAN PT | TRUE | TRUE | M | | R | 50 | R | | 45.05 | 9.85 | 9.67 | 2.86 | 13.86 | 2.61 | Proximal | D | A | CC | RL |
| | | | | | | | | | | | | | | | | | 36.71 | 2.63 | Left | D | A | RCC | PD |
| 3 | 326 | 1 | 10D 140 | ARCHED BACKED | TRUE | TRUE | M | | R | 70 | R | 180 | 18.94 | 9.31 | 4.38 | 2.92 | 2.54 | 1.11 | Distal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 18.79 | 2.57 | Lt Dist | B | A | CV | |
| 3 | 327 | 1 | 10B 140 | ARCHED BACKED | TRUE | TRUE | M | | R | 50 | R | 170 | 26.37 | 9.39 | 4.71 | 2.47 | 6.46 | 1.47 | Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 19.24 | 2.64 | Left | B | A | CV | |
| | | | | | | | | | | | | | | | | | 2.65 | 0.96 | Distal | D | A | RCC | |
| 3 | 328 | 1 | 10B 140 | SBB BIPT | TRUE | TRUE | M | | R | 110 | RP | 60 | 33.4 | 0 | 4.91 | 2.73 | 3.7 | 1.07 | Proximal | D | A | CV | DP |
| | | | | | | | | | | | | | | | | | 21.13 | 2.74 | Right | B | A | R | |
| | | | | | | | | | | | | | | | | | 6.25 | 1.05 | Distal | D | L | RCV | PD |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 330 1 | 10D 150 | SBB BIPT | TRUE | TRUE | M | | R | 90 R | 110 | 28.23 0 | 3.1 | 2.03 | 24.85 | 2.01 Left | B | A | RI | |
| 3 | 331 1 | 10D 140 | SBB BIPT | TRUE | TRUE | M | | R | 70 R | 110 | 15.48 0 | 3.36 | 1.04 | 16.11 | 1.01 Left | D | A | CV;R;CV | PD |
| 3 | 332 1 | 10D 140 | SBB PT | FALSE | TRUE | M | 01 | S | 180 RS | 50 | 20.06 0 | 3.33 | 1.51 | 18.5 | 1.43 Right | I | A | RCV | PD |
| 3 | 333 1 | 10B 140 | SBB BIPT | TRUE | TRUE | M | | RP | 50 RP | 110 | 17.87 0 | 3.06 | 1.24 | 14.93 | 1.14 Right | D | A | RCV | |
| 3 | 334 1 | 7C 150 | SBB BIPT | TRUE | TRUE | M | | PT | 50 R | 120 | 26.03 0 | 3.39 | 2.14 | 4.73 | 1.58 Proximal | D | | | |
| | | | | | | | | | | | | | | 20.48 | 1.95 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 3.67 | 1.09 Distal | D | SA | R | LR |
| 3 | 335 1 | 10D 140 | SBB BIPT | TRUE | TRUE | M | | R | 50 RP | 110 | 23.07 0 | 3.09 | 1.38 | 18.7 | 1.21 Left | D | A | CV;R | PD |
| | | | | | | | | | | | | | | 2.89 | 1.11 Proximal | | A | R | RL |
| 3 | 336 1 | 7A 150 | SBB | FALSE | TRUE | M | 01 | S | 180 N | | 23.75 0 | 5.4 | 1.45 | 20.14 | 1.42 Right | I | A | R | DP |
| 3 | 337 1 | 7A 150 | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 15.28 0 | 6.03 | 1.81 | 15.39 | 1.44 Right | I | SA | RCC | PD |
| 3 | 338 1 | 7C 140 | SBB | FALSE | TRUE | M | 01;56 | S | 170 S | 170 | 23.72 0 | 4.79 | 2.7 | 22.45 | 2.82 Left | D | A | RICC | PD |
| 3 | 339 1 | 7C 140 | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 12.96 0 | 5.33 | 1.4 | 12.77 | 1.19 Right | I | SA | R | DP |
| 3 | 340 1 | 10A 140 | SBB | FALSE | TRUE | M | 01;7 | S | 180 S | 130 | 14.93 1 | 6.65 | 1.84 | 14.11 | 1.54 Right | I | SA | RI | PD |
| 3 | 341 1 | 10B 140 | SBB | TRUE | TRUE | M | | PT | 50 PT | 120 | 21.57 5.19 | 4.88 | 2.74 | 4.95 | 2.25 Proximal | I | | | |
| | | | | | | | | | | | | | | 18.35 | 2.39 Left | D | A | CV;R | |
| | | | | | | | | | | | | | | 5.15 | 2.11 Distal | D | | | |
| | | | | | | | | | | | | | | 12.99 | 0.59 Right | D | L | RCC | |
| 3 | 342 1 | 10C 150 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 12.74 0 | 6.62 | 2.92 | 12.95 | 3.26 Left | D | A | RI | PD |
| 3 | 343 1 | 10D 150 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 20.61 0 | 4.01 | 1.67 | 20.3 | 1.57 Right | D | A | R | |
| 3 | 344 1 | 10C 150 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 160 | 18.75 0 | 4.84 | 1.88 | 16.63 | 1.82 Left | D | SA | R | |
| 3 | 345 1 | 7A 140 | TRAP/RECT | TRUE | FALSE | M | | RX | 180 RX | 180 | 13.8 0 | 6.13 | 2.14 | 5.93 | 1.29 | D | A | R | ORL |
| | | | | | | | | | | | | | | 12.61 | 1.03 | D | A | RCC | OPD |
| | | | | | | | | | | | | | | 5.35 | 1.91 | D | A | R | OLR |
| 3 | 346 1 | 7C 140 | SBB | FALSE | TRUE | M | 56;234 | R | 180 S | 180 | 9.44 0 | 6.66 | 2.08 | 5.41 | 2.17 Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | 7.87 | 2.1 Left | D | A | R | PD |
| 3 | 347 1 | 7C 150 | SBB | FALSE | TRUE | M | 01;234 | S | 30 R | 160 | 14.34 0 | 5.72 | 2.28 | 10.84 | 2.39 Left | D | A | R | |
| | | | | | | | | | | | | | | 5.62 | 1.63 Distal | D | A | R | RL |
| 3 | 348 1 | 7C 140 | SBB W/ NOTCH | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 19.16 0 | 8.58 | 3.13 | 19.15 | 3.63 Left | D | A | NOTCH;R | |
| 3 | 349 1 | 10B 140 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 140 | 12.59 0 | 5.55 | 2.07 | 8.35 | 2.37 Left | D | L | R | |
| 3 | 350 1 | 10B 140 | SBB | TRUE | TRUE | M | | PT | 160 R | 180 | 14.93 | 3.93 | 1.74 | 2.96 | 1.83 Proximal | D | | | |
| | | | | | | | | | | | | | | 12.02 | 1.78 Right | D | L | CV;R | DP |
| | | | | | | | | | | | | | | 3.02 | 1.04 Distal | D | A | R | |
| 3 | 351 1 | 10D 140 | RET B | FALSE | TRUE | M | 01;56 | S | 10 S | 180 | 14.48 0 | 2.94 | 1.72 | 7.27 | 1.82 Lt Partial | D | L | R | PD |
| 3 | 352 1 | 10B 150 | SBB | FALSE | TRUE | M | 456 | N | S | 70 | 27.27 0 | 8.06 | 2.14 | 26.93 | 1.99 Left | D | A | RCC | PD |
| 3 | 353 1 | 10B 150 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 26.95 0 | 4.92 | 2.21 | 24.8 | 2.61 Left | B | A | R | |
| | | | | | | | | | | | | | | 3.17 | 0.7 Distal | D | A | RCC | LR |
| 3 | 354 1 | 10B 140 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 15.95 0 | 3.95 | 1.8 | 14.69 | 1.91 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 15.32 | 0.52 Right | D | L | I | PD |
| 3 | 355 1 | 10B 160 | SBB | FALSE | TRUE | M | 01;234 | S | 180 R | 160 | 15.32 0 | 7.69 | 2.04 | 13.12 | 1.82 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 5.25 | 2.1 Distal | D | SA | R | RL |
| 3 | 356 1 | 10D 170 | SBB | FALSE | TRUE | M | 0 | S | 180 R | 180 | 15.24 3.03 | 6.04 | 2.48 | 14.88 | 1.95 Left | D | A | R | |
| | | | | | | | | | | | | | | 4.26 | 1.79 Distal | D | A | CC | |
| | | | | | | | | | | | | | | 3.19 | 0.87 Rt Partial | D | SA | NOTCH | |
| 3 | 357 1 | 10C 170 | SBB | FALSE | TRUE | M | 01;56 | S | 10 S | 10 | 18.64 0 | 7.1 | 2.53 | 17.61 | 2.6 Right | | A | R | |
| 3 | 358 1 | 10D 160 | SBB | FALSE | TRUE | M | 01;56 | S | 170 S | 180 | 12.85 0 | 4.49 | 1.5 | 12.82 | 1.17 Left | D | SA | R | PD |
| 3 | 359 1 | 10D 160 | SBB | FALSE | TRUE | M | 56 | PT | 160 S | 180 | 14.29 0 | 6.57 | 2.48 | 6.32 | 2 Proximal | I | | | |
| | | | | | | | | | | | | | | 11.79 | 2.57 Left | D | SA | R | PD |
| 3 | 360 1 | 10D 150 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 30 | 28.33 | 5.87 | 2.55 | 4.73 | 1.35 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 28.19 | 2.34 Left | D | A | R | PD |
| 3 | 361 1 | 10D 160 | SBB | FALSE | TRUE | M | 01 | S | 180 N | | 22.05 18.69 | 5.59 | 1.84 | 18.01 | 1.6 Rt Partial | D | A | R | |
| | | | | | | | | | | | | | | 4.72 | 0.3 Rt Partial | D | A | R | |
| 3 | 362 1 | 10D 170 | TRAP/RECT | TRUE | FALSE | M | | RX | 30 RX | 140 | 18.63 3.76 | 6.39 | 3.53 | 5.71 | 3.11 | D | SA | R | OLR |
| | | | | | | | | | | | | | | 14.04 | 3.11 | D | A | R | |
| | | | | | | | | | | | | | | 5.21 | 2.53 | D | A | R | ORL |
| 3 | 363 1 | 10A 160 | IRR BB | TRUE | TRUE | M | | PT | 140 N | | 18.48 0 | 5.95 | 1.75 | 5.23 | 1.83 Proximal | D | | | |
| | | | | | | | | | | | | | | 6.5 | 1.65 Rt Partial | D | A | CC | PD |
| 3 | 364 1 | 7A 160 | SBB | TRUE | TRUE | M | 234 | R | PT | 120 | 22.03 14.7 | 4.88 | 2.83 | 1.95 | 1.65 Proximal | | A | | |
| | | | | | | | | | | | | | | 16.11 | 2.78 Left | D | A | R | |
| | | | | | | | | | | | | | | 8.1 | 2.27 Distal | D | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 365 1 | 10A 170 | TRUNC | FALSE | TRUE | M | 01 | S | 180 R | 140 | 20.38 | 6.16 | 2.73 | 13.09 | 2.72 | Lt Dist | | SA | CV;CC | PD |
| 3 | 366 1 | 7A 160 | ARCHED BACKED | FALSE | TRUE | M | 56 | S | 180 PT | 50 | 18.05 12.79 | 8.06 | 2.92 | 10.56 | 2.74 | Proximal | D | | | |
| | | | | | | | | | | | | | | 7.06 | 2.88 | Lt Partial | D | A | NOTCH | |
| | | | | | | | | | | | | | | 10.47 | 3.54 | Lt Partial | D | SA | CV | |
| 3 | 367 1 | 10C 160 | EL WAD PT | TRUE | TRUE | P | | N | R | 180 | 40.98 0 | 13.47 | 3.6 | 35.26 | 1.21 | Right | D | SA | RCV | PD |
| | | | | | | | | | | | | | | 7.53 | 0.88 | Distal | D | A | R | |
| 3 | 368 1 | 10B 150 | RET B | FALSE | TRUE | M | 01;56 | S | 180 S | 30 | 20.15 0 | 9.68 | 2.05 | 10.44 | 0.7 | Right | D | SA | R | |
| 3 | 369 1 | 10C 170 | SBB PT | TRUE | TRUE | M | 9 | RP | 160 RP | 50 | 20.67 | 4.29 | 2.42 | 13.8 | 2.65 | Right | B | A | R | |
| | | | | | | | | | | | | | | 2.79 | 1.18 | Rt Partial | D | A | CV | DP |
| | | | | | | | | | | | | | | 2.43 | 1.53 | Rt Partial | D | A | CV | |
| 3 | 370 1 | 9C 150 | SBB PT | TRUE | TRUE | M | | R | 110 R | 60 | 20.02 | 3.53 | 1.61 | 15.47 | 1.14 | Right | D | A | CV;R;CV | PD |
| 3 | 371 1 | 9B 160 | SBB PT | TRUE | TRUE | M | | RP | 50 R | 120 | 20.45 0 | 3.22 | 1.56 | 1.52 | 0.46 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 12.13 | 1.58 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | 4.06 | 0.72 | Distal | D | A | R | PD |
| 3 | 372 1 | 7A 160 | QALKHAN PT | TRUE | TRUE | M | 01 | R | 40 R | 120 | 32.65 16.72 | 14.66 | 4.15 | 20.07 | 2.78 | Lt Prox | D | SA | CV;CC | PD |
| | | | | | | | | | | | | | | 19.75 | 3.14 | Lt Dist | D | SA | R | |
| 3 | 385 1 | 7A 140 | TRUNC | TRUE | TRUE | P | | MB | 120 R | 180 | 17.37 6.42 | 7.45 | 2.2 | 7.04 | 3.2 | Proximal | I | | | |
| | | | | | | | | | | | | | | 2.63 | 0.52 | Distal | D | A | R | |
| | | | | | | | | | | | | | | 1.69 | 0.98 | Rt Partial | D | SA | NOTCH | |
| 3 | 386 1 | 7C 140 | TRUNC | TRUE | TRUE | M | 7 | MB | 120 R | 120 | 25.24 15.1 | 10.77 | 3.57 | 14.95 | 3.34 | Lt Prox | I | | | |
| | | | | | | | | | | | | | | 6.53 | 1.78 | Distal | D | SA | RI | |
| | | | | | | | | | | | | | | 14.25 | 1.95 | Rt Partial | D | A;SA | NOTCH;R | |
| 3 | 412 1 | 9A 120 | SBB | FALSE | TRUE | M | 56;789 | R | 130 S | 180 | 22.62 0 | 8.41 | 2.5 | 6.88 | 2.31 | Proximal | D | A;SA | R | RL |
| | | | | | | | | | | | | | | 16.74 | 2.61 | Right | D | SA;A | RI | |
| | | | | | | | | | | | | | | 17.25 | 0.52 | Left | D | L | NOTCH | |
| 3 | 413 1 | 9A 120 | SBB PT | FALSE | TRUE | M | 01;9 | S | 180 PT | 110 | 19.51 | 5.18 | 2.8 | 11.74 | 2.76 | Lt Partial | D | A | RCV | |
| | | | | | | | | | | | | | | 8.38 | 2.38 | Lt Partial | D | | | |
| 3 | 414 1 | 9C 120 | SBB | FALSE | TRUE | M | 01;56 | S | 160 S | 180 | 21.75 0 | 5.58 | 2.38 | 21.86 | 2.25 | Left | D | SA | R | DP |
| 3 | 415 1 | 9C 110 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 10.09 0 | 4.39 | 1.99 | 9.38 | 2.02 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | 3.96 | 1.49 | Distal | D | SA | CV;R | PD |
| 3 | 416 1 | 9C 120 | SBB | TRUE | TRUE | M | | rp | 70 rp | 120 | 21.25 0 | 3.3 | 1.45 | 11.49 | 1.48 | Left | D | SA | R | DP |
| 3 | 417 1 | 9C 120 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 14.29 0 | 4.33 | 2.11 | 3.77 | 1.5 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 13.76 | 2.53 | Left | D | A | RCC | |
| 3 | 418 1 | 9C 110 | LUNATE | TRUE | TRUE | M | | R | 50 R | 110 | 19.55 8.91 | 6.53 | 2.02 | 15.49 | 1.8 | Lt Prox | D | SA;A | CV | PD |
| | | | | | | | | | | | | | | 7.43 | 1.54 | Lt Dist | D | A | CV | |
| 3 | 419 1 | 9D 120 | SBB | FALSE | TRUE | M | 56 | RP | 80 S | 180 | 18.98 | 7.02 | 2.23 | 14.14 | 2.06 | Lt Partial | D | A | R | DP |
| 3 | 420 1 | 9B 120 | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 12.8 0 | 4.14 | 2.38 | 3.64 | 1.63 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 11.68 | 2.15 | Left | D | A | R | PD;DP |
| | | | | | | | | | | | | | | 4.05 | 2.09 | Distal | D | A | R | |
| 3 | 421 1 | 9D 110 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 S | 150 | 15.92 0 | 2.88 | 1.3 | 6.17 | 1.55 | Lt Prox | D | A | CV | PD |
| | | | | | | | | | | | | | | 10.18 | 0.77 | Lt Partial | D | A | R;CV | DP |
| 3 | 422 1 | 7B 110 | ARCHED BACKED | FALSE | FALSE | M | 01 | RPX | 50 SX | 140 | 26.82 0 | 5.36 | 3.39 | 8.03 | 2.1 | | D | | | |
| | | | | | | | | | | | | | | 18.13 | 2.86 | | D | A | CVI | |
| 3 | 423 1 | 7C 110 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 14.19 0 | 5 | 1.43 | 14.08 | 1.17 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | 13.15 | 0.26 | Left | D | L | R | |
| 3 | 424 1 | 7C 110 | SBB | FALSE | TRUE | M | 0;5 | RS | RS | 180 | 15.93 0 | 6.34 | 1.99 | 14.22 | 1.78 | Right | D | A | CV;R | PD |
| | | | | | | | | | | | | | | 4.01 | 1.17 | Distal | D | SA | R | LR |
| 3 | 425 1 | 7A 120 | SBB | FALSE | TRUE | M | 56;01 | S | 180 S | 180 | 25.02 0 | 6.36 | 2.87 | 24.09 | 2.37 | Right | D | A | RI | DP |
| 3 | 426 1 | 7A 120 | SBB | FALSE | TRUE | M | 56 | RP | 60 S | 180 | 28.33 9.16 | 5.34 | 2.84 | 9.2 | 2.72 | Proximal | D | A | | PD |
| | | | | | | | | | | | | | | 20.12 | 2.89 | Left | D | A | RCV | PD |
| 3 | 427 1 | 7D 110 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 110 S | 180 | 12.18 | 4.6 | 1.83 | 10.25 | 1.81 | Rt Prox | B | A | CV;R | PD |
| | | | | | | | | | | | | | | 11.95 | 1.12 | Left | D | SA | R | PD |
| 3 | 428 1 | 7B 120 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 10 | 17.3 | 4.57 | 1.63 | 16.53 | 0.94 | Right | D | A | R | PD |
| 3 | 429 1 | 7B 120 | SBB | FALSE | TRUE | M | 01;56 | S | 10 S | 180 | 21.96 0 | 5.86 | 2.57 | 16.58 | 2.47 | Lt Partial | D | A | R | DP |
| 3 | 430 1 | 7D 110 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 30 R | 110 | 37.75 7.44 | 13.6 | 3.62 | 14.95 | 4.7 | Proximal | D | SA | CC;CVR | LR |
| | | | | | | | | | | | | | | 30.98 | 3.74 | Left | D;B | A | RCC | PD |
| 4 | 431 1 | 6B 110 | SBB | TRUE | TRUE | D | | RP | 120 N | | 27.42 0 | 3.99 | 1.99 | 25.16 | 1.89 | Right | D | A | RCC | PD |
| 4 | 432 1 | 5A 100 | SBB | TRUE | TRUE | M | | RP | 120 RP | 30 | 35.1 0 | 5.8 | 2 | 29.38 | 1.9 | Rt Prox | D | A | CV;RCC | DP |
| | | | | | | | | | | | | | | 3.04 | 1.7 | Distal | D | SA | CV | DP |
| 4 | 433 1 | 5A 110 | SBB | TRUE | TRUE | M | | R | 180 RS | 140 | 16.02 13.27 | 4.06 | 2.23 | 2.86 | 2.65 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 10.51 | 1.92 | Lt Partial | D | A | R | |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | 3 | 1.15 | Lt Dist | D | A | CV | PD;RL |
| | | | | | | | | | | | | | | | | | | 1.75 | 1.06 | Distal | D | A | R | RL |
| 4 | 434 | 1 | 5A | 110 | SBB | FALSE | TRUE | M | 01 | S | 30 | R | 180 | 12.79 | 0 | 4.06 | 2.31 | 12.39 | 2.47 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | | 2.93 | 1.92 | Distal | D | SA | R | |
| 4 | 435 | 1 | 6A | 100 | SBB | TRUE | TRUE | D | | R | 170 | N | | 21.12 | 6.86 | 4.79 | 3.12 | 3.03 | 1.57 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | | 19.22 | 2.88 | Left | D | A | R | DP |
| 4 | 436 | 1 | 6D | 100 | SBB | FALSE | TRUE | M | 01;56 | S | 30 | S | 10 | 12 | 0 | 4.4 | 1.87 | 9.73 | 1.68 | Right | D | SA | R | |
| 4 | 437 | 1 | 6B | 110 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 120 | 25.61 | 16.76 | 7.03 | 2.46 | 22.72 | 2.51 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | | 11.46 | 1.75 | Lt Partial | D | A | R | |
| 4 | 438 | 1 | 5A | 110 | SBB | TRUE | TRUE | M | 789;4 | R | 160 | R | 30 | 29.41 | 0 | 6.35 | 2.02 | 5.56 | 1.01 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | | 22.76 | 0.85 | Right | D | SA | R | |
| | | | | | | | | | | | | | | | | | | 7.93 | 0.33 | Distal | D | A | R | |
| 4 | 439 | 1 | 3C | 110 | LUNATE | FALSE | TRUE | M | 01 | S | 180 | RM | 140 | 21.83 | 14.68 | 7.73 | 2.81 | 23.65 | 2.05 | Lt Dist | I | L | CV | DP |
| | | | | | | | | | | | | | | | | | | 1.22 | 1.54 | Distal | D | L | | |
| | | | | | | | | | | | | | | | | | | 6.1 | 1.64 | Distal | I | | | |
| 4 | 440 | 1 | 5A | 110 | LUNATE | FALSE | TRUE | M | 01 | S | 30 | RM | 130 | 24.15 | 12.77 | 8.03 | 2.58 | 9.6 | 1.43 | Lt Partial | I | L | R | DP |
| | | | | | | | | | | | | | | | | | | 6.85 | 2.37 | Lt Partial | D | A | CC | PD |
| | | | | | | | | | | | | | | | | | | 2.88 | 1.81 | Distal | D | A | R | DP |
| | | | | | | | | | | | | | | | | | | 3.3 | 1.48 | Distal | | | | |
| 4 | 441 | 1 | 3C | 100 | ARCHED BACKED | TRUE | TRUE | M | | RP | 60 | S | 140 | 33.58 | 22.92 | 8.39 | 3.5 | 6.42 | 3.05 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | | 26.7 | 3.12 | Left | D | A | ICV | DP;PD |
| 4 | 442 | 1 | 6C | 100 | TRAP/RECT | TRUE | TRUE | M | | RP | 30 | R | 160 | 17.48 | 0 | 6.54 | 2.2 | 2.5 | 0.69 | Proximal | D | L | R | |
| | | | | | | | | | | | | | | | | | | 13.19 | 1.68 | Left | D | SA | RSIN | PD |
| | | | | | | | | | | | | | | | | | | 5.59 | 1.64 | Distal | D | SA | R | LR |
| 4 | 443 | 1 | 6D | 100 | SBB BILATERAL | TRUE | TRUE | M | | R | 50 | R | 120 | 18.83 | 0 | 2.8 | 1.23 | 16.11 | 1.28 | Lt Prox | D | A | CV;R | PD |
| | | | | | | | | | | | | | | | | | | 2.55 | 1.04 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | | 9.64 | 0.8 | Rt Partial | D | SA | R | DP |
| 4 | 444 | 1 | 5C | 110 | SBB | TRUE | TRUE | M | | R | 180 | PT | 140 | 23.75 | 0 | 4.84 | 2.46 | 3.89 | 1.68 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | | 19.21 | 2.95 | Left | D | A;SA | R | |
| 4 | 445 | 1 | 5B | 100 | SBB | TRUE | TRUE | M | | R | 180 | PT | 120 | 21.47 | 0 | 4.22 | 2.54 | 3.42 | 1.45 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | | 16.34 | 2.59 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | | 4.34 | 1.93 | Distal | | | | |
| 4 | 446 | 1 | 3B | 110 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 22.08 | 7.53 | 5.05 | 2.11 | 18.46 | 1.87 | Right | D | A | CV;R | PD |
| | | | | | | | | | | | | | | | | | | 2.53 | 0.99 | Distal | D | SA | R | LR |
| | | | | | | | | | | | | | | | | | | 6.12 | 0.89 | Lt Partial | D | L | R | |
| 4 | 447 | 1 | 5C | 110 | ARCHED BACKED | TRUE | TRUE | M | | R | 120 | R | 180 | 24.66 | 16.42 | 6.72 | 2.83 | 26 | 2.46 | Rt Prox | D;B;D | A | CVI | |
| | | | | | | | | | | | | | | | | | | 3.82 | 1.99 | Distal | D | SA | R | |
| 4 | 448 | 1 | 6C | 110 | ARCHED BACKED | TRUE | TRUE | M | | RS | 50 | R | 180 | 18.93 | 8.56 | 4.98 | 2.3 | 14.52 | 2.44 | Lt Prox | B | SA;A | R,CV,R | |
| | | | | | | | | | | | | | | | | | | 3.26 | 1.44 | Distal | D | A | R | |
| 4 | 449 | 1 | 6D | 100 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 180 | S | 180 | 16.63 | 0 | 5.45 | 2.35 | 4.17 | 0.77 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | | 17.1 | 2.38 | Left | D;B | A | CV | |
| | | | | | | | | | | | | | | | | | | 13.7 | 1.15 | Right | | L | CC | DP |
| 4 | 450 | 1 | 6B | 110 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 60 | S | 180 | 21.11 | 8.7 | 4.2 | 2.57 | 5.58 | 1.94 | Proximal | D | A | CV,CC | |
| | | | | | | | | | | | | | | | | | | 13.47 | 2.45 | Left | D;B | A | R | |
| 4 | 451 | 1 | 6D | 100 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | RS | 50 | 22.92 | 0 | 4.8 | 2.2 | 23.99 | 2 | Lt Prox | D | SA;A | CV;R | DP |
| 4 | 452 | 1 | 5A | 110 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 30 | S | 180 | 24.63 | 4.48 | 8.85 | 3.14 | 4.73 | 1.73 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | | 3.61 | 3.14 | Proximal | D | SA | CC | |
| | | | | | | | | | | | | | | | | | | 19.85 | 2.56 | Left | D | SA;A | CV;R | PD |
| 4 | 453 | 1 | 5C | 110 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 180 | 29 | 11.17 | 6.8 | 3.25 | 7.14 | 1.84 | Proximal | D | L | R | PD |
| | | | | | | | | | | | | | | | | | | 18.71 | 3.26 | Left | D | A | CV;R | |
| 4 | 454 | 1 | 6D | 100 | SBB | FALSE | TRUE | M | 01 | S | 180 | PT | 140 | 20.11 | 1 | 7.89 | 2.39 | 15.95 | 2.39 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | | 5.48 | 2 | Distal | D | | | |
| 4 | 455 | 1 | 4D | 110 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 20 | PT | 130 | 23.83 | 1 | 8.07 | 3.37 | 17.2 | 3.42 | Left | D | A;SA | CV | |
| | | | | | | | | | | | | | | | | | | 5.54 | 2.8 | Distal | D | | | |
| 4 | 456 | 1 | 5C | 130 | SBB | FALSE | TRUE | M | 01;5 | S | 180 | PT | 130 | 31.94 | 8.73 | 6.57 | 3.31 | 31.69 | 3.22 | Left | D | A | CV;R | DP |
| | | | | | | | | | | | | | | | | | | 3.96 | 0.97 | Distal | D | A | RCC | |
| 4 | 457 | 1 | 6B | 120 | SBB | FALSE | TRUE | M | 56 | RS | 180 | S | 180 | 18.83 | 0 | 4.98 | 1.25 | 17.04 | 1.1 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | | 4.98 | 0.53 | Lt Partial | I | L | CV | |
| | | | | | | | | | | | | | | | | | | 1.15 | 0.53 | Proximal | I | A | R | |
| 4 | 458 | 1 | 4B | 120 | SBB | FALSE | TRUE | M | 56 | RS | 20 | S | 180 | 16.7 | 0 | 5.73 | 2.46 | 1.92 | 1.6 | Proximal | D | SA | R | |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 458 | 2 | 4B | 120 | SBB | FALSE | TRUE | M | 56 | RS | 20 | S | 180 | 16.7 | 0 | 5.73 | 2.46 | 15.65 | 2.23 | Left | D | A | RI | |
| 4 | 459 | 1 | 3C | 120 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 160 | 29.79 | 0 | 4.63 | 2.03 | 28.99 | 1.86 | Left | D | SA | R | PD |
| 4 | 460 | 1 | 4C | 130 | SBB | FALSE | TRUE | M | 01 | S | 10 | R | 130 | 26.77 | 16.48 | 8.33 | 3.45 | 26.4 | 3.12 | Right | D | A | R | |
| 4 | 460 | 2 | 4C | 130 | SBB | FALSE | TRUE | M | 01 | S | 10 | R | 130 | 26.77 | 16.48 | 8.33 | 3.45 | 9.06 | 1.56 | Lt Dist | D | L | | |
| 4 | 460 | 3 | 4C | 130 | SBB | FALSE | TRUE | M | 01 | S | 10 | R | 130 | 26.77 | 16.48 | 8.33 | 3.45 | 6.59 | 0.92 | Lt Partial | I | SA | CV | |
| 4 | 461 | 1 | 5C | 130 | SBB | FALSE | TRUE | M | 01;56 | S | | S | | 31.95 | 27.43 | 5.07 | 2.35 | 32.22 | 1.89 | Left | D | A | R | PD |
| 4 | 462 | 1 | 3D | 130 | SBB | TRUE | TRUE | M | | S | 160 | N | | 40.05 | 17.85 | 7.51 | 2.87 | 40.15 | 2.89 | Right | D | A | RCC | |
| 4 | 463 | 1 | 6B | 120 | SBB | FALSE | TRUE | M | 01;56 | S | 160 | S | 180 | 18.24 | 0 | 5.31 | 1.85 | 18.28 | 1.93 | Left | D | A | R | |
| 4 | 464 | 1 | 5D | 130 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 160 | 14.51 | 5.7 | 4.06 | 2.14 | 13.49 | 2.06 | Left | D | A | RCV | PD |
| 4 | 465 | 1 | 5D | 130 | SBB | FALSE | TRUE | M | 01;56 | S | 140 | S | 180 | 14.75 | 0 | 4.48 | 1.64 | 14.49 | 1.52 | Left | D | A | R | PD |
| 4 | 466 | 1 | 5A | 130 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 12.68 | 0 | 4.1 | 2.1 | 12.24 | 2.1 | Right | D | A | RI | |
| 4 | 467 | 1 | 5C | 130 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 170 | 15.91 | 0 | 4.51 | 1.58 | 14.03 | 1.05 | Right | D | A | RCC | |
| 4 | 467 | 2 | 5C | 130 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 170 | 15.91 | 0 | 4.51 | 1.58 | 4.11 | 0.47 | Distal | D | A | R | |
| 4 | 468 | 1 | 5C | 130 | SBB | FALSE | TRUE | M | 56 | S | 180 | R | 180 | 17.24 | 0 | 7.43 | 2.48 | 6.03 | 1.7 | Proximal | D | A | R | |
| 4 | 468 | 2 | 5C | 130 | SBB | FALSE | TRUE | M | 56 | S | 180 | R | 180 | 17.24 | 0 | 7.43 | 2.48 | 16.09 | 2.2 | Right | D | A | R | PD |
| 4 | 469 | 1 | 5A | 130 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 20.91 | 0 | 6.61 | 2.84 | 19.97 | 2.49 | Right | B | A | R | |
| 4 | 469 | 2 | 5A | 130 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 20.91 | 0 | 6.61 | 2.84 | 11.53 | 0.49 | Lt Partial | D | L | I | |
| 4 | 470 | 1 | 5C | 120 | SBB | FALSE | TRUE | M | 01 | S | 30 | R | 180 | 16.5 | 0 | 4.56 | 1.76 | 15.81 | 1.76 | Right | D | SA | R | DP |
| 4 | 470 | 2 | 5C | 120 | SBB | FALSE | TRUE | M | 01 | S | 30 | R | 180 | 16.5 | 0 | 4.56 | 1.76 | 3.2 | 1.25 | Distal | D | SA | R | |
| 4 | 471 | 1 | 3C | 120 | SBB | TRUE | TRUE | M | | PT | 140 | N | | 23.94 | 23.21 | 6.37 | 1.95 | 4.6 | 2.28 | Proximal | D | | | |
| 4 | 471 | 2 | 3C | 120 | SBB | TRUE | TRUE | M | | PT | 140 | N | | 23.94 | 23.21 | 6.37 | 1.95 | 21.11 | 1.75 | Right | D | A | R | |
| 4 | 471 | 3 | 3C | 120 | SBB | TRUE | TRUE | M | | PT | 140 | N | | 23.94 | 23.21 | 6.37 | 1.95 | 21.66 | 0.74 | Left | I | L | R | |
| 4 | 472 | 1 | 5A | 130 | ARCHED BACKED | FALSE | TRUE | M | 56;234 | PT | 120 | S | 180 | 14.9 | 4.6 | 2.51 | 1.89 | 5.16 | 1.4 | Proximal | D | | | |
| 4 | 472 | 2 | 5A | 130 | ARCHED BACKED | FALSE | TRUE | M | 56;234 | PT | 120 | S | 180 | 14.9 | 4.6 | 2.51 | 1.89 | 12.84 | 1.89 | Right | D | A | R;CV | |
| 4 | 473 | 1 | 6A | 120 | SBB | FALSE | TRUE | M | 56 | PT | 20 | S | 180 | 14.9 | 4.5 | 6.59 | 1.97 | 7.11 | 1.85 | Proximal | D | | | |
| 4 | 473 | 2 | 6A | 120 | SBB | FALSE | TRUE | M | 56 | PT | 20 | S | 180 | 14.9 | 4.5 | 6.59 | 1.97 | 12.28 | 1.8 | Left | D | SA | CV;R | |
| 4 | 474 | 1 | 6B | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | PT | 30 | S | 180 | 14.77 | 5.47 | 5.32 | 1.79 | 4.17 | 1.67 | Distal | D | | | |
| 4 | 474 | 2 | 6B | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | PT | 30 | S | 180 | 14.77 | 5.47 | 5.32 | 1.79 | 12.81 | 1.72 | Left | D | A | CV;R | |
| 4 | 475 | 1 | 3D | 130 | IRR BB | FALSE | TRUE | M | 56 | PT | 30 | S | 30 | 13.29 | 12.89 | 7.78 | 2.49 | 6.31 | 2.56 | Proximal | D | | | |
| 4 | 475 | 2 | 3D | 130 | IRR BB | FALSE | TRUE | M | 56 | PT | 30 | S | 30 | 13.29 | 12.89 | 7.78 | 2.49 | 13.51 | 2.43 | Left | D | A | SIN | |
| 4 | 476 | 1 | 5D | 130 | SBB | TRUE | TRUE | M | | R | 180 | PT | 140 | 18.95 | 0 | 5.64 | 3.1 | 4.62 | 3 | Proximal | D | SA | R | |
| 4 | 476 | 2 | 5D | 130 | SBB | TRUE | TRUE | M | | R | 180 | PT | 140 | 18.95 | 0 | 5.64 | 3.1 | 13.44 | 3 | Left | B | A | RCC | |
| 4 | 476 | 3 | 5D | 130 | SBB | TRUE | TRUE | M | | R | 180 | PT | 140 | 18.95 | 0 | 5.64 | 3.1 | 7.47 | 2 | Distal | D | | | |
| 4 | 477 | 1 | 3C | 130 | SBB | TRUE | TRUE | M | | PT | 50 | R | 180 | 28.27 | 0 | 4.8 | 2.55 | 6.57 | 2.47 | Proximal | D | | | |
| 4 | 477 | 2 | 3C | 130 | SBB | TRUE | TRUE | M | | PT | 50 | R | 180 | 28.27 | 0 | 4.8 | 2.55 | 23.5 | 2.33 | Left | B | A | R | |
| 4 | 477 | 3 | 3C | 130 | SBB | TRUE | TRUE | M | | PT | 50 | R | 180 | 28.27 | 0 | 4.8 | 2.55 | 3.01 | 1.46 | Distal | D | SA | R | |
| 4 | 478 | 1 | 4B | 130 | RET B | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 26.16 | 0 | 8.15 | 1.86 | 25.29 | 1.11 | Right | D | L | R | |
| 4 | 478 | 2 | 4B | 130 | RET B | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 26.16 | 0 | 8.15 | 1.86 | 5.13 | 0.72 | Distal | D | SA | R | |
| 4 | 478 | 3 | 4B | 130 | RET B | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 26.16 | 0 | 8.15 | 1.86 | 9.42 | 0.4 | Lt Partial | D | L | R | |
| 4 | 479 | 1 | 5A | 130 | SBB W/ NOTCH | FALSE | TRUE | P | 56 | N | | S | 180 | 19.61 | 5.99 | 8.82 | 3.21 | 15.56 | 2.03 | Lt Partial | D | A | NOTCH;R | |
| 4 | 480 | 1 | 3B | 130 | IRR BB | TRUE | TRUE | M | | PT | 30 | PT | 140 | 17.97 | 5.96 | 6.43 | 2.61 | 5.21 | 2.35 | Proximal | D | | | |
| 4 | 480 | 2 | 3B | 130 | IRR BB | TRUE | TRUE | M | | PT | 30 | PT | 140 | 17.97 | 5.96 | 6.43 | 2.61 | 11.34 | 2.67 | Left | D | A | CVI | |
| 4 | 480 | 3 | 3B | 130 | IRR BB | TRUE | TRUE | M | | PT | 30 | PT | 140 | 17.97 | 5.96 | 6.43 | 2.61 | 3.59 | 1.83 | Distal | D | | | |
| 4 | 481 | 1 | 5C | 130 | IRR BB | FALSE | TRUE | M | 56 | RP | 40 | S | 180 | 27.43 | 11.07 | 8.64 | 2.88 | 11.24 | 2.99 | Lt Prox | | A | SIN | |
| 4 | 481 | 2 | 5C | 130 | IRR BB | FALSE | TRUE | M | 56 | RP | 40 | S | 180 | 27.43 | 11.07 | 8.64 | 2.88 | 5.24 | 2.27 | Rt Partial | D | L | | |
| 4 | 482 | 1 | 5B | 130 | SBB | TRUE | TRUE | M | | N | | RS | 30 | 24.56 | 6.95 | 10.71 | 4.05 | 18.47 | 2.38 | Lt Partial | D | L;SA | R | PD |
| 4 | 482 | 2 | 5B | 130 | SBB | TRUE | TRUE | M | | N | | RS | 30 | 24.56 | 6.95 | 10.71 | 4.05 | 2.92 | 0.31 | Distal | | L | R | |
| 4 | 483 | 1 | 3B | 130 | IRR BB | FALSE | TRUE | P | 01 | S | 140 | R | 120 | 25.47 | 13.1 | 10.85 | 2.37 | 21.99 | 1.09 | Left | D | SA | CV | PD |
| 4 | 483 | 2 | 3B | 130 | IRR BB | FALSE | TRUE | P | 01 | S | 140 | R | 120 | 25.47 | 13.1 | 10.85 | 2.37 | 16.1 | 0.91 | Rt Partial | D | SA | CV | DP |
| 4 | 484 | 1 | 3D | 120 | IRR BB | TRUE | TRUE | P | 56 | N | | S | 180 | 29.17 | 12.37 | 12.61 | 3.14 | 6.13 | 2.04 | Lt Partial | D | SA | CCR | PD |
| 4 | 485 | 1 | 3D | 120 | SBB | TRUE | TRUE | P | | N | | PT | 120 | 35.75 | 17.26 | 15.92 | 3.28 | 17.85 | 2.73 | Lt Dist | D | SA | R | PD |
| 4 | 485 | 2 | 3D | 120 | SBB | TRUE | TRUE | P | | N | | PT | 120 | 35.75 | 17.26 | 15.92 | 3.28 | 5.67 | 2.57 | Distal | D | | | |
| 4 | 486 | 1 | 5B | 130 | SBB | TRUE | TRUE | P | | N | | PT | 160 | 33.33 | 22.09 | 17.05 | 3.88 | 8.77 | 2.67 | Distal | D | SA | R | LR |
| 4 | 486 | 2 | 5B | 130 | SBB | TRUE | TRUE | P | | N | | PT | 160 | 33.33 | 22.09 | 17.05 | 3.88 | 9.32 | 2.86 | Distal | D | | | |
| 4 | 487 | 1 | 5D | 120 | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | 160 | R | 180 | 21.22 | 6.91 | 4.73 | 2.09 | 23.23 | 1.96 | Left | D;B | A | CV;R | PD |
| 4 | 487 | 2 | 5D | 120 | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | 160 | R | 180 | 21.22 | 6.91 | 4.73 | 2.09 | 10.83 | 1.7 | Rt Partial | | L | CC | PD |
| 4 | 488 | 1 | 5A | 120 | ARCHED BACKED | FALSE | TRUE | M | 01;56 | RP | 60 | S | 180 | 20.7 | 6.77 | 5.06 | 2.52 | 3.43 | 1.97 | Proximal | D | A | CV | RL |
| 4 | 488 | 2 | 5A | 120 | ARCHED BACKED | FALSE | TRUE | M | 01;56 | RP | 60 | S | 180 | 20.7 | 6.77 | 5.06 | 2.52 | 12.35 | 1.75 | Left | D | A | R | |
| 4 | 489 | 1 | 3A | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 160 | 32.15 | 11.05 | 6.2 | 3.17 | 10.65 | 2.02 | Proximal | D | | | |
| 4 | 489 | 2 | 3A | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 160 | 32.15 | 11.05 | 6.2 | 3.17 | 23.47 | 2.33 | Left | D;B | A | CV | |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 489 | 3 | 3A | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 160 | 32.15 | 11.05 | 6.2 | 3.17 | 3.95 | 1.85 | Distal | D | SA | IR | |
| 4 | 490 | 1 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | | 44.13 | 15.24 | 6.6 | 3.23 | 7.36 | 1.6 | Proximal | D | A | R | RL |
| 4 | 490 | 2 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | | 44.13 | 15.24 | 6.6 | 3.23 | 36.25 | 2.83 | Left | D | A | CV;R | DP |
| 4 | 491 | 1 | 5A | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 70 | S | 180 | 23.71 | 14.91 | 6.63 | 2.48 | 22.89 | 2.72 | Lt Prox | D | SA | CV | PD |
| 4 | 492 | 1 | 3A | 120 | ARCHED BACKED | TRUE | TRUE | M | | RS | 70 | R | 180 | 15.41 | 6.54 | 3.93 | 2.09 | 17.46 | 2.16 | Left | D | A | CV | |
| 4 | 492 | 2 | 3A | 120 | ARCHED BACKED | TRUE | TRUE | M | | RS | 70 | R | 180 | 15.41 | 6.54 | 3.93 | 2.09 | 2.87 | 1.79 | Distal | D | SA | R | |
| 4 | 492 | 3 | 3A | 120 | ARCHED BACKED | TRUE | TRUE | M | | RS | 70 | R | 180 | 15.41 | 6.54 | 3.93 | 2.09 | 5.95 | 0.42 | Rt Partial | D | SA | RCC | |
| 4 | 493 | 1 | 6B | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 70 | S | 180 | 22.58 | 11.43 | 5.02 | 2.08 | 7.25 | 1.23 | Proximal | D | A | R | PD |
| 4 | 493 | 2 | 6B | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 70 | S | 180 | 22.58 | 11.43 | 5.02 | 2.08 | 12.13 | 2.13 | Left | D | A | R | |
| 4 | 494 | 1 | 4C | 130 | ARCHED BACKED | FALSE | TRUE | M | 56 | RS | 50 | S | 180 | 19.77 | 7.41 | 4.41 | 2.08 | 14.14 | 1.84 | Lt Prox | D;B | A | CV;R | |
| 4 | 495 | 1 | 5C | 120 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 70 | S | 180 | 13.41 | 8.69 | 4.39 | 1.79 | 14.14 | 1.41 | Lt Prox | D | SA;A | CV;R | RL |
| 4 | 496 | 1 | 3D | 120 | ARCHED BACKED | FALSE | TRUE | M | 56;4 | RP | 50 | S | 50 | 25.93 | 9.81 | 6.42 | 2.71 | 23.17 | 2.58 | Lt Prox | D;B | A | CV | |
| 4 | 496 | 2 | 3D | 120 | ARCHED BACKED | FALSE | TRUE | M | 56;4 | RP | 50 | S | 50 | 25.93 | 9.81 | 6.42 | 2.71 | 16.23 | 0.65 | Right | D | SA | CC | DP |
| 4 | 497 | 1 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | PT | 60 | R | 180 | 21.05 | 9.47 | 5.01 | 1.93 | 7.63 | 1.46 | Proximal | D | | | |
| 4 | 497 | 2 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | PT | 60 | R | 180 | 21.05 | 9.47 | 5.01 | 1.93 | 12.77 | 2.23 | Left | I;B | A | CVR | PD |
| 4 | 497 | 3 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | PT | 60 | R | 180 | 21.05 | 9.47 | 5.01 | 1.93 | 3.3 | 1.31 | Distal | D | SA | R | |
| 4 | 497 | 4 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | PT | 60 | R | 180 | 21.05 | 9.47 | 5.01 | 1.93 | 11.51 | 0.84 | Rt Partial | D | L | CCR | |
| 4 | 498 | 1 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 21.62 | 8.31 | 4.87 | 2.43 | 20.47 | 2.51 | Lt Prox | D;I | A | CV;R | |
| 4 | 498 | 2 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 21.62 | 8.31 | 4.87 | 2.43 | 3.23 | 1.97 | Distal | D | SA | R | |
| 4 | 498 | 3 | 3B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 21.62 | 8.31 | 4.87 | 2.43 | 6.1 | 0.58 | Rt Partial | D | L | RCC | |
| 4 | 499 | 1 | 3D | 120 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 21.67 | 11.74 | 4.95 | 2.22 | 22.64 | 2.32 | Lt Prox | D;B;I | A | CV | RL;PD |
| 4 | 499 | 2 | 3D | 120 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 21.67 | 11.74 | 4.95 | 2.22 | 3.03 | 1.71 | Distal | D | SA | R | |
| 4 | 499 | 3 | 3D | 120 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 21.67 | 11.74 | 4.95 | 2.22 | 5.86 | 0.66 | Rt Partial | D | L | R | |
| 4 | 500 | 1 | 4B | 110 | ARCHED BACKED | TRUE | TRUE | M | 234 | R | 40 | R | 180 | 25.58 | 8.57 | 5.58 | 2.9 | 28.08 | 2.34 | Lt Prox | D | SA | CV;R | PD |
| 4 | 500 | 2 | 4B | 110 | ARCHED BACKED | TRUE | TRUE | M | 234 | R | 40 | R | 180 | 25.58 | 8.57 | 5.58 | 2.9 | 3.94 | 1.08 | Distal | D | A | RCC | LR |
| 4 | 501 | 1 | 5B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 25.97 | 11.32 | 5.91 | 2.25 | 3.65 | 3.12 | Proximal | D | A | CC | |
| 4 | 501 | 2 | 5B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 25.97 | 11.32 | 5.91 | 2.25 | 18.99 | 2.01 | Left | D | A | R | |
| 4 | 501 | 3 | 5B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 25.97 | 11.32 | 5.91 | 2.25 | 3.79 | 2.19 | Distal | D | SA | R | |
| 4 | 501 | 4 | 5B | 130 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 | R | 180 | 25.97 | 11.32 | 5.91 | 2.25 | 12.19 | 0.73 | Rt Partial | D | SA | R | |
| 4 | 502 | 1 | 4A | 130 | SBB PT | FALSE | TRUE | M | 56 | R | | S | 180 | 19.63 | 0 | 3.48 | 1.95 | 19.99 | 1.77 | Lt Prox | D | A | CV;R | |
| 4 | 502 | 2 | 4A | 130 | SBB PT | FALSE | TRUE | M | 56 | R | | S | 180 | 19.63 | 0 | 3.48 | 1.95 | 17.03 | 0.53 | Right | D | L | R | |
| 4 | 503 | 1 | 6D | 120 | IRR BB | TRUE | TRUE | M | | R | 160 | N | | 34.66 | 25.66 | 7.96 | 2.86 | 2.5 | 1.51 | Proximal | D | SA | CV | |
| 4 | 503 | 2 | 6D | 120 | IRR BB | TRUE | TRUE | M | | R | 160 | N | | 34.66 | 25.66 | 7.96 | 2.86 | 33.18 | 2.76 | Right | D | A | CC | |
| 4 | 504 | 1 | 3C | 120 | IRR BB | TRUE | TRUE | M | | R | 30 | R | | 37.25 | 28.18 | 7.47 | 2.15 | 4.56 | 2.47 | Proximal | D | SA | RCC | |
| 4 | 504 | 2 | 3C | 120 | IRR BB | TRUE | TRUE | M | | R | 30 | R | | 37.25 | 28.18 | 7.47 | 2.15 | 31.79 | 1.71 | Left | D | A | CC | PD |
| 4 | 504 | 3 | 3C | 120 | IRR BB | TRUE | TRUE | M | | R | 30 | R | | 37.25 | 28.18 | 7.47 | 2.15 | 3 | 0.2 | Distal | | A | CV | |
| 4 | 505 | 1 | 5C | 140 | ARCHED BACKED | TRUE | TRUE | M | | S | 180 | R | 180 | 15.36 | 0 | 4.12 | 2.07 | 12.86 | 1.97 | Lt Partial | D | A | CV | |
| 4 | 505 | 2 | 5C | 140 | ARCHED BACKED | TRUE | TRUE | M | | S | 180 | R | 180 | 15.36 | 0 | 4.12 | 2.07 | 3.16 | 1.6 | Distal | D | SA | R | |
| 4 | 505 | 3 | 5C | 140 | ARCHED BACKED | TRUE | TRUE | M | | S | 180 | R | 180 | 15.36 | 0 | 4.12 | 2.07 | 14.68 | 1.3 | Right | D | L | CC | |
| 4 | 506 | 1 | 6B | 140 | ARCHED BACKED | FALSE | TRUE | M | 56;234 | RP | 50 | S | 180 | 21.93 | 0 | 6.57 | 2.08 | 2.82 | 0.97 | Proximal | D | A | CV | |
| 4 | 506 | 2 | 6B | 140 | ARCHED BACKED | FALSE | TRUE | M | 56;234 | RP | 50 | S | 180 | 21.93 | 0 | 6.57 | 2.08 | 16.35 | 2.65 | Left | D | A | CVI | |
| 4 | 507 | 1 | 5C | 160 | ARCHED BACKED | FALSE | TRUE | M | 1 | RS | 180 | PT | 160 | 17.95 | 6.29 | 7.55 | 2.59 | 12 | 2.78 | Lt Prox | D | SA;A | CV | |
| 4 | 507 | 2 | 5C | 160 | ARCHED BACKED | FALSE | TRUE | M | 1 | RS | 180 | PT | 160 | 17.95 | 6.29 | 7.55 | 2.59 | 3.72 | 2.07 | Lt Partial | D | A | R | |
| 4 | 507 | 3 | 5C | 160 | ARCHED BACKED | FALSE | TRUE | M | 1 | RS | 180 | PT | 160 | 17.95 | 6.29 | 7.55 | 2.59 | 3.8 | 1.94 | Distal | D | | | |
| 4 | 508 | 1 | 4A | 160 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 140 | 22.41 | 15.5 | 6.1 | 1.94 | 24.5 | 2.04 | Lt Dist | D | A | R;CV | |
| 4 | 509 | 1 | 4D | 160 | SBB | FALSE | TRUE | M | 01;34 | S | 180 | R | 180 | 23.9 | 5.17 | 6.64 | 3.33 | 24.21 | 3.3 | Left | B | A | CV | |
| 4 | 509 | 2 | 4D | 160 | SBB | FALSE | TRUE | M | 01;34 | S | 180 | R | 180 | 23.9 | 5.17 | 6.64 | 3.33 | 4.48 | 2.22 | Distal | D | SA | R | RL |
| 4 | 510 | 1 | 6B | 150 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 160 | 28.56 | 12.66 | 6.67 | 3.33 | 3.66 | 1.38 | Proximal | D | A | R | |
| 4 | 510 | 2 | 6B | 150 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 160 | 28.56 | 12.66 | 6.67 | 3.33 | 24.93 | 2.8 | Left | D | A | ICV | DP;PD |
| 4 | 510 | 3 | 6B | 150 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 160 | 28.56 | 12.66 | 6.67 | 3.33 | 4.44 | 2.28 | Distal | D | A | RI | |
| 4 | 510 | 4 | 6B | 150 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 160 | 28.56 | 12.66 | 6.67 | 3.33 | 4.18 | 0.6 | Rt Partial | D | L | NOTCH | |
| 4 | 511 | 1 | 5D | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 30 | 18.54 | 1 | 6.15 | 2.69 | 6.08 | 1.51 | Proximal | D | A | R | |
| 4 | 511 | 2 | 5D | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 30 | 18.54 | 1 | 6.15 | 2.69 | 12.78 | 2.61 | Left | D | A | CV | PD |
| 4 | 511 | 3 | 5D | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 30 | 18.54 | 1 | 6.15 | 2.69 | 18.22 | 1.16 | Right | D | L | R | PD |
| 4 | 512 | 1 | 5A | 160 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 22.64 | 10.65 | 5.33 | 2.9 | 5.13 | 1.9 | Proximal | D | A | R | RL |
| 4 | 512 | 2 | 5A | 160 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 22.64 | 10.65 | 5.33 | 2.9 | 18.32 | 2.65 | Left | B | A | CV | DP |
| 4 | 512 | 3 | 5A | 160 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 | R | 180 | 22.64 | 10.65 | 5.33 | 2.9 | 3.39 | 2.14 | Distal | D | A | R | LR |
| 4 | 513 | 1 | 3C | 150 | ARCHED BACKED | TRUE | TRUE | M | | R | 50 | R | 170 | 26.81 | 15.24 | 7.32 | 3.2 | 29.87 | 1.97 | Lt Prox | D | A;SA | CV | PD |
| 4 | 514 | 1 | 5A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 60 | R | 180 | 25.71 | 9.23 | 6.03 | 2.4 | 3.3 | 1.46 | Proximal | D | L | R | RL |
| 4 | 514 | 2 | 5A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 60 | R | 180 | 25.71 | 9.23 | 6.03 | 2.4 | 23.3 | 2.06 | Left | D | SA | CV | PD |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 514 | 3 | 5A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 60 R | 180 | 25.71 | 9.23 | 6.03 | 2.4 | 3.29 | 0.69 | Distal | D | A | R | |
| 4 | 514 | 4 | 5A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 60 R | 180 | 25.71 | 9.23 | 6.03 | 2.4 | 5.27 | 0.4 | Rt Partial | I | SA | R | |
| 4 | 515 | 1 | 4A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 R | 10 | 19.48 | 8.02 | 4.18 | 2.19 | 2.5 | 0.89 | Proximal | D | A | R | RL |
| 4 | 515 | 2 | 4A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 R | 10 | 19.48 | 8.02 | 4.18 | 2.19 | 17.75 | 2.29 | Left | D | A | CV | |
| 4 | 515 | 3 | 4A | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 R | 10 | 19.48 | 8.02 | 4.18 | 2.19 | 2.37 | 1.32 | Distal | D | SA | CV | |
| 4 | 516 | 1 | 3A | 140 | RET B | FALSE | TRUE | M | 01;56 | S | 80 S | 170 | 14.3 | 0 | 5.79 | 1.73 | 9.11 | 0.59 | Lt Partial | D | SA | R | PD |
| 4 | 516 | 2 | 3A | 140 | RET B | FALSE | TRUE | M | 01;56 | S | 80 S | 170 | 14.3 | 0 | 5.79 | 1.73 | 13.22 | 1.09 | Right | D | L | R | PD |
| 4 | 517 | 1 | 3B | 150 | SCALENE BB | FALSE | TRUE | M | 56 | RP | 50 S | 180 | 16.33 | 10.17 | 6.29 | 2.32 | 8.14 | 1.97 | Proximal | D | A | RI | PD |
| 4 | 517 | 2 | 3B | 150 | SCALENE BB | FALSE | TRUE | M | 56 | RP | 50 S | 180 | 16.33 | 10.17 | 6.29 | 2.32 | 7.59 | 2.11 | Left | D | A | R | |
| 4 | 517 | 3 | 3B | 150 | SCALENE BB | FALSE | TRUE | M | 56 | RP | 50 S | 180 | 16.33 | 10.17 | 6.29 | 2.32 | 15.49 | 0.72 | Right | D | L | R | DP |
| 4 | 518 | 1 | 4A | 150 | SBB | FALSE | TRUE | M | 01;56;89 | S | 180 | 10 | 22.55 | 0 | 5.29 | 2.04 | 21.48 | 2 | Right | B | A | RCC | |
| 4 | 518 | 2 | 4A | 150 | SBB | FALSE | TRUE | M | 01;56;89 | S | 180 | 10 | 22.55 | 0 | 5.29 | 2.04 | 4.83 | 0.68 | Lt Partial | D | L | R | PD |
| 4 | 519 | 1 | 3C | 150 | SBB | FALSE | TRUE | M | 01;56;P | S | 180 S | 160 | 14.8 | 0 | 3.39 | 2.28 | 14.45 | 1.9 | Right | D | A | R;CC | DP |
| 4 | 520 | 1 | 5B | 140 | SBB | FALSE | TRUE | M | 01 | S | 170 R | 180 | 26.77 | 0 | 4.87 | 2.66 | 25.1 | 2.16 | Left | D | A | CC;R | PD |
| 4 | 520 | 2 | 5B | 140 | SBB | FALSE | TRUE | M | 01 | S | 170 R | 180 | 26.77 | 0 | 4.87 | 2.66 | 3.45 | 1.31 | Distal | D | A | RCC | LR |
| 4 | 520 | 3 | 5B | 140 | SBB | FALSE | TRUE | M | 01 | S | 170 R | 180 | 26.77 | 0 | 4.87 | 2.66 | 3.37 | 0.86 | Lt Partial | | L | | DP |
| 4 | 521 | 1 | 3D | 140 | ARCHED BACKED W/ NOTCH | TRUE | TRUE | M | 2 | R | 50 PT | 120 | 20.85 | 5.88 | 7.06 | 3.51 | 7.16 | 2.77 | Proximal | D | A | NOTCH | |
| 4 | 521 | 2 | 3D | 140 | ARCHED BACKED W/ NOTCH | TRUE | TRUE | M | 2 | R | 50 PT | 120 | 20.85 | 5.88 | 7.06 | 3.51 | 12.14 | 3.49 | Left | D | A | CV | |
| 4 | 521 | 3 | 3D | 140 | ARCHED BACKED W/ NOTCH | TRUE | TRUE | M | 2 | R | 50 PT | 120 | 20.85 | 5.88 | 7.06 | 3.51 | 9.68 | 2.43 | Distal | D | | | |
| 4 | 522 | 1 | 5B | 160 | SBB | TRUE | TRUE | P | | N | MB | 130 | 15.21 | 6.47 | 8.05 | 2.32 | 11.21 | 1.25 | Lt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 9.12 | 1.64 | Rt Dist | I | | | |
| | | | | | | | | | | | | | | | | | 3.32 | 0.51 | Distal | D | L | R | DP |
| 4 | 523 | 1 | 4B | 160 | SCALENE BB | FALSE | TRUE | M | 56 | RS | 160 S | 10 | 37.48 | 14.97 | 6.94 | 2.79 | 1.35 | 0.38 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 14.54 | 2.92 | Lt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 25.43 | 2.74 | Lt Partial | D | A | R | PD |
| 4 | 524 | 1 | 3D | 160 | SBB | FALSE | TRUE | M | 56 | R | 10 S | 170 | 21.73 | 0 | 7.84 | 2.9 | 6.6 | 2.55 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | | | | 18.48 | 2.38 | Left | D | SA | R | |
| 4 | 525 | 1 | 5B | 160 | ARCHED BACKED | FALSE | TRUE | M | 56 | PT | 50 S | 180 | 16.95 | 12.39 | 5.25 | 2.27 | 8.42 | 2.18 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 9.72 | 2.34 | Left | D | A | CV | |
| | | | | | | | | | | | | | | | | | 5.36 | 0.47 | Rt Partial | D | SA | R | |
| 4 | 526 | 1 | 4A | 150 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 70 S | 30 | 16.96 | 15.52 | 5.35 | 2.67 | 4.99 | 1.89 | Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 7.26 | 2.5 | Left | D | A | CV | |
| 4 | 527 | 1 | 5B | 140 | SBB | FALSE | TRUE | M | 56 | PT | 40 S | 180 | 19.78 | 15.75 | 5.05 | 2.33 | 6.58 | 1.75 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 15.62 | 2.44 | Left | D | A | R | PD |
| 4 | 528 | 1 | 5C | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 S | 10 | 23.62 | 13.19 | 6.64 | 2.2 | 9.87 | 2.31 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 23.75 | 2.02 | Lt Prox | D | A | CV;R | PD |
| 4 | 529 | 1 | 5D | 140 | SBB | TRUE | TRUE | M | | PT | 120 R | 110 | 31.59 | 0 | 6.41 | 2.95 | 7.03 | 2.67 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 26.36 | 2.77 | Right | B | A | R | |
| | | | | | | | | | | | | | | | | | 6.4 | 1.53 | Rt Prox | D | L | CV;R | DP |
| 4 | 530 | 1 | 5C | 150 | ARCHED BACKED | TRUE | TRUE | M | | RP | 70 PT | 140 | 28.09 | 9.74 | 5.26 | 2.64 | 3.335 | 1.77 | Proximal | D | SA | CV | RL |
| | | | | | | | | | | | | | | | | | 21.01 | 2.32 | Left | B | A | CV | PD |
| | | | | | | | | | | | | | | | | | 3.99 | 1.87 | Distal | D | | | |
| | | | | | | | | | | | | | | | | | 22.51 | 1.4 | Right | D | SA | CC | |
| 4 | 531 | 1 | 5C | 140 | ARCHED BACKED | TRUE | TRUE | M | | RP | 50 R | 180 | 16.5 | 5.64 | 4.33 | 2.14 | 4.6 | 1.42 | Proximal | D | SA | CV | |
| | | | | | | | | | | | | | | | | | 10.02 | 2.01 | Left | D | A | CV | PD |
| | | | | | | | | | | | | | | | | | 3.02 | 1.23 | Distal | D | A | R | LR |
| 4 | 532 | 1 | 3B | 140 | SBB | TRUE | TRUE | M | | RS | 170 PT | 50 | 26.77 | 0 | 5.08 | 2.44 | 1.31 | 0.67 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 22.18 | 2.22 | Right | D;B | A | R | DP;PD |
| | | | | | | | | | | | | | | | | | 4.02 | 2.37 | Distal | D | | | |
| 4 | 533 | 1 | 3A | 140 | SBB | TRUE | TRUE | M | | PT | 140 R | 180 | 12.35 | 0 | 3.69 | 1.91 | 4.1 | 1.6 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 9.44 | 1.39 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 2.97 | 0.67 | Distal | D | A | R | RL |
| 4 | 534 | 1 | 4A | 160 | ARCHED BACKED | TRUE | TRUE | M | | R | 180 PT | 130 | 18.03 | 0 | 4.46 | 2.24 | 3.71 | 1.72 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 14.39 | 2.16 | Left | D | SA | RCV | DP |
| | | | | | | | | | | | | | | | | | 4.24 | 1.75 | Distal | D | | | |
| 4 | 535 | 1 | 4D | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 70 S | 180 | 22.76 | 0 | 3.95 | 2.03 | 25.06 | 2.05 | Lt Prox | D | SA;A | CV;R | PD |
| | | | | | | | | | | | | | | | | | 4.59 | 0.87 | Rt Partial | D | L | NOTCH;R | |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 536 | 1 | 3A | 140 | SBB | FALSE | TRUE | P | 56 | N | S | 10 | 19.33 | 0 | 3.69 | 1.81 | 19.14 | 1.52 | Right | I;D | A | R | PD |
| | | | | | | | | | | | | | | | | | 6.28 | 0.46 | Lt Partial | D | L | R | PD |
| 4 | 537 | 1 | 3B | 140 | SBB | TRUE | TRUE | M | 01 | R | 180 R | 180 | 17.14 | 0 | 4.23 | 2.27 | 16.47 | 2.44 | Right | D | SA | RI | PD |
| | | | | | | | | | | | | | | | | | 3.42 | 0.57 | Distal | D | A | R | LR |
| 4 | 538 | 1 | 6B | 140 | SBB | TRUE | TRUE | M | | R | 20 RN | 100 | 31.53 | 0 | 4.75 | 2.96 | 4.16 | 2.47 | Proximal | D | SA | CV | |
| | | | | | | | | | | | | | | | | | 29.98 | 3.28 | Left | D | SA | R | PD |
| 4 | 539 | 1 | 3B | 140 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 10.35 | 0 | 4.58 | 2.56 | 9.98 | 2.75 | Left | D | A | R | PD |
| 4 | 540 | 1 | 4B | 140 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 12.83 | 0 | 4.3 | 1.63 | 12.86 | 1.66 | Left | B | A | R | |
| 4 | 541 | 1 | 4D | 150 | SBB | FALSE | TRUE | M | 56 | R | 170 S | 170 | 16.31 | 0 | 5.7 | 2.36 | 5.3 | 2.53 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 15.64 | 1.41 | Right | D | L | R | PD |
| 4 | 542 | 1 | 5C | 150 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 13.32 | 0 | 4.62 | 2.45 | 11.84 | 2.5 | Left | B;D | A | RCC | PD;DP |
| 4 | 543 | 1 | 3A | 140 | SBB | TRUE | TRUE | M | 01;56 | S | 160 S | 10 | 34 | 20.34 | 7.11 | 2.71 | 32.05 | 2.38 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 3.3 | 0.84 | Lt Partial | D | SA | CC | PD |
| | | | | | | | | | | | | | | | | | 4.3 | 0.66 | Lt Partial | D | SA | R | |
| 4 | 544 | 1 | 4B | 160 | SBB | FALSE | TRUE | M | 01;5 | S | 180 PT | 150 | 23.69 | 1 | 5.71 | 3.18 | 20.88 | 3.24 | Left | B | SA;A | R | |
| | | | | | | | | | | | | | | | | | 4.04 | 1.72 | Distal | D | | | |
| 4 | 545 | 1 | 4D | 140 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 160 | 21.19 | 0 | 5.45 | 1.9 | 19.87 | 1.67 | Left | D | A | RI | PD |
| 4 | 546 | 1 | 3D | 160 | SBB | TRUE | TRUE | M | | R | 30 RP | 130 | 24.07 | 0 | 4.3 | 2.29 | 3.26 | 1.77 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 17.81 | 2.09 | Left | B | A | R | PD;DP |
| | | | | | | | | | | | | | | | | | 2.42 | 1.02 | Distal | D | A | CV | |
| 4 | 547 | 1 | 4D | 150 | ARCHED BACKED | TRUE | TRUE | M | | R | 180 R | 180 | 20.73 | 0 | 3.89 | 2.05 | 3.19 | 1.22 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 22.22 | 2.16 | Left | D | A | IR;ICV | |
| | | | | | | | | | | | | | | | | | 1.28 | 0.62 | Distal | D | A | R | |
| 4 | 548 | 1 | 4D | 150 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 40 S | 180 | 16.51 | 6.74 | 5.35 | 2.29 | 3.91 | 1 | Proximal | D | SA | | |
| | | | | | | | | | | | | | | | | | 11.28 | 2.39 | Left | B | A | R | |
| | | | | | | | | | | | | | | | | | 16.3 | 0.75 | Right | D | L | CC;R | DP |
| 4 | 549 | 1 | 3C | 150 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 70 S | 180 | 31.04 | 11.95 | 6.63 | 3.01 | 7.25 | 1.52 | Proximal | D | A | CV | |
| | | | | | | | | | | | | | | | | | 24.52 | 2.8 | Left | B | A | CV;R | |
| 4 | 550 | 1 | 6B | 140 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 50 S | 180 | 28.21 | 10.44 | 5.5 | 2.34 | 3.13 | 1.43 | Proximal | D | A | CV | DP |
| | | | | | | | | | | | | | | | | | 23.36 | 2.22 | Left | D | A | CV;R | PD |
| | | | | | | | | | | | | | | | | | 10.56 | 0.98 | Rt Partial | | L | R | DP |
| 4 | 551 | 1 | 5A | 140 | SBB | TRUE | TRUE | M | | R | 180 RP | 140 | 17.16 | 14.09 | 3.79 | 2.07 | 3.14 | 0.81 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 13.75 | 1.92 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 2.56 | 1.85 | Distal | D | A | R | |
| 4 | 552 | 1 | 4B | 140 | TRIANGLE | TRUE | TRUE | M | | R | 50 R | 130 | 21.27 | 9.72 | 8.35 | 3.14 | 10.63 | 2.06 | Lt Prox | D | A | I | PD |
| | | | | | | | | | | | | | | | | | 13.03 | 3.24 | Lt Dist | D | A | IR | |
| | | | | | | | | | | | | | | | | | 6.01 | 0.74 | Rt Partial | D | L | R | DP |
| 5 | 586 | 1 | 3/45 | | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 11.9 | 0 | 8.4 | 2.69 | 10.21 | 1.45 | Right | D | A | CV;R | DP |
| 5 | 587 | 1 | 3/35 | | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 25.41 | 0 | 8.24 | 3.27 | 22.08 | 2.04 | Right | D | A | R | |
| 5 | 588 | 1 | 3/10 | | BITRUNC | TRUE | TRUE | M | 789 | R | 10 R | 180 | 11.17 | 0 | 8.8 | 1.6 | 6.3 | 1.23 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 6.93 | 1.82 | Distal | D | SA | R | |
| 5 | 589 | 1 | 3/35 | | TRAP/RECT | TRUE | TRUE | M | | R | 170 R | 10 | 18.48 | 0 | 8.49 | 2.6 | 6.83 | 1.47 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 14.36 | 2.18 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 7.44 | 1.89 | Distal | D | SA | R | |
| 5 | 590 | 1 | 3/30 | | TRAP/RECT | TRUE | TRUE | M | | R | 170 R | 10 | 18.4 | 0 | 6.61 | 2.3 | 5.37 | 2.04 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 16.02 | 1.78 | Right | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 6.03 | 1.32 | Distal | D | SA | R | LR |
| 5 | 591 | 1 | 3/25 | | TRAP/RECT | TRUE | TRUE | M | | R | 170 R | 10 | 28.76 | 0 | 8.14 | 1.81 | 8.46 | 1.96 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 25.85 | 2.31 | Right | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 6.97 | 2.38 | Distal | | A | R | |
| 5 | 592 | 1 | 3/20 | | TRAP/RECT | TRUE | TRUE | M | | R | 180 R | 170 | 10.8 | 0 | 6.24 | 1.56 | 6.69 | 1.46 | Proximal | D | A | RCC | LR |
| | | | | | | | | | | | | | | | | | 10.14 | 1.62 | Left | D | A | IR | |
| | | | | | | | | | | | | | | | | | 4.27 | 1.43 | Distal | D | A | IR | LR |
| 5 | 593 | 1 | 3/15 | | TRAP/RECT | TRUE | TRUE | M | | R | 170 R | 180 | 18.56 | 0 | 7.75 | 2.69 | 7.74 | 2.94 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 15.58 | 2.58 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 6.62 | 1.25 | Distal | D | A | R | LR |
| 5 | 594 | 1 | 3/10 | | TRAP/RECT | TRUE | TRUE | M | | R | 170 R | 180 | 22.34 | 0 | 10.19 | 2.56 | 8.21 | 2.41 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 19.2 | 2.25 | Right | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 8.62 | 1.9 | Distal | D | A | R | |
| 5 | 595 | 1 | 3/20 | | SBB | FALSE | TRUE | M | 56 | R | 170 S | 180 | 10.26 | 0 | 5.86 | 1.49 | 8.54 | 0.65 | Left | D | A | R | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 3.54 | 0.64 | Distal | D | A | R | LR |
| 5 | 596 1 | 3/15 | SBB | FALSE | TRUE M | 56 | R | 180 S | 180 | 23.86 0 | 8.3 | 3.06 | 7.86 | 1.74 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 20.74 | 2.75 | Right | D | A | RCC | DP |
| 5 | 597 1 | 3/15 | SBB | FALSE | TRUE M | 01 | S | 160 R | 180 | 20.07 0 | 9.01 | 3.18 | 15.29 | 3.45 | Right | D | A | RCC | |
| | | | | | | | | | | | | | 8.46 | 2.37 | Distal | D | A | R | LR |
| 5 | 598 1 | 3/15 | SBB | FALSE | TRUE M | 56 | R | 180 S | 180 | 9.39 0 | 7.56 | 2.33 | 6.58 | 1.94 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | 8.34 | 2.2 | Left | D | A | R | |
| 5 | 599 1 | 3/15 | SBB | FALSE | TRUE M | 56;3 | R | 170 S | 10 | 26.8 0 | 8.81 | 1.55 | 7.9 | 1.96 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 23.63 | 1.57 | Right | D | SA | R | PD |
| 5 | 600 1 | 3/15 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 180 | 13.3 0 | 6.8 | 2.67 | 12.98 | 2.59 | Left | D | SA | | |
| 5 | 601 1 | 3/20 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 180 | 8.17 0 | 5.36 | 1.98 | 7.76 | 2.05 | Right | D | A | R | |
| 5 | 602 1 | 3/20 | SBB | FALSE | TRUE M | 56 | R | 180 S | 170 | 12.34 0 | 8.6 | 2.2 | 8.01 | 1.97 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 9.89 | 2.21 | Left | D | A | R | |
| 5 | 603 1 | 3/45 | SBB | FALSE | TRUE M | 01;56 | S | 10 S | 180 | 15.34 0 | 5.39 | 1.64 | 14.27 | 0.86 | Left | D | A | R | DP |
| 5 | 604 1 | 3/40 | SBB | FALSE | TRUE M | 01 | S | 180 R | 170 | 10.87 0 | 4.22 | 2.21 | 10.2 | 2 | Left | D | SA | R | |
| | | | | | | | | | | | | | 1.58 | 0.71 | Distal | D | A | R | |
| 5 | 605 1 | 3/35 | SBB | FALSE | TRUE M | 01;789 | S | 180 R | 20 | 16.44 0 | 5.06 | 2.14 | 15.76 | 2.14 | Right | D | A | RCC | PD |
| | | | | | | | | | | | | | 4.62 | 2.03 | Distal | D | A | R | LR |
| 5 | 606 1 | 3/30 | SBB | FALSE | TRUE M | 56 | R | 10 S | 180 | 11.25 0 | 4.88 | 1.49 | 4.15 | 1.12 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 10.15 | 1.11 | Left | D | A | R | DP |
| 5 | 607 1 | 3/25 | SBB | FALSE | FALSE M | 01;56 | SX | 160 SX | 160 | 7.08 0 | 6.59 | 1.02 | 7.13 | 1.3 | | D | A | R | |
| 5 | 608 1 | 3/25 | SBB | FALSE | FALSE M | 01;56 | SX | 180 SX | 160 | 9.56 0 | 4.47 | 2.13 | 8.11 | 2.11 | | B | A | R | |
| 5 | 609 1 | 3/25 | SBB | FALSE | TRUE M | 01 | S | 180 R | 170 | 11.99 0 | 5.31 | 1.87 | 11.1 | 1.06 | Left | D | SA | R | |
| | | | | | | | | | | | | | 4.51 | 1.21 | Distal | D | A | R | LR |
| 5 | 610 1 | 3/25 | SBB | FALSE | TRUE M | 01 | S | 10 R | 10 | 16.3 0 | 5.1 | 2.37 | 16.14 | 1.95 | Right | D | SA | R | |
| | | | | | | | | | | | | | 4.72 | 1.54 | Distal | D | A | RCC | |
| 5 | 611 1 | 3/25 | SBB | FALSE | TRUE M | 56 | R | 180 S | 180 | 13.61 0 | 7.31 | 2.65 | 6.39 | 3.05 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 9.28 | 1.51 | Right | D | SA;A | R | |
| 5 | 612 1 | 6/55 | RET B | FALSE | TRUE M | 01;56 | S | 160 S | 180 | 14.07 0 | 6.84 | 2.35 | 13 | 1.1 | Left | I | L | R | |
| | | | | | | | | | | | | | 13.58 | 0.39 | Right | D | SA | R | |
| 5 | 613 1 | 6/60 | SBB | FALSE | TRUE P | 56 | N | S | 180 | 18.36 0 | 8.24 | 3.58 | 16.33 | 1.26 | Right | D | SA | R | PD |
| 5 | 614 1 | 6/60 | RET B | FALSE | TRUE P | 56 | N | S | 180 | 26.96 0 | 7.85 | 2.96 | 26.14 | 1.16 | Right | D | SA;L | R | DP |
| 5 | 615 1 | 6/55 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 20 | 25.16 0 | 8.91 | 2.68 | 21.62 | 0.78 | Right | D | SA | R | DP |
| 5 | 616 1 | 6/55 | TRAP/RECT | TRUE | TRUE M | | R | 180 R | 180 | 12.49 0 | 6.43 | 1.78 | 5.26 | 1.97 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | 12.05 | 1.89 | Right | D | SA | R | |
| | | | | | | | | | | | | | 5.61 | 1.48 | Distal | D | A | R | |
| 5 | 617 1 | 6/55 | TRAP/RECT | TRUE | TRUE M | | R | 10 R | 180 | 19.61 0 | 6.59 | 2.15 | 6.39 | 1.96 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | 18.67 | 1.64 | Left | D | A | R | |
| | | | | | | | | | | | | | 6.02 | 1.97 | Distal | D | A | R | |
| 5 | 618 1 | 6/50 | SBB | FALSE | TRUE M | 56 | R | 160 S | 180 | 14.37 0 | 4.52 | 1.75 | 4.62 | 1.88 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | 13.38 | 1.86 | Right | D | A | RCC | |
| 5 | 619 1 | 6/50 | SBB | FALSE | TRUE M | 56 | R | 180 S | 180 | 12.37 0 | 4.02 | 1.79 | 3.4 | 1.5 | Proximal | D | A | R | |
| | | | | | | | | | | | | | 12.34 | 1.73 | Right | D | SA;A | R | |
| 5 | 620 1 | 6/55 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 180 | 18.73 0 | 7.25 | 2.65 | 17.68 | 0.71 | Right | D | SA | R | DP |
| 5 | 621 1 | 6/50 | SBB | FALSE | TRUE P | 56 | N | S | 180 | 11.77 0 | 5.84 | 1.68 | 10.37 | 1.3 | Left | D | A | RCC | PD |
| 5 | 622 1 | 6/60 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 180 | 14.01 0 | 9.37 | 3.13 | 13.98 | 3.03 | Right | D | A | IR | DP |
| 5 | 623 1 | 6/60 | SBB | FALSE | TRUE M | 01;56 | S | 180 S | 180 | 10.42 0 | 4.29 | 1.67 | 9.83 | 1.29 | Right | D | A | R | PD |
| 5 | 624 1 | 6/60 | SBB | FALSE | FALSE M | 01;56 | SX | 160 SX | 180 | 16.32 0 | 8.71 | 3.18 | 15.9 | 1.22 | | D | L | R | |
| 5 | 625 1 | 6/60 | SBB | FALSE | FALSE M | 01;56 | SX | 10 SX | 180 | 15.67 0 | 9.01 | 3.09 | 14.49 | 0.89 | | D | SA | R | |
| 5 | 626 1 | 6/40 | SBB | FALSE | TRUE M | 01 | S | 180 R | 10 | 12.45 0 | 8.68 | 2.62 | 11.56 | 2.58 | Right | D | SA | R | DP |
| | | | | | | | | | | | | | 7.48 | 2.1 | Distal | D | A | R | |
| 5 | 627 1 | 6/35 | SBB | FALSE | TRUE M | 56;7 | R | 20 S | 170 | 17.85 0 | 8.36 | 2.26 | 7.8 | 2.92 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | 12.05 | 2.35 | Left | D | A | IR | PD |
| 5 | 628 1 | 6/30 | SBB | FALSE | TRUE M | 56 | R | 180 S | 10 | 15.16 0 | 8.64 | 2.33 | 6.1 | 2.47 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | 13.22 | 1.93 | Right | D | L;SA | R | DP |
| | | | | | | | | | | | | | 11.47 | 0.85 | Left | D | L | RCC | |
| 5 | 629 1 | 6/30 | SBB | FALSE | TRUE M | 56 | R | 180 S | 180 | 18.06 0 | 6.49 | 1.75 | 5.33 | 1.59 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | 15.55 | 1.86 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | 5.14 | 0.35 | Rt Partial | D | SA | NOTCH | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 630 | 1 | 6/45 | SBB | FALSE | TRUE | M | 01;56 | S | 10 | S | 170 | 8.47 | 0 | 3.62 | 1.69 | 7.76 | 1.44 | Left | D | SA | RCC | |
| 5 | 631 | 1 | 6/35 | SBB | FALSE | TRUE | M | 01;56;78 | S | 30 | S | 10 | 18.07 | 0 | 9.23 | 2.03 | 18.07 | 1.35 | Right | D | A | R | PD |
| 5 | 632 | 1 | 6/35 | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 15.64 | 10.23 | 8.07 | 2.96 | 11.92 | 1.62 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 5.58 | 0.44 | Lt Partial | D | A | NOTCH | |
| 5 | 633 | 1 | 6/35 | TRAP/RECT | TRUE | TRUE | M | 789 | R | 180 | R | 10 | 21.53 | 0 | 9.19 | 2.2 | 7.35 | 1.47 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 19.06 | 1.79 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 8.97 | 1.79 | Distal | D | SA | RCC | |
| 5 | 634 | 1 | 6/50 | TRAP/RECT | TRUE | TRUE | M | | RS | 10 | R | 10 | 14.96 | 0 | 8.77 | 3.13 | 2.45 | 1.78 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 14.85 | 1.51 | Right | D | SA | IR | |
| | | | | | | | | | | | | | | | | | 8.21 | 2.49 | Distal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 13.71 | 0.39 | Left | D | SA | R | |
| 5 | 635 | 1 | 6/40 | TRAP/RECT | TRUE | TRUE | M | | R | 180 | R | 180 | 15.55 | 0 | 8.68 | 2.87 | 8.12 | 2.71 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 14.26 | 2.32 | Right | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 7.68 | 2.63 | Distal | D | A | R | |
| 5 | 1442 | 1 | 4/35 | SBB | FALSE | TRUE | M | 56 | R | 35 | S | 170 | 22.43 | | 5.21 | 2.2 | 5.07 | 2.1 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 18.94 | 1.82 | Left | D | A | RSIN | PD |
| 5 | 1443 | 1 | 4/35 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 180 | 10.73 | | 5.75 | 2.48 | 10.56 | 1.93 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 5.36 | 1.62 | Distal | D | SA | R | RL |
| 5 | 1444 | 1 | 4/35 | SBB | FALSE | TRUE | D | 01 | S | 180 | N | | 31.28 | 0 | 7.62 | 3.78 | 21.19 | 1.9 | Rt Partial | D | A | R | |
| 5 | 1445 | 1 | 4/35 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 15 | 13.89 | | 7.45 | 2.92 | 11.7 | 1.15 | Right | D | A | R | |
| 5 | 1446 | 1 | 4/35 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | | 19.76 | | 7.94 | 3.05 | 17.42 | 1.87 | Right | D | SA | R | DP |
| 5 | 1447 | 1 | 4/35 | SBB | TRUE | TRUE | M | | R | 160 | R | 20 | 30.87 | | 10.08 | 2.67 | 9.17 | 1.77 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 26.13 | 2.32 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 9.22 | 2.18 | Distal | D | A | RCC | RL |
| 5 | 1448 | 1 | 4/35 | SBB | FALSE | TRUE | M | 01;45 | S | 180 | S | | 16.19 | | 5.99 | 2.07 | 9.4 | 1.6 | Lt Partial | D | A | CC;R | |
| | | | | | | | | | | | | | | | | | 5.24 | 0.35 | Lt Partial | I | SA | R | DP |
| | | | | | | | | | | | | | | | | | 10.41 | 0.38 | Rt Partial | D | SA | R | PD |
| 5 | 1450 | 1 | 4/30 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 9.84 | | 6.79 | 2.24 | 9.88 | 1.63 | Left | D | SA | R | PD |
| 5 | 1451 | 1 | 4/30 | SBB | FALSE | TRUE | M | 01 | S | 180 | PT | 135 | 20.01 | | 6.58 | | 19.6 | 1.9 | Left | D | A | IR | DP |
| | | | | | | | | | | | | | | | | | 10.18 | 2.8 | Distal | VENTRA | | | |
| | | | | | | | | | | | | | | | | | 4.05 | 1.23 | Distal | D | A | R | RL |
| 5 | 1452 | 1 | 4/30 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 27.37 | 0 | 9.21 | 2.64 | 27.31 | 1.28 | Right | D | SA | R | PD |
| 5 | 1453 | 1 | 4/30 | SBB | FALSE | TRUE | M | 56 | R | 165 | S | 180 | 8.08 | | 5.98 | 1.87 | 5.62 | 1.83 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 7.1 | 1.9 | Right | D | A | R | |
| 5 | 1454 | 1 | 4/30 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 180 | 10.12 | | 5.65 | 1.82 | 5.4 | 1.8 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 9.5 | 1.58 | Left | D | SA | R | PD |
| 5 | 1455 | 1 | 4/30 | RET B | FALSE | TRUE | M | 56 | N | | S | | 26.59 | 20 | 12.53 | 3.22 | 19.87 | 0.75 | Left | D | L | I | PD |
| 5 | 1456 | 1 | 4/30 | RET B | FALSE | TRUE | M | 01;56 | S | 180 | S | 165 | 22.02 | 0 | 9.29 | 4.1 | 21.97 | 0.58 | Right | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 18.29 | 0.74 | Left | D | L | R | PD |
| 5 | 1457 | 1 | 4/25 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 180 | 14.19 | | 5.78 | 1.93 | 5.3 | 2.14 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 14 | 2.17 | Right | D | SA | R | PD |
| 5 | 1458 | 1 | 4/25 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 20 | 10.75 | | 5.94 | 1.43 | 8.62 | 0.84 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.64 | 1.08 | Distal | D | SA | IR | |
| 5 | 1459 | 1 | 4/25 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 135 | 16.51 | 14.16 | 7.29 | 1.23 | 13.09 | 0.58 | Left | D | A | R | PD |
| 5 | 1460 | 1 | 4/25 | SBB | FALSE | TRUE | M | 01;56 | S | 45 | S | 180 | 15.28 | | 7.48 | 2.4 | 11.49 | 1.12 | Left | D | A | R | DP |
| 5 | 1461 | 1 | 4/25 | SBB | TRUE | TRUE | M | | R | 10 | R | 180 | 9.09 | | 6.12 | 1.92 | 6.18 | 2.04 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 6.88 | 2.08 | Left | D | SA | R | RL |
| 5 | 1462 | 1 | 4/20 | RET B | FALSE | TRUE | P | 56 | S | 180 | S | 180 | 19.02 | | 6.35 | 2.71 | 17.23 | 1.01 | Right | D | L | R | DP |
| 5 | 1463 | 1 | 4/20 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 11.47 | | 6.97 | 1.89 | 11.44 | 1.75 | Right | D | L | R | DP |
| 5 | 1464 | 1 | 4/20 | RET B | FALSE | TRUE | P | 56 | N | | S | 180 | 13.01 | | 6.46 | 1.79 | 12.68 | 0.91 | Left | D | SA | D | |
| 5 | 1465 | 1 | 4/20 | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 10.78 | | 6.58 | 2.15 | 10.76 | 2.27 | Left | D | A | RCC | PD |
| 5 | 1466 | 1 | 4/20 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 8.86 | | 6 | 2.65 | 7.72 | 2.42 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 5.53 | 2.72 | Distal | D | A | R | RL |
| 5 | 1467 | 1 | 4/20 | SBB | TRUE | TRUE | M | | R | 15 | R | 180 | 16.17 | | 10.04 | 2.78 | 8.12 | 3.04 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 13.2 | 3.07 | Left | D | SA | IR | PD |
| | | | | | | | | | | | | | | | | | 9.74 | 2.3 | Distal | D | SA | R | RL |
| 5 | 1468 | 1 | 4/20 | SBB | TRUE | TRUE | M | | R | 180 | R | 180 | 14.52 | | 7.58 | 2.53 | 6.35 | 2.4 | Proximal | D | SA | IR | |
| | | | | | | | | | | | | | | | | | 13.68 | 1.92 | Left | D | SA | RCC | DP |
| | | | | | | | | | | | | | | | | | 7.31 | 1.65 | Distal | D | SA | R | LR |
| 5 | 1469 | 1 | 4/20 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 | SX | 180 | 14.16 | | 5.67 | 2.36 | 14.24 | 2.55 | | B | SA;A | R | OPD |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1470 1 | 4/15 | SBB | TRUE | TRUE | M | | R | 20 R | 180 | 14.31 | | 6.95 | 1.46 | 8.1 | 1.41 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | 13.13 | 0.96 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | 2.65 | 0.67 | Distal | D | A | R | |
| 5 | 1471 1 | 4/15 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 7.59 | | 5.65 | 1.69 | 5.14 | 1.63 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | 7.3 | 1.9 | Right | D | SA | R | |
| 5 | 1472 1 | 4/15 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 13.92 | | 6.15 | 1.62 | 4.03 | 1.88 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 13.76 | 1.37 | Left | D | SA | R | |
| 5 | 1473 1 | 4/15 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 135 | 18.13 | | 6.84 | 2.57 | 17.98 | 2.63 | Right | D | A | R | |
| 5 | 1474 1 | 4/15 | SBB | FALSE | TRUE | M | 01;56 | S | S | 160 | 13.3 | | 9.45 | 3.7 | 11.56 | 3.67 | Left | D | A | R | |
| 5 | 1475 1 | 4/15 | SBB | TRUE | TRUE | M | | R | 40 R | 150 | 22.74 | | 7.72 | 3.03 | 6.01 | 2.72 | Proximal | D | SA;A | CV;R | RL |
| | | | | | | | | | | | | | | | 15.7 | 2.37 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 8.4 | 2.45 | Distal | D | A | R | |
| 5 | 1476 1 | 4/25 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 14.92 | | 7.23 | 2.46 | 14.08 | 2.06 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 6 | 2.1 | Distal | D | A | R | LR |
| 5 | 1477 1 | 4/25 | SBB | FALSE | FALSE | M | 56 | RX | 180 SX | 180 | 15.3 | | 6.12 | 2.24 | 4.11 | 2.13 | | D | SA | R | |
| | | | | | | | | | | | | | | | 15.25 | 2.24 | | D | A | R | |
| 5 | 1478 1 | 4/25 | SBB | FALSE | FALSE | M | 56 | RX | 180 SX | 180 | 10.31 | | 6.74 | 2.43 | 6.44 | 2.75 | | D | A | R | |
| | | | | | | | | | | | | | | | 9.39 | 1.93 | | D | SA | R | |
| 5 | 1479 1 | 4/20 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 8.78 | | 4.85 | 2.09 | 8.3 | 1.92 | | D | A | R | |
| 5 | 1480 1 | 4/20 | SBB | FALSE | FALSE | M | 01;56 | SX | 135 SX | 20 | 13.64 | | 6.91 | 2.83 | 13.6 | 1.33 | | D | SA | R | OPD |
| 5 | 1481 1 | 4/25 | SBB | TRUE | FALSE | M | | RX | 180 RX | 180 | 17.4 | | 6.34 | 3.08 | 5.41 | 3.4 | | D | SA | R | ORL |
| | | | | | | | | | | | | | | | 15.29 | 3.09 | | D | A | RCC | |
| | | | | | | | | | | | | | | | 5.51 | 2.45 | | D | SA | R | ORL |
| | | | | | | | | | | | | | | | 17.39 | 0.83 | | D | L | R;CC;R | |
| 5 | 1482 1 | 4/25 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 11.5 | | 5.78 | 2.06 | 10.69 | 1.55 | | D | SA | R | |
| 5 | 1483 1 | 4/20 | SBB | FALSE | FALSE | M | 56 | RX | 20 SX | 180 | 8.4 | | 4.66 | 2.82 | 5.04 | 2.62 | | D | SA | RCC | |
| | | | | | | | | | | | | | | | 7.23 | 2.87 | | D | A | R | |
| 5 | 1484 1 | 4/30 | SBB | FALSE | FALSE | M | 56 | RX | 180 SX | 180 | 11.52 | | 6.64 | 1.29 | 5.19 | 1.2 | | D | A | R | |
| | | | | | | | | | | | | | | | 10.24 | 1.29 | | D | A | R | |
| 5 | 1485 1 | 4/30 | SBB | FALSE | FALSE | M | 01;56 | SX | 165 SX | 170 | 10.37 | | 5.27 | 1.8 | 8.91 | 1.81 | | D | SA | R | |
| 5 | 1486 1 | 4/35 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 7.94 | | 5.77 | 2.07 | 8.35 | 2.02 | | D | SA | R | |
| 5 | 1487 1 | 4/30 | SBB | FALSE | FALSE | M | 01 | SX | 180 RX | 170 | 10.4 | | 5.77 | 2.24 | 9.02 | 2.41 | | D | A | R | OPD |
| | | | | | | | | | | | | | | | 5.65 | 2.3 | | D | SA | R | |
| 5 | 1488 1 | 4/30 | SBB | FALSE | FALSE | M | 01 | SX | 20 RX | 170 | 10.02 | | 5.3 | 1.94 | 8.32 | 2.22 | | D | SA | R | |
| | | | | | | | | | | | | | | | 4.86 | 1.83 | | D | A | R | |
| 5 | 1489 1 | 4/35 | RET B | FALSE | TRUE | P | 56 | N | S | 180 | 19.47 | | 6.46 | 2.28 | 18.11 | 0.57 | Left | D | SA | R | |
| 7 | 752 1 | ? | SBB | TRUE | TRUE | M | | RS | 180 R | 180 | 15.65 | | 9.2 | 3.18 | 8.15 | 0.55 | Proximal | I | A | R | |
| | | | | | | | | | | | | | | | 15.07 | 2.8 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 7.96 | 2.53 | Distal | D | SA;A | IR | |
| | | | | | | | | | | | | | | | 11.33 | 0.49 | Right | I | SA | R | |
| 7 | 753 1 | E37A | SBB | TRUE | TRUE | M | | R | 170 R | 20 | 24.32 | | 8.89 | 3.57 | 8.63 | 3.09 | Proximal | D | SA | RCV | RL |
| | | | | | | | | | | | | | | | 20.1 | 3.29 | Right | D | SA;A | RCC | |
| | | | | | | | | | | | | | | | 8.49 | 3.53 | Distal | D | SA | R | |
| 7 | 754 1 | D35C | SBB | FALSE | TRUE | M | 01;34 | S | 180 R | 165 | 16.06 | | 9.9 | 3.08 | 12.65 | 3.06 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 8.75 | 2.89 | Distal | D | A | R | |
| 7 | 755 1 | ? | SBB | FALSE | TRUE | M | 01 | S | 180 R | 40 | 29.2 | | 7.69 | 4.94 | 24.65 | 4.82 | Right | B | A | IR | |
| | | | | | | | | | | | | | | | 8.32 | 4.19 | Distal | D | A | IR | |
| 7 | 756 1 | E33D | SBB | TRUE | TRUE | M | 789 | R | 170 R | 180 | 24.88 | | 9.23 | 3.2 | 7.38 | 2.88 | Proximal | D | A | IR | |
| | | | | | | | | | | | | | | | 22.88 | 2.66 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | 3.76 | 1.58 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 22.84 | 1.31 | Left | D | L | R | |
| 7 | 757 1 | F37B | SBB | TRUE | TRUE | M | | R | 10 R | 180 | 20.86 | | 8.98 | 4.11 | 8.47 | 3.52 | Proximal | D | A | RCC | RL |
| | | | | | | | | | | | | | | | 17.97 | 4 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | 8.77 | 3.61 | Distal | D | SA | IR | |
| 7 | 758 1 | D34A | SBB | FALSE | TRUE | M | 01 | RS | N | | 19 0 | | 9.04 | 3.25 | 14.52 | 2.71 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | 3.5 | 1.81 | Proximal | D | A | I | |
| 7 | 759 1 | E37B | SBB | FALSE | TRUE | M | 01 | S | 180 R | | 23.25 | | 10.11 | 4.79 | 19.07 | 2.59 | Right | D | L | R | |
| | | | | | | | | | | | | | | | 6.88 | 0.6 | Distal | D | SA | IR | |
| | | | | | | | | | | | | | | | 22.91 | 0.34 | Left | I | L | CV | |
| 7 | 760 1 | F35D | TRUNC | TRUE | TRUE | M | | MB | 45 R | 180 | 21.28 | 19.09 | 11.39 | 4.44 | 14.59 | 4.51 | Rt Prox | I | | | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 10.28 | 3.43 Distal | D | SA | R | LR |
| | | | | | | | | | | | | | | 8.82 | 2.01 Lt Prox | D | A | NOTCH | DP |
| 7 | 762 1 | G35C | RET B | TRUE | TRUE | P | | N | R | 10 | 20.68 10.61 | 10.76 | 2.94 | 17.37 | 0.93 Left | D | L | CV | PD |
| | | | | | | | | | | | | | | 6.08 | 2.25 Distal | D | A | R | LR |
| 7 | 763 1 | G35C | RET B W/ NOTCH | FALSE | TRUE | P | 56 | N | S | 170 | 21.9 | 10.29 | 3.05 | 10.17 | 0.5 Left | D | L | NOTCH;R | |
| 7 | 764 1 | F36A | IRR BB | FALSE | TRUE | M | 56 | R | 115 S | 180 | 25.81 | 10.2 | 2.49 | 27.6 | 2.67 Rt Prox | D | A | SIN | PD |
| 7 | 765 1 | E38D | SBB | FALSE | TRUE | P | 56 | N | S | 165 | 16.44 | 12.52 | 3.14 | 12.41 | 2.44 Left | D | A | R | |
| | | | | | | | | | | | | | | 4.43 | 0.55 Rt Partial | D | SA | NOTCH | PD |
| 7 | 766 1 | D38C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 29.46 | 10.11 | 4.04 | 28.2 | 3.21 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 25.78 | 0.36 Left | D | L | | |
| 7 | 767 1 | E36D | SBB | TRUE | TRUE | M | | R | 140 RS | 150 | 8.97 4.13 | 8.93 | 3.02 | 7.11 | 3.55 Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | 6.33 | 3.08 Right | D | A | R | |
| | | | | | | | | | | | | | | 9.06 | 0.66 Distal | D | A | R | |
| 7 | 768 1 | E39C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 10 | 7.16 | 7.33 | 2.17 | 4.66 | 1.46 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 6.98 | 2.26 Distal | D | A | R | |
| 7 | 769 1 | E39C | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 15.87 | 8.74 | 2.51 | 7.38 | 1.19 Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 13.68 | 0.65 Right | D | A | R | PD |
| 7 | 770 1 | ? | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 19.4 | 8.05 | 2.16 | 8.46 | 1.36 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 18.44 | 1.05 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 8.36 | 1.9 Distal | D | SA | R | LR |
| 7 | 771 1 | E40A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 165 | 14.34 | 7.44 | 3.11 | 14.12 | 3.01 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.19 | 2.12 Distal | D | A | R | RL |
| 7 | 772 1 | D35A | SBB | TRUE | TRUE | M | | R | 180 R | 155 | 27.17 22.48 | 9.57 | 2.03 | 6.26 | 1.05 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 21.22 | 1.66 Left | D | A;SA | R | DP |
| | | | | | | | | | | | | | | 9.08 | 1.57 Distal | D | A | R | RL |
| 7 | 773 1 | G36C | SBB | TRUE | TRUE | M | | R | 180 RN | | 28.92 | 8.06 | 3.81 | 6.49 | 2.95 Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 28.58 | 3.78 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 29.82 | 0.54 Lt Dist | I | L | | |
| 8 | 774 1 | I19D | SBB | FALSE | TRUE | M | 01;56 | S | 180 R | 20 | 15.47 | 5.34 | 2.01 | 12.6 | 2.08 Right | D | A | R | |
| 8 | 775 1 | H21B | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 18.83 | 4.32 | 1.66 | 17.58 | 2.06 Right | B | A | R | |
| 8 | 776 1 | I18B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 10 | 10.79 | 4.72 | 2.24 | 10 | 2.19 Right | B | A | IR | PD |
| 8 | 777 1 | H23A | SBB | FALSE | TRUE | M | 01;56 | S | 160 S | 180 | 8.4 | 5.28 | 1.46 | 8.64 | 0.76 Left | D | A | R | DP |
| 8 | 778 1 | I21C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 12.28 | 4.1 | 1.55 | 12.28 | 0.98 Right | D | A | R | DP |
| 8 | 779 1 | J21A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 170 | 8.38 | 5.5 | 1.77 | 8.23 | 1.75 Right | D | SA | R | DP |
| 8 | 780 1 | L18D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 8.62 | 3.9 | 2 | 8.51 | 2.03 Right | D | A | R | |
| 8 | 781 1 | L18C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 9.14 | 3.9 | 1.97 | 8.32 | 1.58 Left | D | A | R | PD |
| 8 | 782 1 | J20A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 9.35 | 5.32 | 1.84 | 8.65 | 1.68 Right | D | A | R | DP |
| 8 | 783 1 | J18B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 10 | 5.43 | 5.3 | 2.26 | 5.57 | 2.11 Left | D | A | R | DP |
| 8 | 784 1 | G22A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 8.93 | 4.01 | 2.14 | 8.85 | 2.09 Right | D | A | R | DP |
| 8 | 785 1 | L15C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 9.38 | 4.46 | 1.44 | 9.38 | 1.39 Right | D | A | R | PD |
| 8 | 786 1 | J21A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 12.95 | 4.44 | 1.65 | 12.73 | 1.74 Right | B | A | R | |
| 8 | 787 1 | I21C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 170 | 8.79 | 4.04 | 1.34 | 6.18 | 1.03 Left | I | A | R | DP |
| 8 | 788 1 | K20D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 160 | 7.47 | 8.29 | 1.68 | 3.97 | 0.9 Left | D | A | R | DP |
| 8 | 789 1 | I20C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 11.56 | 4.43 | 1.73 | 10.83 | 1.17 Right | D | A | R | PD |
| 8 | 790 1 | L23A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 11.23 | 3.64 | 1.54 | 10.15 | 1.77 Left | D | A | IR | DP |
| 8 | 791 1 | K18D | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 4.74 | 4.45 | 1.66 | 3.84 | 1.68 | D | A | R | |
| 8 | 792 1 | M15C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 9.37 | 4.4 | 1.99 | 9.35 | 1.84 Left | D | A | R | DP |
| 8 | 793 1 | I21D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 40 | 13.89 | 4.14 | 1.4 | 10.97 | 1.21 Right | D | A | R | DP |
| 8 | 794 1 | K21B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 11.51 | 4.84 | 2.02 | 10.31 | 2.06 Right | B | A | R | |
| 8 | 795 1 | I20A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 15 | 5.09 | 1.91 | 14.7 | 1.9 Right | D | A | R | DP |
| 8 | 796 1 | J19D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 13.93 | 4.68 | 1.72 | 13.82 | 1.57 Left | D | A | R | DP |
| 8 | 797 1 | J18D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 16.09 | 4.9 | 1.79 | 15.7 | 1.74 Right | D | A | R | DP |
| 8 | 798 1 | L22C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 20 | 11.28 | 5.36 | 2.05 | 10.17 | 1.69 Right | D | A | R | PD |
| 8 | 799 1 | J17C | SBB | FALSE | TRUE | M | 01;56;23 | S | 180 S | 180 | 12.2 | 3.8 | 1.92 | 11.98 | 1.98 Left | D | A | R | |
| 8 | 800 1 | I19D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 16.11 | 3.97 | 2.42 | 16.03 | 2.41 Left | D | A | R | |
| 8 | 801 1 | I18C | SBB | FALSE | TRUE | M | 01;56 | S | 30 S | 180 | 12.82 | 3.64 | 1.78 | 9.94 | 1.75 Left | D | A | R | DP |
| 8 | 802 1 | M19B | SBB | FALSE | TRUE | M | 01;56 | S | 170 S | 180 | 2.07 | 4.9 | 2.08 | 9.6 | 1.94 Right | D | A | R | DP |
| 8 | 803 1 | G18B | SBB | TRUE | TRUE | M | | R | 15 R | 180 | 19.76 | 4.75 | 2.74 | 3.45 | 2.02 Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 17.88 | 2.74 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 4.13 | 2.56 Distal | D | A | R | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 804 1 | J21C | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 10.51 | 5.51 | 1.63 | 4.62 | 1.7 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 9.89 | 1.4 | Left | D | A | R | PD |
| 8 | 805 1 | L16C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 25 | 10.1 | 4.89 | 1.46 | 8.8 | 1.51 | Right | D;I | A | IR | |
| | | | | | | | | | | | | | | 3.74 | 0.91 | Distal | D | A | RCC | LR |
| 8 | 806 1 | H23C | SBB | FALSE | TRUE | M | 56 | R | 155 S | 180 | 18.89 | 4.74 | 2.86 | 3.52 | 2.06 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 18.19 | 2.85 | Right | B | SA;A | IR | DP |
| 8 | 807 1 | J22C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 13.14 | 4.67 | 1.35 | 12.26 | 1.34 | Left | D | A | R | |
| | | | | | | | | | | | | | | 4.81 | 1.42 | Distal | D | A | R | LR |
| 8 | 808 1 | M19C | SBB | FALSE | FALSE | M | 56 | RX | 180 SX | 180 | 9.72 | 4.41 | 1.72 | 4.11 | 1.78 | | D | A | R | |
| | | | | | | | | | | | | | | 8.69 | 1.83 | | D | A | R | |
| 8 | 809 1 | H18D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 15.4 | 4.1 | 1.23 | 14.79 | 1.21 | Left | D | A | R | |
| | | | | | | | | | | | | | | 3.29 | 0.64 | Distal | D | A | R | |
| 8 | 810 1 | I18D | SBB | FALSE | TRUE | M | 56 | R | 20 S | 180 | 13.7 | 4.54 | 2.6 | 3.26 | 1.48 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | 13.19 | 2.34 | Left | D | A | R | DP |
| 8 | 811 1 | I18C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 15 | 13.84 | 5.6 | 1.52 | 11.95 | 0.95 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | 3.84 | 0.63 | Distal | D | A | RCC | LR |
| 8 | 812 1 | I20A | SBB | FALSE | FALSE | M | 56 | RX | 20 SX | 180 | 9.9 | 4.76 | 2.38 | 3.83 | 2.38 | | D | A | RCC | |
| | | | | | | | | | | | | | | 8.99 | 1.99 | | D | A | R | OPD |
| 8 | 813 1 | L16D | SBB | FALSE | FALSE | M | 56 | RX | 20 SX | 180 | 8.73 | 4.57 | 2.3 | 2.7 | 1.33 | | D | A | RCC | OLR |
| | | | | | | | | | | | | | | 7.83 | 2.13 | | D | A | R | OPD |
| 8 | 814 1 | J20D | SBB | FALSE | TRUE | M | 56 | R | 175 S | 180 | 8.23 | 5.2 | 1.82 | 5.25 | 1.67 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 6.84 | 1.89 | Right | D | SA | R | DP |
| 8 | 815 1 | M20D | SBB | FALSE | TRUE | M | 56 | R | 170 S | 180 | 8.59 | 3.97 | 1.61 | 3.77 | 1.26 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 8.47 | 1.02 | Right | D | A | R | DP |
| 8 | 968 1 | M21D | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 11.58 | 3.85 | 2.02 | 3.41 | 1.37 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 11.46 | 1.65 | Left | D | A | R;CC | DP;PD |
| | | | | | | | | | | | | | | 9.38 | 0.65 | Right | I | L | R | DP |
| 8 | 969 1 | J18B | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 5.02 | 5.36 | 2.03 | 5.44 | 1.58 | Proximal | D | A;SA | R | RL |
| | | | | | | | | | | | | | | 4.63 | 2.3 | Right | D | A | R | |
| 8 | 970 1 | I19B | SBB | FALSE | TRUE | M | 01 | S | 155 R | 180 | 9.47 | 5.27 | 1.74 | 9.2 | 1.79 | Left | D | A | IR | |
| | | | | | | | | | | | | | | 5.33 | 1.25 | Distal | | A | R | RL |
| 8 | 971 1 | I19A | SBB | FALSE | TRUE | M | 56 | R | 180 S | 170 | 8.56 | 7.04 | 1.71 | 7.35 | | Proximal | D | A | RCC | RL |
| | | | | | | | | | | | | | | 6.51 | 1.85 | Left | D | A | R | DP |
| 8 | 972 1 | K19C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 20 | 7 | 5.14 | 2.12 | 6.93 | 2.04 | Right | D | A | R | |
| | | | | | | | | | | | | | | 4.84 | 1.49 | Distal | D | SA | R | RL |
| 8 | 973 1 | L18C | SBB | FALSE | TRUE | M | 56 | R | 40 S | 180 | 7.16 | 4.63 | 1.17 | 4.49 | 0.59 | Proximal | D | A | CCR | |
| | | | | | | | | | | | | | | 4.65 | 0.7 | Left | D | A | IR | |
| 8 | 974 1 | K19D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 7.62 | 4.13 | 1.88 | 7.19 | 1.72 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | 3.73 | 1.21 | Distal | D | A | R | RL |
| 8 | 975 1 | G21A | SBB | FALSE | TRUE | M | 56 | R | 30 S | 180 | 9.15 | 6.55 | 1.4 | 5.6 | 1.28 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 6.29 | 1.52 | Left | D | A | R | DP |
| 8 | 976 1 | G19C | SBB | FALSE | FALSE | M | 56 | RX | 10 SX | 180 | 7.42 | 4.15 | 1.5 | 3.68 | 1.57 | | D | A | R | |
| | | | | | | | | | | | | | | 6.86 | 1.14 | | D | A | R | OPD |
| 8 | 977 1 | M18C | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 7.66 | 4.16 | 1.96 | 4.2 | 0.95 | Proximal | D | A | CC | LR |
| | | | | | | | | | | | | | | 7.04 | 1.97 | Right | D | A | R | PD |
| 8 | 978 1 | K20D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 160 | 14.36 | 4.5 | 2.34 | 13.21 | 2.33 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | 4 | 1.66 | Distal | D | A | R | RL |
| 8 | 979 1 | G22A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 155 | 17.23 | 4.71 | 1.04 | 14.98 | 0.95 | Left | D | A | R | |
| | | | | | | | | | | | | | | 4.25 | 0.65 | Distal | D | A | R | LR |
| 8 | 980 1 | L19D | SBB | FALSE | TRUE | M | 56 | R | 15 S | 180 | 12.02 | 4.46 | 2.28 | 3.99 | 1.83 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | 10.84 | 1.61 | Left | D | A | R | PD |
| 8 | 981 1 | I19A | SBB | FALSE | TRUE | M | 56 | R | 10 S | 180 | 10.01 | 5.1 | 1.3 | 4.13 | 1.25 | Proximal | D | A | RCC | LR |
| | | | | | | | | | | | | | | 8.51 | 1.25 | Left | D | A | R | DP |
| 8 | 982 1 | L20A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 12.46 | 5.59 | 1.6 | 11.81 | 1.37 | Right | D | A | R | |
| | | | | | | | | | | | | | | 3.8 | 0.95 | Distal | D | A | R | |
| 8 | 983 1 | G22A | SBB | FALSE | TRUE | M | 56 | R | 170 S | 170 | 12.49 | 4.57 | 1.77 | 3.71 | 1.06 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 12.26 | 1.74 | Right | D | A | R | |
| | | | | | | | | | | | | | | 9.12 | 0.4 | Left | D | L | R | |
| 8 | 984 1 | I20C | SBB | FALSE | TRUE | M | 01 | S | 180 R | ,180 | 13.76 | 4.49 | 1.71 | 12.87 | 1.65 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | 4.38 | 0.94 | Distal | D | A | R | RL |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 985 1 | J20C | SBB | FALSE | TRUE | M | 56 | R | 15 S | 180 | 10.63 | 4.29 | 1.37 | 4.14 | 1.77 Proximal | D | A | IR | RL |
| | | | | | | | | | | | | | | 9.67 | 1.66 Left | D | A | R | |
| 8 | 986 1 | G21D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 20 | 11.66 | 4.37 | 1.89 | 11.03 | 1.95 Right | I | A | RI | |
| | | | | | | | | | | | | | | 2.78 | 0.66 Distal | D | A | R | |
| | | | | | | | | | | | | | | 4.74 | 0.58 Left | | L | IR | |
| 8 | 987 1 | I21A | ISOCELES TRIANGLE | FALSE | TRUE | M | 56 | R | 25 S | 180 | 11.61 5.41 | 5.66 | 1.73 | 6.43 | 1.42 Lt Prox | D | A | R | |
| | | | | | | | | | | | | | | 6.88 | 1.79 Lt Partial | D | A | RCC | |
| 8 | 988 1 | L20A | SBB | FALSE | FALSE | M | 56 | RX | 180 SX | 180 | 9 | 4.22 | 2.13 | 3.03 | 1.73 | D | A | R | |
| | | | | | | | | | | | | | | 8.69 | 2.09 | D | A | R | |
| 8 | 989 1 | M20A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 11.42 | 4.5 | 2.39 | 11.02 | 2.4 Left | D | A | RCC | DP |
| | | | | | | | | | | | | | | 4.59 | 1.8 Distal | D | A | IR | |
| 8 | 990 1 | J19A | SBB | FALSE | TRUE | M | 56 | R | 160 S | 180 | 13.55 | 4.74 | 1.9 | 4.7 | 1.47 Proximal | D | A | CCR | RL |
| | | | | | | | | | | | | | | 11.35 | 2.03 Right | D | A | RCC | |
| 8 | 991 1 | J19C | SBB | FALSE | TRUE | M | 56;34 | R | 30 S | 155 | 15.02 | 4.21 | 1.69 | 3.67 | 1.12 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 13.04 | 1.51 Left | D | A | R;IR | |
| | | | | | | | | | | | | | | 7.06 | 0.4 Rt Partial | I | L | R | |
| 8 | 992 1 | J22B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 9.87 | 4.88 | 2.01 | 8.67 | 2.18 Left | B | A | IR | |
| | | | | | | | | | | | | | | 4.43 | 1.58 Distal | D | A | IR | |
| 8 | 993 1 | H20C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 13.12 | 4.28 | 1.67 | 12.62 | 1.65 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 3.3 | 1.21 Distal | D | A | R | |
| 8 | 994 1 | H14D | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 9.84 | 4.67 | 1.75 | 3.74 | 1.32 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 9.69 | 1.69 Left | D | A | R | PD |
| 8 | 995 1 | I19C | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 14.73 | 5.38 | 1.76 | 4.66 | 0.85 Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | 14.81 | 1.37 Left | D | A | R | |
| 8 | 996 1 | M18C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 14.22 | 5.18 | 1.23 | 13.12 | 1.05 Left | D | A | R | |
| | | | | | | | | | | | | | | 4.73 | 0.54 Distal | D | A | R | |
| 8 | 997 1 | L18A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 15.51 | 3.87 | 1.9 | 15.34 | 1.16 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 2.65 | 1.38 Distal | D | A | RCC | |
| 8 | 998 1 | H22D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 14.81 | 4.36 | 1.93 | 13.76 | 1.9 Left | D | A | IR | |
| | | | | | | | | | | | | | | 4.34 | 1.19 Distal | D | A | CCR | |
| 8 | 999 1 | J18C | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 19.71 | 4.63 | 1.75 | 3.35 | 1.38 Proximal | I | A | R | RL |
| | | | | | | | | | | | | | | 19.39 | 1.71 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 2.81 | 0.99 Distal | | A | | |
| 8 | 1000 1 | L15B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 165 | 21.12 | 4.63 | 1.82 | 20.63 | 1.72 Left | D | A | R | |
| | | | | | | | | | | | | | | 3.6 | 1.44 Distal | D | A | R | |
| 8 | 1001 1 | H20B | SBB | FALSE | TRUE | M | 56 | R | 15 S | 180 | 18.92 | 4.06 | 1.66 | 3.34 | 1.37 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 19.23 | 1.77 Left | D | A | RCV | |
| 8 | 1002 1 | I20D | SBB | TRUE | TRUE | M | | R | 170 R | 15 | 19.86 | 5.58 | 1.96 | 5.08 | 1.36 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 17.74 | 2.51 Right | D | SA | IR | PD |
| | | | | | | | | | | | | | | 4 | 2.26 Distal | D | SA | R | |
| 8 | 1003 1 | H22B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 10.79 | 4.75 | 2.01 | 10.26 | 2.13 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 4.42 | 1.51 Distal | D | A | R | LR |
| 8 | 1004 1 | H18C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 30 | 17.29 | 4.7 | 2.3 | 15.95 | 2.38 Right | D | A | R | |
| | | | | | | | | | | | | | | 5.27 | 1.19 Distal | D | A | I | |
| 8 | 1005 1 | I20B | SBB | FALSE | TRUE | M | 56 | R | 20 S | 180 | 11.01 | 4.5 | 1.37 | 4.53 | 1.43 Proximal | D | A | I | |
| | | | | | | | | | | | | | | 9.79 | 1.43 Left | D | A | R | PD |
| 8 | 1006 1 | H21B | SBB | FALSE | TRUE | M | 56 | R | 30 S | 170 | 17.86 | 5.09 | 1.88 | 5.14 | 1.9 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 14.83 | 2.31 Left | D | SA;A | R | |
| 8 | 1007 1 | G22B | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 19.69 | 5.8 | 1.96 | 4.15 | 2 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 19.66 | 1.66 Right | D | A | R | |
| 8 | 1008 1 | L20A | SBB | TRUE | TRUE | M | | R | 160 R | 20 | 20.6 | 6.19 | 1.7 | 4.37 | 1.59 Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 16.36 | 1.52 Right | D | L | R | DP |
| | | | | | | | | | | | | | | 4.68 | 1.16 Distal | D | A | R | |
| 8 | 1009 1 | M20B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 11.09 | 4.31 | 2.11 | 10.5 | 2.16 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 3.78 | 2.1 Distal | D | A | R | |
| | | | | | | | | | | | | | | 6.22 | 0.4 Rt Partial | D | L | R | PD |
| 8 | 1010 1 | I23B | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 13.19 | 5.5 | 2.24 | 2.55 | 1.72 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 13.03 | 2.1 Right | D | A | IR | |
| 8 | 1011 1 | I20C | SBB | TRUE | TRUE | M | | R | 180 | 30 | 16.2 | 4.28 | 2.2 | 4.07 | 1.83 Proximal | D | A | IR | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 14.65 | 1.9 Right | D | A | R | |
| | | | | | | | | | | | | | | 16.46 | 0.45 Left | I | L | R | |
| 8 | 1012 1 | K20A | SBB | TRUE | TRUE | M | | R | 170 R | 10 | 11.69 | 5.08 | 1.4 | 5 | 1.47 Proximal | D | SA | RCC | LR |
| | | | | | | | | | | | | | | 9.3 | 0.38 Right | D | SA | R | |
| | | | | | | | | | | | | | | 4.56 | 1.52 Distal | D | SA | R | RL |
| 8 | 1013 1 | L18B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 10.09 | 5.08 | 1.67 | 8.53 | 1.69 Right | D | A | IR | |
| | | | | | | | | | | | | | | 3.63 | 1.01 Distal | D | A | R | LR |
| 8 | 1014 1 | G22B | SBB | FALSE | FALSE | M | 56 | RX | 30 SX | 10 | 9.61 | 4.66 | 2.16 | 4.4 | 2.31 | D | A | RCV | |
| | | | | | | | | | | | | | | 8.82 | 2.15 | D | A | R | |
| 8 | 1015 1 | G18B | SBB | FALSE | TRUE | M | 01 | S | 20 R | 180 | 14.58 | 6.11 | 1.88 | 11.96 | 1.72 Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | 4.97 | 1.23 Distal | D | A | R | LR;RL |
| 8 | 1016 1 | M18D | SBB | FALSE | TRUE | M | 01 | S | 160 R | 180 | 13.23 13.23 | 4.31 | 1.75 | 12.72 | 1.65 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 3.6 | 1.15 Distal | D | A | RCC | |
| 8 | 1017 1 | H20B | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 10.27 | 4.31 | 1.77 | 10.22 | 1.4 | D | A | R | ODP |
| 8 | 1018 1 | I19A | ARCHED BACKED | FALSE | TRUE | P | 56 | N | S | 50 | 15.23 | 9.17 | 2.49 | 15.88 | 0.77 Left | D | SA | CV | DP |
| 8 | 1019 1 | H21C | IRR BB | FALSE | TRUE | M | 01 | S | 180 RP | 120 | 14.7 0 | 7.78 | 1.77 | 12.32 | 1.85 Lt Dist | D | SA | SIN | DP |
| 8 | 1020 1 | M21A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 60 | 16.09 | 3.92 | 2.14 | 12.99 | 2.07 Right | D | A | R | PD |
| | | | | | | | | | | | | | | 3 | 1.86 Distal | D | A | RCC | DP |
| | | | | | | | | | | | | | | 14.06 | 0.47 Left | D | L | I | |
| 8 | 1021 1 | G20D | TRUNC | FALSE | TRUE | M | 56 | R | 180 S | 180 | 9.68 | 10.94 | 2.47 | 9.33 | 2.51 Proximal | D | A | RCC | RL |
| 8 | 1022 1 | L20C | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 8.5 | 7.54 | 1.8 | 5.99 | 1.84 Left | D | A | R | PD |
| 8 | 1023 1 | K19C | SBB | FALSE | FALSE | M | 01 | RPX | 105 SX | 50 | 1.38 | 3.32 | 1.31 | 5.1 | 1.51 | D | SA | RCV | |
| | | | | | | | | | | | | | | 1.66 | 0.3 | D | A | R | |
| | | | | | | | | | | | | | | 8.28 | 1 | D | SA | R;I | |
| 8 | 1025 1 | I20A | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 12.9 9.05 | 5.83 | 1.86 | 12.37 | 1.96 Right | I;D | A | RCC | |
| 9 | 816 1 | L19C | SBB | TRUE | TRUE | M | | R | 180 R | 10 | 18.79 | 9.71 | 3.08 | 8.99 | 3.1 Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 15.73 | 2.56 Right | D | A | R | |
| | | | | | | | | | | | | | | 9.82 | 3.08 Distal | D | A | R | LR |
| 9 | 817 1 | L21A | SBB | TRUE | TRUE | P | | N | R | 180 | 30.15 | 8.24 | 3.76 | 26.66 | 3.7 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 5.47 | 3.77 Distal | D | A | IR | |
| 9 | 818 1 | L20C | SBB | TRUE | TRUE | M | | R | 165 R | 180 | 18.3 | 7.55 | 2.57 | 7.55 | 1.88 Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 15.47 | 1.55 Right | D | A | IR | PD;DP |
| | | | | | | | | | | | | | | 6.74 | 2.19 Distal | D | A | R | |
| 9 | 819 1 | K19D | SBB | TRUE | TRUE | P | | N | N | | 28 12.03 | 9.51 | 4.52 | 24.97 | 4.54 Left | D | A | IR | |
| 9 | 820 1 | ? | SBB | TRUE | TRUE | M | | R | 180 R | 40 | 34.63 | 10.7 | 5.1 | 8.1 | 4 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 28.57 | 4.86 Right | B | A | IR | DP |
| 9 | 821 1 | L20D | SBB | TRUE | TRUE | P | | N | R | 180 | 20.82 | 8.66 | 3.14 | 19.44 | 3 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 6.84 | 1.7 Distal | D | A | IR | RL |
| | | | | | | | | | | | | | | 5.16 | 0.67 Rt Partial | D | SA | NOTCH | |
| 9 | 822 1 | J19B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 13.59 | 8.63 | 2.11 | 11.02 | 1.41 Right | D | SA;L | R | DP |
| | | | | | | | | | | | | | | 6.09 | 2.13 Distal | D | A | IR | |
| 9 | 823 1 | L24B | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 13.28 | 7.46 | 1.61 | 7.24 | 1.47 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 12.14 | 1.5 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 7.43 | 1.9 Distal | D | A | R | LR |
| 9 | 824 1 | ? | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 17.21 | 7.55 | 2.59 | 15.64 | 2.02 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 6.29 | 2.94 Distal | D | SA | R | RL |
| 9 | 825 1 | N21A | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 21.19 | 8.2 | 2.36 | 7.7 | 2.26 Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | 21.28 | 2.39 Right | D | A | R | PD |
| 9 | 826 1 | K19D | SBB | FALSE | TRUE | M | 0;56 | RS | 180 S | 10 | 11.3 | 7.84 | 1.78 | 3.62 | 1.64 Proximal | D | A | CCR | |
| | | | | | | | | | | | | | | 10.13 | 1.15 Left | D | A | I | PD |
| 9 | 827 1 | L19B | RET B | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 17.88 | 7.52 | 1.94 | 15.51 | 0.76 Right | D | A | R | |
| | | | | | | | | | | | | | | 7.43 | 0.34 Lt Partial | D | | R | |
| 9 | 828 1 | M19B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 15.1 | 8.18 | 2.53 | 13.35 | 2.11 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 7.49 | 2 Distal | | A | R | RL |
| 9 | 829 1 | L21B | SBB | TRUE | TRUE | P | | N | R | 180 | 22.06 | 7 | 2.43 | 19.43 | 2.47 Left | D | A | IR | PD;DP |
| | | | | | | | | | | | | | | 7.45 | 3.1 Distal | D | SA | R | RL |
| 9 | 830 1 | ? | SBB | TRUE | TRUE | M | | S | 10 S | 180 | 18.64 | 9.01 | 3.55 | 7.89 | 2.77 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 17.25 | 3.45 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 7.91 | 3.1 Distal | D | A | CCR | |
| 9 | 831 1 | M24C | IRR BB | FALSE | TRUE | D | 0123 | MB | 50 N | | 10.21 8.05 | 6.76 | 1.28 | 6.35 | 1.33 Lt Partial | D | A | CC | DP |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 8.88 | 2.19 | Rt Prox | I | | | |
| 9 | 832 1 | L19B | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 12.39 | | 7.41 | 2.47 | 6.52 | 2.38 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | 11.55 | 2.37 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | 7.23 | 3.6 | Distal | D | SA | R | |
| 9 | 833 1 | ? | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 26.38 | | 8 | 2.97 | 7.29 | 1.88 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 25.53 | 2.71 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 13.43 | 0.79 | Rt Partial | D | L | NOTCH | |
| 9 | 834 1 | L20D | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 19.67 | | 7.81 | 2.19 | 4.89 | 0.94 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 19.57 | 1.92 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 7.53 | 2.27 | Distal | D | A | R | |
| 9 | 835 1 | L21D | RET B | FALSE | TRUE | M | 01;56;7 | S | 180 S | 180 | 15.13 | | 7.94 | 1.9 | 12.58 | 0.39 | Right | D | L | R | |
| 9 | 836 1 | K15C | IRR BB | FALSE | TRUE | M | 901;3 | S | 30 R | 30 | 22.74 | 14.8 | 11.9 | 4.21 | 6.69 | 2.59 | Rt Partial | I | L | CC | |
| | | | | | | | | | | | | | | | 10.99 | 4.35 | Distal | D | SA | RCC | |
| | | | | | | | | | | | | | | | 19.18 | 0.5 | Left | D | A | I | |
| 9 | 837 1 | L19D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 21.08 | | 7.64 | 2.76 | 18.69 | 3.43 | Right | D | SA | R | DP |
| | | | | | | | | | | | | | | | 5.74 | 3.18 | Distal | D | SA | R | |
| | | | | | | | | | | | | | | | 18.61 | 0.5 | Left | D | SA | IR | PD |
| 9 | 838 1 | L21B | SBB | FALSE | TRUE | M | 012 | S | 140 R | 180 | 16.1 | | 7.09 | 1.83 | 11.61 | 1.79 | Right | D | SA;A | R | DP |
| | | | | | | | | | | | | | | | 6.56 | 2.11 | Distal | D | SA | R | |
| 9 | 839 1 | L19C | SBB | FALSE | TRUE | M | 01 | S | 20 R | 180 | 13.7 | | 7.75 | 3.45 | 13.13 | 3.5 | Right | D | A | IR | |
| | | | | | | | | | | | | | | | 5.84 | 2.41 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 11.68 | 0.96 | Left | I | SA | I | |
| 9 | 840 1 | M17B | SBB | TRUE | TRUE | M | | R | 180 MB | 125 | 12.67 | 3.74 | 8.09 | 2.84 | 7.71 | 2.63 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | 6.31 | 2.38 | Rt Dist | I | | | |
| | | | | | | | | | | | | | | | 3.25 | 1.49 | Rt Partial | D | SA | CC | |
| | | | | | | | | | | | | | | | 12.79 | 2.99 | Left | D | SA | R | DP |
| 9 | 841 1 | L19A | SBB | TRUE | TRUE | M | | R | 180 R | 25 | 29.17 | | 8.87 | 3.46 | 8.13 | 3.7 | Proximal | D | A;SA | R | RL |
| | | | | | | | | | | | | | | | 25.88 | 3.32 | Right | D | A | R | |
| | | | | | | | | | | | | | | | 6.85 | 3 | Distal | D | A | R | |
| 9 | 842 1 | L19C | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 21.41 | | 7.87 | 4.03 | 7.9 | 3.19 | Proximal | D | SA;A | CCR | RL |
| | | | | | | | | | | | | | | | 20.67 | 4.03 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | 7.36 | 3.09 | Distal | D | A | R | |
| 9 | 843 1 | L19A | SBB | TRUE | TRUE | M | | R | 20 R | 160 | 28.04 | | 8.13 | 4.6 | 7.13 | 4.7 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 25.31 | 4.64 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 5.02 | 2.6 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 6.95 | 0.61 | Rt Partial | D | L | NOTCH | |
| 9 | 844 1 | L19C | SBB | TRUE | TRUE | P | | N | R | 170 | 31.39 | 8.79 | 10.76 | 4.15 | 29.34 | 3.55 | Left | D | A;SA | R | PD |
| | | | | | | | | | | | | | | | 6.23 | 2.89 | Distal | D | A | R | |
| 9 | 845 1 | L19C | SBB | TRUE | TRUE | M | | R | 180 R | 30 | 21.46 | | 8.37 | 3.34 | 7.79 | 3.63 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | 15.34 | 3.42 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | 8.45 | 2.94 | Distal | D | A | R | LR |
| | | | | | | | | | | | | | | | 2.71 | 0.57 | Lt Partial | D | L | NOTCH | |
| 9 | 846 1 | K18D | SBB | TRUE | TRUE | M | | R | 20 R | 180 | 22.76 | | 9.41 | 4.16 | 9.1 | 3.66 | Proximal | D | A | IR | |
| | | | | | | | | | | | | | | | 18.36 | 3.39 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 6.23 | 2.43 | Distal | D | SA | R | LR |
| 9 | 847 1 | L18A | SBB | TRUE | TRUE | P | | N | N | | 29.72 | | 9.93 | 2.93 | 25.4 | 2.61 | Right | D | A | CC;IR | DP |
| | | | | | | | | | | | | | | | 26.08 | 0.53 | Left | I;D | L | I | |
| 9 | 848 1 | L18C | SBB | TRUE | TRUE | M | 34 | R | 180 R | 160 | 29.25 | | 9.22 | 3.1 | 4.38 | 2.05 | Proximal | D | A | CVR | RL |
| | | | | | | | | | | | | | | | 26.8 | 2.05 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 6.85 | 1.63 | Distal | D | A | IR | |
| 9 | 849 1 | L19A | SBB | FALSE | TRUE | M | 01 | S | 180 N | | 29.34 | | 7.18 | 3.02 | 24.78 | 3.01 | Right | D | A | IR | DP |
| 9 | 850 1 | L19B | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 27.4 | | 9.45 | 3.52 | 7.54 | 3.08 | Proximal | D | SA | CC | RL |
| | | | | | | | | | | | | | | | 26.76 | 3.44 | Left | D | A | R | PD |
| 9 | 851 1 | L18C | SBB | TRUE | TRUE | M | 01 | R | 180 R | 180 | 21.18 | | 9.32 | 3.05 | 7.61 | 2.62 | Proximal | D | A | R | LR;RL |
| | | | | | | | | | | | | | | | 19.32 | 1.8 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 8.73 | 3.05 | Distal | D | A | RCC | RL |
| 9 | 852 1 | L19A | SBB | TRUE | TRUE | M | | RS | 170 R | 10 | 31.19 | | 9.17 | 2.78 | 7.42 | 0.51 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 26.94 | 1.81 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | 6.96 | 1.78 | Distal | D | A | IR | |
| 9 | 853 1 | L18D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 23.04 | | 9.13 | 3.67 | 22.66 | 3.61 | Left | D | A | IR | DP |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 7.32 | 2.58 Distal | D | SA | R | LR |
| 9 | 854 1 | L19A | SBB | FALSE | TRUE | M | 56;34 | R | 20 S | 180 | 23.8 | 8.9 | 3.86 | 7.2 | 3.85 Proximal | D | A | IR | |
| | | | | | | | | | | | | | | 22.48 | 4.24 Left | D | A | R | |
| 9 | 855 1 | L19B | TRUNC | FALSE | TRUE | M | 01 | S | 180 R | 10 | 19.54 | 9.79 | 3.09 | 7.75 | 4.47 Distal | D | SA | RCC | RL |
| 9 | 856 1 | L21D | IRR BB | FALSE | TRUE | D | 01 | S | 180 N | | 14.26 | 6.03 | 2.58 | 11.2 | 3.12 Rt Partial | D | SA | IR | PD;DP |
| | | | | | | | | | | | | | | 8.8 | 0.64 Lt Partial | D | A | CV | |
| 9 | 857 1 | L18D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 150 | 21.84 | 8.01 | 2.37 | 18.04 | 2.32 Left | D | A | R | |
| 9 | 858 1 | L19B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 23.61 | 9.51 | 2.92 | 22 | 2.29 Right | D | A | IR | DP |
| | | | | | | | | | | | | | | 7.98 | 3.17 Distal | D | A | R | LR |
| 9 | 859 1 | K19D | SBB | FALSE | TRUE | M | 01 | s | 15 R | 160 | 26.59 | 8.97 | 2.4 | 22.14 | 2.57 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.38 | 2.26 Distal | D | A | R | |
| 9 | 860 1 | L18C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 40 | 18.75 7.26 | 12.27 | 3.17 | 6.62 | 1.92 Right | D | A | R | |
| 9 | 861 1 | L19C | SBB | TRUE | TRUE | M | | R | 20 R | 180 | 21.74 | 8.47 | 2.5 | 6.25 | 2.04 Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | 19.78 | 2.57 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 6.61 | 1.3 Distal | D | A | R | LR |
| 9 | 862 1 | L19A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 18.84 | 8.95 | 3.38 | 18.1 | 3.35 Right | D | SA | IR | |
| | | | | | | | | | | | | | | 7.19 | 2.5 Distal | D | A | IR | |
| 9 | 863 1 | L19C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 18.93 | 9.62 | 3.8 | 15.39 | 2.22 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 8.61 | 3.19 Distal | D | A | IR | LR |
| 9 | 864 1 | L21C | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 26.61 | 11.06 | 2.76 | 25.07 | 2.84 Right | D | A | R | |
| 9 | 865 1 | L18C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 20.7 | 9.1 | 3.62 | 20.26 | 3.65 Right | D | SA | IR | PD |
| | | | | | | | | | | | | | | 8.39 | 3.74 Distal | D | A | R | |
| 9 | 866 1 | L19C | SBB | FALSE | TRUE | M | 01;5 | S | 15 N | | 26.36 | 7.67 | 3.74 | 24.55 | 4.18 Right | D | A | IR | |
| 9 | 867 1 | J19D | SBB | TRUE | TRUE | M | | R | 180 R | 10 | 20.56 | 8.36 | 2.81 | 8.56 | 2.87 Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | 19.23 | 3.45 Right | D | SA | R | PD |
| | | | | | | | | | | | | | | 7.56 | 2.87 Distal | D | A | R | LR |
| 9 | 868 1 | L19C | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 21.78 | 8.65 | 3.52 | 8.83 | 3.35 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 19.49 | 3.03 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 8.51 | 2.05 Distal | D | A | R | LR |
| 9 | 869 1 | L19C | SBB | FALSE | TRUE | M | 10;56;2 | S | 180 S | 180 | 31.45 | 8.08 | 3.13 | 31.18 | 2.97 Left | D | A | RCC | PD |
| 9 | 870 1 | L19B | SBB | TRUE | TRUE | M | 01 | R | 180 R | 180 | 20.08 | 8.42 | 3.23 | 8.01 | 3.02 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 18.29 | 3.16 Left | B | A | R | PD |
| | | | | | | | | | | | | | | 8.5 | 2.7 Distal | I;D | A | R | RL |
| 9 | 871 1 | L19A | SBB | TRUE | TRUE | M | | R | R | 180 | 21.41 | 6.16 | 2.09 | 6.01 | 2.19 Proximal | D | A;SA | R | RL |
| | | | | | | | | | | | | | | 19.38 | 2.2 Right | D | A | CCR | PD |
| | | | | | | | | | | | | | | 6.33 | 1.82 Distal | D | A | R | |
| 9 | 872 1 | M24A | SBB | FALSE | TRUE | M | 56 | RS | 180 S | 180 | 19.77 | 9.01 | 3.46 | 17.25 | 2.61 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 5.07 | 0.42 Proximal | | A | R | |
| 9 | 873 1 | L21A | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 10.57 | 7.41 | 2.12 | 7.1 | 1.55 Left | D | A | IR | DP |
| 9 | 874 1 | M21A | SBB | TRUE | TRUE | M | | R | 20 R | 180 | 33.43 | 9.83 | 3.15 | 7.77 | 3.17 Proximal | D | A | RCC | RL |
| | | | | | | | | | | | | | | 30.11 | 2.09 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.44 | 2.15 Distal | D | SA | R | RL |
| 9 | 875 1 | L18C | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 21.91 | 9.34 | 3.06 | 8.59 | 2.8 Proximal | D | A | IR | LR;RL |
| | | | | | | | | | | | | | | 19.73 | 3.09 Left | D | A | R | |
| | | | | | | | | | | | | | | 7.76 | 3.24 Distal | D | A | R | |
| 9 | 876 1 | L19A | SBB | TRUE | TRUE | M | | R | 180 R | 10 | 21.88 | 7.63 | 2.81 | 6.8 | 2.09 Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | 19.44 | 1.57 Right | D | L | R | |
| | | | | | | | | | | | | | | 6.82 | 2.72 Distal | D | SA | CC | |
| 9 | 877 1 | J19D | TRUNC | FALSE | TRUE | M | 56 | R | 180 S | 180 | 26.14 | 6.23 | 2.49 | 5.86 | 2.37 Proximal | D | SA | R | |
| 9 | 878 1 | L19C | SBB | FALSE | TRUE | M | 01;56 | S | 20 S | 180 | 13.04 | 8.36 | 2.11 | 11.26 | 1.56 Left | D | A | IR | PD |
| 9 | 879 1 | L18C | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 26.22 | 10 | 4.41 | 23.71 | 4.09 Left | D | SA | RCC | |
| 9 | 880 1 | J19D | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 19.02 | 7.81 | 2.85 | 7.06 | 2.91 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 17.37 | 2.61 Right | D | A | R | PD |
| 9 | 881 1 | ? | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 21.32 | 8.19 | 4.29 | 20.53 | 3.78 Right | D | SA;A | R | |
| | | | | | | | | | | | | | | 17.7 | 0.45 Left | D | A | I | |
| 9 | 882 1 | K18A | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 16.9 | 9.28 | 3.56 | 8.39 | 3.39 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 15.38 | 3.58 Left | D | SA | R | |
| | | | | | | | | | | | | | | 8.2 | 3.46 Distal | D | SA | R | RL |
| 9 | 883 1 | L18D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 30 | 9.27 | 6.82 | 2.75 | 6.49 | 2.29 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 7.52 | 2.81 Distal | D | A | R | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 7.45 | 1.08 | Left | D | L | R | PD |
| 9 | 884 1 | L20A | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 9.39 | 8.99 | 2.49 | 8.25 | 2.25 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 8.67 | 1.07 | Right | D | A | R | DP |
| 9 | 885 1 | L20B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 9.42 | 7.27 | 1.85 | 8.86 | 1.54 | Right | D | A | D | DP |
| | | | | | | | | | | | | | | 4.45 | 0.83 | Lt Partial | I | L | R | DP |
| 9 | 886 1 | L19A | SBB | FALSE | TRUE | M | 56 | RS | 180 S | 180 | 11.17 | 6.12 | 3.12 | 9.57 | 2.1 | Right | D | SA | I | |
| | | | | | | | | | | | | | | 4.55 | 0.45 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 10.86 | 2.14 | Left | D | L | R | |
| 9 | 939 1 | K18D | SBB | TRUE | TRUE | M | | R | 10 R | 180 | 26.04 | 9.33 | 3.61 | 8.42 | 2.85 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 23.83 | 2.64 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 8.74 | 3.75 | Distal | D | SA | RCC | |
| 9 | 940 1 | L19C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 24.23 24.23 | 7.99 | 1.73 | 19.97 | 2.04 | Right | D | A | RCC | DP |
| | | | | | | | | | | | | | | 22.69 | 1.33 | Left | D | A | R | PD |
| 9 | 941 1 | L24D | IRR BB | TRUE | TRUE | M | 789 | R | 170 RN | | 25.99 17.17 | 11.04 | 2.77 | 6.77 | 2.77 | Proximal | D | SA | RCC | LR |
| | | | | | | | | | | | | | | 24.19 | 2.62 | Right | D | A | R;CV | DP |
| 9 | 942 1 | L19A | RET B | TRUE | TRUE | M | | R | 180 R | 180 | 22.7 | 8.74 | 3.28 | 7.16 | 3.16 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 11.38 | 3.28 | Rt Partial | D | L | R | DP |
| | | | | | | | | | | | | | | 3.64 | 0.84 | Rt Partial | D | SA | R | |
| | | | | | | | | | | | | | | 8.27 | 2.38 | Distal | D | A | IR | |
| 9 | 943 1 | L19C | SBB | TRUE | TRUE | M | | R | 170 R | 180 | 14.06 | 8.56 | 3.09 | 7.7 | 4.39 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | 12.96 | 3.15 | Right | D | SA | R | |
| | | | | | | | | | | | | | | 8.28 | 2.15 | Distal | D | A | R | LR |
| 9 | 944 1 | K19D | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 30.46 10.3 | 10.36 | 3 | 28.56 | 2.81 | Right | D | A | R | DP |
| 9 | 945 1 | L24B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 15.01 | 6.76 | 2.05 | 14.74 | 1.25 | Left | D | A | R | PD |
| 9 | 946 1 | L19A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 25.86 | 10.75 | 4 | 25.54 | 4.35 | Right | D | A | IR | |
| | | | | | | | | | | | | | | 8.14 | 3.17 | Distal | D | A | R | LR |
| 9 | 947 1 | ? | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 20.88 16.81 | 10.35 | 4.59 | 8.32 | 2.77 | Proximal | D | A | CV | |
| | | | | | | | | | | | | | | 18.74 | 4.4 | Right | D | A | R | |
| | | | | | | | | | | | | | | 7.64 | 3.38 | Distal | D | A | R | LR |
| 9 | 948 1 | L19A | SBB | FALSE | TRUE | M | 56;01 | S | 35 S | 180 | 27.01 | 9.61 | 2.6 | 25.88 | 2.28 | Right | D | A | R | DP |
| 9 | 949 1 | K19D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 23.51 | 7.66 | 4.26 | 22.73 | 4 | Right | D | SA | IR | PD |
| | | | | | | | | | | | | | | 6.97 | 3.81 | Distal | D | A | R | |
| 9 | 950 1 | M17C | SBB | FALSE | TRUE | M | 56 | RS | 180 S | 180 | 18.67 | 9.2 | 1.8 | 4.03 | 1.23 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 17.2 | 1.08 | Right | D | A | R | DP |
| 9 | 951 1 | L19C | SBB | TRUE | TRUE | M | | R | 180 R | 170 | 17.92 | 8.07 | 2.52 | 5.57 | 0.56 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 16.73 | 1.91 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 6 | 1.37 | Distal | D | A | R | LR |
| 9 | 952 1 | J20A | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 19.67 | 7.73 | 2.1 | 6.93 | 1.87 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 18.4 | 1.87 | Right | D | A | CV;R | DP |
| 9 | 953 1 | L18D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 24.6 | 10.83 | 3.31 | 23.06 | 3.1 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | 5.63 | 2.78 | Distal | D | A | R | LR |
| 9 | 954 1 | M20C | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 18.24 14.28 | 10.08 | 3.37 | 13.01 | 3.64 | Rt Partial | D | A | RCC | |
| 9 | 955 1 | ? | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 10 | 9.21 | 7.41 | 1.98 | 9.18 | 1.75 | Left | D | A | R | |
| 9 | 956 1 | L19C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 19.39 | 8.65 | 2.92 | 15.53 | 1.4 | Lt Partial | D | A;SA | CC;R | PD |
| 9 | 957 1 | L18D | SBB | FALSE | TRUE | M | 0;56 | S | 180 S | 30 | 9.72 | 7.59 | 2.56 | 8.76 | 1.95 | Left | D | A | R | DP |
| 9 | 958 1 | L21C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 13.22 | 6.91 | 2.21 | 14.47 | 2.3 | Left | D | A | I | |
| | | | | | | | | | | | | | | 6.05 | 1.11 | Distal | D | A | R | |
| 9 | 959 1 | L21D | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 23.83 6.33 | 10.49 | 2.94 | 22.54 | 3.09 | Right | D | A | RSIN | DP |
| 9 | 960 1 | L20C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 10.11 | 7.18 | 1.58 | 9.92 | 1.19 | Right | D | A | R | |
| 9 | 961 1 | L20A | SBB | FALSE | TRUE | P | 56 | N | S | 30 | 18.3 | 8.54 | 2.02 | 14.44 | 1.68 | Left | D | A | R | PD |
| 9 | 962 1 | L20C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 18.82 | 7.7 | 2.02 | 18.44 | 1.82 | Left | D | A | R | PD |
| 9 | 963 1 | K10B | SBB | FALSE | TRUE | M | 01;56 | S | S | 180 | 13.49 | 9.94 | 1.54 | 12.99 | 1.32 | Left | D | A | R | |
| 9 | 964 1 | L19C | SBB | FALSE | TRUE | D | 01 | S | 180 | | 11.74 | 7.7 | 1.94 | 11.13 | 1.76 | Left | D | A | R | PD |
| 9 | 965 1 | L21B | IRR BB | FALSE | TRUE | M | 0123;56 | S | 180 S | 10 | 13.34 | 7.5 | 1.6 | 13.14 | 1.52 | Left | D | A | IR | PD |
| 9 | 966 1 | K20B | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | | 10.47 | 6.4 | 1.97 | 8.49 | 1.65 | Left | D | SA | R | PD |
| 9 | 967 1 | J20A | RET B | FALSE | TRUE | M | 01;5;234 | S | 180 RS | 180 | 22.16 | 10.4 | 2.61 | 6.34 | 1.58 | Distal | D | A | R | |
| 10 | 887 1 | O26C | SBB PT | FALSE | TRUE | M | 01 | S | 180 R | | 8.01 0 | 3.12 | 1.84 | 8.26 | 1.56 | Left | D | A | R | |
| 10 | 888 1 | O28D | SBB PT | FALSE | TRUE | D | 01 | S | 180 N | | 10.29 0 | 4.35 | 1.4 | 4.2 | 1.67 | Rt Partial | D | A | R | |
| 10 | 889 1 | O24A | SBB PT | FALSE | TRUE | M | 56 | R | S | 180 | 11.76 11.76 | 5.19 | 1.98 | 11.54 | 1.89 | Right | D | A | IR | |
| 10 | 890 1 | M25A | SBB | FALSE | TRUE | M | 56 | rp | S | 180 | 10.48 10.48 | 4.21 | 2.28 | 6.39 | 2.38 | Rt Partial | B | A | CV | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 891 | 1 | M30C | SBB | FALSE | TRUE | M | 56 | S | 180 | R | 40 | 9.09 | 4.6 | 4.15 | 1.72 | 4.5 | 1.58 | Rt Partial | D | A | R | |
| | | | | | | | | | | | | | | | | | 4.83 | 1.7 | Rt Partial | D | A | CC | |
| 10 | 892 | 1 | L26A | SBB PT | FALSE | TRUE | M | 01 | S | 180 | R | | 8.02 | 0 | 3.43 | 1.69 | 8.24 | 1.53 | Right | B | A | R | |
| 10 | 893 | 1 | Q27D | SBB | FALSE | TRUE | M | | RP | 50 | S | 180 | 6.86 | | 3.72 | 1.79 | 3.53 | 0.72 | Lt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 4.66 | 1.87 | Lt Partial | B | A | CV | |
| 10 | 894 | 1 | ? | SBB PT | FALSE | FALSE | M | 01 | SX | 180 | RX | | 8.02 | 0 | 2.56 | 2.13 | 8.69 | 2.06 | | D | A | R;CV | ODP |
| | | | | | | | | | | | | | | | | | 7.18 | 1.23 | | I | L | R | OPD |
| 10 | 895 | 1 | ? | SBB PT | FALSE | FALSE | M | 56 | RX | | SX | 180 | 9.2 | 9.2 | 3.33 | 2.22 | 9.3 | 1.76 | | D | A | CV | |
| | | | | | | | | | | | | | | | | | 8.42 | 1.22 | | I | L | CV | |
| 10 | 896 | 1 | P27A | SBB | FALSE | TRUE | M | 01 | S | 180 | rp | 60 | 11.47 | | 4.97 | 1.38 | 7.44 | 1.55 | Rt Partial | D | A | SIN | |
| | | | | | | | | | | | | | | | | | 2.82 | 0.66 | Rt Partial | D | A | R | |
| 10 | 897 | 1 | O28B | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 5.56 | | 4.6 | 1.44 | 5.7 | 1.51 | Left | D | A | R | PD |
| 10 | 898 | 1 | N24D | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 4.54 | | 4.48 | 1.58 | 5.31 | 1.57 | Left | D | A | R | |
| 10 | 899 | 1 | Q29C | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 6.11 | | 4.16 | 2.15 | 6.08 | 2.16 | Right | D | A | R | DP |
| 10 | 900 | 1 | N28C | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 155 | 5.83 | | 5.47 | 2.13 | 5.75 | 2.17 | Right | B | A | R | PD |
| 10 | 901 | 1 | M26C | SBB | FALSE | TRUE | M | 01;56 | S | 30 | S | 30 | 6 | | 4.79 | 2.08 | 5.53 | 2.09 | Left | B | A | R | |
| 10 | 902 | 1 | N25B | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 4.66 | | 4.54 | 2.6 | 4.15 | 2.75 | Left | D | A | R | |
| 10 | 903 | 1 | K26C | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 5.75 | | 3.96 | 2.06 | 5.94 | 2.23 | Right | D | A | R | DP |
| 10 | 904 | 1 | N28B | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 7.48 | | 4.64 | 1.95 | 6.66 | 0.85 | Right | D | L | R | DP |
| 10 | 905 | 1 | ? | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 5.78 | | 4.66 | 1.53 | 5.4 | 1.51 | Left | D | A | R | PD |
| 10 | 906 | 1 | Q26A | TRUNC | TRUE | TRUE | D | | R | 180 | RN | | 7.06 | | 9.83 | 2 | 10.16 | 2.41 | Proximal | D | A | CV | |
| | | | | | | | | | | | | | | | | | 4.15 | 0.88 | Distal | I | L | CV | RL |
| 10 | 907 | 1 | M27A | IRR BB | TRUE | TRUE | P | | N | | RP | 130 | 23.36 | 7.64 | 10.87 | 2.8 | 14.64 | 2.42 | Lt Dist | D | A | I | |
| | | | | | | | | | | | | | | | | | 7.3 | 0.4 | Lt Partial | D | A | CV | |
| 10 | 908 | 1 | L26A | IRR BB | FALSE | TRUE | P | 56 | N | | S | 180 | 20.25 | 8.1 | 13.93 | 3.46 | 19.3 | 3.3 | Lt Dist | D | A | CC | PD |
| 10 | 909 | 1 | K24B | SBB | FALSE | TRUE | P | 56 | N | | S | | 22.28 | 5.93 | 12.42 | 3.8 | 11.73 | 1.78 | Lt Partial | D | SA | R | |
| 10 | 910 | 1 | N25B | ARCHED BACKED | TRUE | TRUE | M | | R | 130 | N | | 18.22 | | 4.69 | 1.84 | 8.7 | 1.4 | Rt Prox | D | A | CV | |
| | | | | | | | | | | | | | | | | | 13.87 | 1.83 | Rt Partial | D | A | R | DP |
| 10 | 911 | 1 | M24B | ARCHED BACKED | TRUE | TRUE | M | | S | 40 | R | 110 | 16.98 | 6.97 | 4.05 | 1.65 | 6.29 | 0.51 | Distal | D | A | NOTCH;R | |
| | | | | | | | | | | | | | | | | | 13.56 | 1.32 | Right | D | A | CV | DP |
| 10 | 912 | 1 | N23A | IRR BB | TRUE | TRUE | M | | S | 60 | N | | 35.77 | 13.1 | 6.6 | 3.65 | 20.22 | 2.63 | Left | D | A | RI | PD |
| 10 | 913 | 1 | N24B | ARCHED BACKED | TRUE | TRUE | M | | RS | 120 | R | 50 | 18.81 | 10.59 | 4.28 | 2.14 | 3.76 | 1.4 | Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.79 | 2.22 | Right | D | A | CV | |
| | | | | | | | | | | | | | | | | | 7.93 | 1.79 | Distal | D | A | R | DP |
| 10 | 914 | 1 | M26B | ARCHED BACKED | TRUE | TRUE | M | 01 | S | 25 | R | 60 | 22.83 | | 3.64 | 2.42 | 16.63 | 2.76 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 3.68 | 1.6 | Distal | D | A | R | DP |
| 10 | 915 | 1 | M25C | SBB | TRUE | TRUE | M | | R | 35 | R | 115 | 26.34 | 20.71 | 5.32 | 2.59 | 7.12 | 2.1 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 17.2 | 2.18 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 4.11 | 1.59 | Distal | D | A | R | |
| 10 | 916 | 1 | L26B | SCALENE BB | TRUE | TRUE | M | 01 | S | 180 | R | 140 | 22.16 | 16.5 | 7.6 | 2.14 | 14.43 | 1.68 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 8.7 | 2.74 | Distal | D | SA | R | |
| 10 | 917 | 1 | M26A | SCALENE BB | TRUE | TRUE | M | | N | | R | 150 | 22.92 | 18.35 | 7.55 | 2.15 | 18.09 | 2.28 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 8.81 | 2.37 | Distal | D | A | R | LR |
| 10 | 918 | 1 | L25B | SCALENE BB | TRUE | TRUE | M | | RN | | R | 150 | 21.64 | 19.46 | 6.15 | 2.28 | 19.67 | 2.26 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.27 | 2.06 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 2.58 | 1.66 | Proximal | I | L | | |
| | | | | | | | | | | | | | | | | | 18.13 | 0.76 | Right | I | L | R | |
| 10 | 919 | 1 | N25B | SCALENE BB | TRUE | TRUE | M | | RP | 145 | R | 180 | 28.68 | 5.27 | 6.31 | 2.22 | 4.9 | 0.9 | Distal | D | A | CV | |
| | | | | | | | | | | | | | | | | | 23.61 | 2.27 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 5.08 | 1.37 | Proximal | D | A | CC | LR |
| 10 | 920 | 1 | L26C | SBB | TRUE | TRUE | P | | N | | R | 145 | 33.56 | 30.62 | 7.68 | 2.88 | 29.13 | 2.41 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 9.52 | 2.68 | Distal | D | A | R | LR |
| 10 | 921 | 1 | N25A | SBB | TRUE | TRUE | P | | RN | | RP | 40 | 26.13 | 23.6 | 7.11 | 2.75 | 2.77 | 2.13 | Proximal | D | L | CV | |
| | | | | | | | | | | | | | | | | | 22.63 | 2.79 | Right | D | A;SA | RCV | DP |
| | | | | | | | | | | | | | | | | | 6.9 | 1.91 | Distal | D | A | RCC | |
| 10 | 922 | 1 | M25C | SBB | TRUE | TRUE | M | | R | 125 | R | 140 | 22.13 | 18.42 | 6.35 | 2.32 | 4.04 | 1.45 | Proximal | D | SA | CV | RL |
| | | | | | | | | | | | | | | | | | 18.05 | 2.11 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 6.74 | 2.42 | Distal | D | A | R | RL |
| 10 | 923 | 1 | N24D | SBB BIPT | TRUE | TRUE | M | | R | 110 | R | 70 | 33.77 | | 4.46 | 2.31 | 34.38 | 2.47 | Right | | A | CV;R;CV | PD |
| 10 | 924 | 1 | N25A | SBB | FALSE | FALSE | M | 01 | SX | 180 | PTX | 140 | 13.4 | | 3.28 | 1.84 | 11.39 | 1.82 | | B | A | R | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 3.7 | 1.35 | I | | | |
| 10 | 925 1 | P27A | SBB | FALSE | TRUE | M | 56 | RP | 90 S | 180 | 8.67 8.67 | 3.95 | 1.57 | 7.11 | 1.54 Left | D | A | R | PD |
| 10 | 926 1 | N25D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 140 | 11.01 | 3.92 | 1.15 | 9.77 | 1.11 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 3.22 | 0.85 Distal | D | A | CC | |
| 10 | 927 1 | P26A | SBB | FALSE | TRUE | M | 56 | R | 55 S | 180 | 12.6 | 5.18 | 2.06 | 6.87 | 1.56 Distal | D | A | RCC | |
| | | | | | | | | | | | | | | 6.21 | 1.49 Left | D | A | IR | |
| 10 | 928 1 | M25B | SBB PT | FALSE | TRUE | M | 56 | R | 85 S | 180 | 10.87 10.87 | 4.7 | 1.66 | 10.58 | 1.55 Left | B | A | RCV | |
| 10 | 929 1 | O27B | SBB | FALSE | TRUE | M | 01 | S | 180 RP | 55 | 10.66 0 | 4.88 | 1.8 | 6.69 | 1.14 Right | D | A | R | PD |
| | | | | | | | | | | | | | | 2.43 | 1.23 Distal | D | A | CC | |
| 10 | 930 1 | P27A | SBB | FALSE | TRUE | M | 01 | S | 125 PT | 120 | 12.38 | 5.58 | 1.58 | 7.62 | 1.39 Left | D | A | CV;CC | PD |
| | | | | | | | | | | | | | | 6.88 | 1.86 Distal | I | | | |
| 10 | 931 1 | N25B | SBB | FALSE | TRUE | M | 01 | S | 180 RP | 50 | 9.75 | 4.49 | 1.95 | 5.83 | 1.85 Right | D | A | R | |
| | | | | | | | | | | | | | | 4.81 | 1.58 Distal | D | A | R | DP |
| 10 | 932 1 | M25D | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 65 S | 180 | 13.15 | 5.14 | 1.75 | 2.4 | 1.34 Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | 7.9 | 1.78 Left | D | A | ICV | |
| 10 | 933 1 | P26C | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 120 S | 180 | 11.11 11.11 | 4.68 | 2.63 | 13.09 | 2.71 Rt Prox | B | A | CV | |
| 10 | 934 1 | P26A | ARCHED BACKED | FALSE | TRUE | M | 01;56 | R | 130 S | 180 | 9.93 7.64 | 4.39 | 2.36 | 7.17 | 2.17 Rt Prox | D | A | R | |
| | | | | | | | | | | | | | | 3.5 | 2.35 Rt Dist | D | A | IR | |
| 10 | 935 1 | L25D | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 9.74 | 5.83 | 1.95 | 4.17 | 1.26 Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | 9.29 | 1.91 Left | D | A | R | DP |
| 10 | 936 1 | ? | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 6.47 | 4.58 | 1.72 | 6.21 | 1.72 Left | D | A | R | |
| | | | | | | | | | | | | | | 4.14 | 1.52 Distal | D | A | R | RL |
| 10 | 937 1 | ? | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 5.96 | 4.62 | 1.71 | 5.45 | 1.19 Left | D | SA | R | PD |
| | | | | | | | | | | | | | | 4.31 | 1.84 Distal | D | SA | R | |
| 10 | 938 1 | O24D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 6.72 | 4.18 | 1.94 | 5.22 | 1.45 Left | D | A | IR | |
| | | | | | | | | | | | | | | 3.79 | 1.4 Distal | D | SA | CV | RL |
| | | | | | | | | | | | | | | 6.17 | 0.93 Right | D | L | R | |
| 10 | 1026 1 | M25B | SBB | FALSE | TRUE | M | 56 | R | 130 S | 155 | 21.37 6.83 | 4.98 | 2.55 | 5.33 | 2.26 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 16.39 | 2.6 Right | D | A | RCV | |
| 10 | 1027 1 | ? | SBB | TRUE | TRUE | M | 01 | S | 180 R | 150 | 25.25 22.5 | 5.75 | 2.28 | 21.84 | 2.35 Left | D | A | R | |
| | | | | | | | | | | | | | | 4.93 | 2.11 Distal | D | A | R | LR |
| | | | | | | | | | | | | | | 21.94 | 0.62 Right | I | L | R | |
| 10 | 1028 1 | M25D | SBB | TRUE | TRUE | M | | R | 55 PT | 135 | 16.87 | 5.11 | 2.39 | 4.08 | 1.54 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 4.5 | 2.18 Lt Partial | D | A | CC | DP |
| | | | | | | | | | | | | | | 4.8 | 1.79 Lt Partial | D | A | CC | |
| 10 | 1029 1 | N27B | ARCHED BACKED | TRUE | TRUE | M | | R | 40 N | | 14.118 | 4.25 | 1.94 | 4.81 | 1.89 Proximal | D | A | CC | |
| | | | | | | | | | | | | | | 10.75 | 1.67 Left | D | A | I | |
| 10 | 1030 1 | Q29A | SBB | FALSE | TRUE | M | 56 | R | 50 S | 35 | 14.9 5.3 | 4.53 | 1.85 | 7.63 | 1.79 Proximal | I | A | R | |
| | | | | | | | | | | | | | | 9.32 | 1.73 Left | D | A | IR | |
| 10 | 1031 1 | N27B | ARCHED BACKED | FALSE | TRUE | M | 56 | PT | 135 S | 180 | 11.92 0 | 6.39 | 1.87 | 10.22 | 1.84 Left | D | A | CV | |
| 10 | 1032 1 | N24B | SBB | TRUE | TRUE | M | | R | 115 RS | 50 | 19.54 14.75 | 4.67 | 2.22 | 5.95 | 2.17 Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 9.86 | 1.96 Right | D | A | R | PD |
| | | | | | | | | | | | | | | 3.97 | 1.62 Distal | D | A | IR | |
| 10 | 1033 1 | L25B | SBB | TRUE | TRUE | M | | R | 180 R | 125 | 14.45 9.61 | 4.62 | 2 | 2.12 | 1.39 Proximal | D | A | CV | |
| | | | | | | | | | | | | | | 8.34 | 2.36 Left | D | A | R | |
| | | | | | | | | | | | | | | 6.31 | 2.25 Distal | D | A | R | |
| 10 | 1034 1 | N25A | SEE SKETCHP100 | TRUE | TRUE | M | | R | 80 R | 140 | 22.66 10.15 | 7.03 | 2.62 | 17.7 | 2.81 Lt Prox | D | A | CV | |
| | | | | | | | | | | | | | | 6.87 | 1.95 Distal | D | A | R | |
| 10 | 1035 1 | M25A | SBB | TRUE | TRUE | M | 9 | RS | 30 R | 150 | 22.59 | 5.51 | 2.68 | 1.82 | 1.94 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 10.07 | 1.9 Lt Partial | D | A | RCC | |
| | | | | | | | | | | | | | | 2.79 | 1.15 Distal | D | L | NOTCH | |
| 10 | 1036 1 | O28A | IRR BB | FALSE | TRUE | M | 23456 | rp | 120 S | 180 | 22.66 10.01 | 7.87 | 2.65 | 6.68 | 1.89 Lt Partial | D | A | CC | |
| | | | | | | | | | | | | | | 2.2 | 1.74 | D | A | R | |
| 10 | 1037 1 | L26D | TRUNC | FALSE | TRUE | M | 01 | S | 180 R | 50 | 14.47 9.33 | 5.09 | 1.76 | 6.94 | 1.49 Distal | D | A | R | |
| | | | | | | | | | | | | | | 2.35 | 0.44 Rt Partial | D | A | R | PD |
| 10 | 1038 1 | ? | SPIKE | FALSE | TRUE | M | 01 | S | 180 R | 60 | 9.53 0 | 4.83 | 2.22 | 11.11 | 2.32 Right | D | A | CV;R | |
| 10 | 1039 1 | O25D | SPIKE | FALSE | TRUE | M | 56 | RP | 60 S | 180 | 9.13 9.13 | 3.77 | 2.3 | 11.06 | 2.2 Lt Prox | D | A | ICV | |
| 10 | 1040 1 | O26B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 120 | 10.94 | 4.51 | 2.6 | 5.91 | 2.42 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.87 | 2.1 Distal | D | A | R | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1041 1 | M29A | ARCHED BACKED | FALSE | TRUE | M | 12;56 | S | 110 S | 115 | 20.29 10.41 | 5.88 | 2.5 | 12.94 | 2.52 | Rt Partial | D | A | RCV | |
| 10 | 1042 1 | N25A | SBB | FALSE | TRUE | M | 56 | S | 180 R | 50 | 18.59 13.01 | 6.09 | 2.65 | 12.78 | 2.2 | Right | D | A | RCC | DP |
| | | | | | | | | | | | | | | 7.7 | 2.03 | Distal | D | A | CC | |
| 10 | 1043 1 | O27B | ARCHED BACKED | TRUE | TRUE | M | | R | 115 R | 180 | 16.88 16.88 | 5.39 | 2 | 16.68 | 2.06 | Rt Prox | D | A | CV | PD |
| | | | | | | | | | | | | | | 4.64 | 1.72 | Distal | D | A | I | |
| 10 | 1044 1 | M25A | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | 180 S | 65 | 18.45 3.85 | 8.43 | 2.37 | 9.91 | 2.33 | Right | B | A | R | |
| 10 | 1045 1 | N24C | IRR BB | TRUE | TRUE | M | | MB | 135 N | | 20.02 7.48 | 7.83 | 2.32 | 13.05 | 2.11 | Right | D | A | IR | DP |
| 10 | 1046 1 | L28A | IRR BB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 20.58 | 6.55 | 2.4 | 7.77 | 1.82 | Rt Partial | D | A;SA | RI | |
| 10 | 1047 1 | N25A | IRR BB | FALSE | TRUE | M | 01 | S | 10 N | | 23.84 | 7.47 | 1.88 | 22.38 | 1.89 | Left | D | A | I | |
| 10 | 1048 1 | O27B | SBB | TRUE | TRUE | P | | N | MB | 50 | 19.11 | 4.87 | 2.15 | 18.16 | 1.51 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | 8.14 | 2.52 | Distal | I | | | |
| 10 | 1049 1 | M25C | SBB | TRUE | TRUE | M | | R | 160 R | 60 | 20.49 18.14 | 5.93 | 2.29 | 6.06 | 1.55 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | 16 | 2.45 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | 2.82 | 1.71 | Distal | D | A | R | |
| 10 | 1050 1 | M28B | ARCHED BACKED | TRUE | FALSE | M | | RPX | 140 RPX | 50 | 13.91 | 3.85 | 1.69 | 2.86 | 0.75 | | D | SA | R | |
| | | | | | | | | | | | | | | 8.91 | 1.71 | | D | A | ICVR | |
| | | | | | | | | | | | | | | 1.95 | 1.29 | | D | SA | R | |
| 10 | 1082 1 | M24D | SBB | TRUE | TRUE | M | | R | 80 R | 130 | 15.58 | 4.19 | 1.79 | 4.48 | 1.44 | Proximal | D | A | I | |
| | | | | | | | | | | | | | | 7.68 | 1.73 | Left | D | A | R | |
| | | | | | | | | | | | | | | 5.86 | 1.63 | Distal | D | A | R | |
| | | | | | | | | | | | | | | 2.18 | 0.5 | Rt Partial | D | A | CV;R | DP |
| 10 | 1083 1 | O27D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 55 | 13.38 | 5.03 | 1.88 | 8.36 | 1.23 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | 6.64 | 1.92 | Distal | D | A | RCC | |
| 10 | 1084 1 | L26B | ARCHED BACKED | TRUE | TRUE | M | | RP | 25 R | 130 | 22.07 11.94 | 6.42 | 2.91 | 3.06 | 1.82 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 8.3 | 2.36 | Left | I | A | RCC | PD |
| | | | | | | | | | | | | | | 11.45 | 2.83 | Distal | D | A;SA | CV | |
| 10 | 1085 1 | ? | ARCHED BACKED | TRUE | FALSE | M | | RX | 70 RX | 130 | 19 14.68 | 5.07 | 1.99 | 1.64 | 1.41 | | D | A | R | |
| | | | | | | | | | | | | | | 10.08 | 2.06 | | D | A | RCV | |
| | | | | | | | | | | | | | | 6.31 | 1.87 | | D | A | RCC | ORL |
| 10 | 1086 1 | O27D | TRIANGLE | TRUE | FALSE | M | | RPX | 60 RPX | 125 | 14.57 7.31 | 5.03 | 2.08 | 5.11 | 2.17 | | D | A | R | ORL |
| | | | | | | | | | | | | | | 3.08 | 2.31 | | D | A | R | |
| | | | | | | | | | | | | | | 1.88 | 0.56 | | D | A | CV | |
| 10 | 1087 1 | M25A | ARCHED BACKED | TRUE | TRUE | M | | R | 70 RP | 140 | 15.62 12.37 | 4.65 | 2.08 | 13.61 | 2.06 | Lt Prox | I | A | CV | DP |
| | | | | | | | | | | | | | | 3.96 | 1.21 | Distal | D | A | R | |
| 10 | 1088 1 | L27B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 50 | 12.12 | 5.02 | 1.48 | 8.16 | 1.36 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | 6.63 | 1.05 | Distal | D | A | CC | |
| 10 | 1108 1 | N28D | ARCHED BACKED | TRUE | TRUE | M | | PT | 25 PT | 120 | 19.37 | 7.8 | 2.94 | 12.86 | 3.11 | Left | D | A | IR | |
| 11 | 1051 1 | O20C | SBB | FALSE | TRUE | M | 01 | S | 120 R | 140 | 28.94 | 6.51 | 2.05 | 27.73 | 2.33 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | 7.34 | 2.3 | Distal | D | SA | RCC | LR |
| 11 | 1052 1 | P20D | SBB | TRUE | TRUE | M | 56 | R | 180 S | 135 | 25.04 | 6.41 | 2.26 | 3.15 | 2.73 | Proximal | D | L | R | LR |
| | | | | | | | | | | | | | | 20.68 | 2.24 | Left | D | SA;A | RCC | PD |
| | | | | | | | | | | | | | | 7.86 | 1.2 | Rt Partial | D | SA | R | DP |
| 11 | 1053 1 | R22B | SBB | TRUE | TRUE | P | | N | R | 135 | 22.06 18.1 | 6.9 | 1.89 | 15.29 | 1.06 | Left | D | L;A | R | |
| | | | | | | | | | | | | | | 8.55 | 1.5 | Distal | D | SA | R | |
| 11 | 1054 1 | L21D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 150 | 11.81 | 6.36 | 2.1 | 9.08 | 1.55 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.45 | 1.7 | Distal | D | A | R | LR |
| 11 | 1055 1 | N20D | IRR BB | FALSE | TRUE | D | 01 | S | 30 N | | 17.71 8.17 | 6.89 | 1.58 | 7.41 | 1.47 | Lt Partial | D | A | CC | DP |
| 11 | 1056 1 | L21D | SBB | TRUE | TRUE | P | | N | R | 135 | 20.84 | 6.55 | 4.63 | 14.58 | 4.86 | Left | D | L;A | R | |
| | | | | | | | | | | | | | | 6.88 | 0.96 | Distal | D | SA | R | LR |
| 11 | 1057 1 | Q21A | SBB | TRUE | TRUE | P | | N | R | 135 | 34.7 | 6.05 | 3.61 | 30.81 | 3.31 | Left | D | SA;A | RCC | |
| | | | | | | | | | | | | | | 7.1 | 3.04 | Distal | D | A | R | |
| 11 | 1058 1 | L19A | SBB | TRUE | FALSE | M | | NX | RX | 135 | 34.91 29.96 | 6.66 | 2.81 | 27.03 | 2.09 | | D | SA | RCC | OPD |
| | | | | | | | | | | | | | | 8.61 | 2.31 | | D | SA | R | OLR |
| 11 | 1059 1 | L20B | SBB | FALSE | TRUE | P | 56 | N | S | 10 | 10.54 7.65 | 8.28 | 2.5 | 10.08 | 2.56 | Left | D | SA | R | |
| 11 | 1060 1 | M20A | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 11.83 11.83 | 8.19 | 2.7 | 11.58 | 3.16 | Left | D | A | RCC | |
| 11 | 1061 1 | L22C | SBB | TRUE | TRUE | M | | N | R | 145 | 21.93 | 6.34 | 1.95 | 18.46 | 2.26 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | 7.08 | 2.02 | Distal | | A | IR | LR |
| 11 | 1062 1 | P22A | SBB | FALSE | TRUE | M | 01 | S | 180 RS | 145 | 14.99 | 6.35 | 3.05 | 7.82 | 3.26 | Left | D | A | R | |
| | | | | | | | | | | | | | | 9.32 | 1.65 | Distal | D | A | R | |
| 11 | 1063 1 | Q19D | SBB | FALSE | TRUE | M | 56 | N | S | 180 | 12 | 5.86 | 2.82 | 11.71 | 1.94 | Left | D | A | R | PD |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 2.4 | 1.88 | Rt Partial | D | L | R | PD |
| 11 | 1064 | 1 | O21C | SBB | TRUE | TRUE | P | | N | | R | 150 | 19.42 | | 6.27 | 2.45 | 16.833 | 1.95 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 6.79 | 2.12 | Distal | D | A | R | RL |
| 11 | 1065 | 1 | O22C | SBB | TRUE | TRUE | M | | R | 135 | R | 140 | 21.71 | | 5.29 | 2.24 | 6.33 | 2.36 | Rt Prox | D | A | R;CV | RL |
| | | | | | | | | | | | | | | | | | 20.8 | 2.3 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 6.33 | 1.58 | Distal | D | A | R | LR |
| 11 | 1066 | 1 | L22B | SBB | TRUE | TRUE | M | | N | | R | 150 | 25.37 | | 5.81 | 3.22 | 22.33 | 2.77 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.31 | 2.65 | Distal | D | A | R | LR;RL |
| 11 | 1067 | 1 | K20D | SBB | TRUE | TRUE | M | | RN | | R | 140 | 25.22 | | 6.4 | 2.39 | 3.11 | 2.73 | Proximal | D | L | CV | |
| | | | | | | | | | | | | | | | | | 18.57 | 2.51 | Left | D | A | IR | |
| | | | | | | | | | | | | | | | | | 9.02 | 2.41 | Distal | D | SA | RCV | |
| 11 | 1068 | 1 | M22D | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 19.88 | | 6.06 | 3 | 19.56 | 2.94 | Left | D | A | R | PD |
| 11 | 1069 | 1 | O21D | SBB | FALSE | TRUE | M | 01;56 | S | | S | 180 | 19.75 | | 5.49 | 1.41 | 18.85 | 0.92 | Right | D | A | R | |
| 11 | 1070 | 1 | K22C | SBB | FALSE | TRUE | P | 56 | N | | S | 140 | 29.51 | | 6.24 | 2.54 | 25.62 | 2.61 | Left | D | A | R | PD |
| 11 | 1071 | 1 | L21B | SBB | TRUE | TRUE | P | | N | | R | 150 | 25.12 | | 6.41 | 2.75 | 21.39 | 2.44 | Left | D | A | RICC | |
| | | | | | | | | | | | | | | | | | 8.13 | 2.41 | Distal | D | A | R | RL |
| 11 | 1072 | 1 | P21B | TRUNC | FALSE | TRUE | M | 01 | S | 180 | R | 135 | 20.43 | | 6.24 | 2.88 | 7.04 | 3.18 | Distal | D | SA | R | |
| 11 | 1073 | 1 | N20B | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 12.58 | | 5.45 | 2.1 | 12.42 | 1.76 | Left | D | A | RCC | PD |
| 11 | 1074 | 1 | R21D | SBB | FALSE | TRUE | M | 01;56 | S | 180 | R | 180 | 14.16 | | 5.42 | 2.44 | 12.54 | 2.12 | Right | D | A | IR | DP |
| 11 | 1075 | 1 | O22B | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 14.29 | | 6.39 | 1.73 | 14.48 | 1.97 | Left | D | SA | R | PD |
| 11 | 1076 | 1 | K22B | SBB | TRUE | TRUE | P | | N | | R | 140 | 22.38 | | 6.16 | 2.09 | 18.43 | 2.93 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 6.89 | 2.31 | Distal | D | SA | R | LR |
| 11 | 1077 | 1 | N20D | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 145 | 12.18 | | 6.28 | 1.85 | 9.11 | 2.2 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 6.29 | 1.58 | Distal | D | A | R | |
| 11 | 1078 | 1 | N21C | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 130 | 13.98 | | 4.98 | 2.69 | 8.92 | 2.53 | Left | B | A | R | |
| | | | | | | | | | | | | | | | | | 6.33 | 2.4 | Distal | D | A | R | |
| 11 | 1079 | 1 | P21A | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 160 | 15.84 | | 5.47 | 1.81 | 13.7 | 1.95 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 6.22 | 2.32 | Distal | D | SA | R | LR |
| 11 | 1080 | 1 | M20B | SBB | TRUE | FALSE | M | | NX | | RX | 140 | 32.54 | | 6.39 | 2.39 | 26.21 | 1.77 | | D | SA | RCC | OPD |
| | | | | | | | | | | | | | | | | | 6.37 | 2.64 | | D | SA;A | R | ORL |
| 11 | 1081 | 1 | O20C | SBB | FALSE | TRUE | P | 56 | N | | S | 140 | 22.09 | | 7.08 | 1.91 | 15.93 | 1.79 | Left | D | A | RCC | |
| 11 | 1210 | 1 | L22B | SBB | FALSE | TRUE | D | 01 | S | 180 | N | | 11.23 | 0 | 6.76 | 2.38 | 10.51 | 2.62 | Right | D | SA | CCR | |
| 11 | 1211 | 1 | O21B | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 130 | 7.49 | 0 | 6.23 | 1.53 | 8.09 | 1.44 | Left | D | SA;A | CVI | PD |
| | | | | | | | | | | | | | | | | | 2.58 | 0.7 | Distal | D | A | RCV | RL |
| 11 | 1212 | 1 | N22D | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 9.14 | | 9.13 | 1.99 | 6.43 | 2.18 | Left | D | SA | RCC | PD |
| 11 | 1213 | 1 | N21A | SBB | FALSE | TRUE | M | 01 | S | 180 | N | 180 | 15.66 | | 5.58 | 2.36 | 11.94 | 1.93 | Right | D | A | R | DP |
| 11 | 1214 | 1 | M22B | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 140 | 10.42 | | 6.87 | 1.7 | 6.97 | 2.07 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 7.83 | 1.95 | Distal | D | SA | R | LR |
| 11 | 1215 | 1 | Q22B | SBB | TRUE | TRUE | P | | N | | R | 155 | 27.22 | | 7.56 | 2.68 | 10.35 | 1.97 | Lt Partial | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 8.85 | 2.66 | Lt Partial | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 7.11 | 2.69 | Distal | D | A | R | |
| 11 | 1216 | 1 | L20C | SBB | TRUE | TRUE | P | | N | | R | 135 | 19.21 | | 5.53 | 2.32 | 17.24 | 2.4 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | | 5.63 | | D | A | R | |
| 11 | 1217 | 1 | O21B | SBB | TRUE | TRUE | P | | N | | R | 125 | 32.16 | | 6 | 2.73 | 24.87 | 2.99 | Left | D | SA;A | RCC | PD;DP |
| | | | | | | | | | | | | | | | | | 6.99 | 2.46 | Distal | D | A | R | RL |
| 11 | 1218 | 1 | L20C | SBB | TRUE | TRUE | P | | N | | R | 130 | 29.59 | | 5.67 | 3.1 | 14.82 | 2.82 | Lt Partial | D | SA;A | RCC | PD |
| | | | | | | | | | | | | | | | | | 8.84 | 2.81 | Lt Partial | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 4.04 | 2.59 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 2.81 | 0.6 | Distal | D | A | R | |
| 11 | 1219 | 1 | O21D | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 24.34 | | 6.74 | 2.78 | 25.14 | 2.37 | Left | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 8.4 | 0.61 | Rt Partial | D | A | CV | DP |
| 11 | 1220 | 1 | L21C | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 170 | 14.59 | | 5.08 | 2.73 | 2.71 | 1.12 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | | | | 14.04 | 2.42 | Left | D | A | R | PD |
| 11 | 1221 | 1 | K21D | SBB | TRUE | TRUE | P | | N | | R | 130 | 23.15 | | 5.94 | 2.81 | 19.53 | 2.48 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 4.71 | 2.7 | Distal | D | A | R | |
| 11 | 1222 | 1 | Q22B | SBB | TRUE | TRUE | P | | N | | R | 140 | 33 | | 5.35 | 3.11 | 28.07 | 2.37 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 7.2 | 2.77 | Distal | D | A | RCV | |
| 11 | 1223 | 1 | N20D | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 145 | 22.15 | | 7.21 | 3.45 | 20.72 | 2.92 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 7.03 | 2.73 | Distal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 6.57 | 1.12 | Rt Partial | D | L | R | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 1224 1 | L21A | SBB | TRUE | TRUE | P | | N | R | 155 | 22.86 | | 6.87 | 2.86 | 21.03 | 3.12 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 8.01 | 2.11 | Distal | D | A | R | RL |
| 11 | 1225 1 | L21A | SBB | TRUE | TRUE | P | | N | R | 155 | 21 | | 6.53 | 2.64 | 19.87 | 2.54 | Left | D | SA;A | RCC | PD |
| | | | | | | | | | | | | | | | 6.35 | 1.92 | Distal | D | A | IR | |
| 11 | 1226 1 | P20C | SBB | TRUE | TRUE | P | | N | R | 130 | 33.4 | | 5.53 | 2.31 | 29.38 | 2.39 | Left | D;B;D | A | R | |
| | | | | | | | | | | | | | | | 4.21 | 1.45 | Distal | D | A | R | |
| 11 | 1227 1 | M20A | SBB | TRUE | TRUE | P | | N | R | 150 | 30.5 | | 7 | 2.56 | 25.89 | 1.79 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | 8.46 | 1.79 | Distal | D | A | R | LR |
| 11 | 1228 1 | P22C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 18.59 | | 9.13 | 2.3 | 17.54 | 3 | Left | D | SA | RCC | DP |
| 11 | 1229 1 | R21C | SBB | TRUE | TRUE | M | | R | 150 R | 125 | 31.56 | | 5.78 | 3.3 | 2.43 | 0.7 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 3.83 | 2.38 | Distal | D | SA | R | |
| | | | | | | | | | | | | | | | 29.44 | 2.22 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | | 13.05 | 0.55 | Rt Prox | D | L;SA | CV | |
| 11 | 1230 1 | R21D | SBB | FALSE | TRUE | P | 56 | S | S | 170 | 14.37 | | 6.6 | 1.78 | 12.65 | 1.85 | Left | D | A | R | PD |
| 11 | 1231 1 | K22B | SBB | TRUE | TRUE | P | | N | R | 130 | 23.05 | | 6.67 | 2.51 | 18.87 | 2.04 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | 8.98 | 1.08 | Distal | D | SA | R | LR |
| 11 | 1232 1 | M21B | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 9.84 | | 6.58 | 2.1 | 8.79 | 2.3 | Left | D | A | IR | DP |
| 11 | 1233 1 | O19A | SBB | FALSE | TRUE | P | | N | R | 130 | 28.43 | | 6.73 | 3.16 | 21.78 | 2.36 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 3.69 | 3.11 | Distal | D | SA | R | |
| | | | | | | | | | | | | | | | 3.63 | 1.91 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 5.77 | 1.53 | Rt Partial | D | L | R | |
| 11 | 1234 1 | O22B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 145 | 13.07 | | 5.69 | 3.1 | 8.22 | 2.96 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 7.61 | 2.05 | Distal | D | A | R | |
| 11 | 1235 1 | N22A | SBB | TRUE | TRUE | P | | N | R | 160 | 20.88 | | 6.78 | 2.51 | 17.28 | 1.98 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 8.13 | 1.95 | Distal | D | A | R | |
| 11 | 1236 1 | N22D | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 14.74 | | 5.85 | 2.1 | 14.63 | 1.91 | Left | D | A | R | |
| 11 | 1237 1 | N20D | SBB | TRUE | TRUE | P | | N | R | 140 | 23.27 | | 6.95 | 2.14 | 12.34 | 1.28 | Lt Partial | D | SA | R | PD |
| | | | | | | | | | | | | | | | 7.42 | 1.92 | Distal | D | A | R | LR |
| 11 | 1238 1 | R20D | SBB | TRUE | TRUE | P | | N | R | 130 | 28.22 | | 6.08 | 3.1 | 12.16 | 2.4 | Lt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | 11.46 | 3.08 | Lt Partial | D | A | R | DP |
| | | | | | | | | | | | | | | | 6.95 | 2.33 | Distal | D | A | R | |
| 11 | 1239 1 | R21A | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 10.08 | | 5.13 | 1.85 | 7.9 | 1.85 | Left | D | A | R | PD |
| 11 | 1240 1 | L21B | SBB | TRUE | TRUE | P | | N | R | 150 | 20.89 | 16.81 | 7.57 | 2.2 | 10.82 | 1.39 | Lt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | 4.66 | 1.91 | Lt Partial | D | A | R | DP |
| | | | | | | | | | | | | | | | 5.55 | 1.01 | Distal | D | A | R | LR |
| 11 | 1241 1 | O20B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 155 | 11.75 | | 5.76 | 1.89 | 8.05 | 1.86 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 3.29 | 1.85 | Distal | | A | | |
| 11 | 1242 1 | O20B | SBB | FALSE | TRUE | M | 01 | S | 180 R | 125 | 9.66 | | 5.37 | 2.84 | 4.94 | 2.79 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 4.15 | 2.61 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 2.8 | 0.9 | Distal | D | A | R | RL |
| 11 | 1243 1 | L20D | SBB | TRUE | TRUE | P | | N | R | 125 | 30.11 | | 6.12 | 2.94 | 24.44 | 2.88 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 6.13 | 3.28 | Distal | D | SA | CV | |
| 11 | 1244 1 | P21A | SBB | TRUE | TRUE | P | | N | R | 125 | 30.63 | | 5.4 | 2.29 | 23.68 | 1.78 | Left | D | SA;A | R | PD |
| | | | | | | | | | | | | | | | 4.73 | 1.85 | Distal | D | SA | CV | |
| | | | | | | | | | | | | | | | 7.6 | 1.16 | Rt Partial | D | L;SA | R | PD |
| 11 | 1245 1 | P21B | SBB | TRUE | TRUE | M | | R | 125 RS | 145 | 25.38 | | 6.36 | 3.23 | 22.72 | 2.85 | Left | D | A | IR | |
| | | | | | | | | | | | | | | | 7.55 | 2.27 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | 10.1 | 2.84 | Rt Prox | D | L | CV | |
| 11 | 1246 1 | R21C | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 14.1 | | 5.82 | 3 | 14.44 | 2.66 | Left | D | A | R | DP |
| 11 | 1247 1 | R21A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 7.74 | | 5.58 | 3.42 | 7.64 | 3.26 | Left | D | A | R | PD |
| 11 | 1248 1 | Q21A | SBB | TRUE | TRUE | P | | N | R | 120 | 26.59 | | 5.44 | 2 | 22.64 | 1.58 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | 4.12 | 1.38 | Distal | D | A | RCV | LR |
| 11 | 1249 1 | R22D | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 13.54 | | 5.83 | 2.59 | 11.34 | 1.67 | Left | D | A | R | PD |
| 11 | 1250 1 | N22A | SBB | TRUE | TRUE | P | | N | R | 130 | 17.01 | | 6.61 | 2.18 | 11.72 | 2.45 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 8.08 | 1.86 | Distal | D | A | RCV | |
| 11 | 1251 1 | P20A | SBB | FALSE | TRUE | P | 56 | N | S | 20 | 10.59 | | 6.22 | 2.3 | 8.87 | 2.1 | Left | D | A | IRCC | PD |
| 11 | 1269 1 | O20D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 130 | 12.73 | | 5.85 | 2.3 | 9.95 | 2.02 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | 6.24 | 2.44 | Distal | D | A | R | |
| 11 | 1270 1 | Q21A | SBB | TRUE | TRUE | P | | N | R | 155 | 34.44 | | 7.43 | 2.4 | 32.98 | 3.09 | Left | D | A | R | |
| | | | | | | | | | | | | | | | 7.51 | 2.69 | Distal | D | A | R | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 1271 1 | L22B | SBB | TRUE | TRUE | P | | N | R | 145 | 18.28 | 5.58 | 2.02 | 2.94 | 1.88 Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 12.21 | 1.54 Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | 6.87 | 1.12 Distal | D | A | R | LR |
| 11 | 1745 1 | A21a | SBB | TRUE | TRUE | P | | N | RS | 140 | 19.26 0 | 5.89 | 2.32 | 15.29 | 2.46 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 4.06 | 1.24 Distal | D | L | R | |
| 11 | 1746 1 | N20D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 135 | 23.93 0 | 5.82 | 3.14 | 21.13 | 2.63 Left | D | A | R | |
| | | | | | | | | | | | | | | 5.94 | 2.18 Distal | D | SA | R | |
| 11 | 1747 1 | L21D | SBB | TRUE | TRUE | P | | N | R | 130 | 20.59 0 | 5.94 | 2.56 | 15.87 | 2.6 Left | D | A | R | |
| | | | | | | | | | | | | | | 6.36 | 2.99 Distal | | SA | R | |
| 11 | 1748 1 | N20D | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 15.19 0 | 6.26 | 2.19 | 14.12 | 2.46 Left | D | A | R | |
| 11 | 1749 1 | L20D | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 9.77 0 | 5.43 | 1.54 | 8.66 | 1.6 Left | D | SA | R | |
| 12 | 1124 1 | M28D | SBB | TRUE | TRUE | P | 7 | N | R | 35 | 31.96 22.73 | 15.47 | 3.99 | 20.19 | 3.01 Right | D | A | RCC | DP |
| | | | | | | | | | | | | | | 19.29 | 2.4 Distal | D | A | RSIN | LR |
| 12 | 1125 1 | K30A | SBB | FALSE | TRUE | M | 56 | R | 50 S | 25 | 20.69 8.22 | 8.75 | 2.98 | 9.96 | 3.13 Proximal | D | SA | R;CC | |
| | | | | | | | | | | | | | | 16.71 | 3.08 Left | D | A | R | PD |
| 12 | 1126 1 | K30D | ARCHED BACKEd | FALSE | TRUE | M | 01 | S | 180 R | 70 | 23.43 | 6.97 | 3.41 | 8.22 | Rt Partial | B | A | R | |
| | | | | | | | | | | | | | | 15.34 | 3.65 Rt Dist | D | A | CV | |
| 12 | 1127 1 | L29C | SBB | FALSE | TRUE | M | 01 | S | 170 R | 180 | 9.98 | 5.36 | 2.41 | 10.15 | 2.45 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 5.61 | 0.97 Distal | D | SA | CV | |
| 12 | 1128 1 | K29D | SBB | FALSE | TRUE | M | 01 | S | 180 RP | 120 | 12.12 | 6.39 | 3.73 | 7.32 | 3.9 Left | D | SA | R | |
| | | | | | | | | | | | | | | 6.25 | 2.25 Distal | D | SA | R | |
| 12 | 1129 1 | M27C | SBB | FALSE | TRUE | M | 01 | S | 180 R | 65 | 22.25 | 6.99 | 2.77 | 15.24 | 2.53 Right | D | A | IR | PD |
| | | | | | | | | | | | | | | 7.23 | 1.99 Distal | D | A | IR | |
| 12 | 1130 1 | L30D | SBB | FALSE | TRUE | M | 01 | S | 180 RP | 135 | 14.62 | 6.24 | 3.02 | 10.12 | 2.78 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 2.62 | 1.05 Distal | D | A | R | |
| 12 | 1131 1 | K30A | SBB | FALSE | TRUE | M | 01 | S | 180 R | 60 | 20.98 | 6.63 | 2.86 | 14.95 | 3.14 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 6.87 | 1.48 Distal | D | SA | RSIN | |
| 12 | 1132 1 | L30D | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 RS | 75 | 24.22 | 7.81 | 3.55 | 10.46 | 3.38 Rt Partial | D | A | IR | |
| | | | | | | | | | | | | | | 11.37 | 1.64 Rt Dist | D | A | R | DP |
| 12 | 1133 1 | K30D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 120 | 17.18 | 7.49 | 2.24 | 11.64 | 1.49 Left | D | A | R | |
| | | | | | | | | | | | | | | 7.46 | 2.62 Distal | D | A | R | |
| 12 | 1134 1 | K29C | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 55 S | 180 | 16.2 | 6.72 | 2.13 | 3.3 | 1.68 Rt Partial | D | A | R | DP |
| | | | | | | | | | | | | | | 15.09 | 1.48 Rt Dist | D | A | R;CV | PD |
| 12 | 1135 1 | K28A | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | 180 S | 56 | 14.18 | 6.53 | 1.79 | 6.34 | 1.56 Lt Partial | D | A | R | DP |
| | | | | | | | | | | | | | | 7.9 | 0.96 Lt Dist | D | A | CV | PD |
| 12 | 1136 1 | L30D | SBB | FALSE | TRUE | M | 01 | S | 180 R | 120 | 14.77 | 5.84 | 3.02 | 6.76 | 1.67 Left | D | A | R | DP |
| | | | | | | | | | | | | | | 9.11 | 1.01 Distal | D | A | R | PD |
| 12 | 1137 1 | L30A | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 R | 60 | 14.47 | 5.87 | 2.15 | 8.8 | 1.89 Right | D | A | R | |
| | | | | | | | | | | | | | | 8.27 | 1.95 Distal | D | A | CV | |
| 12 | 1138 1 | K30D | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 R | 55 | 23.41 | 5.79 | 3.44 | 18.35 | 3.36 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 6.93 | 2.4 Distal | D | A | R | |
| 12 | 1139 1 | M28C | SBB | TRUE | TRUE | P | | N | N | 30 | 28.14 | 6.33 | 2.97 | 25.83 | 2.32 Right | D | A | IR | |
| 12 | 1140 1 | K30D | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 22.61 16.5 | 11.35 | 2.6 | 17.73 | 3.03 Left | D | A | RCC | |
| | | | | | | | | | | | | | | 8.94 | 0.62 Rt Dist | I | SA | CV | |
| 12 | 1141 1 | K27A | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | | 16.19 8.97 | 8.35 | 1.82 | 13.81 | 1.92 Left | D | A | RCC | |
| 12 | 1142 1 | K29B | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 19.58 19.58 | 11.56 | 3.58 | 16.72 | 3.06 Right | D | A | R | PD |
| 12 | 1143 1 | K29D | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 60 S | 180 | 14.49 14.49 | 8.18 | 2.88 | 15.75 | 2.6 Lt Prox | D | A | CV | |
| 12 | 1144 1 | L27A | SBB | FALSE | TRUE | M | 56 | R | 20 S | 180 | 15.09 | 7.41 | 2.12 | 4.6 | 2.2 Proximal | D | SA | R | |
| | | | | | | | | | | | | | | 12.42 | 1.98 Left | D | A | R | |
| 12 | 1145 1 | K72D | SBB | FALSE | TRUE | M | 56 | RP | 50 S | 180 | 16.23 | 7.23 | 2.21 | 3.03 | 1.27 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 10.01 | 1.5 Left | D | A | R | DP |
| 12 | 1146 1 | M27A | SBB | FALSE | TRUE | M | 56 | RP | 135 S | 180 | 10.79 | 6.09 | 2.51 | 1.65 | 0.34 Proximal | D | A | R | |
| | | | | | | | | | | | | | | 6.55 | 2.6 Right | D | A | R | |
| 12 | 1147 1 | M27D | SBB | FALSE | TRUE | D | 01 | S | 180 N | | 11.3 | 6.5 | 2.35 | 7.05 | 1.7 Left | D | A | R | PD |
| 12 | 1148 1 | L30C | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 rp | 70 | 12.36 0 | 7.86 | 1.96 | 11.51 | 1.61 Right | D | A | CV | DP |
| | | | | | | | | | | | | | | 2.56 | 0.67 Distal | D | A | R | |
| | | | | | | | | | | | | | | 2.41 | 0.43 Lt Partial | D | A | CV | |
| 12 | 1153 1 | L29C | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 16.1 | 6.51 | 2.98 | 8.69 | 2.16 | D | L | R | |
| 12 | 1154 1 | K30C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 18.8 | 6.22 | 2.03 | 17.43 | 0.98 Left | D | SA | R | |
| 12 | 1155 1 | L27C | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 155 | 25 11.04 | 9.18 | 3.18 | 23.48 | 2.75 Right | D | A | RCC | DP |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 7.27 | 0.78 | Lt Partial | D | L | CV | |
| 12 | 1157 | 1 | K28C | TRUNC | FALSE | TRUE | P | 5 | N | | RS | 180 | 19.89 | | 14.05 | 3.14 | 4.27 | 2.71 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 15.57 | 0.46 | Left | D | SA | | |
| 12 | 1158 | 1 | K29B | IRR BB | FALSE | TRUE | P | 6 | N | | RS | 180 | 22.74 | | 12.18 | 4.22 | 3.03 | 3.34 | Distal | D | SA | CC | LR |
| | | | | | | | | | | | | | | | | | 8.91 | 0.62 | Lt Partial | D | SA | | |
| 12 | 1159 | 1 | K30C | SBB | FALSE | TRUE | P | 56 | RN | | S | 180 | 21.51 | 10.27 | 11.17 | 4.55 | 19.61 | 4.41 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 15.31 | 0.45 | Right | D | SA | | |
| 12 | 1160 | 1 | L30D | SBB | FALSE | TRUE | P | 6 | N | | RS | 20 | 21.54 | | 9.03 | 3.27 | 4.53 | 2.85 | Distal | D | A | ICC | |
| | | | | | | | | | | | | | | | | | 5.83 | 0.94 | Rt Partial | D | SA | R | DP |
| | | | | | | | | | | | | | | | | | 8.3 | 1.56 | Rt Prox | D | L | CV | |
| 12 | 1162 | 1 | K30D | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 20.4 | | 9.42 | 2.92 | 16.7 | 2.93 | Left | D | A | RCC | PD |
| 12 | 1163 | 1 | L26A | SBB | FALSE | TRUE | D | 01 | S | 180 | RN | | 13.08 | | 8.36 | 2.41 | 11.51 | 1.97 | Left | D | SA | RCV | PD |
| 12 | 1164 | 1 | L26C | IRR BB | TRUE | TRUE | P | | N | | rp | 30 | 17.38 | | 9.67 | 2.84 | 15.14 | 2.13 | Right | D | SA | SIN | |
| | | | | | | | | | | | | | | | | | 9.38 | 0.49 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 5.19 | 0.59 | Lt Partial | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 2.04 | 0.57 | Lt Partial | D | SA | R | |
| 12 | 1165 | 1 | M27A | IRR BB | FALSE | TRUE | P | 56 | N | | S | 180 | 13.27 | | 7.26 | 2 | 14.37 | 1.46 | Right | D | SA | IR | PD |
| 12 | 1166 | 1 | K28B | SBB | FALSE | TRUE | M | 01;56 | S | 140 | S | 150 | 16.25 | | 6.35 | 1.89 | 16.49 | 1.51 | Left | D | A | IR | |
| 12 | 1167 | 1 | L29B | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 155 | 7.17 | | 4.7 | 1.53 | 7.23 | 0.93 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 3.5 | 1.02 | Distal | D | A | NOTCH | |
| 12 | 1168 | 1 | M27C | SBB | FALSE | TRUE | M | 01;56 | S | 25 | S | 25 | 6.53 | | 6.25 | 1.67 | 6.42 | 1.68 | Right | D | A | R | DP |
| 12 | 1169 | 1 | K26D | ARCHED BACKED | TRUE | TRUE | M | | RP | 180 | R | 180 | 11.68 | | 5.66 | 3.3 | 2.31 | 1.95 | Proximal | D | SA | RCV | |
| | | | | | | | | | | | | | | | | | 8.25 | 3.26 | Right | D | A | RCV | |
| | | | | | | | | | | | | | | | | | 6.43 | 2.31 | Distal | D | A | CV | |
| 12 | 1170 | 1 | L26D | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 5.15 | | 6.5 | 2.28 | 5.06 | 1.332 | Right | | A | R | |
| 12 | 1171 | 1 | M27A | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 6.33 | | 6.23 | 2.78 | 5.97 | 2.8 | Right | D | A | R | |
| 12 | 1172 | 1 | M26C | SBB | FALSE | TRUE | P | 56 | N | | S | 20 | 9.91 | 5.78 | 7.79 | 2.42 | 9.22 | 2.87 | Left | D | A | R | PD |
| 12 | 1173 | 1 | L29C | SBB | FALSE | TRUE | M | | S | 180 | S | 180 | 5.81 | | 7.35 | 3.58 | 5.13 | 3.46 | Left | B | A | R | |
| 12 | 1174 | 1 | K28B | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 13.17 | 13.17 | 8.21 | 3.64 | 12.95 | 3.95 | Left | D | SA | IR | PD |
| 12 | 1175 | 1 | L30A | SBB | FALSE | TRUE | M | 01;56 | S | 20 | S | 180 | 9.62 | | 7.03 | 1.73 | 9.63 | 1.97 | Right | D | A | SIN | |
| 12 | 1176 | 1 | M27A | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 7.01 | | 7.58 | 3.11 | 5.23 | 3.33 | Right | B | A | R | |
| 12 | 1177 | 1 | L29D | IRR BB | TRUE | TRUE | D | | MB | 120 | N | | 16.95 | 10.26 | 8.19 | 2.74 | 10.88 | 1.79 | Rt Partial | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 10.58 | 2.7 | Lt Prox | D | | | |
| 12 | 1178 | 1 | K28A | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 6.68 | | 6.69 | 3.62 | 7.27 | 3.62 | Left | D | A | IR | |
| 12 | 1179 | 1 | L27B | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 10.61 | | 6 | 2.49 | 9.27 | 1.27 | Left | D | A | R | PD |
| 12 | 1180 | 1 | K27B | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 11.03 | | 8.09 | 1.7 | 8.09 | 1.46 | Left | D | SA | R | |
| 12 | 1181 | 1 | M26B | SBB | FALSE | TRUE | M | 01 | S | 35 | RS | 150 | 7.9 | | 7.17 | 1.36 | 3.84 | 1.44 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 3.75 | 0.98 | Distal | D | A | R | |
| 12 | 1182 | 1 | L30B | IRR BB | FALSE | TRUE | P | 56 | N | | S | 180 | 18.01 | | 11.36 | 3.21 | 15.14 | 3.06 | Left | D | A | I | |
| 12 | 1183 | 1 | K28A | SBB | FALSE | TRUE | D | 01 | S | 180 | N | | 17.15 | | 5.54 | 2.87 | 7.93 | 2 | Rt Partial | | A | CC | |
| 12 | 1184 | 1 | L26D | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 6.81 | 6.81 | 7.3 | 1.71 | 8.02 | 1.74 | Left | D | A | CC | |
| 12 | 1185 | 1 | K26B | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 25 | 5.69 | | 6.27 | 2.16 | 4.93 | 2.57 | Left | D | SA | R | |
| 12 | 1186 | 1 | M26C | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 5.83 | | 6.8 | 2.86 | 5.37 | 2.73 | Left | B | A | R | |
| 12 | 1187 | 1 | L29C | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 6.58 | | 6.42 | 1.65 | 5.5 | 1.79 | Left | D | SA | R | |
| 12 | 1188 | 1 | K28D | SBB | FALSE | TRUE | M | 01 | S | 180 | PT | 20 | 9.6 | | 7.48 | 2.85 | 7.7 | 2.9 | Right | D | A | RCC | |
| 12 | 1189 | 1 | M26C | ARCHED BACKED | TRUE | TRUE | M | | R | 160 | R | 65 | 18.71 | 10.13 | 7.26 | 3 | 4.29 | 3.81 | Proximal | D | SA | CV | |
| | | | | | | | | | | | | | | | | | 17.62 | 2.83 | Right | D | A;SA | CV | DP |
| | | | | | | | | | | | | | | | | | 5.67 | 1.11 | Distal | D | A | R | |
| 12 | 1190 | 1 | L26B | ARCHED BACKED | TRUE | TRUE | M | | R | 50 | R | 130 | 19.09 | | 6.08 | 2.14 | 5.3 | 1.84 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 8.65 | 1.52 | Lt Partial | D | A | R | |
| | | | | | | | | | | | | | | | | | 7.84 | 2.45 | Lt Dist | D | A | ICV | |
| 12 | 1191 | 1 | L27D | ARCHED BACKED | TRUE | TRUE | M | | R | 125 | R | 55 | 16.43 | 7.8 | 6.18 | 2.28 | 19.6 | 1.2 | Right | D | A | CV | DP |
| 12 | 1192 | 1 | L30D | ARCHED BACKED | TRUE | TRUE | M | | rp | 65 | R | 110 | 23.94 | 14.17 | 5.85 | 2.84 | 7.66 | 1.87 | Proximal | D | A | CC | DP |
| | | | | | | | | | | | | | | | | | 14.3 | 2.71 | Lt Dist | D | A | CV | PD |
| 12 | 1193 | 1 | M28A | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | | S | 170 | 20.72 | | 6.98 | 2.79 | 4.59 | 2.43 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 17.4 | 2.84 | Rt Dist | | A | CV | DP |
| 12 | 1194 | 1 | L30C | ARCHED BACKED | FALSE | TRUE | M | | R | 60 | R | 155 | 24.58 | 8.71 | 7.34 | 2.1 | 8.15 | 2 | Lt Dist | D | A | IR | |
| | | | | | | | | | | | | | | | | | 12.61 | 2.03 | Lt Prox | D | A | RCV | |
| 12 | 1195 | 1 | M27A | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 10 | S | . 15 | 23.15 | 5.23 | 7.22 | 2.89 | 5.85 | 2.27 | Proximal | D | A | RCV | |
| | | | | | | | | | | | | | | | | | 22.89 | 1.22 | Left | D | SA | CV | PD |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|12|1196|1|L27B|ARCHED BACKED|TRUE|TRUE|M|01|R|120 R|60|23.4||6.34|3.63|22.3|3.49|Rt Prox|D|A|CV||
|||||||||||||||||4.52|1.53|Distal|D|A|R||
|||||||||||||||||2.03|1.42|Distal|D|L|R||
|||||||||||||||||3.33|0.8|Lt Partial|D|A|R||
|12|1197|1|M26C|ARCHED BACKED|FALSE|TRUE|P|01|S|180 R|55|18.21||5.98|2.25|16.84|2.36|Right|D|A|R;CV||
|||||||||||||||||3.01|1.18|Distal|D|A|CV|LR|
|12|1198|1|K30A|ARCHED BACKED|FALSE|TRUE|M|56|R|60 RS|125|20.5|12.83|8.27|3.05|12|3.53|Rt Prox|D|SA|CV||
|||||||||||||||||12.52|3.65|Rt Dist|D|SA|CV||
|12|1199|1|L30C|ARCHED BACKED|TRUE|TRUE|M|01|R|110 R|60|20.66|11.89|7.79|2.78|12.85|2.35|Rt Prox|D|SA|R|PD|
|||||||||||||||||10.68|2.1|Rt Dist|D|SA|R|PD|
|12|1200|1|M28D|ARCHED BACKED|FALSE|TRUE|M|01|S|180 R|55|21.21|13.45|7.73|2.49|12.94|2.06|Rt Partial|D|A|R||
|||||||||||||||||9.54|2.63|Rt Partial|D|A|RCV||
|||||||||||||||||2.61|1.2|Distal|D|A|R|LR|
|12|1201|1|K29D|TRUNC|TRUE|TRUE|P||N|R|150|22.85||12.3|2.85|8.84|2.62|Distal|D|SA|R|LR;RL|
|12|1202|1|K30C|SBB|TRUE|TRUE|P||N|R|60|26.56|10.95|10.42|2.82|26.25|2.24|Rt Dist|D|SA;A|IR||
|12|1203|1|K28A|RET B|FALSE|TRUE|D|01|S|180 N||19||8.87|3.66|10.34|2.09|Rt Partial|D|L|R|DP|
|12|1204|1|L29B|SBB|FALSE|TRUE|P|56|N|S|20|17.02|17.02|6.58|1.92|7.72|0.76|Rt Partial|D|A|R||
|12|1205|1|K28D|IRR BB|FALSE|TRUE|M|01;56|S|180 S|180|22.65|16.31|10.55|3.47|14.57|3.18|Rt Partial|D|A|IR|DP|
|12|1206|1|M29A|ARCHED BACKED|TRUE|TRUE|M||R|60 RP|140|18.84||7.37|2.31|5.51|1.87|Proximal|D|A|R||
|||||||||||||||||5.29|1.88|Lt Partial|D|SA|R||
|||||||||||||||||8.91|2.18|Lt Partial|D|SA|CV||
|12|1207|1|L28A|ARCHED BACKED|FALSE|TRUE|M|01|S|180 R|115|14.87||7.01|2.3|10.65|2.5|Left|D|SA|RCV||
|||||||||||||||||7.21|1.93|Distal|D|A|CV||
|12|1208|1|L28C|TRIANGLE|TRUE|TRUE|M||RP|60|140|18.48|9.55|7.66|2.81|8.84|2.77|Lt Partial|D|SA|RCV|PD|
|||||||||||||||||7.67|3.16|Lt Partial|D|A|SIN||
|12|1209|1|M26C|ARCHED BACKED|TRUE|TRUE|M|56|R|155 R|70|18.66|12.42|7.37|3.15|4.75|3.59|Proximal|D|SA|CV||
|||||||||||||||||16.66|2.46|Right|D|A;SA|CV|DP|
|||||||||||||||||3.05|1.11|Distal||A|R||
|13|252|1|2/80-90|RET B|FALSE|TRUE|P|56|N|S|180|13.08|0|4.87|1.7|12.72|0.57|Right|I|SA|R||
|13|253|1|4/60-70|SBB|FALSE|TRUE|M|01|S|10 R|160|28.68|0|6.8|2.69|27.04|2.87|Left|D|SA|SIN||
|||||||||||||||||5.82|0.65|Distal|D|L|R|LR|
|13|254|1|4/80-90|ARCHED BACKED|FALSE|TRUE|M|56|R|30 S|180|13.52|10.65|3.86|1.89|5.52|1.39|Proximal|D|A|CV|RL|
|||||||||||||||||12.12|1.63|Left|D|A|RI||
|13|255|1|2/80-90|ARCHED BACKED BIPT|TRUE|TRUE|M||R|110 RP|50|19.34|3.65|3.03|1.5|15.16|0.69|Left|I|L|R||
|||||||||||||||||17.36|1.55|Right|D|A|RCV|PD|
|13|256|1|2/80-90|ARCHED BACKED BIPT|TRUE|TRUE|M||R|110 R|60|18.05|13.09|3.71|2.21|11.36|2.29|Rt Prox|D|A|CV||
|||||||||||||||||5.85|2.2|Rt Dist|D|A|RI||
|13|257|1|2/70-80|ARCHED BACKED BIPT|TRUE|TRUE|M||R|70 R|110|17.22|8.49|4.33|1.64|1.3|0.51|Proximal|D|A|RI||
|||||||||||||||||9.65|0.98|Rt Partial|D|A|CV|PD|
|||||||||||||||||7.14|1.67|Rt Dist|D|SA|CV||
|13|258|1|2/70-80|ARCHED BACKED|FALSE|TRUE|M|01;2|S|180 R|110|20.21|0|3.76|1.91|9.43|2.06|Lt Partial|D|A|RI|PD|
|||||||||||||||||13.14|1.61|Lt Dist|D|A|CV|DP|
|13|259|1|4/60-70|ARCHED BACKED|FALSE|TRUE|M|01;56|S|180 R|170|18.29|11.95|10.66|3.91|10.6|4.01|Rt Partial|D|A|R|DP|
|||||||||||||||||8.81|3.44|Rt Dist|D|SA|R|DP|
|||||||||||||||||3.51|0.75|Distal|D|A|R||
|||||||||||||||||15.94|0.79|Left|I|SA|R;NOTCH||
|13|260|1|2/70-80|SBB|FALSE|TRUE|P|01;56|S|180 S|180|11.96|0|5.94|1.78|10.76|1.32|Left|D|SA|R|PD|
|||||||||||||||||5.86|1.42|Rt Partial|D|L|R|PD|
|13|261|1|4/60-70|RET B|FALSE|TRUE|P|01|S|170 R|10|10.89|0|4.97|2.82|10.77|1.1|Left|D|L|R|PD|
|||||||||||||||||3.74|1.17|Distal|D|L|R|LR|
|||||||||||||||||5.78|1.98|Rt Partial|D|L|R|PD|
|13|262|1|4/80-70|ARCHED BACKED PT|FALSE|FALSE|M|01|SX|160 RX|80|8.95|1|4.44|1.11|9.19|0.93||I|A;SA|R;CV||
|13|263|1|4/70-80|RET B|FALSE|TRUE|M|01;56|S|180 S|180|12.58|0|8.82|1.59|11.14|0.33|Left|D|L|R||
|13|264|1|2/50-60|ARCHED BACKED|FALSE|TRUE|M|01;234|S|10 R|140|18.75|11.28|8.22|2.15|10.83|0.77|Lt Partial|D|SA|R|DP|
|||||||||||||||||5.88|1.55|Lt Dist|D|SA|CC|PD|
|||||||||||||||||3.14|1.24|Distal|D|A|CC||

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 265 | 1 | 2/50-60 | ARCHED BACKED | FALSE | TRUE | M | 56;234 | R | 50 | S | 160 | 16.31 | 0 | 5.59 | 2.24 | 9.5 | 1.34 | Left | D | SA | CC | |
| | | | | | | | | | | | | | | | | | 7.35 | 2.22 | Proximal | D | A | R;CV | RL |
| | | | | | | | | | | | | | | | | | 11.16 | 0.61 | Right | | L | R;N;R;N | PD |
| 13 | 266 | 1 | 4/60-70 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 30 | 16.18 | 0 | 7.13 | 2.48 | 13.26 | 1.58 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.93 | 2.17 | Distal | I | A | R | LR |
| | | | | | | | | | | | | | | | | | 14.58 | 0.76 | Left | D | L | RI | |
| 13 | 267 | 1 | 4/80-90 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 170 | 16.3 | 0 | 6.79 | 1.95 | 15.26 | 1.52 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.77 | 0.53 | Distal | D | A | R | |
| 13 | 268 | 1 | 4/80-90 | SBB | FALSE | TRUE | M | 56 | S | 180 | R | 40 | 14.25 | 0 | 6.1 | 1.72 | 9.48 | 1.46 | Right | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 7.16 | 1.61 | Distal | D | SA | CC | |
| 13 | 269 | 1 | 4/60-70 | SBB | FALSE | TRUE | M | 01;56;23 | S | 180 | S | 180 | 18.93 | 1 | 7.46 | 1.97 | 17.58 | 1.43 | Left | D | A | R | PD |
| 13 | 270 | 1 | 2/70-80 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 16.69 | 0 | 5.35 | 2.6 | 16.12 | 1.8 | Left | D | A | RI | PD |
| 13 | 271 | 1 | 4/70-80 | SBB | FALSE | TRUE | M | 01;56 | S | 170 | S | 180 | 13.07 | 0 | 5.72 | 3.27 | 11.79 | 2.75 | Right | D | A | R | PD |
| 13 | 272 | 1 | 4/80-90 | SBB | FALSE | TRUE | M | 56;01 | S | 180 | S | 10 | 14.82 | 0 | 5.69 | 2.32 | 12.07 | 2.29 | Right | B | A | R | |
| 13 | 273 | 1 | 2/50-60 | QALKHAN PT | TRUE | TRUE | M | | RS | 30 | RM | 50 | 34.02 | 7.88 | 13.95 | 4.33 | 27.95 | 4.6 | Left | D | SA;A | IR | PD |
| | | | | | | | | | | | | | | | | | 3.76 | 1.44 | Proximal | I | SA | R | |
| | | | | | | | | | | | | | | | | | 1.43 | 1.34 | Distal | I | L | | RL |
| 13 | 274 | 1 | 4/70-80 | QALKHAN PT | TRUE | TRUE | M | | R | 50 | R | 140 | 26.98 | 5.49 | 9.24 | 3.02 | 12.42 | 3.05 | Proximal | D | A;SA | NOTCH | |
| | | | | | | | | | | | | | | | | | 22.6 | 2.3 | Lt Dist | D | A | RCC;CV | PD |
| 13 | 1272 | 1 | 60 | RET B | FALSE | TRUE | P | 56 | N | | S | 170 | 22.05 | 19.32 | 9.06 | 2.44 | 18.67 | 0.51 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 15.44 | 0.4 | Right | | | IR | |
| 13 | 1273 | 1 | 70 | RET B | TRUE | TRUE | P | | N | | RN | 80 | 20.32 | 20.32 | 9.32 | 2.3 | 18.5 | 0.99 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | | | 7.12 | 0.54 | Distal | D | SA | R | LR |
| 13 | 1274 | 1 | 70 | RET B | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 12.56 | | 9.04 | 1.78 | 11.4 | 0.55 | Left | D | SA | R | PD |
| 13 | 1275 | 1 | 80 | RET B | FALSE | TRUE | M | 01;56 | S | | S | 180 | 12.5 | 5.23 | 8.86 | 1.79 | 4.09 | 0.55 | Lt Partial | D | SA | IR | |
| | | | | | | | | | | | | | | | | | 10.7 | 0.88 | Right | D | SA | R | DP |
| 13 | 1276 | 1 | 50-90 | RET B | FALSE | TRUE | M | 56 | RS | 180 | S | 180 | 14.81 | | 5.56 | 1.43 | 4.97 | 0.39 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 13.84 | 0.44 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 13.64 | 0.47 | Right | D | A | R | DP |
| 13 | 1277 | 1 | 50-90 | ARCHED BILATERAL BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 120 | 18.84 | 8.5 | 6.81 | 2.63 | 6.8 | 0.5 | Lt Partial | D | L | R | |
| | | | | | | | | | | | | | | | | | 6.51 | 1.78 | Lt Dist | D | SA | R | LR |
| | | | | | | | | | | | | | | | | | 5.67 | 1.36 | Distal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 18 | 1.64 | Right | D | A | RCC | DP |
| 13 | 1278 | 1 | 70 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 120 | S | 180 | 14.8 | 12.08 | 9.85 | 3.43 | 2.9 | 1.23 | Proximal | D | A | CV | |
| | | | | | | | | | | | | | | | | | 13.75 | 0.64 | Left | D | SA | I | PD |
| | | | | | | | | | | | | | | | | | 6.71 | 0.73 | Proximal | D | A | IR | |
| | | | | | | | | | | | | | | | | | 6.82 | 2.36 | Rt Partial | D | A;SA | CC | PD |
| | | | | | | | | | | | | | | | | | 5.54 | 0.82 | Rt Partial | D | SA | R | |
| 13 | 1279 | 1 | 80 | SBB | TRUE | TRUE | M | | R | 180 | RS | 180 | 16.61 | | 7.38 | 2.09 | 4.66 | 1.1 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 16.04 | 0.95 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | | | | 2.29 | 1.16 | Distal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 15.6 | 1 | Right | D | A | I | |
| 13 | 1280 | 1 | 70 | SBB BILATERAL | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 12.18 | | 7.68 | 2.46 | 12.01 | 1.26 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 10.4 | 0.92 | Right | D | A | R | DP |
| 13 | 1281 | 1 | 80 | ARCHED BACKED PT | FALSE | TRUE | M | 56 | R | | S | 180 | 14.29 | 14.29 | 6.05 | 2.6 | 8.46 | 2.56 | Lt Prox | D | L | CV | PD |
| | | | | | | | | | | | | | | | | | 13.65 | 2.11 | Rt Prox | D | A;SA | CV;R | PD |
| 13 | 1282 | 1 | 70 | IRR BB W/ NOTCH | FALSE | TRUE | M | 01 | S | 180 | PT | 135 | 26.95 | 16 | 15.99 | 3.18 | 15.33 | 2.17 | Distal | D | A | NOTCH | LR |
| 13 | 1283 | 1 | 70 | SBB | TRUE | TRUE | P | | N | | R | 135 | 17.59 | 0 | 6.58 | 2.84 | 18.41 | 0.45 | Lt Dist | D | | R;CV | |
| | | | | | | | | | | | | | | | | | 17.42 | 1.06 | Right | D | A | R | |
| 13 | 1284 | 1 | 80 | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 14.5 | 14.5 | 8.94 | 2.54 | 13.66 | 1.2 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 13.56 | 0.4 | Right | D | A | CV | |
| 13 | 1285 | 1 | 50 | SBB | FALSE | TRUE | M | 01;56 | S | 35 | S | 180 | 27.15 | | 5.7 | 2.93 | 27.28 | 3.29 | Right | B | A | R | |
| 13 | 1286 | 1 | 80 | ARCHED BACKED | FALSE | TRUE | M | 56 | rp | 45 | S | 35 | 21.08 | | 7.18 | 3.68 | 5.02 | 2.55 | Proximal | D | | | |
| | | | | | | | | | | | | | | | | | 3.71 | 1.45 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 18.58 | 3.45 | Left | D | A | CV;R | |
| | | | | | | | | | | | | | | | | | 5.75 | 0.52 | Rt Partial | D | L | R | |
| 13 | 1287 | 1 | 70 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 60 | S | 180 | 17.02 | 10.6 | 7.53 | 2.15 | 9.93 | 1.97 | Lt Prox | D | A | R | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 9.07 | 2.45 Lt Partial | D | A | R | |
| | | | | | | | | | | | | | | 15.52 | 0.34 Right | I | SA | R | |
| 13 | 1288 1 | 70 | ARCHED BACKED | TRUE | TRUE | M | | R | 50 RS | 180 | 21.29 | 8.46 | 2.58 | 8.8 | 3.06 Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | 13.73 | 1.22 Left | D | SA | R | PD |
| | | | | | | | | | | | | | | 2.35 | 1.02 Distal | D | A | R | |
| | | | | | | | | | | | | | | 18.94 | 1.53 Right | D | L | R | DP |
| 13 | 1289 1 | 50-90 | SBB | TRUE | TRUE | M | | R | 50 R | 150 | 16.33 | 5 | 2.2 | 5.65 | 1.78 Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | 10.39 | 1.64 Left | D | A | IR | |
| | | | | | | | | | | | | | | 4.23 | 1.08 Distal | I | A | CC | |
| | | | | | | | | | | | | | | 12.6 | 0.37 Right | D | L | I | |
| 13 | 1290 1 | 50-90 | IRR BB | FALSE | TRUE | M | 01 | S | 180 S | 135 | 18.66 | 8.27 | 2.34 | 5 | 0.78 Lt Partial | D | SA | R | PD |
| | | | | | | | | | | | | | | 5.81 | 1.82 Lt Partial | D | A | CC | PD |
| | | | | | | | | | | | | | | 5.74 | 1 Rt Partial | D | L | R | |
| 13 | 1291 1 | 70 | ARCHED BACKED | FALSE | TRUE | M | 56 | PT | 45 S | 180 | 26.24 | 7.96 | 3.19 | 5.61 | 2.8 Proximal | D | | | |
| | | | | | | | | | | | | | | 10.38 | 3.59 Lt Prox | D | SA | RCV | PD |
| | | | | | | | | | | | | | | 10.76 | 2.58 Lt Partial | D | A | IR | PD |
| 13 | 1292 1 | 60 | SBB | FALSE | TRUE | M | 01 | S | 180 S | 170 | 18.47 11.41 | 10.13 | 3.96 | 11.41 | 4.04 Right | D | A | R | DP |
| | | | | | | | | | | | | | | 8.78 | 3.82 Distal | D | SA | R | LR |
| 13 | 1293 1 | 70 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 11 | 8.07 | 1.71 | 10.11 | 1.22 Right | D | A | R | PD |
| | | | | | | | | | | | | | | 9.06 | 0.59 Left | D | A | IR | |
| 13 | 1294 1 | 70 | SBB | FALSE | TRUE | P | 56 | RN | S | 180 | 12.03 | 5.99 | 1.72 | 3.46 | 3.9 Proximal | D | L | | |
| | | | | | | | | | | | | | | 11.05 | 1.41 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 6.06 | 1.3 Rt Partial | D | SA | R | DP |
| 13 | 1295 1 | 80 | RET B | TRUE | TRUE | P | | N | RS | 10 | 10.44 | 6.25 | 2.38 | 6.03 | 0.61 Distal | D | A | R | RL |
| | | | | | | | | | | | | | | 5.09 | 0.47 Right | D | L | IR | DP |
| 13 | 1296 1 | 70 | RET B | FALSE | TRUE | M | 56 | R | 45 S | 170 | 14.67 | 10.66 | 2.37 | 8.4 | 2.11 Proximal | D | A | NOTCH | RL |
| | | | | | | | | | | | | | | 14.12 | 0.62 Right | I | SA | IR | |
| 13 | 1297 1 | 80 | SBB | FALSE | TRUE | M | 56 | R | 70 S | 180 | 13.21 13.21 | 6.62 | 2.79 | 7.3 | 1.91 Lt Prox | D | SA | R | PD |
| | | | | | | | | | | | | | | 12.88 | 3.45 Right | D | A;SA | RCC | DP |
| 13 | 1298 1 | 60 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 10 | 10.53 | 4.96 | 2.69 | 10.56 | 1.57 Left | D | L | R | PD |
| | | | | | | | | | | | | | | 3.36 | 1.2 Distal | D | L | R | LR |
| | | | | | | | | | | | | | | 5.55 | 1.37 Rt Partial | D | L | R | PD |
| 13 | 1299 1 | 70 | VARIA | FALSE | TRUE | P | 56 | N | S | 10 | 8.88 6.75 | 13.16 | 1.76 | 7.62 | 1.09 Lt Prox | I | A | R | PD |
| | | | | | | | | | | | | | | 13.86 | 1.35 Rt Prox | I | A | R | |
| 13 | 1300 1 | 60 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 14.84 4.18 | 8.66 | 1.93 | 11.96 | 0.88 Right | D | SA | R | DP |
| 13 | 1301 1 | 60 | IRR BB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 25.22 13.36 | 11 | 3.71 | 11.87 | 3.7 Lt Partial | D | A | RCC | |
| | | | | | | | | | | | | | | 24.34 | 1.3 Right | D | L | IR | DP |
| 13 | 1302 1 | 60 | SBB | FALSE | TRUE | M | 01 | S | 10 R | 140 | 28.93 | 6.45 | 2.56 | 24.7 | 2.75 Left | D | SA | RSIN | PD |
| | | | | | | | | | | | | | | 5.62 | 0.59 Distal | D | A | R | |
| 13 | 1303 1 | 60 | SBB | FALSE | TRUE | M | 01;56 | S | 140 S | 180 | 22.41 | 7.75 | 2.72 | 18.94 | 2.28 Right | D | SA;A | RCC | PD |
| | | | | | | | | | | | | | | 13.59 | 0.67 Lt Partial | D | L | R | |
| 13 | 1304 1 | 50 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 170 | 21.65 21.65 | 6.07 | 2.63 | 20.06 | 2.89 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 4.56 | 2.84 Rt Partial | I | L | R | |
| 13 | 1305 1 | 50-90 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 14.2 | 5.97 | 1.88 | 14.22 | 1.88 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 4.75 | 1.47 Distal | D | SA | R | RL |
| 13 | 1306 1 | 60 | SBB | TRUE | TRUE | M | | RS | 180 R | 35 | 16.09 | 7.53 | 2.21 | 2.5 | 0.55 Proximal | I | A | R | RL |
| | | | | | | | | | | | | | | 12.93 | 1.81 Right | D | A | R | PD |
| | | | | | | | | | | | | | | 5.8 | 1.6 Distal | I | A | R | LR |
| | | | | | | | | | | | | | | 14.35 | 0.84 Left | D | L | IR | |
| 13 | 1307 1 | 70 | SBB | FALSE | TRUE | M | 56 | R | 50 S | 180 | 12.73 | 3.81 | 1.75 | 2.84 | 1.64 Proximal | D | A | RCC | PD |
| | | | | | | | | | | | | | | 9.17 | 1.74 Left | D | A | R | DP |
| 13 | 1308 1 | 60 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 170 | 12.4 | 6.25 | 3.56 | 11.28 | 3.44 Left | D | A | IR | PD |
| | | | | | | | | | | | | | | 3.47 | 2.51 Distal | D | A | R | RL |
| | | | | | | | | | | | | | | 9.81 | 1.38 Right | D | L | R | DP |
| 13 | 1309 1 | 50-90 | SBB | FALSE | TRUE | M | 56 | R | 45 S | 180 | 17.38 | 4.26 | 1.72 | 4.18 | 1.55 Proximal | D | A | CC | |
| | | | | | | | | | | | | | | 14.66 | 1.67 Left | D | A | R | PD |
| | | | | | | | | | | | | | | 15.47 | 0.7 Right | D | SA | R | DP |
| 13 | 1310 1 | 70 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 10.25 | 5.26 | 2.83 | 9.29 | 2.13 Left | D | A | SIN | DP |
| | | | | | | | | | | | | | | 3.87 | 0.39 Rt Partial | D | L | R | |
| 13 | 1311 1 | 80 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 180 | 16.49 | 6.78 | 1.79 | 14.72 | 1.59 Left | D | SA;A | R | PD |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 5.49 | 0.67 | Distal | D | A | R | |
| 13 | 1312 1 | 60 | SBB | FALSE | TRUE | M | 56 | R | 135 S | 180 | 19.28 | 7.87 | 3.88 | 6 | 2.82 | Proximal | D | SA | CC | |
| | | | | | | | | | | | | | | 16.39 | 3.46 | Right | D | SA;A | IR | DP |
| | | | | | | | | | | | | | | 6.76 | 0.58 | Lt Partial | D | SA | NOTCH;R | PD |
| 13 | 1313 1 | 80 | SBB | FALSE | TRUE | M | 56 | R | 45 S | 180 | 19.32 | 7.01 | 3.07 | 7.02 | 2.86 | Proximal | D | SA | CC | RL |
| | | | | | | | | | | | | | | 14.92 | 2.96 | Left | D | A | R | PD |
| 13 | 1314 1 | 80 | SBB | FALSE | TRUE | M | 56 | RP | 45 S | 180 | 13.83 | 6.55 | 1.94 | 6.31 | 1.98 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | 9.12 | 1.7 | Left | D | A | R | PD |
| 13 | 1315 1 | 80 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 25 | 14.63 | 5.63 | 2.07 | 12.27 | 2.17 | Right | B | A | R | PD |
| | | | | | | | | | | | | | | 14.16 | 0.46 | Left | I | L | R | DP |
| 13 | 1316 1 | 70 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 17.18 | 5.39 | 2.25 | 16.28 | 1.96 | Left | D | A | IR | PD |
| 13 | 1317 1 | 70 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 15.72 | 7.44 | 3.45 | 15.33 | 3.64 | Right | B | A | RCC | |
| 13 | 1318 1 | 70 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 12.47 | 5 | 1.76 | 3.27 | 0.82 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 12.13 | 1.72 | Right | D | SA | R | |
| | | | | | | | | | | | | | | 7.32 | 0.52 | Left | D | SA | IR | |
| 13 | 1319 1 | 80 | SBB | FALSE | TRUE | M | 01;56 | S | 10 S | 180 | 18.36 | 8.35 | 2.74 | 19.73 | 1.75 | Right | D | A | I | DP |
| | | | | | | | | | | | | | | 5.88 | 0.88 | Lt Partial | I | SA | IR | DP |
| 13 | 1320 1 | 80 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 180 | 10.93 | 4.3 | 1.67 | 2.49 | 0.89 | Proximal | I | A | CV | |
| | | | | | | | | | | | | | | 10.45 | 1.64 | Right | D | A | R | PD |
| 13 | 1321 1 | 60 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 18.87 0 | 7.54 | 2.25 | 17.78 | 1.59 | Left | D | A | R | PD |
| 13 | 1322 1 | 70 | SBB | FALSE | TRUE | M | 01;56 | S | 170 S | 180 | 12.93 | 5.57 | 3.05 | 11.65 | 3.03 | Right | D | A | R | DP |
| 13 | 1323 1 | 80 | SBB | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 13.57 0 | 5.37 | 1.97 | 12.62 | 1.54 | Right | D | A | R | DP |
| 13 | 1324 1 | 80 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 R | 70 | 16.39 0 | 5.69 | 2.08 | 18.8 | 1.4 | Rt Dist | D | A | R;CV | DP |
| 13 | 1325 1 | 50-90 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 170 R | 110 | 13.98 | 3.64 | 1.48 | 16.69 | 1.47 | Lt Dist | D | A | R;CV | PD |
| | | | | | | | | | | | | | | 12.65 | 0.33 | Right | D | L | R | |
| 13 | 1326 1 | 70 | ARCHED BACKED | TRUE | TRUE | M | | R | 180 R | 80 | 18.25 | 3.63 | 2.08 | 2.64 | 1.23 | Proximal | I | SA | CV | |
| | | | | | | | | | | | | | | 19.1 | 1.61 | Rt Dist | D | A | IR;CV | PD |
| 13 | 1327 1 | 50-90 | SBB PT | FALSE | TRUE | M | 01 | S | 180 R | | 21.31 0 | 6.08 | 2.1 | 21.75 | 0.95 | Right | D | A | R | |
| | | | | | | | | | | | | | | 4.87 | 0.39 | Lt Partial | I | L | R | |
| 13 | 1328 1 | 80 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 R | 45 | 18.83 | 4.21 | 1.46 | 14.55 | 1.47 | Right | D | A | R;CC | DP |
| | | | | | | | | | | | | | | 4.22 | 1.22 | Distal | D | A | R | |
| 13 | 1329 1 | 80 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 45 S | 180 | 13.47 13.47 | 4.15 | 1.74 | 3.16 | 1.27 | Proximal | D | A | CV | DP |
| | | | | | | | | | | | | | | 11.54 | 1.8 | Left | D | A | R | PD |
| 13 | 1330 1 | 70 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 R | 100 | 13.93 | 3.68 | 2.04 | 15.1 | 2.18 | Lt Dist | B;D | A | R;CV | PD |
| | | | | | | | | | | | | | | 13.48 | 0.6 | Right | I | L | R | PD |
| 13 | 1331 1 | 70 | ARCHED BACKED | TRUE | TRUE | M | | R | 70 R | 100 | 17.44 12.5 | 4.33 | 1.61 | 19.86 | 1.2 | Left | D | A | CV | PD |
| 13 | 1332 1 | 50-90 | SBB | TRUE | TRUE | M | | R | 45 R | 90 | 15.11 | 3 | 1.96 | 2.58 | 1.33 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | 2.02 | 0.93 | Proximal | I | L | R | |
| | | | | | | | | | | | | | | 13.64 | 1.89 | Lt Dist | D | A | IR | PD |
| | | | | | | | | | | | | | | 13.25 | 0.54 | Right | I | L | IR | PD |
| 13 | 1333 1 | 70 | SBB | FALSE | TRUE | M | 01 | S | 180 R | 70 | 22.58 | 5.47 | 2.33 | 18.54 | 1.9 | Right | D | L | R | PD |
| | | | | | | | | | | | | | | 4.66 | 0.83 | Distal | D | SA | RCC | RL |
| 13 | 1334 1 | 50-90 | ARCHED BACKED | TRUE | TRUE | M | | MB | 55 R | 80 | 16.72 3.85 | 5.52 | 2.26 | 6.76 | 1.91 | Proximal | VENT | | | |
| | | | | | | | | | | | | | | 12.37 | 2.45 | Rt Dist | D | SA | CV | DP |
| | | | | | | | | | | | | | | 9.96 | 1.86 | Lt Dist | | SA;L | R;CV | PD |
| 13 | 1335 1 | 80 | ARCHED BACKED | TRUE | TRUE | M | | RP | 100 R | 65 | 18.04 | 3.81 | 2.05 | 10.36 | 2.17 | Rt Prox | D | A | RCV | PD |
| | | | | | | | | | | | | | | 2.58 | 1.53 | Distal | D | A | R | PD |
| | | | | | | | | | | | | | | 7.47 | 0.94 | Lt Partial | D | L | R | PD |
| 13 | 1336 1 | 50-90 | ARCHED BACKED | TRUE | TRUE | M | | R | 65 R | 100 | 22.64 | 4.4 | 1.24 | 1.41 | 1.28 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | 11.65 | 1.23 | Lt Partial | D | A | IR | |
| | | | | | | | | | | | | | | 4.54 | 1.15 | Distal | D | A | RCV | |
| | | | | | | | | | | | | | | 5.9 | 1.18 | Rt Partial | | SA | R | |
| 13 | 1337 1 | 80 | ARCHED BACKED | TRUE | FALSE | M | | RPX | 50 RX | 95 | 19.43 | 2.82 | 1.45 | 1 | 0.81 | | D | SA | R | |
| | | | | | | | | | | | | | | 14.43 | 1.41 | | D | A | R | OPD |
| | | | | | | | | | | | | | | 3.31 | 1.46 | | D | A | R | |
| | | | | | | | | | | | | | | 18.73 | 0.6 | | | A | D | |
| 13 | 1338 1 | 50-90 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 170 R | 95 | 13.5 | 3.82 | 2 | 14.1 | 1.32 | Lt Dist | D | L;SA | CV | DP |
| 13 | 1339 1 | 70 | NOTCH | FALSE | TRUE | M | 01;56 | S | 10 S | 180 | 19.64 | 9.59 | 3.91 | 6.52 | 2.02 | Lt Partial | D | SA | NOTCH | |
| 13 | 1340 1 | 70 | NOTCH | FALSE | TRUE | M | 01;56 | S | 180 S | 180 | 18.13 | 10.01 | 2.64 | 7.12 | 1.36 | Lt Partial | I | SA | NOTCH | |
| 13 | 1341 1 | 60 | IRR BB | FALSE | TRUE | P | 56 | N | S | 180 | 19.49 9.26 | 10.59 | 2.81 | 8.81 | 2.52 | Rt Partial | D | SA;A | CV;R | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 11.43 | 1.05 | Lt Partial | D | SA | R | PD |
| 13 | 1342 | 1 | 80 | IRR BB W/ NOTCH | FALSE | TRUE | M | 01;56 | S | 180 | S | 170 | 23.12 | 20.73 | 9.59 | 2.8 | 21.03 | 2.51 | Left | D | SA | NOTCH;SI | PD |
| 13 | 1343 | 1 | 70 | NOTCH | FALSE | TRUE | P | 56 | N | | S | 180 | 20.56 | 20.56 | 13.13 | 3.49 | 14.3 | 1.63 | Rt Partial | D | SA | NOTCH | |
| 13 | 1344 | 1 | 50-90 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 50 | S | 180 | 38.7 | 20.47 | 17.1 | 4.9 | 23.82 | 4.07 | Proximal | D | A | R;CC | PD |
| | | | | | | | | | | | | | | | | | 22.05 | 2.95 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | | | | 16.25 | 0.94 | Right | I | L | IR | PD |
| 13 | 1345 | 1 | 70 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 135 | S | 180 | 16 | | 9.54 | 3.68 | 9.04 | 2.84 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 9.32 | 2.54 | Left | | A | R | PD |
| 13 | 1346 | 1 | 60 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 45 | S | 170 | 19.7 | 7.21 | 10.13 | 2.59 | 11.73 | 2.2 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 11.3 | 2.61 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 6.78 | 0.83 | Right | D | L | R | DP |
| 13 | 1347 | 1 | 50-90 | QALKHAN PT | TRUE | TRUE | M | | S | 45 | RS | 180 | 33.72 | 8.41 | 14.04 | 4.21 | 3.82 | 2.54 | Proximal | I | SA | R | |
| | | | | | | | | | | | | | | | | | 26.47 | 4.99 | Left | D;B | SA | R | PD |
| 13 | 1348 | 1 | 60 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 45 | S | 180 | 29.26 | 6.33 | 8.75 | 3.18 | 10.64 | 3.22 | Proximal | D | SA;A | R | LR |
| | | | | | | | | | | | | | | | | | 24.11 | 2.34 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 9.9 | 0.7 | Rt Partial | I | SA | NOTCH | |
| 13 | 1349 | 1 | 50 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 45 | S | 180 | 22.71 | 11.61 | 12.2 | 2.98 | 15.97 | 2.5 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 13.02 | 2.32 | Left | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 7.9 | 0.4 | Rt Partial | I | L | R | |
| 13 | 1350 | 1 | 50-90 | QALKHAN PT | FALSE | TRUE | M | 56 | R | 50 | S | 180 | 25.67 | 11.75 | 10 | 3.42 | 14.91 | 2.28 | Proximal | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 15.5 | 2.59 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | | | | 2.47 | 0.58 | Rt Partial | I | SA | NOTCH | |
| 14 | 1490 | 1 | 1/50 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 180 | 9.43 | | 6.13 | 1.65 | 9.96 | 1.36 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 6.29 | 1.62 | Distal | D | SA | RCC | |
| 14 | 1491 | 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | R | 20 | S | 180 | 10.64 | | 4.7 | 1.85 | 4.41 | 1.9 | Proximal | D | SA | RCC | RL |
| | | | | | | | | | | | | | | | | | 9.33 | 1.85 | Left | D | A | RCC | PD |
| 14 | 1492 | 1 | 1/10 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 12.93 | | 6.98 | 2.9 | 11.5 | 2.54 | Right | B | A | R | |
| 14 | 1493 | 1 | 1/10 | SBB | FALSE | TRUE | M | 01;56 | S | 165 | S | 20 | 14.11 | | 5.37 | 2.48 | 12.03 | 1.13 | Right | D | SA | D | PD |
| 14 | 1494 | 1 | 1/50 | RET B | FALSE | TRUE | P | 56 | N | | S | 180 | 29.87 | | 7.97 | 3.08 | 13.17 | 0.64 | Rt Partial | D | L | R | |
| 14 | 1495 | 1 | 1/30 | SBB | TRUE | TRUE | M | | PT | 135 | PT | 65 | 22.95 | | 3.57 | 2.05 | 3.34 | 1.63 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 17.03 | 2.16 | Right | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 2.98 | 1.46 | Distal | DORSAL | | | |
| 14 | 1496 | 1 | 1/0 | SBB | TRUE | TRUE | M | | PT | 70 | rp | 120 | 17.62 | | 4.41 | 2.52 | 5.8 | 2.07 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 8.54 | 2.42 | Right | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 2.38 | 1.01 | Distal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 5.32 | 1.84 | Distal | DORSAL | | | |
| 14 | 1497 | 1 | 1/0 | SBB PT | TRUE | TRUE | M | | R | | R | | 22.18 | 11.83 | 4.75 | 1.6 | 22.15 | 2.03 | Rt Prox | D | L;A | R | DP |
| | | | | | | | | | | | | | | | | | 10.96 | 0.55 | Lt Partial | D | SA | R | PD |
| 14 | 1498 | 1 | 1/50 | SBB | TRUE | TRUE | M | | R | | R | | 33.92 | 19.01 | 6.16 | 1.87 | 17.05 | 2.02 | Rt Prox | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 15.04 | 2.19 | Rt Partial | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 33 | 2.17 | Left | D | SA | R | DP |
| 14 | 1499 | 1 | 1/30 | SBB | FALSE | TRUE | M | 56 | R | 60 | S | 10 | 12.24 | | 4.29 | 1.89 | 6.06 | 1.34 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 6.97 | 1.48 | Left | D | A | R | DP |
| 14 | 1500 | 1 | 1/20 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 10 | 11.84 | | 5.58 | 2.66 | 4.78 | 1.04 | Proximal | D | SA | R | RL |
| | | | | | | | | | | | | | | | | | 11.16 | 2.45 | Right | D | SA | R | DP |
| 14 | 1501 | 1 | 1/30 | RET B | FALSE | TRUE | M | 01 | S | 180 | rp | 120 | 12.88 | | 6.18 | 1.84 | 12.16 | 1.25 | Right | D | L | IR | DP |
| | | | | | | | | | | | | | | | | | 3.05 | 0.32 | Distal | D | A | R | |
| | | | | | | | | | | | | | | | | | 6.93 | 1.5 | Distal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 7.7 | 0.56 | Left | D | L | CV | PD |
| 14 | 1502 | 1 | 1/50 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 170 | rp | 80 | 15.83 | | 4.01 | 1.59 | 14.58 | 1.85 | Rt Dist | D | A | CV | |
| | | | | | | | | | | | | | | | | | 1.59 | 0.99 | Distal | | | | |
| | | | | | | | | | | | | | | | | | 6.12 | 0.9 | Lt Partial | D | L | CV;R | |
| 14 | 1503 | 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | rp | 110 | S | 180 | 20.23 | | 3.03 | 1.69 | 2.3 | 1.32 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 1.87 | 0.94 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 14.94 | 1.67 | Right | B;D | A | IR | |
| | | | | | | | | | | | | | | | | | 17.83 | 0.51 | Left | D | L | R | |
| 14 | 1504 | 1 | 1/50 | ARCHED BACKED | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 17.66 | | 3.61 | 2.7 | 18.36 | 2.59 | Right | D | A | CV;R;CV | |
| 14 | 1505 | 1 | 1/50 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | rp | 50 | 13.8 | | 3.66 | 1.75 | 13.17 | 1.53 | Rt Dist | D | A | R;CV | PD |
| | | | | | | | | | | | | | | | | | 1.48 | 0.94 | Distal | | | | |
| 14 | 1506 | 1 | 1/50 | ARCHED BACKED | TRUE | TRUE | M | | R | 80 | R | 100 | 20.65 | | 3.43 | 1.82 | 2.39 | 0.56 | Proximal | D | A | R | RL |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 19.27 | 1.91 | Lt Dist | D | A | R;CV | PD |
| | | | | | | | | | | | | | | | | | 9.13 | 0.67 | Rt Partial | D | L | R | DP |
| 14 | 1507 | 1 | 1/50 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | rp | 75 | 16.07 | | 3.29 | 1.76 | 13.17 | 1.6 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 2.16 | 0.48 | Distal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 1.49 | 0.75 | Distal | DORSAL | | | |
| 14 | 1508 | 1 | 1/0 | SBB | TRUE | TRUE | W | | N | | N | | 27.65 | 14.38 | 8.5 | 2.48 | 22.37 | 2.19 | Right | D | A | R | DP |
| 14 | 1509 | 1 | 1/30 | RET B | TRUE | TRUE | D | | R | 55 | N | | 22.49 | | 5.17 | 1.79 | 5.17 | 1.65 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 11.32 | 1.12 | Lt Partial | D | SA;L | R | |
| 14 | 1510 | 1 | 1/10 | SBB | FALSE | TRUE | M | 56 | PT | 50 | S | 180 | 11.91 | | 3.27 | 1.57 | 3.31 | 1.09 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 9.45 | 1.55 | Left | B | A | R | |
| 14 | 1511 | 1 | 1/50 | SBB | FALSE | TRUE | M | 01;56 | S | 170 | S | 180 | 12.36 | | 5.49 | 2.27 | 11.8 | 2.34 | Left | D | SA | R | PD |
| 14 | 1512 | 1 | 1/20 | SBB | FALSE | TRUE | M | 56 | PT | 70 | S | 20 | 16.44 | | 4.9 | 2.05 | 4.56 | 0.6 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 5.42 | 1.68 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 11.67 | 2.19 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 13.74 | 0.45 | Right | I | SA | R | |
| 14 | 1513 | 1 | 1/30 | ARCHED BACKED | FALSE | TRUE | M | 56 | rp | 70 | S | 180 | 18.75 | | 4.35 | 1.79 | 5.35 | 1.58 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 3.57 | 1.15 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 14.23 | 1.82 | Left | D | A | R | DP |
| 14 | 1514 | 1 | 1/30 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 95 | 17.38 | | 3.93 | 1.58 | 18.65 | 1.77 | Lt Dist | D | A | R;CV | DP |
| 14 | 1515 | 1 | 2/10 | SBB | TRUE | TRUE | M | | PT | 135 | R | 180 | 29.86 | | 7.17 | 4.03 | 5.73 | 3.03 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 25.71 | 3.74 | Right | D | A | IR | |
| | | | | | | | | | | | | | | | | | 5.28 | 1.13 | Distal | D | SA | CV | LR |
| 14 | 1516 | 1 | 1/30 | IRR BB | TRUE | TRUE | P | | N | | PT | 120 | 22.81 | 17.25 | 8.17 | 1.38 | 4 | 1.11 | Rt Partial | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 7.01 | 0.94 | Distal | DORSAL | | | |
| 14 | 1517 | 1 | 1/10 | SBB | FALSE | TRUE | M | 56 | rp | 55 | S | 180 | 13.66 | | 5.44 | 1.5 | 5.02 | 1.48 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 1.97 | 1.24 | Proximal | | | | |
| | | | | | | | | | | | | | | | | | 7.91 | 1.01 | Left | D | A | R | PD |
| 14 | 1518 | 1 | 1/10 | TRIANGLE | TRUE | TRUE | M | | R | 135 | R | 80 | 15.85 | 5.92 | 4.94 | 2.47 | 5.7 | 2.53 | Proximal | D | A;SA | RCC | RL |
| | | | | | | | | | | | | | | | | | 11.23 | 2.21 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 13.02 | 1.11 | Left | D | L | R | DP |
| 14 | 1519 | 1 | 1/0 | SBB | TRUE | TRUE | M | | R | 20 | R | 155 | 16.76 | | 4.61 | 1.51 | 4.08 | 1.9 | Proximal | D | SA | RCC | RL |
| | | | | | | | | | | | | | | | | | 12.85 | 1.45 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | | | 4.78 | 1.49 | Distal | D | SA | R | LR |
| 14 | 1520 | 1 | 2/20 | SBB ARCHED | TRUE | TRUE | P | | RN | 135 | R | 50 | 24.28 | | 4.25 | 1.9 | 3.68 | 1.57 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 19.74 | 1.22 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 3.72 | 0.88 | Distal | D | SA | R | RL |
| 14 | 1521 | 1 | 2/20 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 95 | 19.11 | | 3.14 | 1.17 | 20.58 | 1.17 | Left | D | A | RCV | |
| 14 | 1522 | 1 | 2/20 | SBB | FALSE | TRUE | M | 01;56 | S | 45 | S | 20 | 13.92 | | 3.02 | 1.25 | 13.93 | 1.25 | Right | D | A | R | PD |
| 14 | 1523 | 1 | 1/30 | BITRUNC | FALSE | TRUE | M | 56 | R | 135 | R | 50 | 23.9 | | 9.45 | 2.01 | 15.96 | 1.95 | Proximal | D | SA | CC | RL |
| | | | | | | | | | | | | | | | | | 7.24 | 0.98 | Distal | D | SA | CC | RL |
| 14 | 1524 | 1 | 2/0 | SBB | TRUE | TRUE | M | | R | 155 | R | 20 | 18.11 | | 6.88 | 2.31 | 6.99 | 1.89 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 13.77 | 2.08 | Right | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 6.07 | 2.3 | Distal | D | A | R | |
| 14 | 1525 | 1 | 2/0 | SBB | TRUE | TRUE | M | | R | 45 | R | 145 | 25.95 | | 5.56 | 1.77 | 4.98 | 2.57 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 21.42 | 1.95 | Left | D | A | IR | PD |
| | | | | | | | | | | | | | | | | | 5.16 | 1.91 | Distal | D | A | RCC | |
| 14 | 1526 | 1 | 2/0 | RET B | FALSE | TRUE | P | 56 | N | | S | 135 | 27.73 | 9.51 | 14.16 | 1.92 | 14.19 | 0.82 | Lt Partial | D | SA | I | |
| 14 | 1527 | 1 | 2/0 | RET B | FALSE | TRUE | M | 01 | S | 180 | N | | 26.89 | | 8.35 | 2.24 | 26.55 | 1.26 | Right | D | L | R | DP |
| 14 | 1528 | 1 | 2/20 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 150 | 9.99 | | 4.88 | 2.73 | 9.17 | 2.92 | Left | B | SA | R | |
| | | | | | | | | | | | | | | | | | 9.29 | 0.91 | Right | D | L | R | DP |
| 14 | 1529 | 1 | 2/20 | SBB | FALSE | TRUE | M | 56 | R | 170 | S | 180 | 14.82 | | 5.01 | 1.93 | 5.27 | 1.37 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 13.55 | 1.82 | Right | D | A | R | DP |
| 14 | 1530 | 1 | 2/20 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 16.42 | | 5.07 | 2.43 | 15.58 | 2.53 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 12.5 | 2.1 | Right | D | L | R | PD |
| 14 | 1531 | 1 | 2/10 | SBB | TRUE | TRUE | M | 1 | R | 180 | R | 180 | 16.72 | | 4.92 | 2.34 | 2.46 | 1.56 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 14.69 | 2.05 | Left | D | SA | RCC | DP |
| | | | | | | | | | | | | | | | | | 3.86 | 1.88 | Distal | D | SA | R | |
| 14 | 1533 | 1 | 2/10 | SBB | FALSE | TRUE | M | 56 | R | 160 | S | 20 | 15.86 | | 6.32 | 2.44 | 5.2 | 2.25 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 14.53 | 2.06 | Right | D | SA | R | PD |
| 14 | 1534 | 1 | 2/40 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | | 13.88 | | 3.65 | 1.58 | 13 | 1.73 | Right | D | SA | R | DP |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 1535 1 | 2/40 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 26.85 | 6.73 | 2.57 | 26.72 | 2.73 | Left | I;D | A | RCC | |
| 14 | 1536 1 | 2/20 | ARCHED BACKED | FALSE | TRUE | M | 56 | RP | 50 | S | 180 | 18.44 | 4.23 | 2.04 | 18.5 | 1.83 | Lt Prox | D | A | CV;R | |
| 14 | 1537 1 | 2/20 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 13.42 | 4.51 | 1.35 | 13.49 | 1.28 | Left | D | A | R | PD |
| 14 | 1538 1 | 2/20 | SBB | FALSE | TRUE | M | 01 | S | 10 | R | 135 | 15.88 | 5.28 | 2.15 | 12.65 | 0.82 | Left | D | SA | R | DP |
| | | | | | | | | | | | | | | | 4.51 | 2.5 | Distal | D | SA | R | |
| 14 | 1539 1 | 2/30 | SBB | TRUE | TRUE | M | | PT | 135 | R | 70 | 23.59 | 3.91 | 1.8 | 3.61 | 1.64 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | 18.35 | 1.77 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | 2.95 | 1.3 | Distal | D | A | R | LR |
| 14 | 1540 1 | 2/30 | SBB | TRUE | TRUE | D | | R | 120 | N | | 23.07 | 4.75 | 2.06 | 7.61 | 1.45 | Proximal | D | A | IR | |
| | | | | | | | | | | | | | | | 15.45 | 2.08 | Right | D | A | IR | |
| 14 | 1541 1 | 2/20 | SBB BIPT | TRUE | TRUE | D | | RP | 85 | N | | 24.25 | 3.29 | 1.57 | 23.99 | 1.44 | Lt Prox | D | A | CV;R;CV | PD |
| 14 | 1542 1 | 2/0 | SBB | TRUE | TRUE | M | | R | 180 | PT | 135 | 13.34 | 3.84 | 1.7 | 3.7 | 1.6 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 10.77 | 1.76 | Left | D | A | RCC | PD |
| | | | | | | | | | | | | | | | 3.77 | 1.52 | Distal | DORSAL | | | |
| 14 | 1543 1 | 2/40 | SBB | FALSE | TRUE | M | 01 | S | 180 | MB | 45 | 13.85 | 4.11 | 2.38 | 11.25 | 2.37 | Right | D | A | R | PD;DP |
| | | | | | | | | | | | | | | | 3.61 | 2.34 | Distal | DORSAL | | | |
| 14 | 1544 1 | 2/40 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 80 | 14.36 | 3.09 | 1.85 | 15.34 | 1.8 | Rt Dist | D | A | CV | PD |
| 14 | 1545 1 | 2/40 | ARCHED BACKED | FALSE | TRUE | M | 56 | R | 110 | S | 55 | 17.62 | 3.18 | 1.1 | 17.11 | 0.84 | Rt Prox | D | A | CV | |
| 14 | 1546 1 | 2/40 | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 180 | R | 80 | 13.82 | 4.09 | 2.09 | 14 | 1.72 | Rt Dist | D | SA | CV | DP |
| 14 | 1547 1 | 2/40 | SBB | FALSE | TRUE | M | 56 | R | 85 | S | 135 | 18.65 | 3.6 | 1.86 | 18.24 | 1.92 | Lt Prox | D | A | CV;R | PD;DP |
| | | | | | | | | | | | | | | | 9.51 | 0.58 | Rt Partial | D | L | R | DP |
| 14 | 1548 1 | 2/40 | SBB | TRUE | TRUE | M | | R | 120 | R | 20 | 25.73 | 4.41 | 1.64 | 8.1 | 1.27 | Proximal | D | A | RCV | RL |
| | | | | | | | | | | | | | | | 18.74 | 1.19 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | 2.66 | 0.94 | Distal | D | SA | R | |
| 14 | 1549 1 | 2/10 | SBB | FALSE | TRUE | M | 56 | PT | 135 | S | 160 | 16.84 | 4 | 1.87 | 4.82 | 1.54 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | 15.6 | 2.08 | Rt Prox | D | A | RCC | |
| | | | | | | | | | | | | | | | 8.55 | 0.82 | Lt Partial | I | L | R | DP |
| 14 | 1557 1 | 1/0 | ARCHED BACKED | TRUE | TRUE | P | | RN | | R | 45 | 23.86 | 5.62 | 2.43 | 2.42 | 2.21 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | | 20.31 | 2.4 | Right | D | SA;A | CV | DP |
| | | | | | | | | | | | | | | | 5.13 | 2.37 | Distal | D | A | R | LR |
| 14 | 1558 1 | 1/0 | ARCHED BACKED | TRUE | TRUE | M | | R | 45 | RP | 135 | 27.3 | 3.78 | 1.67 | 3.29 | 1.29 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | 22.83 | 1.48 | Lt Dist | D | A | IR | DP |
| | | | | | | | | | | | | | | | 2.44 | 1.45 | Distal | DORSAL | | | |
| 14 | 1559 1 | 1/0 | ARCHED BACKED | TRUE | TRUE | M | | rp | 120 | rp | 70 | 24.94 | 4.18 | 1.79 | 20.11 | 1.94 | Right | D | A | CV;R;CV | PD |
| | | | | | | | | | | | | | | | 3.64 | 1.32 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | 3.83 | 1.49 | Distal | DORSAL | | | |
| 14 | 1560 1 | 1/0 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 20 | 15.36 | 6.04 | 2.01 | 5.92 | 1.68 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 12.1 | 1.98 | Right | D | SA | RCC | DP |
| 14 | 1561 1 | 1/0 | SBB | FALSE | TRUE | M | 56 | R | 165 | S | 180 | 20.94 | 6.11 | 1.78 | 5.64 | 1.47 | Proximal | D | A | RCC | LR |
| | | | | | | | | | | | | | | | 19.83 | 1.85 | Right | D | SA | RCC | DP |
| 14 | 1562 1 | 1/50 | SBB | FALSE | TRUE | M | 01 | S | 180 | PT | 120 | 12.35 | 3.69 | 2.46 | 8.38 | 2.4 | Left | B | A | R;CV | DP;PD |
| | | | | | | | | | | | | | | | 5.21 | 1.83 | Distal | | | | |
| 14 | 1563 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | PT | 80 | S | 180 | 12.29 | 4.03 | 2.08 | 6.1 | 2.43 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | 7.83 | 2.5 | Left | D | SA | I | PD |
| 14 | 1564 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | R | 170 | S | 25 | 12.89 | 4.72 | 2.22 | 3.99 | 1.95 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | | 9.76 | 2.28 | Right | D | A | R | PD |
| 14 | 1565 1 | 1/50 | SBB | TRUE | TRUE | M | 56 | R | 25 | S | 30 | 25.26 | 5.29 | 2.13 | 4.4 | 2.42 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | | 24.57 | 2.52 | Left | D | A | R | PD |
| 14 | 1566 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 180 | 10.41 | 5.95 | 1.81 | 4.9 | 1.71 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | 10.25 | 1.82 | Right | D | A | R | PD |
| 14 | 1567 1 | 1/50 | SBB | TRUE | TRUE | M | | R | 165 | R | 20 | 17.7 | 4.52 | 2.03 | 4.6 | 1.32 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | | 14.91 | 2.05 | Right | D | SA | RCC | DP |
| | | | | | | | | | | | | | | | 3.58 | 1.78 | Distal | D | A | R | LR |
| 14 | 1568 1 | 1/50 | SBB | TRUE | TRUE | M | | R | 150 | R | 20 | 15.58 | 4.4 | 1.9 | 3.46 | 1.58 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 14.03 | 1.12 | Right | D | A | IRCC | |
| | | | | | | | | | | | | | | | 4.46 | 1.26 | Distal | D | A | RCC | |
| 14 | 1569 1 | 2/0 | SBB | TRUE | TRUE | M | | R | 165 | R | 45 | 18.57 | 5.76 | 2.25 | 4.36 | 1.48 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 15.36 | 2.14 | Right | D | A | IRCC | DP;PD |
| | | | | | | | | | | | | | | | 5.02 | 2.14 | Distal | D | A | RCC | |
| 14 | 1570 1 | 2/20 | SBB | FALSE | FALSE | M | 01 | SX | 180 | RX | 170 | 11.7 | 6.92 | 2.3 | 10.95 | 2.28 | | D | A | R | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 5.6 | 1.6 | | D | A | R | |
| 14 | 1571 | 1 | 2/20 | SBB | FALSE | FALSE | M | 56 | RX | 25 SX | | 19.24 | 5.21 | 2.57 | 4.29 | 1.58 | | D | A | R | |
| | | | | | | | | | | | | | | | 16.43 | 2.5 | | D | A | RCC | |
| | | | | | | | | | | | | | | | 18.38 | 0.46 | | I | L | IR | |
| 14 | 1572 | 1 | 1/0 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 35 | 19.33 | 6.08 | 2.12 | 18.95 | 1.44 | | D | SA | R | |
| 14 | 1573 | 1 | 2/20 | ARCHED BACKED | TRUE | FALSE | M | 6 | PTX | 65 RSX | 120 | 15.74 | 4.19 | 1.52 | 5.64 | 2.09 | | DORSAL | | | |
| | | | | | | | | | | | | | | | 12.11 | 1.61 | | D | A | R;CV | |
| 14 | 1574 | 1 | 2/0 | SBB | FALSE | FALSE | M | 01 | SX | 180 PTX | 120 | 14.27 9.6 | 4.6 | 1.94 | 9.3 | 1.82 | | D | A | R | |
| | | | | | | | | | | | | | | | 6.13 | 2.14 | | DORSAL | | | |
| 14 | 1575 | 1 | 2/0 | SBB | FALSE | FALSE | M | 01 | SX | 180 RPX | 135 | 14.42 0 | 6.16 | 2.11 | 12.29 | 2.23 | | D | SA | RCV | OPD |
| | | | | | | | | | | | | | | | 4.78 | 0.7 | | D | SA | CV | |
| | | | | | | | | | | | | | | | 4.53 | 2.05 | | DORSAL | | | |
| 14 | 1576 | 1 | 1/50 | SBB | FALSE | FALSE | M | 01 | SX | 180 RX | 170 | 10.36 | 4.73 | 2.01 | 9.29 | 2.02 | | | A | R | ODP |
| | | | | | | | | | | | | | | | 4.87 | 2.04 | | D | SA | R | |
| 14 | 1577 | 1 | 1/50 | SBB | FALSE | TRUE | M | 56 | R | 165 S | 180 | 14.69 | 5.63 | 2.68 | 4.75 | 2.56 | Proximal | I | SA | CC | |
| | | | | | | | | | | | | | | | 14.37 | 2.42 | Right | B | A | R | |
| 14 | 1578 | 1 | 1/30 | BITRUNC | FALSE | FALSE | M | 1 | SX | 45 RX | 135 | 12.23 6.9 | 6.23 | 1.48 | 3.96 | 1.55 | | D | SA | R | |
| | | | | | | | | | | | | | | | 7.9 | 1.32 | | D | SA | IR | |
| 14 | 1579 | 1 | 1/30 | SBB | TRUE | TRUE | D | | N | PT | 45 | 20.73 | 4.26 | 2.23 | 13 | 2.28 | Right | D | A;SA | IR | |
| | | | | | | | | | | | | | | | 4.75 | 2.2 | Proximal | VENTRA | | | |
| 14 | 1580 | 1 | 1/50 | SBB PT | TRUE | FALSE | M | | RX | 85 RX | 95 | 23.99 | 2.81 | 1.87 | 22.15 | 1.71 | | B | A | CV;R;CV | |
| 14 | 1581 | 1 | 1/0 | SBB | FALSE | FALSE | M | 01 | SX | 180 PTX | 135 | 17.88 | 6.3 | 2.54 | 15.34 | 2.57 | | D | A | R | |
| | | | | | | | | | | | | | | | 6.83 | 2.26 | | DORSAL | | | |
| 14 | 1582 | 1 | 1/10 | SBB | TRUE | TRUE | M | | R | 135 rp | 70 | 28.41 | 4.07 | 2.46 | 3.38 | 2 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | 20.46 | 2.08 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | 5.85 | 2.09 | Distal | | | | |
| | | | | | | | | | | | | | | | 3.35 | 0.72 | Distal | D | A | R | |
| 14 | 1583 | 1 | 1/30 | SBB | FALSE | FALSE | M | 56;1 | RSX | 45 SX | 180 | 12.31 | 4.11 | 2.19 | 2.72 | 2.09 | | | SA | R | |
| | | | | | | | | | | | | | | | 10.79 | 2.19 | | | A | R | |
| 14 | 1584 | 1 | 1/30 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 SX | 180 | 9.2 | 4.35 | 1.19 | 9.58 | 0.99 | | D | SA | R | |
| 14 | 1585 | 1 | 1/10 | SBB | FALSE | FALSE | M | 1 | RSX | 45 PTX | 135 | 24.87 | 5.27 | 1.82 | 2.6 | 1.89 | | D | A | R | |
| | | | | | | | | | | | | | | | 19.79 | 2.15 | | D | SA;A | R | OPD |
| | | | | | | | | | | | | | | | 2.11 | 1.73 | | D | SA | R | |
| | | | | | | | | | | | | | | | 3.58 | 1.74 | | DORSAL | | | |
| 14 | 1586 | 1 | 1/20 | SBB | FALSE | FALSE | M | 01 | SX | 180 PTX | 110 | 12.93 7.68 | 3.71 | 2.23 | 7.58 | 1.89 | | D | A | R | OPD |
| | | | | | | | | | | | | | | | 2.73 | 1.52 | | D | SA | R | |
| | | | | | | | | | | | | | | | 3.88 | 1.7 | | DORSAL | | | |
| 15 | 1588 | 1 | 5/0 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 10 | 19.02 | 6.89 | 3.14 | 7.13 | 2.63 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | | 17.68 | 2.72 | Right | D | SA | R | PD |
| 15 | 1589 | 1 | 2/10 | SBB | FALSE | TRUE | M | 56 | R | 20 S | | 16.31 | 6.68 | 2.43 | 5.36 | 1.64 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | 14.35 | 2.27 | Left | D | A | RCC | PD |
| 15 | 1590 | 1 | 5/SURF | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 11.69 | 7.44 | 2.67 | 9.99 | 2.2 | Left | D | SA | IR | |
| 15 | 1591 | 1 | 7/20 | SBB | FALSE | TRUE | M | 01 | S | 155 R | 170 | 16.78 | 6.77 | 2.99 | 15.39 | 3.07 | Right | B | A | R | |
| | | | | | | | | | | | | | | | 6.57 | 2.72 | Distal | D | SA | R | LR |
| 15 | 1592 | 1 | 2/10 | SBB | TRUE | TRUE | M | | R | 180 R | 180 | 24.66 | 6.82 | 3.4 | 5.84 | 3.13 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 24.54 | 3.5 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | | 4.89 | 2.19 | Distal | D | A | R | |
| 15 | 1593 | 1 | 7/10 | SBB | FALSE | TRUE | M | 01 | S | 160 R | 20 | 19.11 | 6.69 | 2.43 | 17.16 | 2.66 | Right | D | SA | R | PD |
| | | | | | | | | | | | | | | | 6.58 | 2.35 | Distal | D | SA | R | |
| 15 | 1594 | 1 | 5/0 | SBB | FALSE | TRUE | M | 01 | S | 160 R | 180 | 14.6 | 6.83 | 3.57 | 12.75 | 3.46 | Right | D | A | R | |
| | | | | | | | | | | | | | | | 5.59 | 3.56 | Distal | D | SA | RCV | |
| 15 | 1595 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 01 | S | 180 R | 20 | 10.72 9.77 | 10.26 | 3.42 | 9.93 | 3.18 | Right | D | SA | R | DP |
| | | | | | | | | | | | | | | | 10.36 | 2.41 | Distal | D | SA | R | RL |
| 15 | 1596 | 1 | 6/SURF | SBB | FALSE | TRUE | M | 56 | S | 180 R | 30 | 18.77 | 7.86 | 2.9 | 7.69 | 2.87 | Proximal | D | SA;A | R | LR |
| | | | | | | | | | | | | | | | 15.92 | 3.29 | Left | D | SA | IRCC | |
| 15 | 1597 | 1 | 7/20 | SBB | FALSE | TRUE | M | 56 | R | 180 S | 20 | 25.38 | 7.36 | 3.34 | 6.16 | 2.79 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | 24.54 | 3.28 | Left | D;I;D | A | R | |
| 15 | 1598 | 1 | 8/10 | SBB | FALSE | TRUE | M | 01;56 | S | S | 180 | 15.61 | 8.86 | 3.4 | 14.54 | 3.71 | Right | B | A | IR | |
| | | | | | | | | | | | | | | | 11.04 | 1.45 | Left | I | L | IR | |
| 15 | 1599 | 1 | 4/SURF | SBB | FALSE | TRUE | P | 56 | N | S | 180 | 17.79 | 7.93 | 2.6 | 14.59 | 2.48 | Left | D | A | IR | PD |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 1600 | 1 | 5/SURF | SBB | FALSE | TRUE | M | 01;56 | S | 20 | S | 180 | 21.91 | | 7.7 | 2.28 | 20.75 | 2.43 | Left | D | A | RCC | |
| 15 | 1601 | 1 | 9/60 | SBB | FALSE | TRUE | P | 56 | N | | S | 20 | 19.44 | | 6.48 | 1.76 | 16.13 | 0.64 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 5.71 | 1.26 | Lt Partial | I | L | R | PD |
| 15 | 1602 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 24.43 | | 6.79 | 3.78 | 24.04 | 3.67 | Left | D | A | IR | |
| 15 | 1603 | 1 | 4/SURF | RET B | FALSE | TRUE | M | 01;56 | S | 180 | S | 165 | 16.33 | | 6.88 | 2.41 | 10.6 | 1.71 | Lt Partial | D | L | R | |
| 15 | 1604 | 1 | 2/SURF | SBB | TRUE | TRUE | P | | N | | R | 10 | 27.1 | | 8.3 | 3.76 | 24.1 | 3.12 | Left | D | A | IR | |
| | | | | | | | | | | | | | | | | | 6.15 | 2.3 | Distal | D | A | R | |
| 15 | 1605 | 1 | 3/20 | SBB | FALSE | TRUE | D | 01 | S | 180 | N | | 21.37 | | 6.49 | 1.52 | 20.35 | 0.67 | Left | D | A | R | |
| 15 | 1606 | 1 | 3/10 | SBB | FALSE | TRUE | D | 01 | S | 180 | N | | 29.47 | | 7.36 | 2.93 | 28.67 | 2.74 | Right | D | A | RCC | DP |
| 15 | 1607 | 1 | 4/SURF | SBB | TRUE | TRUE | M | 6 | R | 165 | R | 10 | 17.87 | | 6.86 | 3.04 | 5.54 | 1.62 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 15.17 | 3 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 3.06 | 3.03 | Distal | D | SA | CV | |
| 15 | 1608 | 1 | 7/10 | SBB | FALSE | TRUE | P | 56 | N | | S | 10 | 21.3 | | 6.85 | 2.4 | 19.31 | 1.77 | Right | D | A | R | |
| | | | | | | | | | | | | | | | | | 12.34 | 1.08 | Lt Partial | I | L | RCC | |
| 15 | 1609 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 170 | 17.72 | | 6.54 | 2.08 | 12.11 | 1.84 | Rt Partial | D | A | R | |
| 15 | 1610 | 1 | 7/10 | SBB | FALSE | TRUE | P | 56 | N | | S | 35 | 15.66 | | 5.76 | 2.06 | 15.38 | 1.73 | Left | D | SA;A | R | PD |
| 15 | 1611 | 1 | 7/20 | SBB | FALSE | TRUE | M | 01;56 | S | 170 | S | 20 | 16.02 | | 7.11 | 2.65 | 15.23 | 2.89 | Left | D | A | R | |
| 15 | 1612 | 1 | 11/40 | SBB | FALSE | TRUE | M | 01;56 | S | 165 | S | 180 | 18.45 | | 7.13 | 2.58 | 19.22 | 2.31 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 9.68 | 2.32 | Right | B | L | R | |
| 15 | 1613 | 1 | 11/40 | SBB | FALSE | TRUE | M | 56 | N | | S | | 34.56 | 16.24 | 8.8 | 4.15 | 31.07 | 3.95 | Right | D | A | R | |
| 15 | 1614 | 1 | 11/40 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 170 | 17.94 | | 6.15 | 2.11 | 17.66 | 2.35 | Left | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 5.27 | 2.09 | Distal | D | A | R | |
| 15 | 1615 | 1 | 11/40 | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 20.75 | | 7.63 | 4.4 | 17.82 | 3.66 | Right | D | A | R | |
| 15 | 1616 | 1 | 4/SURF | ARCHED BACKED | FALSE | TRUE | M | 01 | S | 165 | R | 85 | 19.16 | 0 | 7.76 | 1.89 | 19.99 | 2.04 | Rt Dist | D | A | CV | PD |
| 15 | 1617 | 1 | 7/20 | SBB | TRUE | TRUE | W | | N | | N | | 25.26 | | 7.05 | 1.82 | 25.02 | 1.58 | Right | D | A | R | |
| 15 | 1618 | 1 | 7/30 | TRUNC W/ NOTCH | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 12.93 | | 11.28 | 2.7 | 10.28 | 2.55 | Distal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 8.83 | 2.87 | Rt Partial | D | SA | NOTCH | |
| 15 | 1619 | 1 | 11/50 | BITRUNC | TRUE | TRUE | M | 90 | R | 180 | R | 180 | 12.82 | | 10.29 | 2.63 | 6.48 | 2.87 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 10.36 | 2.49 | Distal | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 6.42 | 0.91 | Lt Partial | D | SA | NOTCH | |
| 15 | 1620 | 1 | 4/SURF | BITRUNC | TRUE | TRUE | M | | R | 180 | R | 180 | 18.44 | | 6.09 | 2.05 | 6.24 | 1.66 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 4.64 | 1.9 | Distal | D | SA | R | |
| 15 | 1621 | 1 | 3/0 | SBB | TRUE | TRUE | M | | R | 180 | R | 10 | 11.47 | | 6.4 | 1.56 | 6.04 | 1.68 | Proximal | D | A | R | LR |
| | | | | | | | | | | | | | | | | | 9.81 | 1.61 | Right | D | A | R | DP |
| | | | | | | | | | | | | | | | | | 6.24 | 1.91 | Distal | D | SA | R | LR |
| 15 | 1622 | 1 | 3/SURF | SBB | TRUE | TRUE | M | | R | 10 | R | 170 | 15.78 | | 6.02 | 3 | 5.92 | 1.95 | Proximal | D | A | R | RL |
| | | | | | | | | | | | | | | | | | 14.5 | 2.3 | Left | D | A | R | PD |
| | | | | | | | | | | | | | | | | | 5.78 | 1.91 | Distal | D | A | R | LR |
| 15 | 1623 | 1 | 4/SURF | SBB | TRUE | TRUE | M | | R | 180 | R | 10 | 9.43 | | 8.08 | 2.41 | 6.15 | 0.52 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 8.94 | 1.53 | Right | D | SA | R | DP |
| | | | | | | | | | | | | | | | | | 7.17 | 1.6 | Distal | D | | R | |
| 15 | 1624 | 1 | 7/20 | SBB | TRUE | TRUE | M | | R | 180 | R | 180 | 18.17 | | 6.69 | 2.45 | 6.36 | 2.22 | Proximal | D | A | R | |
| | | | | | | | | | | | | | | | | | 16.21 | 1.38 | Left | D | A | IR | |
| | | | | | | | | | | | | | | | | | 6.42 | 2.2 | Distal | D | SA | CV | |
| 15 | 1625 | 1 | 9/70 | SBB | FALSE | TRUE | M | | R | 10 | R | 170 | 18.13 | | 7.44 | 3.22 | 6.64 | 2.89 | Proximal | D | A | IR | |
| | | | | | | | | | | | | | | | | | 15.7 | 2.69 | Left | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 6.7 | 2.63 | Distal | D | A | IR | |
| 15 | 1626 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 18.49 | | 6.09 | 3.77 | 17.55 | 4.05 | Right | D | SA;A | R | |
| | | | | | | | | | | | | | | | | | 6.25 | 3.09 | Distal | D | A | R | |
| 15 | 1627 | 1 | 7/80 | SBB | TRUE | TRUE | M | | R | 180 | R | 20 | 18.91 | | 7.42 | 3.72 | 5.97 | 2.64 | Proximal | D | SA | R | LR |
| | | | | | | | | | | | | | | | | | 15.1 | 3.88 | Right | D | A;SA | R | |
| | | | | | | | | | | | | | | | | | 7.1 | 2.58 | Distal | D | SA;A | CV | LR |
| 15 | 1628 | 1 | 7/10 | SBB | FALSE | TRUE | M | 01;56 | S | 20 | S | 180 | 14.56 | | 5.93 | 3.08 | 13.29 | 3.18 | Right | D | A | RI | |
| 15 | 1629 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 01,56 | S | 180 | S | 180 | 10.41 | | 8.4 | 4.31 | 10.18 | 4.28 | Right | D | SA | R | |
| 15 | 1630 | 1 | 7/20 | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 165 | 10.6 | | 7.87 | 4.32 | 9.13 | 2.05 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | | | 7.19 | 1.88 | Distal | D | A | R | |
| 15 | 1631 | 1 | 10/50 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 9.9 | | 7.58 | 3.94 | 9.11 | 3.7 | Right | D | SA | IR | |
| 15 | 1632 | 1 | 3/10 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 12.25 | | 6.24 | 2.16 | 11.86 | 1.39 | Left | D | A | R | DP |
| 15 | 1633 | 1 | 2/SURF | SBB | TRUE | TRUE | M | | R | 170 | R | 10 | 21.31 | | 7.65 | 3.2 | 6.72 | 3.61 | Proximal | D | SA | RCC | |
| | | | | | | | | | | | | | | | | | 18.2 | 3.51 | Right | D | SA | R | DP |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 6.58 | 1.94 | Distal | D | A | R | |
| 15 | 1634 | 1 | 7/30 | SBB | TRUE | TRUE | P | | N | 180 | R | 15 | 28.32 | | 9.03 | 3.54 | 22.58 | 3.52 | Right | D | SA | RCC | DP |
| | | | | | | | | | | | | | | | | | 5.29 | 1.71 | Distal | D | A | R | RL |
| 15 | 1635 | 1 | 7/80 | SBB PT | TRUE | TRUE | W | | N | | N | | 35.76 | | 7.22 | 3.34 | 32.56 | 2.61 | Right | D | SA | RCC | DP |
| 15 | 1636 | 1 | 7/20 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 16.51 | | 6.27 | 1.77 | 16.4 | 1.29 | Left | D | SA | R | |
| | | | | | | | | | | | | | | | | | 15.86 | 1.07 | Right | D | SA | R | |
| 15 | 1637 | 1 | 7/10 | SBB | TRUE | TRUE | D | | R | 180 | N | | 24.6 | | 8.35 | 2.65 | 6.69 | 2.03 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 21.21 | 2.4 | Left | D | A | R | |
| 15 | 1638 | 1 | 4/SURF | IRR BB | FALSE | TRUE | M | 56 | PT | 140 | S | 135 | 15.73 | | 7.22 | 2.14 | 4.38 | 1.96 | Proximal | DORSAL | | | |
| | | | | | | | | | | | | | | | | | 13.89 | 1.98 | Right | D | A | I | |
| 15 | 1639 | 1 | 4/20 | ARCHED BACKED | FALSE | TRUE | P | 456 | N | | S | 180 | 23.443 | | 6.3 | 2.28 | 23.03 | 1.05 | Left | D | | RCV | DP |
| | | | | | | | | | | | | | | | | | 14.2 | 0.47 | Rt Partial | D | SA | R | PD |
| 15 | 1640 | 1 | 7/SURF | SBB | TRUE | TRUE | P | | N | | R | 20 | 28.31 | | 8.73 | 2.62 | 26.17 | 2.16 | Right | D | SA | IR | DP |
| | | | | | | | | | | | | | | | | | 5.59 | 1.96 | Distal | D | A | R | |
| 15 | 1641 | 1 | 3/20 | SBB | TRUE | TRUE | P | | N | | R | 180 | 26.88 | | 8.09 | 3.37 | 26.86 | 3.71 | Left | D | A | RCC | DP |
| | | | | | | | | | | | | | | | | | 6.24 | 3.29 | Distal | D | SA | R | |
| 15 | 1642 | 1 | 10/SRF | SBB | FALSE | FALSE | M | 01;56 | SX | 20 | SX | 180 | 19.46 | | 6.98 | 2.97 | 17.16 | 2.9 | | D | SA | R | ODP |
| 15 | 1643 | 1 | ? | SBB | FALSE | FALSE | M | 01;56 | SX | 180 | SX | 180 | 17.08 | | 7.05 | 2.41 | 16.77 | 2.1 | | D | SA | R | OPD |
| 15 | 1644 | 1 | 4/SURF | SBB | FALSE | FALSE | M | 01;56 | SX | 180 | SX | 180 | 15.77 | | 7.58 | 2.84 | 15.83 | 2.56 | | D | SA | R | OPD |
| 15 | 1645 | 1 | ? | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 180 | 10.49 | | 7.13 | 2.65 | 9.84 | 2.42 | Right | D | SA | IR | |
| 15 | 1646 | 1 | 4/SURF | SBB | FALSE | FALSE | M | 01;56 | SX | 180 | SX | 180 | 14.51 | | 7.15 | 2.93 | 13.72 | 2.86 | | B | A | R | |
| 15 | 1647 | 1 | 11/50 | SBB | FALSE | TRUE | M | 01;56 | S | 180 | S | 165 | 12.18 | | 7.62 | 3.95 | 14 | 3.8 | Right | D | SA | CC | |
| 15 | 1648 | 1 | 11/50 | SBB | FALSE | TRUE | P | 56 | N | | S | 10 | 13.61 | | 6.54 | 1.97 | 9.03 | 1.09 | Left | D | A | CVR | |
| | | | | | | | | | | | | | | | | | 5.15 | 1.07 | Rt Partial | I | L | R | |
| 15 | 1649 | 1 | 11/50 | SBB | FALSE | TRUE | M | 01 | S | 170 | R | 170 | 19.28 | | 7.65 | 4.3 | 19.22 | 4 | Left | D | A | R | |
| | | | | | | | | | | | | | | | | | 7.15 | 4.64 | Distal | D | A | R | |
| 15 | 1650 | 1 | 11/50 | SBB | FALSE | TRUE | P | 56 | N | | S | 180 | 28.12 | | 8.21 | 2.73 | 25.16 | 3.24 | Right | D | A | CV;R | PD |
| 15 | 1651 | 1 | 5/20 | SBB | FALSE | TRUE | M | 01;56 | S | | S | 180 | 9.92 | | 11.09 | 1.61 | 7.62 | 1.56 | Left | D | A | R | |
| 15 | 1652 | 1 | 5/0 | IRR BB | FALSE | TRUE | D | 01 | S | 180 | N | | 18.24 | 18 | 8.12 | 2.2 | 12.58 | | Rt Partial | D | SA | R | DP |
| | | | | | | | | | | | | | | | | | 8.1 | 0.99 | Lt Partial | D | SA | SIN | |
| 15 | 1653 | 1 | 11/50 | IRR BB | FALSE | TRUE | P | 56 | N | | S | 45 | 11.24 | 7.72 | 8.95 | 2.31 | 6.92 | 1.65 | Rt Partial | D | A | CC | DP |
| 15 | 1654 | 1 | 2/10 | IRR BB | FALSE | TRUE | P | 56 | N | | S | 140 | 12.67 | | 9.03 | 2.3 | 12.95 | 1.48 | Right | D | SA | I | PD |
| 15 | 1655 | 1 | 2/10 | IRR BB | FALSE | TRUE | M | 901 | S | 60 | N | | 16.3 | 11.44 | 11.25 | 3.43 | 11.66 | 3.22 | Rt Partial | D | SA;A | SIN | DP |
| 15 | 1656 | 1 | ? | IRR BB | FALSE | TRUE | D | 01 | S | 25 | N | | 13.07 | | 8.83 | 3.86 | 6.05 | 3.84 | Rt Partial | D | SA | R | |
| 15 | 1657 | 1 | 11/60 | SBB | FALSE | TRUE | M | 56 | N | | S | 25 | 13.02 | | 8.68 | 3.25 | 9.12 | 1.27 | Lt Partial | D | SA | CV;R | |
| 15 | 1658 | 1 | 6/SURF | TRUNC | FALSE | FALSE | M | 01 | SX | 180 | RX | 165 | 7.14 | | 13.96 | 2.81 | 12.45 | 2.8 | | D | A | ICCR | |
| 15 | 1659 | 1 | 4/SURF | TRUNC | FALSE | TRUE | M | 01 | S | 180 | R | 25 | 10.69 | | 12.96 | 4.59 | 16.59 | 4.65 | Distal | D | SA | CC | |
| 15 | 1661 | 1 | 7/10 | SBB | FALSE | TRUE | M | 01;6 | S | 180 | RS | 180 | 9.98 | | 10.5 | 2.5 | 8.11 | 1.43 | Right | D | SA | R | PD |
| | | | | | | | | | | | | | | | | | 5.63 | 0.72 | Distal | D | SA | CV | |
| 15 | 1662 | 1 | 7/10 | IRR BB | TRUE | TRUE | P | | N | | MB | 120 | 24.42 | 15.15 | 7.84 | 4.13 | 25.13 | 3.98 | Left | D | SA | CC | |
| | | | | | | | | | | | | | | | | | 13.59 | 4.47 | Rt Dist | V'TRAL | | | |
| 15 | 1663 | 1 | 4/SURF | RET B | FALSE | TRUE | M | 01 | R | 180 | S | 170 | 9.54 | | 10.5 | 2.77 | 7.5 | 2.1 | Proximal | D | A | RCC | |
| | | | | | | | | | | | | | | | | | 9.44 | 2.51 | Right | D | L | R | |
| | | | | | | | | | | | | | | | | | 6.14 | 1.42 | Lt Partial | D | A | RCV | |
| 15 | 1664 | 1 | 5/0 | SBB | TRUE | FALSE | M | | RX | 35 | RX | 155 | 22.21 | | 7.53 | 3.34 | 5.93 | 3.24 | | D | SA | R | |
| | | | | | | | | | | | | | | | | | 18.66 | 1.86 | | D | SA | R | OPD |
| | | | | | | | | | | | | | | | | | 7.05 | 2.44 | | D | A | R | |
| 15 | 1665 | 1 | 5/SURF | SBB | TRUE | FALSE | M | | RX | 180 | RX | 165 | 9.39 | | 7.58 | 2.54 | 7.59 | 2.24 | | D | SA | R | ORL |
| | | | | | | | | | | | | | | | | | 7.99 | 2.38 | | D | SA | R | OPD |
| | | | | | | | | | | | | | | | | | 7.8 | 2.28 | | D | SA | R | |
| 15 | 1666 | 1 | 7/10 | SBB | TRUE | FALSE | M | | RX | 180 | RX | 170 | 18.21 | | 7.24 | 2.43 | 7.03 | 2.45 | | D | SA | RCC | |
| | | | | | | | | | | | | | | | | | 16.76 | 2.54 | | D | A | RCC | OPD |
| | | | | | | | | | | | | | | | | | 7.14 | 2.65 | | D | SA | R | ORL |
| 15 | 1667 | 1 | 11/50 | SBB | FALSE | TRUE | M | 56 | R | 20 | S | 170 | 8.62 | | 8.14 | 2.23 | 8.19 | 2.58 | Right | D | SA | RCC | PD |
| 15 | 1668 | 1 | 11/50 | SBB | FALSE | FALSE | M | 01;56 | SX | 180 | SX | 180 | 13.04 | | 7.64 | 2.13 | 12.2 | 1.88 | | D | A | R | OPD |
| 15 | 1669 | 1 | 11/50 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 10 | 8.97 | | 7.37 | 2.57 | 7.7 | 2.84 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | | 7.63 | 2.67 | Right | D | SA | R | DP |
| 15 | 1670 | 1 | 11/50 | BITRUNC | TRUE | FALSE | M | | RX | 20 | RX | 170 | 10.14 | | 7.88 | 2.48 | 6.32 | 2.37 | | D | A | IR | |
| | | | | | | | | | | | | | | | | | 6.08 | 1.91 | | D | SA | R | |
| 15 | 1671 | 1 | 11/40 | SBB | FALSE | FALSE | M | 56 | RX | 180 | SX | 25 | 15.3 | | 6.95 | 2.69 | 6.5 | 2.15 | | D | A | R | |

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| | | | | | | | | | | | | | | | | 15.05 | 2.34 | | D | SA | | OPD |
| 15 | 1672 | 1 | 7/20 | SBB | TRUE | FALSE | M | | RX | 20 | RX | 160 | 21.4 | 6.79 | 4.34 | 5.13 | 2.44 | | D | A | R | |
| | | | | | | | | | | | | | | | | 19.38 | 5.27 | | B | SA | IR | |
| | | | | | | | | | | | | | | | | 6.08 | 3.16 | | D | SA | R | |
| 15 | 1673 | 1 | 4/20 | SBB | FALSE | FALSE | M | 01 | SX | 180 | RX | 170 | 11.26 | 7.85 | 2.64 | 10.23 | 1.95 | | D | A | IR | |
| | | | | | | | | | | | | | | | | 7.57 | 2.41 | | D | A;SA | RCC | |
| 15 | 1674 | 1 | 3/10 | SBB | FALSE | FALSE | M | 56 | RX | 180 | SX | 180 | 12.7 | 7.27 | 2.2 | 6.22 | 2.91 | | D | A | R | ORL |
| | | | | | | | | | | | | | | | | 11.87 | 2.8 | | D | SA | IR | |
| 15 | 1675 | 1 | 9/80 | SBB | FALSE | FALSE | M | 56 | RX | 20 | SX | 10 | 25.68 | 8.21 | 4.57 | 6.24 | 2.49 | | D | SA | RCV | |
| | | | | | | | | | | | | | | | | 23.41 | 5.28 | | D | SA | RCC | |
| 15 | 1676 | 1 | 4/SURF | SBB | FALSE | TRUE | M | 56 | R | 170 | S | 20 | 24.72 | 6.6 | 2.63 | 6.63 | 2.87 | Proximal | D | A | RCC | RL |
| | | | | | | | | | | | | | | | | 22.55 | 2.7 | Right | D | A | CC;R | |
| 15 | 1677 | 1 | 5/SURF | SBB | FALSE | TRUE | M | 01 | S | 180 | R | 180 | 20.09 | 7.87 | 4.14 | 18.95 | 4.19 | Left | D | SA | RCC | |
| | | | | | | | | | | | | | | | | 7.9 | 3.95 | Distal | D | SA | R | |
| 15 | 1678 | 1 | 3/0 | SBB | FALSE | FALSE | M | 01 | SX | 180 | RX | 170 | 15.31 | 7.16 | 2.51 | 12.6 | 2.1 | | D | A | IR | |
| | | | | | | | | | | | | | | | | 7.13 | 2.05 | | D | SA | RCC | |
| 15 | 1679 | 1 | 4/10 | SBB | FALSE | FALSE | M | 01 | SX | 25 | RX | 165 | 14.35 | 7.88 | 3.05 | 10.87 | 1.71 | | D | SA | R | |
| | | | | | | | | | | | | | | | | 8.33 | 2.29 | | D | A | RCC | |
| 15 | 1680 | 1 | 11/50 | SBB | FALSE | FALSE | M | 56 | RX | 25 | SX | | 14.05 | 6.84 | 2.3 | 6.6 | 1.23 | | D | A | I | |
| | | | | | | | | | | | | | | | | 8.26 | 1.4 | | D | A | R | |
| 15 | 1681 | 1 | 11/40 | SBB | FALSE | TRUE | M | 56 | R | 180 | S | 180 | 18.85 | 6.7 | 2.66 | 5.32 | 2.63 | Proximal | D | SA | R | |
| | | | | | | | | | | | | | | | | 17.68 | 3.03 | Left | D | SA | R | PD |
| 15 | 1682 | 1 | 4/20 | SBB | FALSE | FALSE | M | 01 | SX | 180 | RX | 180 | 8.22 | 8.41 | 2.58 | 8.08 | 1.45 | | D | SA | R | |
| | | | | | | | | | | | | | | | | 7.86 | 2.74 | | D | SA | RCC | |
| 15 | 1683 | 1 | 7/20 | SBB | FALSE | FALSE | M | 01 | SX | 180 | RX | 180 | 11.63 | 7.43 | 3.81 | 10.51 | 3.91 | | D | SA | IR | |
| | | | | | | | | | | | | | | | | 8.15 | 3.63 | | D | SA | R | |
| 15 | 1684 | 1 | 6/0 | SBB | FALSE | FALSE | M | 56 | RX | 180 | SX | 180 | 20.97 | 7.78 | 2.83 | 6.39 | 2.85 | | D | A | R | |
| | | | | | | | | | | | | | | | | 19.95 | 3.41 | | D | A | R | |
| 15 | 1685 | 1 | 2/10 | SBB | TRUE | TRUE | P | | N | | MB | 45 | 21.62 | 6.95 | 3.69 | 16.23 | 3.72 | Right | D | A | CCR | PD |
| | | | | | | | | | | | | | | | | 9.88 | 3.8 | Distal | VENTRA | | | |
| | | | | | | | | | | | | | | | | 3.92 | 0.94 | Distal | D | SA | R | LR |

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