# *Cosmology and the orientation of burials in Neolithic China*

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# Cosmology and the orientation of burials in Neolithic China

By

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A thesis submitted in fulfilment of the requirements for the qualification of PhD

Volume 1: Text

Department of Archaeology

Durham University

September 2024

## Abstract

Many of China's Neolithic cemeteries have been excavated and published, and these display some internal consistency in the orientation of burials within each cemetery. This consistency sometimes extends beyond the individual cemetery, in some cases even to an entire geographical region or culture, raising the question of what factors influenced the choice of grave and cemetery orientation. This study investigates the patterns of burial orientation across multiple Neolithic sites in China, aiming to determine whether graves were aligned with specific celestial objects and what this alignment signified to the people of that era. The study divides China into seven regions, utilizing data from the second national relic survey and adopting Shelach's (2015) approach to allow for an examination of the geo-climatic characteristics and their influence on human subsistence activities, providing essential background for understanding Neolithic cosmology. The research explores the relationship between burial orientation, the landscape and the skyscape, while also considering the material culture within burials, revealing that burial orientations were influenced by the lifestyles and cosmological beliefs of the living. For example, millet farming societies in the Yellow River basin aligned burials with celestial phenomena, reflecting a belief system tied to natural cycles and rebirth. In contrast, the Yangzi River basin's reliance on rice farming and abundant resources may have led to a less unified belief system. The study concludes that burial orientations were not directly related to death but to the living's basic needs and their derived concepts of life and death, forming an integral part of their cosmology. This preliminary study aims to fill a gap in Chinese scholarship by introducing novel methods from European prehistory studies.

# Acknowledgement

I would like to give my special thanks to my team of supervisors: to Professor Chris Scarre, for his patience, helpful advice, insightful comments, and persistence in supervising me even during the most difficult times of the Covid. To Associate Professor Marta Diaz-Guardamino for her encouraging words and help with the maps, and for her willingness to be my primary supervisor after Chris' retirement. To Dr Fabio Silva for his enormous help on the aspect of Skyscape Archaeology, I benefited from every comments. Thanks to them for giving me the opportunity to be their PhD student.

This work was partially funded by County Durham Community Foundation, the Sophia Centre and Journal of Skyscape Archaeology, so I would like to express my gratitude for their support. Thanks also due to Cambridge Proofreading and DeepSeek for proofreading and editing work.

Thanks so much to my parents and friends for being patient enough to listen to me discuss my subject. The experience during the epidemic brought us not only life challenges but also spiritual as well. We were in contact almost every day to encourage each other when lock-down in the time of Covid. Finally, this project would not have been possible without the support and kindness of all those mentioned above.

Unfortunately, the effects of the Covid meant that for this research ended up only had one week to visit the Taosi site. It is hoped that there will be more opportunities to visit these sites in the future.

# Table of Contents


Abstract .......... II

Acknowledgement .......... III

Table of Contents .......... 1

List of Maps .......... 6

List of Figures .......... 8

List of Tables .......... 21

List of Abbreviations .......... 23

Chapter 1 Introduction .......... 24

1.1 What is cosmology? .......... 24

1.2 A brief introduction to Chinese cosmology .......... 25

1.3 Understanding Cosmologies through Archaeoastronomy: A Cognitive Archaeology Perspective .......... 29

1.4 Burial orientation and Chinese cosmology .......... 33

1.5 Aim and thesis layout .......... 39

Chapter 2 Literature Review .......... 42

2.1. Archaeoastronomy .......... 42

2.1.1 The development of archaeoastronomical research .......... 42

2.1.2 The development of archaeoastronomy in China .......... 46

2.1.3 The development of Chinese archaeoastronomy by sinologists .......... 53

2.2 Review of the archaeoastronomy of Neolithic sites. .......... 57

2.3 Astronomy in early China according to ancient Chinese literature .......... 61

2.3.1 Celestial phenomena .......... 65

2.3.2 Cardinal direction .......... 84

Chapter 3 Methodology ........................................................................................................ 88

3.1 Introduction ........................................................................................................ 88

3.2 Site selection and data collection ........................................................................ 91

3.3 Display site ........................................................................................................ 94

3.3.1 Site location ................................................................................................ 94

3.3.2 Spatial distribution of regions in ArcGIS .................................................... 100

3.3.3 Surrounding landscape of sites in HeyWhatsThat ....................................... 103

3.4 Data analysis ...................................................................................................... 104

3.4.1 Uncertainty of Grave Measurement ............................................................. 104

3.4.2 Magnetic Azimuth and True Azimuth .......................................................... 107

3.4.3 Calculating Declination (δ) ........................................................................... 108

3.4.4 Estimating altitude and elevation in HeyWhatsThat ..................................... 109

3.4.5 Estimating possible celestial targets from skyscapeR .................................... 110

3.4.6 Observing Potential Celestial Targets in Stellarium ...................................... 111

3.5 Summary ............................................................................................................ 115

Chapter 4 Site selection ...................................................................................................... 118

4.1 Background to the development of the Neolithic period in China ............................. 118

4.1.1 Regional division ......................................................................................... 120

4.1.2 Chronological division .................................................................................. 123

4.1.3. Introduction of selected sites ....................................................................... 126

4.2. the Yellow River .................................................................................................. 129

4.2.1 Jiahu in Henan ............................................................................................. 134

4.2.2 Jiangzhai in Shaanxi ..................................................................................... 147

4.2.3 Longgangsi in Shaanxi .................................................................................. 154

4.2.4 Dahecun in Henan ........ 159

4.2.5 Xipo in Henan ........ 163

4.2.6 Taosi in Shanxi ........ 169

4.2.7 Qingliangsi in Shaanxi ........ 177

4.2.8 Liuwan in Qinghai ........ 183

4.2.9 Yangshan in Qinghai ........ 194

4.2.10 Dawenkou in Shandong ........ 198

4.2.11 Wangyin in Shandong ........ 203

4.3 The Yangzi River ........ 206

4.3.1 Chengtoushan in Hunan ........ 210

4.3.2 Longqiuzhuang in Jiangsu ........ 218

4.3.3 Lingjiatan in Anhui ........ 222

4.3.4 Xuejiagang in Anhui ........ 231

4.3.5 Yuchisi in Anhui ........ 235

4.4 The south region ........ 239

4.4.1 Shixia in Guangdong ........ 241

4.5 Tibet ........ 246

4.5.1 Qugong in Tibet ........ 248

4.6 Summary ........ 252

Chapter 5 Results ........ 257

5.1 Introduction ........ 257

5.2 Regional studies of Chinese sites ........ 260

5.2.1 The Yellow River ........ 260

5.2.1.1 The middle reaches ........ 260

5.2.1.2 the lower reaches ........ 291

5.2.1.3 the upper reaches ........ 297

5.2.2 The Yangzi River ........ 304

5.2.2.1 the middle reaches........ 304

5.2.2.2. The lower reaches........ 309

5.2.3 The Southern region ........ 318

5.2.4 Tibet ........ 321

5.3 Summary ........ 323

Chapter 6 Discussion........ 328

6.1 Introduction ........ 328

6.2 the cultural, chronological and regional patterns behind burial orientation ........ 330

6.2.1. Was there a shared pattern of the burial orientation? ........ 331

6.2.2. What are the regional patterns? And culture relations? Do they stay the same through time? ........ 331

6.3 Landscape........ 340

6.3.1 Whether the grave orientation relate to the surrounding rivers or mountains, plains? ........ 341

6.3.2 How do topographic features influence grave orientation at different elevations? ........ 343

6.4 Skyscape........ 347

6.4.1 Most important celestial phenomena by region and site........ 347

6.4.2 The effect of topography and climate on observation habits and subsistence activity........ 352

6.4.2.1 Nomadism ........ 354

6.4.2.2 Millet-farming model ........ 354

6.4.2.3 Rice-farming model........ 356

6.4.2.4 Fishing and gathering .......... 357

6.4.3 The relationship between climate, agricultural model, seasons and celestial observation .......... 357

6.4.3.1 Times of cultivation and harvest for dry and rice farming in the Yellow and Yangzi River regions .......... 357

6.4.3.2 The relationship between farming-related celestial events and burial orientation .......... 362

6.5 Supporting evidence from burial objects .......... 368

6.5.1 How do the motifs on Yangshao pottery express the culture's cosmology? .......... 368

6.5.2 Do pottery patterns at Taosi express similar cosmology to that ofthe Yangshao culture? .......... 371

6.5.3 How do patterns in the Dawenkou culture express 'life' in a way that relates to sunrise? .......... 373

6.5.4 What kinds of celestial beliefs distinguish in the MYangzi River region from the Yellow River region? .......... 376

6.5.5 How do celestial beliefs in the LYangzi River basin relate to death? .......... 381

6.6 Summary of regional differences in celestial beliefs underlying burial orientations .......... 386

Chapter 7 Conclusion .......... 393

7.1 Introduction .......... 393

7.2 Summary of the argument .......... 393

7.3 Skyscape archaeology in prehistoric studies .......... 395

Bibliography .......... 397

# List of Maps


Map 4.1, regional division of China (Esri, 2021). ....................122

Map 4.2, the 18 Neolithic sites in China studied in this PhD. ....................128

Map 4.3, boundaries of the upper, middle, and lower reaches of the Yellow River and the outline of the Yellow River basin (Esri, 2021). ....................131

Map 4.4, the selected Neolithic sites in the Yellow River region. ....................134

Map 4.5, Jiahu ....................135

Map 4.6 Jiangzhai. ....................148

Map 4.7, Longgangsi. ....................155

Map 4.8, Dahecun. ....................160

Map 4.9, Xipo. ....................164

Map 4.10, Taosi. ....................169

Map 4.11, Qingliangsi. ....................178

Map 4.12, Liuwan. ....................183

Map 4.13, Yangshan. ....................195

Map 4.14, Dawenkou. ....................199

Map 4.15, Wangyin. ....................204

Map 4.16, the boundaries between the Upper, Middle and Lower Yangzi River and the overall extent of the Yangzi River basin (Esri, 2021). ....................207

Map 4.17, the selected Neolithic sites in the Yangzi River region. ....................210

Map 4.18, Chengtoushan. ....................211

Map 4.19, Longqiuzhuang. ....................219

Map 4.20, Lingjiatan. ....................223

Map 4.21, Xuejiagang. ....................232

Map 4.22, Yuchisi. ....................235

Map 4.23, the selected Neolithic sites in the southern region. ........ 241

Map 4.24, Shixia. ........ 242

Map 4.25, the selected Neolithic site in the Tibet region. ........ 247

Map 4.26, Qugong. ........ 248

Map 5.1, the overall view grave orientaion at Jiahu. ........ 261

Map 5.2, the overall view grave orientaion at Jiangzhai. ........ 265

Map 5.3, the overall view grave orientaion at Longgangsi. ........ 269

Map 5.4, the overall view grave orientaion at Dahecun. ........ 271

Map 5.5, the overall view grave orientaion at Xipo. ........ 274

Map 5.6, the overall view grave orientaion at Taosi. ........ 278

Map 5.7, the overall view grave orientaion at Qingliangsi. ........ 281

Map 5.8, the overall view grave orientation at Dawenkou. ........ 292

Map 5.9, the overall view grave orientation at Wangyin. ........ 295

Map 5.10, the overall view grave orientation at Liuwan. ........ 299

Map 5.11, the overall view grave orientation at Yangshan. ........ 303

Map 5.12, the overall view grave orientation at Chengtoushan. ........ 305

Map 5.13 the overall view grave orientation at Longqiuzhuang ........ 310

Map 5.14, the overall view grave orientation at Lingjiatan. ........ 312

Map 5.15 the overall view grave orientation at Xuejiagang. ........ 314

Map 5.16 the overall view grave orientation at Yuchisi. ........ 316

Map 5.17, the overall view grave orientation at Shixia. ........ 319

Map 5.18, the overall view grave orientation at Qugong. ........ 322

# List of Figures

Figure 2.1, the nine stars of the Big Dipper at Qingtai site (left) and Shuanghuaishu site (right) (Zhen, 2021). ........ 51

Figure 2.2, reconstruction of Taosi observatory (top) and schematic diagram of Taosi observatory (bottom; Beijing Planetarium, 2023, Available at: https://www.bjp.org.cn/xwzx/gndt/4028c136878ba76801878dc2c691000e.shtml) ........ 59

Figure 2.3, burial structure of Tomb M45 at Xishuipo (left; CRARIHP and CRPAPC, 2012, p. 113) and diagram of Gaitian theory applied to the structure of Tomb M45 (right; Feng, 1990b). ........ 61

Figure 2.4, archaeological and dynastic chronology of early China (Pankenier, 2013, p. xxvi) ........ 64

Figure 2.5, the 28 mansions and the Big Dipper. ........ 66

Figure 2.6, the position of mansions at sunset on the spring equinox (top), the position of mansions at sunrise on the spring equinox (bottom) (Stellarium, 2022). ........ 68

Figure 2.7 the position of mansions at sunset on the summer solstice (top), the position of mansions at sunrise on the summer solstice (bottom) (Stellarium, 2022). ........ 69

Figure 2.8, the position of mansions at sunset on the autumn equinox (top), the position of mansions at sunrise on the autumn equinox (bottom) (Stellarium, 2022). ........ 70

Figure 2.9, the position of mansions at sunset on the winter solstice (top), the position of mansions at sunrise on the winter solstice (bottom) (Stellarium, 2022). ........ 71

Figure 2.10, the character of *long* on oracle bones (left; Feng, 2011, p.10) and the evolution of the character *long* and to the modern period (right; Chaziwang, 2022) ........ 75

Figure 2.11, evolution of the character *xia* up to the modern period (Chaziwang, 2022) ........ 75

Figure 2.12, copy (top) and translation (bottom) of oracle bone no. 290 from Huayuanzhuangdong at Yinxu (Wu, 2014). ........ 78

Figure 2.13, the character of *di* on oracle bones (left; Feng, 2011, p. 10) and the evolution of the character *di* up to the modern period (Chaziwang, 2022). ........ 81

Figure 2.14, star chart showing the character *di* superimposed and linking stars on opposite sides of the celestial pole, as described by Pankenier (2013, p. 105; made in Stellarium, 2022). ........ 81

Figure 3.1, partial layout of Lingjiatan in contour map (APICRA and HCCRMO, 1999). ........ 96

Figure 3.2, example of finding the Lingjiatan site on 2 mile scale of Google Earth (2023) (above) and Baidu Maps (2023) (below). ... 98

Figure 3.3, example of finding the Lingjiatan cemetery on 1000 feet scale of Google Earth (2023) (above) and 200 metres scale of Baidu Maps (2023) (below). ... 99

Figure 3.4, thumbnail of World Hillshade map in ArcGIS Online (Esri, 2023). ... 101

Figure 3.5, burial distribution at the Qingliangsi cemetery (SPIA, YMWCH and RCATCH, 2016). ... 102

Figure 3.6, diagram of partial excavated trenches in 1987 and 1998 (APICRA, 2006). ... 103

Figure 3.7, surrounding landscape at the Xipo cemetery, with two yellow brownish lines indicating the grave orientation range (HeyWhatsThat, 2022). ... 104

Figure 3.8, burial M2137 at Wangyin, illustrating the method for measuring orientation. ... 105

Figure 3.9, uncertainty measurement of the burial M1 at Xipo. ... 107

Figure 3.10, schematic of altitude (hs) and the formula for altitude calculation (Walker, 2019). ... 109

Figure 3.11, schematic of the declination of a horizon point (Ruggles, 2015c: 461). ... 109

Figure 3.12, example of HeyWhatsThat functionality (HeyWhatsThat, 2022). ... 110

Figure 3.13, SPD of the significant burial orientation at Xipo cemetery. ... 111

Figure 3.14, Xing Yi Xiang Fa Yao star map made by Su Song in AD 1088 (top and bottom)(Stellarium, 2022). ... 114

Figure 3.15, simulation of skyscape and landscape at Xipo (Stellarium, 2022). ... 115

Figure 4.1, timetable of the Neolithic cultures in China. ... 125

Figure 4.2, timetable of selected 18 Neolithic sites. ... 129

Figure 4.3, layout of Jiahu site and excavation areas (HPICRA and USTC, 2015, p. 16). ... 136

Figure 4.4, pit H502 containing 1. Fork-shaped object, 2. Chikou pot, 3-10. Tortoise shells (HPICRA and USTC, 2015, p. 69). ... 138

Figure 4.5, burial M22 (left), primary extended single inhumation (1. Ceramic kettle, 2. Basin-shaped tripod, 3. Pot, 4-13 bone arrows, 15. stone axe, 16. Stone chisel); burial M60 (middle), primary extended single inhumation with hands crossed above the abdomen (1. Kettle, 2. Grinding stone, 3-5. Bone dagger, 6-8, bone awls); burial M206 (right), primary extended single inhumation with one arm at an angle (1. Kettle, 2. *yaxiao*) (HPICRA, 1999, p. 153, 161, 167). . 139

Figure 4.6, burial M115 (right) primary single inhumation lacking a skull (1-4, 6-9. Bone needles, 5. Square-shaped stone pendent, 10. *yaxiao*); burial M105 (middle), primary single inhumation with a repositioned skull; burial M113 (right) primary single inhumation with missing lower limbs (1. Kettle, 2. Pig lower jawbone, 3. Grinding stone, 4-6, bone awls, 7. Bone dart, 8.11.14. yaxiao, 9. Shell, 10.13. bone needles, 12. Tooth ornament, 15. Bony plate) (HPICRA, 1999, p. 173-175). ........ 140

Figure 4.7, burial M303 (left), primary burial with a prone inhumation (1. kettle, 2. *yaxiao*); burial M222 (middle), primary burial with an extended inhumation and one leg curved (1. kettle); burial M353 (right), primary burial with two extended inhumations (1. Ceramic spindle whoral, 2-22, 31-38. Bone needle, 23-24. Bone arrow, 25. Bone dart, 26, 28. Yaxiao, 27. Bone awls, 29-30. Kettle, 39. stone raw material) (HPICRA, 1999, p. 180-182). ........ 141

Figure 4.8, burial M330 (left), secondary burial with a single inhumation in condition 2 (1. Kettle, 2. Handle-shaped stone object, 3. yaxiao); burial M19 (middle), secondary burial in condition 3; burial M281 (right) secondary burial with remains of more than one inhumation (1-4 kettles, 5. Millstone, 6. Yaxiao, 7-9. Bone daggers, 10. Bone needle) (HPICRA, 1999, p. 183-187). ........ 142

Figure 4.9, burial M35, collective burial with one primary inhumation and one secondary inhumation (1. Kettle, 2. Bone awl, 3.6. bone dart, 5. Stone bullet, 7. Bone arrow); burial M352 (middle), a collective burial with one primary inhumation and more than one secondary inhumation (1-6. kettles); burial M288, a *Qianchumu* (HPICRA, 1999, p. 189, 195, 197). ........ 143

Figure 4.10, fork-shaped object from 2001 (left) and in 2013 (right) (HPICRA and USTC , 2015; Yang, *et al.,* 2017). ........ 145

Figure 4.11, tortoise shells contain small stones and fragments, found in 2001 (HPICRA and USTC, 2015). ........ 145

Figure 4.12, three bone flutes (Yang, *et al.,* 2017). ........ 146

Figure 4.13, Layout plan of Jiangzhai site (Gong, 1981). ........ 149

Figure 4.14, layout of burials in the east cemetery (Zhao, 1996). ........ 151

Figure 4.15, layout of graves in northeastern cemetery (Zhao, 1996). ........ 152

Figure 4.16, layout of graves in the southeast cemetery (Zhao, 1996). ........ 153

Figure 4.17, burial M169, secondary burial with multiple interments (XBM, SPIA and LCM, 1988, p. 168). 154

Figure 4.18, the location of Longgangsi (SPIA, 1990, p. 2) . 156

Figure 4.19, distribution of a portion of burials and pits at Longgangsi (Liu, 2000). 157

Figure 4.20, burial M102 in Longgangsi. 1-2. Calaite pendants, 3. Tooth made ornament, 4 and 8. Millstones, 5,6,14,15. Bo, 7. Stone shovel, 9,10,16. Bowls, 11. Ceramic fragment, 12. Tortoise shells, 13. Bottle with a pointed base, 17. Pot with four lugs (SPIA, 1990, p. 72). 159

Figure 4.21, pattern of sun (left) and pattern of corona (right) on ceramic surface (ZICRA, 2001, p. 597). 161

Figure 4.22, burial M20 (left) and M94 (right) are both human skeletons buried in pits in the Longshan period (ZICRA, 2001, p. image 135). 162

Figure 4.23, grave excavation in the late Yangshao period at Dahecun (ZICRA, 2001, p. image 63). 162

Figure 4.24, perforated tortoise shell from pit H170 (ZICRA, 2001, p. image 153). 163

Figure 4.25, plan of Xipo cemetery (IACASS and HPICRA, 2010, p. 15). 167

Figure 4.26, burial M27 at Xipo, 1-2. Large-mouth vat, 3. Kettle, 4. Bo, 5. Gui-shaped object with lid, 6, 9. Gui-shaped object, 7. Fu, 8. Oven (IACASS and HPICRA, 2010, p. 86) 168

Figure 4.27, excavated areas at Taosi site (He and Gao, 2018). 170

Figure 4.28, burial M3288 (left), constructed with stones (IACASS and LCRBSP, 2015: 419); stepped burial M2172 (right) contains 1. Wooden table, 2-3. Wooden gu, 4. Zhefu basin, 5. Zhefu pot with lugs, 6. Zun, 7. Bottle, 8. Kettle, 9. Small pot with lug, 10. Pot-shaped tripod with lug, 11-14. Dou, 15. Gui, 16. Yuanfu pot, 17. Basin-shaped jia, 18-19. Large-mouth pot, 20, 33. Qianfu basin, 21-23. Pig bones, 24. Stone knife, 25. Wooden zu, 26. Wooden spoon, 27. Vat-shaped object, 28, 37. Bone dagger, 29. Wooden object, 30. Wooden bowl, 31. Zun-shaped jia, 32. Oven, 34. Shovel, 35, 36. Wooden dou with a high handle, 30. Yue. 58 pairs of pig mandibles on the second step (IACASS and LCRBSP, 2015, p. 468). 173

Figure 4.29, burial IIM22 (He, 2009). 175

Figure 4.30, plan of the observatory (II FJT2) at Taosi (He, 2018). 176

Figure 4.31, the location of Qingliangsi (SPIA, YMWCH and RCATCH, 2016). 179

Figure 4.32, grave M51 and M61 floor plan and M51 rear view (SPIA et al., 2016, p. 110). 182

Figure 4.33, distribution of the Liuwan burials (ATQPACR and IACASS, 1984, p. 2). .........................184

Figure 4.34, burial M421, 1. Ceramic kettle, 2.3. ceramic spindle whorls, 4. Kallaite ornament, 5. Colour painted kettle, 6. Stone arm ornament, 7. A box for holding arrows (矢箙), 8. Beaded pendant (ATQPACR and IACASS, 1984, p. 18). ..........................................................................185

Figure 4.35, burial M580, 1. Stone adze, 2. Chikou pot, 3. 6. Axes, 4. Stone ball, 5. Arm ornaments (ATQPACR and IACASS, 1984, p. 18). ..........................................................................186

Figure 4.36, burial M1262, 1. Colour painted urn, 2-6. 8. 15. 21. 22. 24. 26. 27. Chikou pots, 7. 11-13. 20. 25. Pot with double lugs, 9. 23. 25. 39. Ceramic balls, 10. Chikou pot with double lugs, 14. 19. 29. Colour painted pot with double lugs, 16. Basin, 17. Pot with single lug, 18. 28. 38. Ceramic spindle whorls, 30. 34. Long neck kettle, 31. 33. 36. Mussels, 32. 37. Colour painted kettles (ATQPACR and IACASS, 1984, p. 70). ..........................................................................189

Figure 4.37, burial M1060, 1. 2. 5. 6. 12. 15. 17. 27. Long neck kettle, 3. 4. 8. 9. 14. 16. 19. 24. 38. Chikou pot with double lugs, 7. 13. 18. 22. 25. 30-32. Colour painted pot with double lugs, 10. 28. 29. Pot with double lugs, 11.13. colour painted urn, 20. Pot with a single lug, 21. 35. Stone chisel, 23. Basin, 26. Colour painted kettle, 34. 36. Stone axe, 37. Ceramic spindle whorl, 39. Chikou pot, 40. Stone ball, 41. Turquoise ornament, 42. Pot with double lugs, 43. 44. Cup (ATQPACR and IACASS, 1984, p. 82) ..........................................................................189

Figure 4.38, partial patterns and symbols on artefacts in the Machang variation (ATQPACR and IACASS, 1984, p. 138-152)..........................................................................................190

Figure 4.39, burial M972: 1. 6. 9. 20. Pot with double lugs, 2. 3. Turquise ornaments, 4. A string of beads, 5. 16. 26. High neck pot with double lugs, 7. Liankou urn, 8. 11. 13. Pot with double large lugs, 10. Ceramic spindle whorl, 13.15. 18. Pot with single lugs, 14. Zhefu pot, 17. Basin, 19. Pot with triple lugs, 21. 22. 28. Pot with a mouth, 23.22. 28. Kettle, 24. Chikou pot, 29. Owl-faced ceramic pot (ATQPACR and IACASS, 1984, p. 189). ....................................................192

Figure 4.40, burial M392: 1. Colour painted pot with double lugs, 2. Basin, 3.9. Pot with double lugs, 4. Zhefu pot, 5. Chikou pot, 6. Pot with two lugs, 7. High neck pot with double lugs, 8. Kettle, 10. Stone knife. M397: 1. Zun, 2. Colour painted pot with double lugd, 3. 5. 7-9. Kettle, 4. Basin, 6. Urn, 10. Adze, 22. Chisel, 12. Knife (ATQPACR and IACASS, 1984, p. 174). ...............................193

Figure 4.41, distribution of graves and pits at Yangshan cemetery (AIQA, 1990, p. 4). ....................196

Figure 4.42, burial M176, showing two individuals flexed to each other (AIQA, 1990, p. image IX)..197

Figure 4.43, burial M68, containing two prone individuals (AIQA, 1990, p. image VIII). ...................197

Figure 4.44, pit H4, 1-4 stones, 5-16 fragments of animal bones (AIQA, 1990, p. 55). ...................... 198

Figure 4.45, plan of Dawenkou site (Chen, *et al.,* 2019)................................................................... 200

Figure 4.46, the orientation of graves at Dawenkou (Underhill, 2000). ........................................... 202

Figure 4.47, burial M1011 Beixin grave, 1-3. arrows (SPICRA, 1997, p. 34). ..................................... 203

Figure 4.48, burial distribution in the southern area of the Wangyin cemetery (IACASS, 2000, p. 150). ........................................................................................................................................ 205

Figure 4.49, burial distribution in the northern area of the cemetery (IACASS, 2000, p. 150)........... 206

Figure 4.50, layout of Chengtoushan showing the excavated areas (HPIACR, 2007, p. 10). .............. 212

Figure 4.51, plan of altar1 and pits at Chengtoushan (He, 1999). ..................................................... 214

Figure 4.52, plan of altar2 (left) (HPIACR, 2007: 283); plan of altar 3 (right) (HPIACR, 2007, p. 283). 215

Figure 4.53, burial M58, extended with flexed limbs inhumation, without grave good (HPIACR, 2007, p. 287). .......................................................................................................................... 215

Figure 4.54, burial M706, extended inhumation lying on a slope (HPIACR, 2007, p. 291). ................ 216

Figure 4.55, burial M678, 681 and 682, 1-2. Jade huang, 3.9.11.12.17.20.22.24.26.27. ceramic lids, 4.6-8.10.13.14. dou, 5.15.19.25. plates, 15. Tripod, 18.21. bowls, 23. Fu, 28. A child's skull. A little cinnabar applied in the pit (HPIACR, 2007, p. 293-4). ........................................................ 216

Figure 4. 56, burial M325, 1.13.21.22.25.26.31.60.71.78.80.91. kettle, 2-4.7.15-18.27.32.33.37.42-44.54.55.63.66.73.87-90.93.94.97.100.102.103. lids, 5.8-12.14.19.20.23.28.30.46.47.53.56-59.61.62.64.67.72.81.83.85.86.95. dou, 6.24.34.39.52.79.98. pots, 29.35.36.45.48.49.65.68.69.74-77.99.101. tripods, 38.50.51. zeng, 40.41.70. small pots, 82. Cup, 84. Yu-shaped object, 92. Spindle whorl, 96. Stone adze (HPIACR, 2007, p. 324)...................... 217

Figure 4.57, plan of Longqiuzhuang (LAT, 1999, p. 9). ........................................................................ 220

Figure 4.58, burial M316 in Longqiuzhuang. 1 is ceramic spindle whorl (LAT, 1999, p. 124). ............ 221

Figure 4.59, the M94 burial owner's face was covered by a bowl (LAT, 1999, p. image 6). ............... 222

Figure 4.60, partial layout of Lingjiatan in elevation map (APICRA and HCCRMO, 1999). ................. 224

Figure 4.61, the plan of altars (APICRA, 2006, p. 32). ......................................................................... 226

Figure 4.62, burial 87M4, 1 stone Yue appears above the burial, 2,5,6,20,23,24,27,43,45,47,54,56-1,56-2,70, 75-2,100,119 stone Yue, 3,7-9,11,12,19,50-1,74 jade stones, 4,104,107 ceramic kettles, 10,53,65,72 jade bracelets, 13,49,50-2,51,69,91 stone adzes, 14,15,52,90,93 stone chisels, 16,25,110 jade Yue, 17,38-2,38-3,92,103,105,106 ceramic fragments, 18,31,41,42,55 stone axes, 21,22,46,64,71,73,83,86,109-2,111-1,112,114,115,116 jade Jue, 26 jade spoon, 28-1 jade axe, 28-2,33,34,37,38-1,39,48,67,75-1-82,84,97,98 jade Huang, 29,35 jade tortoises, 30 jade plate, 32-1,59,87-3,101,117 button-shaped jade ornaments, 32-2,32-3,32-4,89,113,120,126,128,129,130,131 circular-shaped jade ornaments, 36 jade hairpin, 40 crown-shaped jade ornament, 44,60,85 jade Bi, 57,108,109-1 jade rings, 58,127 mushroom-shaped jade ornaments, 61,62,66,121,122,123-1,124,125 plain circular-shaped jade ornaments, 63 jade ornament with handle, 68-1 triangular shaped jade ornament, 68-2,87-1,87-2,88,99,102,111-2,118,123-2 jade pipes, 94 ceramic lid, 95 ceramic pot, 96 jade ornament (APICRA, 2006, p. 48) ....... 228

Figure 4.63, Jade tablet and tortoise from 87M4 (APICRA, 2006, p. 49). ....... 230

Figure 4.64, Hetu and Luoshu (Shi, 2024). ....... 230

Figure 4.65, grave goods of burial M40 in Xuejiagang cemetery, including ceramic wares and perforated knives, *yue* and adzes (APICRA, 2004, p. image 39). ....... 234

Figure 4.66, reconstruction plan of Yuchisi (IACASS and CBMCAP, 2007, p. coloured image 4). ....... 236

Figure 4.67, pit JS10, containing 12 ceramic wares (left) (IACASS and CBMCAP, 2007: 101); the 12 ceramic wares from pit JS10 (right) (IACASS and CBMCAP, 2007, p. 102). ....... 237

Figure 4.68, Shixia site (ICRAG *et al*., 2014, p. 4). ....... 243

Figure 4.69, plan of remains in the Shixia period (ICRAG *et al*., 2014, p. 31). ....... 245

Figure 4.70, burial M70, (ICRAG *et al.*, 2014, p. 537). ....... 246

Figure 4.71, burials of the early phase at Qugong, 1. M111, 2. M112, 3. M109 (IACASS and BCRTAR, 1999, p. 20). ....... 249

Figure 4.72, plan of the I cemetery (IACASS and BCRTAR, 1999, p. 186). ....... 250

Figure 4.73, burial M207 at the II cemetery of Qugong (IACASS and BCRTAR, 1999, p. 194). ....... 251

Figure 4.74, burials M219 in the II cemetery of Qugong (IACASS and BCRTAR, 1999, p. 203). ....... 251

Figure 4.75, 2 sacrificial remains, 1. J1 (1. Ceramic cup, 2-7. Circular based pots, 8. Animal tooth), 2. J2 (1. Horse bones, 2. Ceramic fragments) (IACASS and BCRTAR, 1999, p. 191). ....... 252

Figure 5.1, depicts the panoramic view around the Jiahu site and the grave orientations of the early Jiahu phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiahu grave orientations in the early period (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ............... 262

Figure 5.2, shows the panoramic view around the Jiahu site and the grave orientations of the middle to late Jiahu phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiahu grave orientations in the middle to late period (left), a histogram of true azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ........................................................................................................................ 263

Figure 5.3, the Milky way presents one hour after sunset on summer solstice at Jiahu, without Atmospheric effects. ...................................................................................................... 264

Figure 5.4, illustrates the panoramic view around the Jiangzhai site and the grave orientation range of the Banpo phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiangzhai grave orientations in the Banpo phase (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ........................................................................................................................ 266

Figure 5.5, depicts the panoramic view around the Jiangzhai site and the grave orientation range of the Shijia phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiangzhai grave orientations in the Shijia phase (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ............... 267

Figure 5.6, the Milky Way appeared after sunset on SS at Jiangzhai, without atmospheric effect.... 268

Figure 5.7, shows the panoramic view around the Longgangsi site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Longgangsi grave orientations in the Yangshao period (left), a histogram of azimuth distribution in the significance test of the Banpo phase (middle), and a histogram of declination distribution in the significance test of the Banpo phase (right). ......................................................................................................... 270

Figure 5.8, illustrates the panoramic view around the Dahecun site and the grave orientation range of the late Yangshao period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dahecun grave orientations in the Yangshao period (left), a histogram of azimuth distribution in the significance test of the Yangshao period (middle), and a histogram of declination distribution in the significance test of the Yangshao period (right). ......................................... 273

Figure 5.9, depicts the panoramic view around the Dahecun site and the grave orientation range of the Longshan period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dahecun grave orientations in the Longshan period (left), a histogram of azimuth distribution in the significance test of the Longshan period (middle), and a histogram of declination distribution in the significance test of the Longshan period (right). ........ 273

Figure 5.10, shows the panoramic view around the Xipo site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar chart of grave orientations at Xipo (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ........ 276

Figure 5.11, the Milky Way appeared before dawn on SS at Xipo, without atmospheric effect. ....... 276

Figure 5.12, illustrates the panoramic view around the Taosi site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Taosi grave orientations (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right). ........ 279

Figure 5.13, the Milky Way moved to the central of the orientation range at nightfall on WS at Taosi, without atmospheric effect. ........ 280

Figure 5.14, shows the panoramic view around the Qingliangsi site and the grave orientation range of the 1st phase (HeyWhatsThat, 2022). It includes a polar diagram of grave orientations in the 1st phase (left), a histogram of the 1st phase azimuth distribution in the significance test (middle), and a histogram of the 1st phase declination distribution in the significance test (right). ........ 283

Figure 5.15, illustrates the panoramic view around the Qingliangsi site and the grave orientation range of the 2nd to 4th phases (from left to right) (HeyWhatsThat, 2022). ........ 284

Figure 5.16, includes polar diagrams and histograms of the true azimuth and declination distributions in the significance tests for the 2nd phase (above row), 3rd phase (middle row), and 4th phase (below row). ........ 285

Figure 5.17, the Milky Way appeared before dawn on SS at Qingliangsi cemetery, without atmospheric effect. ........ 285

Figure 5.18, overlaps of significant true azimuth ranges between all sites from the middle reaches of the Yellow River. ........ 286

Figure 5.19, overlaps of significant declination ranges of sites with west-facing burials from the middle reaches of the Yellow River. ........ 288

Figure 5.20, overlaps of declination ranges of sites with northwest-facing burials from the middle reaches of the Yellow River. ........ 289

Figure 5.21, shows the panoramic view around the Dawenkou site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dawenkou grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ..................... 293

Figure 5.22, the Milky Way after nightfall on SS (left); the Milky Way after nightfall on AE (right). .. 294

Figure 5.23, llustrates the panoramic view around the Wangyin site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of all Wangyin grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ..................... 296

Figure 5.24, presents polar diagrams of the early (left), middle (middle), and late (right) Wangyin grave orientations. ..................... 296

Figure 5.25, the Milky Way at dawn on SE (left), at nightfall on AE (right). ..................... 297

Figure 5.26, shows the panoramic view around the Liuwan site and the grave orientation range of the Banshan phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Banshan phase (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........... 300

Figure 5.27, illustrates the panoramic view around the Liuwan site and the grave orientation range of the Machang phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Machang phase (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........... 301

Figure 5.28, depicts the panoramic view around the Liuwan site and the grave orientation range of the Qijia period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Qijia period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). .................. 302

Figure 5.29, shows the panoramic view around the Yangshan site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yangshan grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ..................... 304

Figure 5.30, shows the panoramic view around the Chengtoushan site and the grave orientation range of the Daxi period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Daxi period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........................................................................ 306

Figure 5.31, illustrates the panoramic view around the Chengtoushan site and the grave orientation range of the Qujialing period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Qujialing period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........................................................................ 307

Figure 5.32, depicts the panoramic view around the Chengtoushan site and the grave orientation range of the Shijiahe period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Shijiahe period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........................................................................ 308

Figure 5.33, shows the panoramic view around the Longqiuzhuang site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Longqiuzhuang grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........................ 311

Figure 5.34, the Milky Way before sunrise on SE (left); the Milky Way after sunset on SS (right). .... 311

Figure 5.35, illustrates the panoramic view around the Lingjiatan site (HeyWhatsThat, 2022). ........ 313

Figure 5.36, shows the panoramic view around the Xuejiagang site (HeyWhatsThat, 2022). ........... 314

Figure 5.37, presents a polar diagram of partial Xuejiagang grave orientations. .............................. 315

Figure 5.38, depicts the panoramic view around the Yuchisi site and the grave orientation range of the late Dawenkou period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yuchisi grave orientations in the late Dawenkou period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........................................................................ 317

Figure 5.39, illustrates the panoramic view around the Yuchisi site and the grave orientation range of the Longshan period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yuchisi grave orientations in the Longshan period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........... 318

Figure 5.40, shows the panoramic view around the Shixia site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Shixia grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........ 321

Figure 5.41, illustrates the panoramic view around the Qugong site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Qugong grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right). ........ 323

Figure 6.1 , partial crop calendars for China (USDA, 2023). ........ 359

Figure 6.2 , different subsistence of sites in the MYellow River, according to the significant true azimuth ranges. ........ 363

Figure 6.3, different subsistence of sites in the LYellow River, according to the significant true azimuth ranges. ........ 367

Figure 6.4, ceramic fragments of two pots with different sunburst patterns from Dahecun (ZICRA, 2001, p. image form 30). ........ 369

Figure 6.5, reconstructed pots from Dahecun (Wu, 2020). ........ 370

Figure 6.6, patterns on painted ceramics of the Yangshao culture (Zhang, 2015) ........ 371

Figure 6.7, expanded decoration from a folded-belly basin (IACASS and LCRBSP, 2015, p. 607) ........ 372

Figure 6.8, the painted coiled dragon on four plates and basins (Cui, 2017). ........ 373

Figure 6.9, painted pottery item with solar octagonal star pattern (left) and illustration of a solar octagonal star (Lv, 2015). ........ 374

Figure 6.10, two versions of a carved symbol found on Dawenkou ceramics. ........ 376

Figure 6.11, octagonal stars on pottery from the Tangjiagang culture (Li, 2004). ........ 378

Figure 6.12, 1. five positions, 2. eight directions, 3. nine Squares, 4. octagonal star. ........ 378

Figure 6.13, motifs on spinning wheels (Zhao, 2014). ........ 379

Figure 6.14, octagonal stars on a traditional ethnic costumes (Acheng, 2015, p. 18). ........ 380

Figure 6.15, *tao qun* (Lang, 2014). ........ 381

Figure 6.16, 12 perforated stone knives from burials at Xuejiagang (Feng, 2010, p. 139). ........ 383

Figure 6.17, jade tablet and jade tortoise from Lingjiatan M4 (APICRA, 2006, p. 49). ........ 384

Figure 6.18, jade artefact excavated from M29 (left; APICRA, 2006, p. 249) and a ceramic spinning wheel excavated from M19 (right; APICRA, 2006, p. 209)..........................................................386

# List of Tables

Table 3.1, site information gathered from excavation reports. ........................................................ 94

Table 3.2, burial orientation, position and type of each site, compiled from excavation reports. ... 108

Table 5.1, Basic information of each site (regions, names, periods and grave number). ................. 260

Table 5.2, summary of grave orientation and Jiahu site information. ............................................ 261

Table 5.3, summary of grave orientation and Jiangzhai site information. ....................................... 264

Table 5.4, summary of grave orientation and Longgangsi site information. .................................. 268

Table 5.5, summary of grave orientation and Dahecun site information. ....................................... 271

Table 5.6, summary of grave orientation and Xipo site information. .............................................. 274

Table 5.7, summary of grave orientation and Taosi site information. ............................................. 277

Table 5.8, summary of grave orientation and Qingliangsi site information. .................................. 281

Table 5.9, stars appeared in the overlapped declination range by sites with west-facing burials in the middle reaches of the Yellow River. ........................................................................ 289

Table 5.10, stars appeared in the overlapped declination range by sites with northwest-facing burials in the middle reaches of the Yellow River. ........................................................................ 290

Table 5.11, summary of grave orientation and Dawenkou site information. ................................. 291

Table 5.12, summary of grave orientation and Wangyin site information. ..................................... 294

Table 5.13, summary of grave orientation and Liuwan site information. ........................................ 298

Table 5.14, summary of grave orientation and Yangshan site information. .................................... 302

Table 5.15, summary of grave orientation and Chengtoushan site information. ............................ 305

Table 5.16, summary of grave orientation and Longqiuzhuang site information. ............................ 309

Table 5.17, summary of grave orientation and Lingjiatan site information. .................................. 312

Table 5.18, summary of grave orientation and Xuejiagang site information. ................................. 313

Table 5.19, summary of grave orientation and Yuchisi site information. ....................................... 315

Table 5.20, summary of grave orientation and Shixia site information. .......................................... 318

Table 5.21, summary of grave orientation and Qugong site information. ........................................ 321

Table 6.1, the distribution of burial orientations at 18 sites in 7 regions.......................................... 333

Table 6.2, The distribution of burial orientations at 18 sites in different cultures and variants. ....... 335

Table 6.3, The distribution of burial orientations at 18 sites in different periods. ........................... 336

Table 6.4, the relationship between different type of landscape and sites in seven regions. ........... 342

Table 6.5, sites in different levels of altitude...................................................................................... 345

Table 6.6, the landscape and possible celestial events that can be seen in the range of burial orientation each site. ........................................................................................................................ 349

Table 6.7, the possible celestial events that can be seen in the range of burial orientation and ways of subsistence of each site. ........................................................................................... 353

Table 6.8 , the relationship between farming cycle and the celestial events that pointed by burials from the MYellow River. ........................................................................................... 366

Table 6.9, the relationship between farming cycle and the celestial events that pointed by burials from the LYellow River. ........................................................................................................ 366

## List of Abbreviations

| | |
|---|---|
| UYellow | upper reaches of the Yellow River |
| MYellow | middle reaches of the Yellow River |
| LYellow | lower reaches of the Yellow River |
| MYangzi | middle reaches of the Yangzi River |
| LYangzi | lower reaches of the Yangzi River |

# Chapter 1 Introduction

## 1.1 What is cosmology?

Cosmology is defined as a shared worldview or belief system developed by a community on its members' understanding of the nature of the world – the cosmos (Ruggles, 2005, p. 115; Darvill, 2021a). Although cosmology is intimately related to astronomy, for many indigenous communities, the sky is not the whole world: the earth and all that occurs on it also make up an important part of the worldview. The universe has been viewed as an integrated whole in which the movement of the Sun, Moon, planets, stars, clouds and all other celestial bodies are associated with objects and events in the terrestrial world, including both the spirit world and the world as people perceive it, and a system of relationships is established in human society and the destiny of individuals (Ruggles, 2005, p. 116; Iwaniszewski, 2011; Campion, 2012, p. 3). For many indigenous groups and virtually all prehistoric human societies, cosmology begins with an understanding of the forces of the cosmos, which constitute the 'change' (Krupp, 1997, p. 17). Examples include the changing of day to night and vice versa, the seasons, the growth of animals and the life cycle of plants. These changes do not occur in a disorderly manner but as part of an orderly, oriented world. Therefore, it is a cosmological principle that the activities of humans should remain in step with change in the world around them, that is, in harmony with nature (Krupp, 1997, p. 17; Ruggles, 2005, pp. 116–117).

Krupp (1997, pp. 33–34) argues that in the cosmology of ancient and traditional communities, nature reveals the world to be an arena where any and all creatures can live, but all must also endure the occurrence of death. The cyclical movement of the heavens and the changing of the seasons reveal the processes of creation and change to farmers, hunters, gatherers and herders. In the migration of some birds, the seasonal movement of grassland animals and other natural phenomena, cosmological directionality and the cyclical renewal of life pervade the world in which people live. Thus, people decide what to do and where to do it based on their understanding of the various objects, events and processes perceived in this environment. This cosmology is contrary to systematically thought-out modern scientific theories of the universe and is instead constructed from information embedded in mythological and ritual structures, daily practices and values that are taken for granted (Iwaniszewski, 2015, p. 4).

This argument runs counter to that of literature on the topic prior to the 1960s, which claimed that people in different geo-cultural contexts shared certain basic, universally valid conceptions of the cosmos (Campion, 2012, p. 7). Moreover, more recent research does not assume that a given worldview necessarily produces a unified or fully consistent concept and belief system for every society or member, nor that its existence implies that the concept of cosmology is static, as it is formed by people from their shared and collective experience (Iwaniszewski, 2015, pp. 5–6).

In this thesis, based on the above discussion, the term 'cosmology' is used to refer to the view of those inhabiting Neolithic China regarding the world around them, that is, of nature, which encompassed the sky and everything that occurred in the terrestrial world. It also included their understanding of life and death.

## 1.2 A brief introduction to Chinese cosmology

Modern scholars such as Jiang (2011, p. 9) have argued that in traditional Chinese cosmology, *tian* (天 'heaven') is used to refer to the entirety of nature, a huge entity that has a will and emotions but cannot be fully recognised. People must follow the laws of *tian* and live in harmony with the rhythms of nature. Observing the world they live in (including the constancy and regularity of celestial movements and seasonal phenomena) and adapting their behaviours accordingly is thus a basic necessity for them to survive in that world. The ability to understand the system and ordering of the world and act consistently with it is an elementary qualification for kingship (Pankenier, 2013, pp. 242–246).

Henderson (1984, pp. 1–22) borrows the term 'correlative thought', proposed by Needham, to explain the underlying logic of traditional Chinese philosophy upon which the correspondences between human beings and the universe and between the microcosm and the macrocosm are formed. This logic assumes that the various orders of reality or spheres of the universe are homologous. It puts the human, political and celestial into systematic correspondence. For example, Pankenier (1995a; 1995b) explains that the changing of dynasties (between the Xia, Shang and Zhou) was closely linked to the celestial phenomenon of conjunction between the Five Planets. The observation and interpretation of this celestial event in early China provided the empirical basis for the classical-period belief that the heavens intentionally intervened in human history at certain intervals. It also provided the basis for the five-element cosmology later espoused by Zou Yan (a scholar of the Warring States period), in which the five underlying cosmic forces cyclically and directly influence the destiny of a dynasty (although Zou Yan ignored the true meaning of the Five Planets' conjunctions, opting for the more restricted five elements theory to articulate the cosmology; Pankenier, 1995a; 1995b).

Thus, Pankenier (1995a) argues that the celestial phenomenon of the Five Planets conjunctions was considered to mark a higher deity's endorsement of the rationality of a new regime, effectively, ordaining the new rulers of human society. This notion of the Mandate of Heaven was also particularly important in Confucian political theory, especially for the ruling class. The idea that 'Heaven is personified and people should act in compliance with its will of Heaven' was deeply rooted in the hearts of those of all social classes, rendering it vital for members of the ruling class to hold the mandate (Jiang, 2007, pp. 11–15).

Scholars have also variously interpreted the cosmology expressed in pre-Qin texts, such as the *I Ching* (易经, the *Book of Changes*), which dates from around the ninth century BC (Lai, 2008, p. 199). Wilhelm (1977, p. 562) interpreted Heaven as high and the earth as low. The positions of the lower and the higher are thus also identified. Motion and stillness operate by definite laws; events follow definite trends. Good and bad fortune arise from this. There are phenomena in heaven and shapes on the earth through which change and transformation are manifested. Others have argued that in the *I Ching*'s cosmology, heaven above is round (*yang*) and earth below is square (*yin*), vapour passes between the two, the two are in a power relationship based on various values and they are not opposites but depend on one another and are used in a complementary way, emphasising the interdependent and interrelated character of all things

(Lai, 2008, pp. 207–208, 215–216). Shaughnessy (2022, p. 372) quotes a passage from the 'Record of music' (*Yue Ji* 乐记, a chapter of the *Li Ji* 礼记, the *Record of Ritual*) to explain the relationship between people, things and the universe as expressed in the *I Ching*:

> In heaven it forms images and on earth it forms shapes … The earthly vapor rises up, while the heavenly vapor descends. The yin and yang rub each other, and heaven and earth stir each other. Drumming them with thunder and lightning, and rousing them with the wind and rain, moving them with the four seasons, and brightening them with the sun and moon, the hundred transformations arise in it… (translated by Shaughnessy, 2022, p. 372).

In the *I Ching* cosmology, as this shows, heaven and earth can be understood as two separate but complementary entities. Through the perspective of music, we see that all phenomena in heaven and earth have their place and that they are harmoniously related to each other, changing in an ordered way. While the *dao* of heaven provides the broader cosmic perspective, it is not divorced from the human world, and the macrocosm (e.g. the movement of stars and planets) resonates with the microcosm (e.g. the state; Lai, 2008, pp. 10, 215).

In early Chinese discourse, cosmology was defined differently and different assumptions made by the various schools of thought. Confucius, for example, argued that heaven and earth had neither beginning nor end and that they were unchanging, having always been what they are and will continue to be (Chen Meidong, 2013, p. 21). Confucius assumed that heaven was an impersonal ethical force, a cosmic counterpart to the human sense of ethics, a guarantee that the nature of the universe was somehow a part of the human sense of justice (Creel, 1949, p. 126). Needham (1980, pp. 9, 544) argues that Confucian thinkers may have been uninterested in the surrounding natural world outside of human society and that they believed that the cosmic moral order was primarily concerned with the ideal path or order to be followed by that society. In Xunzi's period, similarly, it was argued that human society should be seen as part of the cosmic order, and that 'rites' (*li* 礼), a term that signifies etiquette, good customs and traditions, should be regarded as cosmic principles (Needham, 1980, p. 28). From this perspective, the whole universe is embedded in nature, and the role of human beings is thus to act in accordance with divine commandments and the forces of nature (Tucker, 1998; Lai, 2008, pp. 35–54; Campion, 2012, p. 99).

The Daoist interpretation of cosmology, on the other hand, focuses on the cosmos' operation as the order of nature. This order relies on a natural curvature of space and time that governs and facilitates all that occurs and does not, therefore, require the assumption of a conscious manipulator (Needham, 1980, pp. 37, 52). Human beings are also part of nature, and the standard of the human being is not the only standard in the universe, contrary to the Confucian view. Therefore, problems should be addressed and solved from the perspective of the whole, a proper understanding of which must include consideration of the individual, the individual's relationship with others and the individual's place within the whole. Relationships between human beings and nature should be characterised by the nature order and peace (Needham, 1980, p. 53; Lai, 2008, pp. 9–10, 105).

Regarding the shape of the cosmos in early Chinese thought, Allen (1991, pp. 76–78) suggests that the character *ya* (亞), which appears in early Shang-dynasty oracle bone inscriptions, represents the shape of the earth. Chang Kwang-chih (1990) believes that the Yin people supposed the earth to be originally square, but with sacred trees that communicated between heaven and earth planted at each of its four corners. The locations of those four trees were called the four dimensions (*siwei* 四维), evenly located between the four cardinal directions, marking northeast, southeast, northwest and southwest. This may also represent what the early Chinese thought of as living or burial space (Feng, 2011, p. 18).

The Gaitian theory (盖天说) is the oldest of the three Chinese schools of cosmology (Qian, 1932, p. 16). The other two, the Huntian (浑天) and Xuanye (宣夜) theories, will not be explored here, as they were formed later (Needham, 1959, pp. 216, 219). It is difficult to verify the origin of the Gaitian theory. The *Zhou Bi Suan Jing* (周髀算经, the *Zhou Gnomon Arithmetic Classic*), dated by Liu (2000) to the early Eastern Han dynasty but by Qian (1964, p. 29) to around the first century BC, mentions that heaven is imagined as an inverted hemispherical lid covering the earth

(Needham, 1959, p. 210). However, Jiang (1996) argues that, heaven and earth are described as parallel planes, with a *xuan ji* (璇玑 'dipper') standing on the earth below the North Pole.

Different assumptions have also been made about the movement of celestial bodies in the Gaitian theory. One is that the firmament carries the Sun and the Moon, rotating from right to left like a millstone, and that the Sun and the Moon, although they have their own motion from left to right, move much more slowly than this giant wheel to which they are attached (Needham, 1959, p. 211). However, Needham (1959, p. 214) suggests that is likely to be a mill, except that the mill wheel does not roll along the circumference but only rotates in the appropriate position. Wu (2020) explains that the scholar of the Eastern Han dynasty Wang Chong, in his book *Lun Heng: Shuo Ri Pian* (论衡·说日篇), restored the Gaitian theory that the sky and the earth are parallel to one another and that the celestial bodies, such as the Sun, move with the sky. When people see the Sun sink into the earth, this is an illusion caused by being too far away to see the Sun, as when someone with a torch walks further and further away from others, leaving them too far from the torch to see its light. Sunset thus indicates that the Sun moves away from the visual range, and sunrise indicates its return.

Ancient and modern Chinese and Western scholars have interpreted the cosmology present in different schools of thought and different pre-Qin texts in a myriad of ways, which are only briefly mentioned here. Since the related debates and unresolved issues are not related to the Neolithic period and lie far distant from it in time, I will not dwell on them further.

## 1.3 Understanding Cosmologies through Archaeoastronomy: A Cognitive Archaeology Perspective

Donald (1991) proposed a four-stage theoretical framework for human cognitive and cultural evolution, delineating the transformation of cognitive capacities and cultural formations from our primate ancestors to modern *Homo sapiens* (spanning approximately 4 million years ago to the present). Central to his thesis is the notion that the evolution of the human mind unfolded through four pivotal cultural-cognitive modalities (*episodic → mimetic → mythic → theoretic*). Critical junctures include the second transition—the emergence of linguistic systems around 200,000 years ago—which introduced novel cognitive capacities for constructing and decoding narratives, and the third transition—a non-biological cognitive leap dominated by visual symbols and external memory systems (analogous to modern computer CPUs interfacing with external storage or networked systems).

Donald (1991, p.210) tends to believe that human evolution may be driven by cultural change—evolutionary pressures arise when cognitive innovations confer a collective cultural advantage upon a hominin group. The second transition, Donald (1991, p. 213) argues, ushered in the *mythic stage* of cognition, wherein language's paramount function in tribal societies lay in mythmaking—the construction of conceptual "models" of the human cosmos. Myths synthetise disparate events within spatiotemporal and causal frameworks, enabling explanation, prediction, and control. By permeating daily life, they shape perception and confer meaning upon phenomena. Thus, social practices—tool use, dietary habits, attire, kinship structures, mortuary rites—and even perceptions of reality become mythically situated. Crucially, mythic narratives not only regulate behaviour and preserve knowledge but also constrain perceptual reality and direct collective cognition. Those who curate these narratives (e.g. priests and shamans), occupy privileged positions within communal cognitive hierarchies (Donald, 1991, p. 214-215, 258).

Mythic culture encompassed all societies of the late Palaeolithic, Mesolithic, and Neolithic periods. Theoretical culture emerged from within and gradually subsumed mythic culture. The transition from mythic to theoretical culture relied on equivalent changes in technological hardware, particularly external memory devices (Donald, 1991, p. 274). Therefore, the third transition must also be referenced and introduced here.

Donald identifies three core cognitive innovations underpinning theoretical culture: the invention of visual symbols, external memory, and theoretical thinking. The invention of visual symbols manifests in three broadly distinct modes, which can be termed pictorial, ideographic, and phonetic. Since the scope of this study primarily concerns the pre-literate period, representative visual symbols from this era include the patterns on Yangshao culture pottery, the symbols of the Dawenkou culture, and the designs on the bowls of the Taosi culture, among others. Thus, this section will focus on Donald (1991, p. 278, 282)'s explanation of the pictorial mode: graphic art evolved as a sophisticated production system governed by conventions and rules, enhancing the utility of mythic expression and preservation, thereby consolidating the power of myth-makers and custodians within collective societies.

The earliest products of theoretical thinking emerged in ancient astronomy, specifically in the construction of analogical models of time and space. Astronomical knowledge served as a powerful tool for social control, with timekeeping based on celestial cycles likely representing the ultimate regulatory activity in early agricultural societies. It was used to determine dates for planting, harvesting, storing, and distributing grain, as well as for religious rituals and various periodic social functions, and could also provide directional guidance (Donald, 1991, p. 335).

Analogical devices were invented early in the history of visual symbols, ultimately enabling humans to track celestial events, construct accurate calendars, and measure daily time. Time was initially indicated by the angle of the sun's shadow, followed by the invention of timekeeping tools such as water clocks and hourglasses (Donald, 1991, p. 336). Once visual analogical symbols were created, they could be repurposed as memory storage media and computational devices. For example, the Taosi observatory, while itself a symbolic invention, allowed people to store and analyse complex information on external devices. Based on the observatory's functions, it can be inferred that the Taosi people systematically observed their surroundings, analysed the regularity and structure of stored data, and formulated predictions based on these patterns.

In his 2013 work, Malafouris proposed a deeper understanding of how cognitive archaeology should be conducted, centring on the relationship between cognition and material culture. To give a simple example, knowing what the Taosi observatory is and how it changed allows us to understand the minds of the people at that time and how they evolved, with a focus on the role of the human body in establishing these connections with the Taosi observatory. This is because cognitive processes are not merely confined to what happens inside the brain; they can also arise from interactions between the brain and things occurring in real space and time. Therefore, cognitive research must extend beyond the individual to encompass interactions between people, artefacts, space, and time (Malafouris, 2013, pp. 66–67). The mind (brain and body) and things are not just causally related; they must operate together to function.

Malafouris (2013, p. 81–82) agrees with Donald on the significance of external memory devices in human cognition, noting that they not only alleviate the brain's workload but also intertwine with and complement the brain, enabling collective minds to utilise these diverse memory storage and retrieval systems. Thus, material culture is not merely a container or "external storage medium" but a fundamental cognitive resource. For example, the pottery of the Yangshao culture and the patterns depicted on its surfaces may not simply be tools for externalised storage; they are also tightly coupled with and inherently part of people's cognitive understanding of the world around them.

Building on Donald's and Malafouris's understanding of cognitive archaeology, a research approach can be derived: through archaeoastronomy, we can explore how the earliest widespread and socially significant theoretical thinking in human history developed. However, the aim of this study is not to investigate how Neolithic people continuously advanced their agricultural society by establishing external data storage for astronomical observation and prediction. Instead, this study seeks to explore whether Neolithic people expressed a shared cosmology or demonstrated their cognitive understanding of a cosmological model through the arrangement of tomb orientations. How did this cognitive understanding of the surrounding world develop? The research methodology of this thesis, which involves cognitive archaeology and post-processualism, will be elaborated in the following sections.

## 1.4 Burial orientation and Chinese cosmology

The burial customs of various cultures and religions reveal a range of considerations on the cosmological relationship between heavenly bodies and the world after death. For example, according to Assmann (2003, pp. 204–207), Old Kingdom Egyptians believed that the entire universe was alive, with a soul and a personality, and that celestial bodies represented or were controlled by different deities to fulfil certain roles. There remains considerable uncertainty as to the exact nature of the ancient Egyptian conception of the soul, but the astronomical calculation of the two shafts in the Great Pyramid of Giza and the interpretation of the relevant texts allow us to hypothesise that these shafts may have been a symbolic passageway to facilitate the ascension of the pharaoh's soul to the astral plane after death (Spencer, 1982, p. 150; Magli and Belmonte, 2009, p. 311; Smith, 2009; Brady, 2012, p. 40). Since the northern shaft points to the region near the North Pole, and considering that the stars are in motion over time, this shaft could have pointed to the apex of the pole star and the circumpolar star Mizar or Kochab in Ursa Minor during the construction of the pyramid, while the southern shaft pointed to the apex of Orion's Belt and the star Sirius (Magli and Belmonte, 2009, pp. 310–312). Sirius is mentioned in the literature as the king's guide, and the constellation Meskhetyu, to which Mizar belongs, was used for the ceremony of the opening of the mouth so that the king could be given life after death; the king also had to open the door of the shaft for his soul to ascend to the immortal stars (Magli and Belmonte, 2009, pp. 310–312; Brady, 2012, pp. 40–42). The concept of the soul's ascent to the stars was subsequently borrowed by ancient Greek culture (Herodotus, 1972). In one rendering, the soul ascended through the planets, and with each planet it passed through, it rid itself of the vices associated with that planet (Campion, 2019).

The native cultures of pre-colonial North America are diverse and complex in their sources, making it difficult to generalise regarding their cosmology (Campion, 2012, pp. 41–43). However, one of the more unifying metaphors seen in the ethnographic evidence is that of the Milky Way as the pathway for souls to reach the Land of the Dead (Lankford, 2007, p. 175). In the Mississippian cultures, Romain (2021) suggests, based on ethnohistorical sources, archaeological evidence and astronomical analyses, that the Cahokia site was oriented to align, at the summer solstice of 1050 BC, with the Rattlesnake Causeway and the Milky Way. The Rattlesnake Causeway was thought to be a terrestrial metaphor for the Path of Souls. Human burials later excavated on Rattlesnake Mound were arranged at its oval entrance, the presumed entrance to the Path of Souls, and the entrance to the Land of the Dead was guarded by the constellation of the Great Serpent, thought to be the guardian of the Land of the Dead, which corresponds to the ecological prevalence of snakes in the Cahokia area (Romain, 2021).

During the Han dynasty in China, people not only to mimic the homes of the living in form by placing artefacts in the burial chamber but also to reflect their perception of the universe in the structure and decoration of the chamber or in the burial objects (Huang, 2010, pp. 192–201). For example, in Mawangdui Tomb No. 1 (M61) in Shaogou, Luoyang, the Western Han mural tomb at Xi'an Jiaotong University and the Xinmang mural tomb in Yintun, celestial images depicting the Sun, Moon, stars, gods, goddesses and beasts in the process of ascension to the heavenly realm formed a miniature cosmic space within the tomb (Pu, 2008, p. 204; He and Li, 2009, pp. 13–35; Huang, 2010). Therefore, it has been argued that Han people may have believed that the tomb was the symbolic centre of the universe and that once the deceased entered the chamber, their soul would ascend into the heavenly realm (Huang, 2010, p. 193). Some scholars have argued that different people across different periods (specifically the Western and Eastern Han) may not have expressed the same cosmology and concept of life and death. For instance, some burial chambers may show historical figures and stories to reflect social customs, portraits to guard the dead against evil spirits and exorcisms or biographical material (Yu Yingshi, 1984, pp. 190–193; Yu Weichao, 1985, pp. 154–156; Wu Hong, 2005, pp. 109–110; Huang, 2010, pp. 204–227). Xing (2011, pp. 390–391) and Wu Hong (2010, pp. 63–64) further speculate that the tomb designers provided what they knew of how the spirit world looked so that the souls of the deceased would still have the vitality and ability to perceive and inhabit this constructed world. In any case, one can decisively state that the Han people expressed their cosmology through burials.

Nonetheless, not all conceptions of the afterlife were related to a celestial presence: on the contrary, conceptions of the hereafter were complex and varied. There may have been pre-Han understandings that did not involve the ascension of the soul. For example, Needham (1974, p. 81) hypothesises that people in the Shang dynasty may not have had much of an idea of where they would go after death, based on oracle bone inscriptions that ask whether an illness or misfortune was due to some dissatisfaction among their ancestors, but they were particularly afraid of these ancestors, and so an image of a shadowy realm somewhere underground gradually developed. However, Pu (2008, p. 206) argues that not all ideas about the soul and the world after death are preserved in the literature. Although, for example, a wealth of oracle bone inscriptions survive from the Shang dynasty, the religious beliefs reflected in them are mainly those of the ruling class. Moreover, these do not contain specific ideas about the soul or the afterlife, and there is no way of knowing what happened to general people (Yu Yingshi, 1984, p. 181). There thus remains much uncertainty due to insufficient information.

In the eighth century BC, a relatively widespread idea held that the dead went to a dark underground area, which later became known as the Yellow Springs (*Huangquan* 黄泉; Needham, 1974, pp. 84–85).To this Pu (2008, p. 207) suggests, however, that the Yellow Springs may have been a representation for the burial chamber and not necessarily for the afterlife. It is the capital of dark world Youdu (幽都), synonymous with a more substantial after-death world. Moreover, it has also been argued that the writings of several major pre-Qin schools express a disbelief in the existence of a world after death and that Mozi only claimed the existence of ghosts and gods, without emphasising the existence of a world after death (Yu Yingshi, 1984, pp. 177–178).

The idea of the world after death is predicated on the assumption that people still exist in some form after death, for example through the premise that everyone has a soul and a spirit, belonging to heaven and earth, *yang* and *yin*, gods and ghosts, and so on (Needham, 1974, pp. 85–86; Yu Yingshi, 1984, pp. 182–183). However, scholars have debated whether the soul and spirit constitute two states of being after death or whether they also exist when one is alive (Pu, 2008, p. 213). As the purpose of this thesis is to study whether there is a cosmological rationale behind Neolithic burial orientation, I mention only briefly the hypotheses put forward by ancient documents in this area, simply to illustrate that the concepts of life and death in early China were complex and diverse and that these may offer some inspiration for exploring the cosmological concepts of the Neolithic. Conversely, they may not be related at all: we cannot know, because none of those records are of Neolithic origin, nor is it within the scope of this research to investigate.

The principle of living in harmony with the heavens and the earth can be observed by archaeoastronomers in past architecture (palaces, temples, altars, institutional buildings, monuments, etc.), in the layout of cities, in cemeteries and in the landscape as a whole (Ruggles, 2005, p. 115). Neolithic burial data from China are abundant and provide the most frequently cited source of information on Late Neolithic societies, which means that such burials have received abundant attention (Liu and Chen, 2012, p. 139). Although ever more excavations and studies are being carried out on settlement sites, many archaeological reports in China do not provide sufficient information on, for example, house remains for systematic analysis, whereas excavated burials can provide details of burial location, orientation, the number, type and position of grave goods and more. This furnishes the first reason why this thesis employs burial material rather than settlement remains.

Neolithic burials have been found in large numbers and were clearly distinguished from settlements; for example, during the Yangshao period, cemeteries were located outside the ditches that surrounded settlements. Such formalisation of cemeteries may indicate the perception of a clear distinction between life and death (Liu and Chen, 2012, p. 79). In many Neolithic burials, the location of graves and the positioning of remains and grave goods were the result of burial processes and rituals dominated by the living (Fung, 2000). We can therefore explore perceptions of life and death through these burials. To a large extent, burial arrangements were also dictated by the social perceptions of the time, granting them cultural significance (Pu, 2008, pp. 220–225). The beliefs in a given culture and region may have been related to astronomy or other aspects of the world, but they are bound to have had a direct impact on the burials.

Moreover, a grave is a closed context, which offers us the opportunity to more closely examine the ideas of a specific period. By examining a large number of burials, we can establish general outlines of the Neolithic peoples' beliefs and treatment of the issues of life and death, which will enable us to make inroads into the question of cosmology, a topic difficult to explore in settlement remains.

Ruggles (2005, p. 116) has claimed that the relationship between people, land and sky can often guide human action in ways that we might consider relatively pragmatic. The extraction of 'astronomical facts' from aspects of the archaeological record, such as the orientation of architecture, to determine cosmological relationships is a necessary and effective form of alignment studies (Iwaniszewski, 2015b, pp. 317–318). Even if all that remains of an ancient culture's architecture are its ruins, the orientation of that architecture will be preserved, and the study of this orientation will allow archaeologists to discover potentially unexpected patterns, such as the orientation of churches in a number of countries (e.g. England, Portugal and Russia) towards the sunrise at the time of their construction (Hoskin, 2001, pp. 7–22). By measuring and analysing the orientations of thousands of tombs and temples in prehistoric Europe, Ruggles found that their orientations were intentionally arranged in such a way as to form characteristic features within a limited range of directions. This suggests that orientation is of almost universal importance, despite the varying traditions and customs of different periods and regions.

As mentioned above, the separation of cemeteries from residential areas may be a sign of a conceptual distinction between life and death, so when the orientation of burials in a given culture or region is consciously controlled within a certain general range, orientation may be of value in further exploring that culture or region's cosmology. Furthermore, in archaeoastronomy, despite the development of a range of evidence (including written documents and ethnohistory), the study of alignment and orientation has remained at the core of the discipline since its beginnings in the 1970s, especially in contexts lacking written materials, such as the Neolithic, and the associated scientific methods, tools and interpretations have continued to evolve (Ruggles, 2005, p. 8; 2015a, pp. 359–366).

In terms of why it is important to focus on the sky and study sky cultures in relation to orientation and alignment, Ruggles (2015a, p. 354) suggests that peoples' perceptions of the world they inhabit influence their conceptions of the universe, shape their beliefs and behaviours and form the material record they leave behind. He argues that the sky was an integral and important part of the environment as perceived by almost all human cultures in the past. Modern society, in contrast, largely fails to notice the sky due to a combination of indoor living and light pollution, which creates a blind spot in our study of past cultures. Modern developments in technology, however, have made it possible to accurately reconstruct the appearance of the sky at given moments in the past and visualise most aspects of it in detail, greatly facilitating archaeoastronomical research.

In recent decades, with the excavation of ever more Neolithic burials, orientation has been emphasised as a key factor in burial practices with differences observed between cultures across regions and within regions (Zhou, 2017; Yu, 2019). The relevant studies, however, have tended to focus on cultural evolution, relating burial orientation to clan affiliation, human mobility and migration, and exchanges with nearby cultures of the same period, while astronomical factors have rarely been mentioned. Wang (1989a, pp. 323–324), in his analysis of the orientation of approximately 9,000 Neolithic burials, suggests that some ancient inhabitants may possibly have used the direction of sunrise and sunset to determine the extent of burial orientations, but the motivation behind this still requires further study.

Pankenier (1995) suggests that certain Neolithic groups on the lower reaches of the Yangzi and Yellow Rivers established the concept of east and west on the basis that they had already determined the directions of sunrise and sunset and devised a method for determining the four directions – and sometimes the four dimensions. Moreover, the entrances to houses at the Early Yangshao site of Banpo were intentionally orientated to face the afternoon sun when it was at its warmest about a month after the winter solstice (Pankenier, 1995). Therefore, exploring the astronomical knowledge of Neolithic peoples and the role astronomy played in their spiritual world by examining the potential celestial phenomena pointed to by the orientation of burials is a promising angle for archaeoastronomical thinking and one to which little attention has been paid. At present, research into the astronomical factors behind the orientation of Chinese prehistoric tombs remains at a relatively preliminary stage. For example, the Early Bronze Age burials at the Gumugou cemetery in Xinjiang are orientated towards the east, so sunrise has been hypothesised to be an important determinant, and the cemetery may have been established in the spring and summer (Li, Esimbek and Ma, 2024). Although Li, Esimbek and Ma (2024) include references to farming evidence and the hypothesis that the wooden pillars outside the burial area were simulating sunlight to emphasise Sun-worship, no statistical testing of the dataset is included, nor do they attempt to validate other possible astronomical targets or other natural factors that may have determined the orientation of the burials.

## 1.5 Aim and thesis layout

For all the above reasons, this study will deploy existing methods and tools (see chapter 3 for details) to explore patterns of burial orientation at multiple sites across several cultural contexts and various regions of Neolithic China. It aims to establish whether the graves were orientated towards specific objects in the sky, and what this may have meant to the people of that time.

The material arrangement of space within Neolithic graves may also express the imagination of the living regarding death and the world after death, as in the case of Xishuipo Tomb M45 (Feng, 1990a; 1990b; see chapter 2), but it is difficult to find other cases of tombs so remarkable. This study also considers the material culture within burials, which is fully documented in appendix 3 and summarily described in the introduction to the burial customs of Neolithic cultures in chapter 4. Nevertheless, the primary focus of this research is not on the internal arrangements of burials but on experimentally exploring the relationship between their orientation and the skyscape.

This thesis divides China into seven regions: the upper, middle and lower reaches of the Yellow River, the middle and lower reaches of the Yangzi River, Tibet, and the south (for more details, see chapter 4). On how to discuss Chinese archaeology during a period in which neither modern

China nor any Chinese identity existed, and how to consider a region with shifting historical boundaries, Shelach (2015, p. 8) concludes that there are generally two approaches. One is to focus only on the core area of Chinese civilisation, that is, the Yellow River and Wei River basins. The other is to include any archaeological material found in the current People's Republic of China as an object of study. Shelach (2015, p. 8), however, proposes a third approach, based on the assumption that Chinese cultures originated many millennia before the Chinese explicitly recognised their own identity or identities, that is, in the Neolithic and Bronze Ages, and that they were the result of constant interactions between different regions and societies within a relatively large area and the gradual development of common cultural elements. He asserts that such a common cultural layer contributes to the formation of a common identity (or identities) and ultimately a unified political entity.

The second approach described by Shelach is used in this study, as its basic material organisation is based on China's second national relic survey (for more details, see chapter 3 and appendix 2) and draws on Shelach's methodology in briefly introducing and describing the geo-climatic characteristics of the different regions of the modern country, such as the major rivers, mountain ranges, plains and plateaus. It also describes the influence of geography on the local environment and climate and explains the corresponding ways in which different groups lived and interacted with the people of different regions in the Neolithic period, given the advantages or limitations of local environmental conditions (for more details, see chapters 4 and 7).

Cosmology is defined as the way in which Neolithic Chinese people perceived the world around them, that is, nature, which encompasses everything that takes place in the sky and on the earth. An introduction to the relationship between the geography of different regions, their climates and the corresponding patterns of human subsistence activities offers, therefore, indispensable background for this study (chapter 4). This allows us to approach the other purpose of the study, which is to provide a (preliminary and abbreviated) background to Neolithic cosmology, mainly in the Yellow River and Yangzi River basins, by studying the orientations of Neolithic Chinese burials and the potential explanatory factors on a regional level. This task should help us identify any unexpected patterns in different cultures.

This is a preliminary and experimental study, necessarily limited due to various constraints, which will be openly discussed in the following chapters. Nonetheless, it aims to fill a major gap in Chinese scholarship by bringing novel methods that have become standard in Europe to the study of Chinese prehistory.

# Chapter 2 Literature Review

## 2.1. Archaeoastronomy

### 2.1.1 The development of archaeoastronomical research

The term 'archaeoastronomy' was reputedly first proposed by Euan MacKie in 1968 (Campion, 2015, p. 13). Archaeoastronomy as a modern discipline developed rapidly in the stimulating environment of the 'space race' between the USA and the Soviet Union and the social and political revolution of the 1960s (Ruggles, 1999, pp. 1–7). It has been defined as the study of past beliefs and practices relating to the sky, especially in the prehistoric period, to address how people have understood, conceptualised and used celestial phenomena and what role the sky played in their cultures through the analysis of material culture (Ruggles, 2005, p. 19; 2009; Silva, 2015, p. 2). The most popular example sites include Stonehenge (Atkinson, 1982, pp. 107–116; Ruggles, 1997; 1999; Sims, 2006; Pearson, 2012; Darvill, 2022), Machu Picchu (Dearborn and Schreiber, 1986; Malville, 2006; 2015; Magli, 2010; Ziółkowski, Kościuk and Victoria, 2013; Victoria, Ziółkowski and Kościuk, 2017; Ziółkowski and Kościuk, 2022) and temples in Malta (Agius and Ventura, 1981; Serio *et al.*, 1992; Ventura, 2004; Cox, 2008; Cox and Lomsdalen, 2010; Lomsdalen, 2013; 2014; 2015).

Even before archaeoastronomy became a recognised discipline, it was not without the work of pioneers. In 1963, Gerald Hawkins published an article arguing that the site of Stonehenge functioned as an astronomical computer, with the annual trajectories of the Sun and Moon marked on it. His work attracted widespread attention and reaction: from an archaeological perspective, Atkinson (1966) pointed out its lack of accuracy, while the astronomer Hoyle (1966) largely endorsed Hawkins' findings. It is also important to mention the engineer Alexander Thom (1955; 1966; 1967; 1971), who measured and statistically analysed a large number of megalithic sites, rather than solely studying Stonehenge in detail, and who not only considered the alignment of the stones but also found that the observation of the horizon was significant. His work is thus more comprehensive and more solidly grounded than that of Hawkins, and it is, therefore, difficult to dismiss it on the grounds that it constitutes 'an argument that may have arisen by chance' (Salt, 2015, p. 215), as has been said of the latter.

The development of archaeoastronomy in the Americas differed significantly from that seen in Europe. This is because archaeology in Europe developed from ancient history, and prehistoric material was not recorded in writing, whereas archaeology in the Americas could draw on the ethnographic historical record maintained among indigenous peoples (Salt, 2015, p. 217). Elizabeth Baity's 1973 survey, for example, draws on ethnoastronomy to include extensive references to proposed alignments in the Americas, while Urton (1981) draws on fieldwork with villagers in Misminary to understand the composition and use of local calendars and the distinctive view of the cosmos with which they are associated. Other studies that have used cultural practices to pioneer archaeoastronomy in the Americas include those of McCluskey (1977), Hedges (1977), Aveni (1975; 1977; 1980; 1982) and Aveni and Urton (1982).

Scholars in the Americas are adept at approaching archaeoastronomy from the astronomical meanings of a place provided directly by records from disciplines such as art history, ethnography and folklore studies or by guiding the search for connections to astronomical targets through familiar cultural symbols (e.g. petroglyphs). They also do well in discussing the social contexts of the practice of astronomy, but the sources tend to be unclear, and few attempts are made to confirm through analysis site interpretations drawn from the ethnographic record. European scholars, by contrast, lack evidence from disciplines such as ethnography and are, therefore, generally more adept at proving the existence of alignments or other astronomically-induced phenomena through astronomical calculations – the application of astronomy to culture – but their work often lacks human significance (Ruggles, 2015a, pp. 355–356; Salt, 2015, pp. 216–219). Aveni (1986) characterises these two approaches as two schools of thought: 'green' and 'brown'.

Theoretical and methodological advances, however, have rendered the 'green' versus 'brown' categorisation of the 1980s inapplicable and united the research methods of scientific analysis and human observation in archaeoastronomy (Iwaniszewski, 2003, p. 7). Due to the increasing diversity of the source materials, methods and uses of astronomy studied, different definitions and names for the discipline have proliferated. For instance, arguing against the existing rigid distinction between archaeoastronomy and ethnoastronomy, Ruggles and Saunders (1993) propose 'cultural astronomy'. Hoskin (1997) suggests 'archaeotopography' because not all alignments and related phenomena are astronomically relevant, and they may depend instead on rivers or roads. Ruggles (2011) even suggests that the term 'archaeoastronomy' is in some respects inaccurate, since it is only in prehistoric contexts that archaeoastronomers must focus exclusively on archaeological data: in other contexts, scholars may focus, even exclusively, on historical evidence, such as documents, inscriptions and ethnohistorical records. Although these debates have had little direct impact on the term 'archaeoastronomy', they have triggered a wider and deeper discussion of the various methods and practices that have been applied to consider humanity's relationship with the sky (Salt, 2015, p. 220).

Kintigh (1992) and Poss (2005) argue that archaeoastronomers should seek to answer questions within the appropriate disciplinary framework, that is, within the relevant cultural and social context or history, and address the relevant societal issues, rather than simply discovering the astronomical facts. Sims (2010a) reasons that at this stage of the discipline's development, it is largely conducted within safe, conservative boundaries, with archaeoastronomers focusing on discovering astronomical alignments but not on exploring the cultures behind them. Since our modern understanding of many alignments may not correspond to that of people at the time, the astronomical phenomena we focus on may be of an inappropriately modern cast (Renfrew and Bahn, 2005, p. 10). For example, we look at the bright part of the night sky; peoples of the past may have focused on the dark part. The discipline should, therefore, entail more than the discovery of objective astronomical facts, such as fitting astronomical phenomena, and include interpreting the relationships between phenomena and the cultures to which they belonged. There is also an overemphasis on statistics at the expense of other methods that can be used to consider individual remains (Sims, 2010a). Parker Pearson *et al*. (2007; 2008; 2011; Parker Pearson, 2012; 2018) respond forcefully to this issue through a reassessment of the relationship between Stonehenge, its monuments and its surrounding landscapes and sites such as

Durrington Walls by reconstructing social processes to explain the astronomical significance of Stonehenge.

The credibility of any interpretation must be assessed in terms of social theory, the strength of the physical evidence and the quality of corroboration from historical and ethnographic sources (Ruggles, 2015a, pp. 353–354). Further evidence from other perspectives or disciplines (e.g. art historiography, ethnography, religion) is also needed to diversify the picture and corroborate whether the astronomical facts are themselves plausible in the relevant cultural context (McCluskey, 2015a, pp. 227–237). Encouraging different research directions through the application of different disciplinary perspectives enriches the study of archaeoastronomy and contributes to the health of the discipline. Two examples from 2006 illustrate this. Aldana (2006) aims to identify the role of the calendar in the Maya hegemonic order based on the history of astronomical techniques and the political history as reflected in numerous dated Maya sources. Broda (2006) describes a method of measurement based on the date of observation of the Sun's zenith passage in tropical Central America and uses this as an entry point for exploring the ways in which astronomical concepts can symbolise the centralisation of power and the legitimisation of political domination in complex societies.

In the last decade, archaeoastronomy has also drawn upon technical methods and findings from other disciplines to create more appropriate research models to present insights from different perspectives (Henty, 2022, p. 193). For example, the phenomenological approach allows us to seek new insights by reconceptualising the sky from the perspective of the monument builders. Despite living under the same sky, different cultures may see the skyscape entirely differently; it is the people of different cultures who make the sky, a natural phenomenon, into a cultural skyscape (Silva, 2015, p. 2). If we focus only on the sunrise and sunset on the horizon, we lose sight of the dynamics of the sky as a whole, which form an integral part of beliefs and practices in human society (Henty, 2022, p. 197).

The concept of skyscape archaeology builds on archaeoastronomy, drawing on archaeological landscapes, taskscapes and seascapes to derive it over time. It does not refer to an archaeology that extends from landscape to a combination of sky and landscape, nor to horizon astronomy, nor to the diverse ways in which different societies perceive things related to the sky; nor is it intended as a new term to replace astronomy (Silva and Henty, 2018). As defined by Silva (2015, p. 3) and Darvill (2021b), skyscape archaeology utilises historical, ethnographical, astronomical, meteorological and climatic evidence to link human beliefs and practices, notions of time and place and structural and material remains to cosmology, to reinterpret how ancient peoples experienced and understood the skyscape and to discuss the role it plays in ontology and cosmology. Skyscape archaeology is concerned with the sociocultural contexts in which particular skyscape elements were meaningful to past communities. In other words, data are combined with social and cultural context to analyse the functional and cognitive impacts of these celestial phenomena on past societies at a macro-level. This involves the introduction of new terms and theories, and the development of archaeoastronomy coincides with that of post-processual archaeology, demonstrating its more diverse aspects.

### 2.1.2 The development of archaeoastronomy in China

Before delving into the topic, it is important to clarify that the term "ancient astronomy" often evokes associations with "Feng Shui" among the general public. In reality, Feng Shui is a highly complex concept encompassing natural, temporal, spatial, social, behavioral, and psychological dimensions, often framed within the context of harmony and balance. Definitions and interpretations of Feng Shui vary between Eastern and Western scholars. For instance, Chatley describes Feng Shui as the art of harmonizing the living and the dead with the cosmic breath of the earth (Needham, 1959). Wang (2005) views it as a comprehensive theory integrating geography, ecology, landscape architecture, ethics, psychology, and aesthetics into ancient architectural planning and design. Ultimately, Feng Shui represents the manifestation of mental and environmental energies, aiming to achieve a harmonious relationship between humans and their natural surroundings.

In the strict sense, Feng Shui did not emerge until the Warring States period, coinciding with the development of the *Zhou Yi* (Book of Changes) and the widespread adoption of the doctrines of yin-yang and the five elements. This period established the principle of "observing astronomy above and geography below" as a dominant intellectual framework, leading to practices aimed at harmonizing human structures, such as houses and graves, with natural forces to achieve the ideal alignment of "right place, right time, and right person" (Liu, 1996). Thus, while Feng Shui shares its origins with ancient astronomy, it evolved into a distinct discipline over time.

In *Astronomical Archaeology in China*, Feng (2010, p. 1) defines archaeoastronomy as the study of ancient human societies through the analysis of artifacts and documents related to astronomical observations or influenced by traditional astronomical beliefs. Feng (2010, p. 11) divides the development of archaeoastronomy in China into three stages: the initial stage, the formative stage, and the mature stage.

In the initial stage, the study of ancient astronomy and archaeoastronomy overlapped significantly, with a focus on historical texts and antiquities. In 1933, Zhu Wenxi published *Astronomical Archaeology Record*, which cataloged and classified historical records related to solar observations, eclipses, comets, and meteorites. Scholars such as Dong (1945, 1950, 1952), Liu (1931, 1933, 1944, 1945a, 1945b, 1946), Guo (1931), Hu (1944, 1945), and Chen (1956) investigated the calendars and eclipses of the Yin dynasty based on oracle bone inscriptions excavated between 1899 and 1937. These studies explored the relationship between astronomy and ancient civilization. Shi (1945) analyzed the orientation of Yin dynasty burials and buildings in Anyang, proposing that the north-south alignment was based on the sun's meridian.

The formative stage saw the integration of archaeological data into astronomical studies. In 1965, Xia Nai published a study on the star map from a Western Han dynasty frescoed tomb in Luoyang, marking the first use of archaeological evidence to discuss ancient Chinese star observations. Xia (1976) further elaborated on the origins of star maps in his study of the 28 Lunar Mansions and the zodiac in a Liao dynasty tomb in Xuanhua. Subsequent research focused on star maps from Western Han tombs and other astronomical artifacts (Xi, 1966; Wang and Chen, 1974; Zhou, 1975, Xia, 1982; Yi, 1975, 1979, 1989 and 1990; HPACR and HPM, 1975; Pan, 1976 and 1989; AGPMOCAS and CCCRMCJP, 1978; Putian County Culture Centre, 1978; Li Di, Gai Shanlin and Lu Sixian, 1989; Liu Nanwei, Li Qibin and Li Jing, 1989; Lu, et al., 1989; Ma, 1989; Luo, 1991).

This period also marked the maturation of archaeoastronomy as a discipline (Feng, 2010, p. 14). Yang (1987) published *Architectural Archaeology*, which, while primarily focused on site descriptions and reconstructions, also explored how ancient societies used astronomy to orient buildings. Significant discoveries included a bronze sundial from the Eastern Han dynasty in Jiangsu, a painted box depicting the Lunar Mansions from the Zenghouyi Tomb in Hubei, and oracle bone inscriptions from Xiaotun. Additionally, rare astronomical manuscripts such as *Five Stars Divination* and *Astronomical Weather Divination* were unearthed from Han tombs in Mawangdui. These findings culminated in the publication of *The Atlas of Astronomical Artifacts* (1980) and *The Collection of Chinese Astronomical Antiquities* (1989), which compiled studies on astronomical artifacts from the Neolithic period to the Ming and Qing dynasties, as well as studies on the astronomical calendar of ethnic minorities. Although these archaeological discoveries and publications relate to ancient astronomy, they laid a foundation for the study of prehistoric astronomical archaeology.

With the discovery of engraved Neolithic pottery, scholars such as Lu Yang and Shao Wangping (1989) and Song Zhenhao (1991) began systematically exploring Neolithic astronomy and Xia, Shang, Zhou dynasties. Sun and Kistemaker (1997) published *The Chinese Sky during the Han*, examining the role of astronomy and astrology in the Han dynasty. Feng (1990a, 1990b) initiated research on the Xishuipo cemetery in Henan, culminating in his seminal work *Astronomical Archaeology in China* (2001), which established a theoretical and practical framework for the field, although his researches are still mainly based on ancient written records. Archaeological evidence plays more of a supporting role. Jiang Xiaoyuan (2011) further explored the social and cultural dimensions of Chinese astronomy in *The Origin of the Study of Heaven*. But all in all, compared with the theoretical development of archaeoastronomy in the West described earlier, the development of archaeoastronomy in China is still at some distance from breaking away from its initial stage.

Despite these advancements, Chinese archaeoastronomy remains largely focused on interpreting ancient texts, with archaeological evidence playing a secondary role. However, the discovery of the Taosi Observatory (IACASS and LMCCBSP, 2015) shifted attention to the astronomical significance of prehistoric sites, fostering collaboration between archaeologists and astronomers. For example, Yi (2005) investigated Han and Wei dynasty sites in the Sanjiang Plain, while Su (2000) studied equinox observations on Lougu Mountain at the Zhujiazhai site of the Dawenkou culture. Liu Bin (2006) explored the similar observation function on the Yao mountain and Huiguan mountain of the Liangzhu culture. He found that the four corners of the altars that built on these two places corresponded exactly to the sunrise and sunset orientations of the winter and summer solstices (Liu, 2007; Liu, *et al*., 2017). Wu and Shuo (2008) identified the sunrise observation of Zhou dynasty Huanqiu at the winter solstice at Daijiayuan in Anhui province.

Moreover, the round mounds discovered at the Niuheliang and Dongshanzui sites of the Hongshan Culture may reflect the cosmological beliefs of ancient peoples from an earlier era. According to Feng (2010), one of the round mounds at Niuheliang, constructed with three concentric circles, might symbolize the shape of the sky in ancient Chinese cosmology. Sun, *et al.,* (2010) measured the angle of the mountain profile, revealing that the mountain ranges' alignment was sufficient to observe and mark the sunrise from the spring and autumn equinoxes to the winter solstice. Sun (2009) also drew on ancient literature to interpret the role of astronomy in the social and cultural life of ancient China. He noted that the calendar was seen as a sign of "divine right granted to kings," and thus, reforming the calendar was tantamount to altering the destiny decreed by heaven, making it a significant religious and political issue.

The first large-scale archaeoastronomical survey of archaeological monuments across China was conducted by Sun and his team (2010), who used a total station to analyze the "astronomical environment" of prehistoric sites, including the Niuheliang site group. Their work also raised the possibility of ancient beliefs related to celestial objects beyond the sun. At the Dazhujiacun site, they discovered an artificial high platform called Doujialing, which may have served as an altar for sun worship. Additionally, a platform to the west of the site was identified as another potential altar. Early surveys revealed eight shallow circular pits around this altar, arranged in a pattern resembling the Big Dipper. The eighth pit, located to the north of the Big Dipper formation, is believed to mark the position of Polaris. Another significant site, Chengzishan, belonging to the Xiajiadian Culture (2050–1550 BC), features the highest nearby mountain peaks aligned precisely to the south of the site. On the opposite side of Chengzishan, a stone platform was discovered with carvings of the Northern Dipper stars, indicating a long-standing tradition of Big Dipper worship.

Lv, Sun, and Shao (2019) examined the central axis of the east gate at the Shimao site, along with the locations of six sacrificial pits nearby. By synthesizing paleographic and classical texts, they proposed that the site's orientation was not based on the sunrise or sunset during the summer solstice but rather on the alignment of the gateway and its façade. During the summer solstice, sunlight directly illuminates the northeast wall of the gate's geometric murals, suggesting that this moment was considered a critical time for agricultural activities such as sowing and cultivation (Lv, Sun, and Shao, 2019). While their study did not account for measurement errors, which could affect the accuracy of their calculations, and lacked specific archaeological evidence regarding farming practices or the lifestyle of the Shimao people, it nonetheless considered these factors.

Building on their findings, Wu (2021) hypothesized that the Shimao site was laid out in a six-part orientation based on the alignment of the Huangchengtai, the eastern gate of the outer city, and the gates and corner towers of the inner city. Wu suggested that the Shimao people determined the due north direction by observing the pole star. However, since the "North Star" was not visible during the site's construction, he proposed that the inhabitants might have used a jade *Xuan Ji* (to be discussed later) as a measuring tool to observe circumpolar stars during the winter solstice, when the night is longest and the measurable arc exceeds half a circumference. This hypothesis is supported by excavated artifacts (Wu, 2021a). Although Xia

Nai (1984) rejected the idea of the *Xuan Ji* as an astronomical instrument, Wu's suggestion highlights its potential symbolic significance as a marker of the Shimao people's advanced civilization, though he did not explore its broader social and cultural implications.

Subsequently, He Nu and his colleagues conducted similar surveys at sites in Hunan, discovering that the mountains surrounding the Shijiahe site were suitable for timekeeping and calendar-making (Wu, 2021). Other findings from their research are awaiting publication. Additional examples include the Qingtai and Shuanghuaishu sites in Henan Province, both associated with the Yangshao culture around 3500 BC. Evidence suggests that the inhabitants marked the positions of the nine stars of the Big Dipper using ceramic pots (figure 2.1 left and right) (Zhang and Zhao, 1987; Gu, *et al*., 2021). his practice may have been part of a Big Dipper cult, which served to indicate travel directions and mark the time of day (Zhen, 2021). The arrangement of these pots is believed to align with the Big Dipper's shape as recorded in later historical texts such as the *Shi Ji*, *Huang Di Nei Jing*, and *Chun Qiu Yun Dou Shu* (春秋运斗枢). However, no astronomical calculations or further research have been conducted to confirm whether this arrangement matches the Big Dipper as observed by people during that time.

**Figure 2.1, the nine stars of the Big Dipper at Qingtai site (left) and Shuanghuaishu site (right) (Zhen, 2021).**

On the other hand, the research method of inferring astronomical relationships from patterns on pottery, stone, and bronze artifacts remains prevalent. Notable examples include Zhu (2011), who compiled historical documents and archaeological materials related to the Big Dipper from the prehistoric period to the Qing dynasty. Xiao (2017), in his doctoral dissertation *The Analysis and Interpretation of Octagonal-Star Images in Prehistoric China*, concluded that the octagonal-star motif originated from early astronomical activities but acquired distinct humanistic significance over time. Zhao, *et al.,* (2013) collaborated on an article titled *EPS Patterns in the Neolithic Age of China and Supernova Explosion*, emphasizing a "burst" of octagonal star patterns dating back 4,000–8,000 years in Neolithic China. They proposed that these patterns reflect celestial phenomena, possibly linked to supernova explosions such as those of the Vela or Cygnus Loop, which would have been visible across different regions of China. Xu (2019), in *How the Sky Illuminates Civilization*, offered a fresh perspective by building on previous scholars' interpretations of ancient astronomical documents and Neolithic artifacts.

Ethnological data in China also provide rich insights. The 56 ethnic groups have developed unique customs and cultural characteristics shaped by their geographical environments. For instance, Zhang Jiabing (1994) explored the traditional cosmology and astronomy of the Hezhe ethnic minority, while Chen, Lu, and Liu (1984) documented the history of astronomy among the Yi people, noting that some ethnic groups still use the sun's movement through mountain ranges to determine solar terms for agricultural activities. In 2013, Chen published *History of Astronomy of China's Minorities*, which meticulously cataloged the astronomical calendars, beliefs, and rituals of all ethnic groups in China. However, it is important to note that this study focuses on the orientation of Neolithic burials rather than the establishment of ethnic astronomical calendars or festivals. Therefore, the review of ethnoastronomical data in this study will primarily concentrate on direction-related content (discussed in Section 2.3.2), as delving into the vast ethnographic data would deviate from the study's original purpose.

Architecture also intersects with archaeoastronomy. Lv (2011) and Liu (2017), both doctoral students supervised by Prof. Zhang, completed dissertations titled *Ancient Architecture and Archaeo-Astronomy* and *Astronomical Connotation and Representation of Architecture*, respectively. Their work is similar in that it synthesizes research findings from both China and the West, explaining how ancient architecture embodied astronomical concepts and served as tools for celestial observation. They analyzed how architectural designs incorporated alignments related to astronomical phenomena, reflecting cosmic structures. Additionally, they examined the application of space-time measurement techniques in European churches and cities and explored the integration of astronomy into contemporary architectural design.

Since the 1990s, Chinese archaeoastronomy has expanded beyond the interpretation of ancient texts and artifacts to include interdisciplinary research on the astronomical significance of archaeological sites themselves. However, the field remains largely focused on identifying evidence of specific celestial events and their roles in prehistoric cultures. Broader archaeological theories related to these findings have rarely been explored or discussed within the Chinese academic community.

### 2.1.3 The development of Chinese archaeoastronomy by sinologists

The study of ancient astronomy in China has also captured the interest of sinologists from other countries. Antoine Gaubil, for instance, was a key figure in introducing Chinese astronomical history to Western scholarship during the 18th and 19th centuries. Schlegel's star charts, published in *Uranographie Chinoise*, became an essential reference for understanding stellar and constellation positions in Chinese astronomy. Other scholars, such as J.B. Biot, A. Remusat, S. Julien, J. Legge, J. Chalmers, S.M. Russell, and F.K. Ginzel, laid the groundwork for early Western scholarly understanding of Chinese astronomical history, as detailed in Needham (1959, p. 182-185).

At the end of the 19th century, a new wave of sinologists emerged. Édouard Chavannes translated and analyzed numerous ancient Chinese texts, including those on astronomy, such as his five-volume French translation of *Records of the Grand Historian* (1895–1905). He also published *Le Calendrier des Yn* (Chavannes, 1890), which explored the calendar system described by Sima Qian, including its nomenclature for years and months, as well as the astronomical principles underlying it.

Leopold de Saussure and Chavannes engaged in a series of debates regarding the role of the Big Dipper as a seasonal indicator in ancient Chinese astronomy. However, their disagreement centered not on the astronomical theory itself but on the methods of interpreting ancient texts (Lei, 2019). De Saussure employed astronomical models and modern scientific methods to verify the accuracy of ancient accounts, while Chavannes advocated for a historical-contextual approach, relying primarily on ancient documents for interpretation (Lei, 2019).

De Saussure, one of the most prominent researchers of ancient Chinese astronomy in the early 20th century, published a series of influential papers, including *Le Texte Astronomique du Yao-Tien* (1907) and *Les Origines de l'Astronomie Chinoise* (1909). Combining theoretical knowledge and practical experience, he offered fresh interpretations of topics previously studied by other historians of astronomy. Pogo (1932) regarded de Saussure as a pioneer in comparative astronomy. However, there are also shortcomings, noted that de Saussure overlooked many relevant documents, and Pelliot (1925) criticized his occasional reliance on dubious or even forged sources.

Chatley (e.g., 1938a, b, and 1939) contributed numerous scientific and technological arguments based on ancient astronomical texts, particularly regarding chronology. Michel (e.g., 1949, 1950a, b, and 1951), on the other hand, focused on the astronomical significance of excavated artifacts from a technological perspective. For further references, see Needham (1959, pp. 795 and 821).

Prior research on Chinese astronomical history primarily adopted a scientific and technological perspective, yielding significant results but leaving the cultural and historical dimensions relatively unexplored. Joseph Needham's *Science and Civilisation in China: Volume 3, Mathematics and the Sciences of the Heavens and the Earth* (1959) marked a turning point. Needham situated ancient Chinese astronomy within the broader context of civilizational history, comparing its development with that of Western astronomy. He traced the evolution of Chinese astronomy from its origins to its convergence with European astronomy during the Ming and Qing dynasties, facilitated by Jesuit missionaries, ultimately contributing to the formation of modern universal astronomy (Deng, 2011). Needham's work systematically introduced ancient

Chinese astronomy to the West, reshaping Western scholars' perceptions and providing the global history of science community with a clearer understanding of Chinese astronomical achievements. However, his discussion of the ancient Chinese calendar was relatively brief, partly due to the underdeveloped state of the field at the time and his belief that the calendar held limited scientific significance (Deng, 2011).

This gap was addressed by Nathan Sivin and Christopher Cullen. Sivin, renowned for his contributions to the history of Chinese science and technology, conducted extensive research on Chinese astronomy during his visits to Cambridge from 1974 to 2000. In 1969, he published *Cosmos and Computation in Early Chinese Mathematical Astronomy*, becoming the first Western scholar to provide a detailed analysis of the mathematical aspects of the ancient Chinese calendar. He further explored the subject in *Astronomy in Contemporary China* (1979) and culminated his four-decade-long research with *Granting the Seasons* (2008), a comprehensive study of the Chinese calendar.

Cullen, who succeeded Needham as the editor-in-chief of the *Science and Civilisation in China* series, is renowned for his contributions to the history of Chinese science. Among his notable achievements are the translation of the *Zhou Gnomon Arithmetic Classic* (1996) and his comprehensive study of early Chinese celestial orbits and calculations of celestial positions, published in *Heavenly Numbers* (Cullen, 2017a). Additionally, he systematically translated and elucidated all surviving ancient texts on celestial calculations, as documented in *The Foundations of Celestial Reckoning* (Cullen, 2017b). Cullen posits that the content of these texts resembles computational procedures, and translating them into modern symbols, algebra, and equations facilitates a deeper understanding of their underlying principles (Zhao and Wang, 2018).

Eberhard, too, embarked on his sinological studies with a focus on the history of science, particularly the astronomy of the Han dynasty, which became the subject of his doctoral thesis (Cohen, 1990). His scholarly journey culminated in the 1970 publication of the fourth volume of his collected works, *Astronomy and Conceptions of the World in Ancient China* (1970).

In the 1980s, numerous studies employed the *Bamboo Annals* and astronomical data to reconstruct the chronology of Shang and Zhou historiography. Among the most distinguished Western scholars in this field is Nivison, who meticulously reconstructed the early Chinese historical chronology by restoring the original text of the *Bamboo Annals* (Shaughnessy and Cheng, 2019). His seminal works include *Astronomical Evidence for the Bamboo Annals' Chronicle of Early Xia* (1990) and *The Riddle of the Bamboo Annals* (2009).

Another pivotal figure in the study of astronomical historiography is Pankenier. His research delves into the interplay between ancient Chinese astronomical phenomena and the epoch-defining political and military events of the time, using astrology as a lens to understand ancient Chinese thought. Pankenier's contributions have significantly advanced the dating of early China. His notable works include *East Asian Archaeoastronomy* (Pankenier, Xu, and Jiang, 2008), *Revealing the Secrets of Ancient Chinese History* (2008b), and *Astrology and Cosmology in Early China* (2013). His interpretations of celestial events during the Three Dynasties offer insights into earlier celestial beliefs, particularly during the Late Neolithic period. These include the directional and calendrical significance of the Big Dipper and the celestial pole, their symbolic association with the emperor, the omens of planetary conjunctions, and the astrological implications of the twenty-eight mansions and the Dragon constellation (Pankenier, 2013). These concepts, which may have evolved through extensive Neolithic experience or existed in simpler forms, reflect a profound understanding of celestial phenomena that was perhaps common knowledge in ancient times.

Numerous other scholars have also engaged with ancient astronomy in their studies of Chinese history. For instance, Schafer is celebrated for his work on the Tang dynasty, particularly his masterpiece *Pacing the Void: T'ang Approaches to the Stars* (1977), which vividly reconstructs the celestial views and beliefs of the Tang Chinese, along with interpretations of related literary works. Karlgren, in *Legends and Cults in Ancient China* (1946), systematically organizes and analyzes pre-Qin texts to trace the evolution of various religious beliefs (Malmqvist, 2009). Keightley's research into Chinese social history began with oracle bone inscriptions from the Three Dynasties (Xia, Shang, Zhou), particularly focusing on Shang historical records, which have also enriched the study of astronomical calendars and related phenomena from that era. Nivison's student, Shaughnessy, concentrated on the literary and cultural history of the Three Dynasties and the Warring States period, meticulously collating and reinterpreting archaeological findings such as bamboo slips, silk manuscripts, and inscriptions, with a particular emphasis on the *Book of Changes*, *Book of History*, and *Classic of Poetry* (e.g., 1997, 2012, 2014, 2022). The astronomical phenomena mentioned in these texts are also examined from a historian's perspective.

In the last century, a wealth of documents on Chinese astronomical history was preserved in Japan, prompting numerous Japanese scholars to undertake related studies. Notable contributions include Iijima Tadao's *Ancient Chinese History and Astronomy* (1939), Shinjo Shinzo's *Study of the History of Oriental Astronomy* (1928), Noda Churro's *Series on the History of Oriental Astronomy* (1943), and Kenji Ozawa's *Studies in the History of Chinese Astronomy* (2010). Influenced by archaeology, religion, comparative linguistics, and other disciplines, both Western and Japanese scholars engaged in debates over the origins of Chinese astronomy. Scholars led by Shinjo Shinzo argued for the independent development of Chinese astronomy, emphasizing its unique characteristics, while those following Iijima Tadao sought to demonstrate its Greek or Babylonian origins (Needham, 1959, p. 186; Deng and Han, 2010).

These studies not only explore ancient astronomy through the interpretation of excavated texts and artifacts but also incorporate modern scientific and practical perspectives, offering fresh insights that diverge from traditional Chinese scholarly views since the early 20th century.

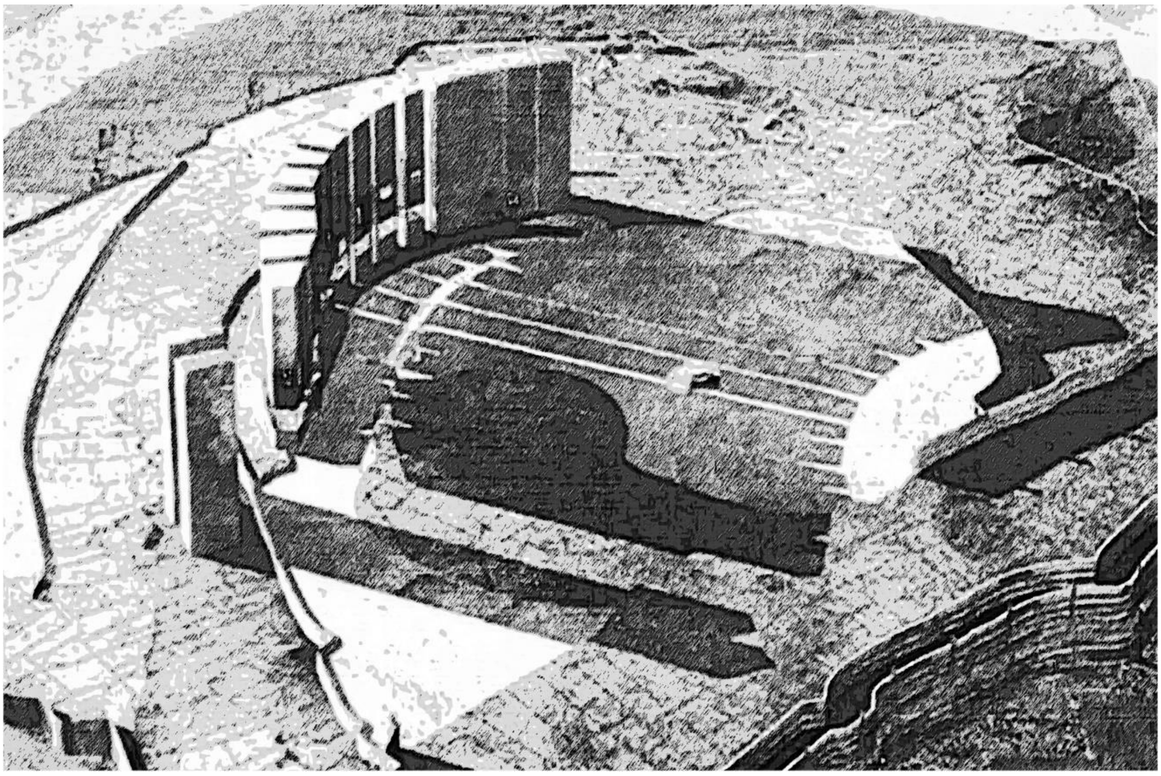
## 2.2 Review of the archaeoastronomy of Neolithic sites.

Since the beginning of the 21st century, scholars have sought to focus more on the relationship between the sites themselves and archaeoastronomy and have thus made initial attempts at multidisciplinary cooperation. Most, however, have stopped at the level of using scientific calculations and observations to establish an astronomical basis for the relationship between sites and their surrounding landscapes, as in the case of the sites mentioned in the section 2.1.2

'The development of archaeoastronomy in China'. In addition to the cases mentioned above, some particularly interesting Neolithic cases for which further evidence has been explored are the Taosi site and Xishuipo Tomb M45.

The discovery of the Neolithic observatory at Taosi and the city at Yaodu in Shanxi province constitutes the most significant event in archaeological and astronomical research in China in the early 21st century. In one early study on the former site, 18 archaeologists and astronomers discussed the possibility that the Taosi site was used as an astronomical observatory (Jiang *et al.*, 2006). Later, a painted wooden pole was discovered in an elite tomb of the Middle Taosi period. The interpretation of historical records and the reconstruction of the ancient observatory (figure 2.2, top) confirmed that ancient groups used the observatory of Taosi to observe the movement of the Sun. As shown in figure 2.2 (bottom), sunrise on solstice and equinox days can be observed between specific pairs of pillars. Taosi may also be the location of the Yao capital in the documentary records (Jiang *et al.*, 2006). Pankenier (2013, pp. 24–26) agrees that astronomical analyses confirm the possibility that the Taosi observatory may use for observation and ritual ceremonies at sunrise on the day of the solstice, but he remains sceptical about the observatory's determination of the equinoxes. This site and observatory will be explored further in chapter 5.

Further evidence can be drawn from the grave goods at Taosi. As noted above, a painted wooden pole was found in one of the kings' tombs of the Middle Taosi period. He Nu (2015, pp. 127–131) assumes that the pole was painted with various coloured segments, similar to a surveyor's pole. It may have been placed on the ground to measure the length of the Sun's shadow. Calculations of the length of the shadow cast by the sundial from the Taosi site between 2100 BC and 2000 BC the data of middle part of the Sun is the most similar one to the wooden pole, which verifies its function as a sundial (He, 2015, pp. 127–131). This supports the likelihood that the Taosi people possessed solid astronomical knowledge and used it skilfully. In addition, He Nu (2015, pp. 143–149) hypothesises that the 29 teeth on a gear-shaped object found in a burial could mark the days of the short months of the lunar calendar, perhaps in addition to having a symbolic function to work with the solar calendar's artefact to deduce the *yin–yang* synodic calendar. However, artefacts associated with the lunar and solar calendars have not been found, and no specific classic texts support this notion, so it is not clear whether this was necessarily the intended function.



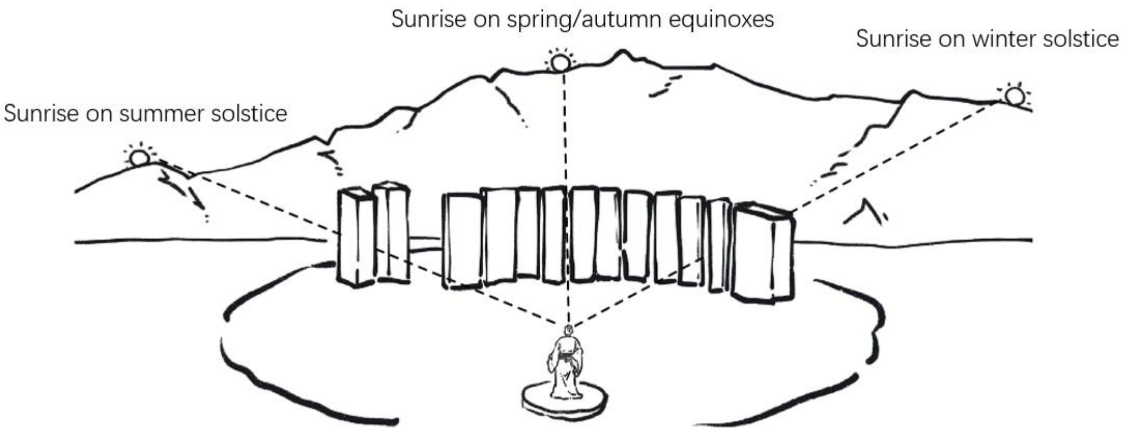



**Figure 2.2, reconstruction of Taosi observatory (top) and schematic diagram of Taosi observatory (bottom; Beijing Planetarium, 2023, Available at: https://www.bjp.org.cn/xwzx/gndt/4028c136878ba76801878dc2c691000e.shtml)**

At the Xishuipo site in Henan (4500–4300 BC), excavation of Grave M45 revealed the head of the individual orientated towards the south, with a dragon and a tiger sculpted in mussel shells to the left and right, both with heads orientated to the north; the dragon is placed to the east, with its back facing west, while the tiger is placed to the west, with its back facing east (CRARIHP and CRPAPC, 2012, p. 112) (figure 2.3, left). In the centre of the tomb was a triangle made of mussel shells, with two tibiae placed parallel to one another at the side. Additionally, three children were buried on the east, west and north sides of the tomb (CRARIHP and CRPAPC, 2012, pp. 112–113). (figure 2.3 left). The unusual oblique positioning of the fourth acolyte's skeleton is also meaningful, in that his head points in the direction of the winter solstice (I am grateful to David Pankenier for this observation). Feng (1990a; 1990b), based on historical records regarding the 28 lunar mansions and the Big Dipper, associates the arrangement of mussel shells with the signs of the Dragon and the Tiger, as well as the Big Dipper as the imperial chariot. Therefore, he asserts that the deceased at the centre was comparing himself to the god of heaven and earth and riding the Big Dipper in the centre of the grave, with the Dragon and Tiger guarding his left and right sides, thus informing people of the progression of time through the changes in the stars and setting the rules and regulations of society. Although the mansions that make up the Dragon and the Tiger were not fully established at this time, Feng believes that the elite individual buried here, at least, had some understanding of the two signs, which in later historical texts represent the east and the west, respectively (Feng, 1990b, pp. 53, 55).

In addition, the burial is rounded at its south end and square at its north end, which Feng (1990b) interprets as a reflection of the Gaitian theory of the circle of heaven and earth. Moreover, the *Zhou Bi Suan Jing* describes the three most important circles in the Gaitian theory as the path of the sun at the summer solstice (inner circle), the spring and autumn equinoxes (intermediate circle) and the winter solstice (outer circle): if we take the two curved sections of the grave wall beside the head of the tomb owner as two sections of the same circle and connect the diameters of the circle of the spring and autumn equinoxes, that is, the sunrise and sunset points, the entire southern half of the tomb chamber coincides with the three circles (figure 2.3, right). Feng (1990b) argues that all of the stars in the diagram match the account of the *Zhou Bi*

*Suan Jing*, so the cosmology of the Yangshao period had at least a complete prototype in early China. Jiang (2011, p. 224) argues that Feng's hypothesis is rather bold, but the argument is quite detailed, except that there remains scope for controversy as to whether the figures constitute celestial maps. However, Jiang (2007, p. 226) suggests that the celestial images in the tombs may be interpreted as communication between the tomb owner and the heavenly realm.

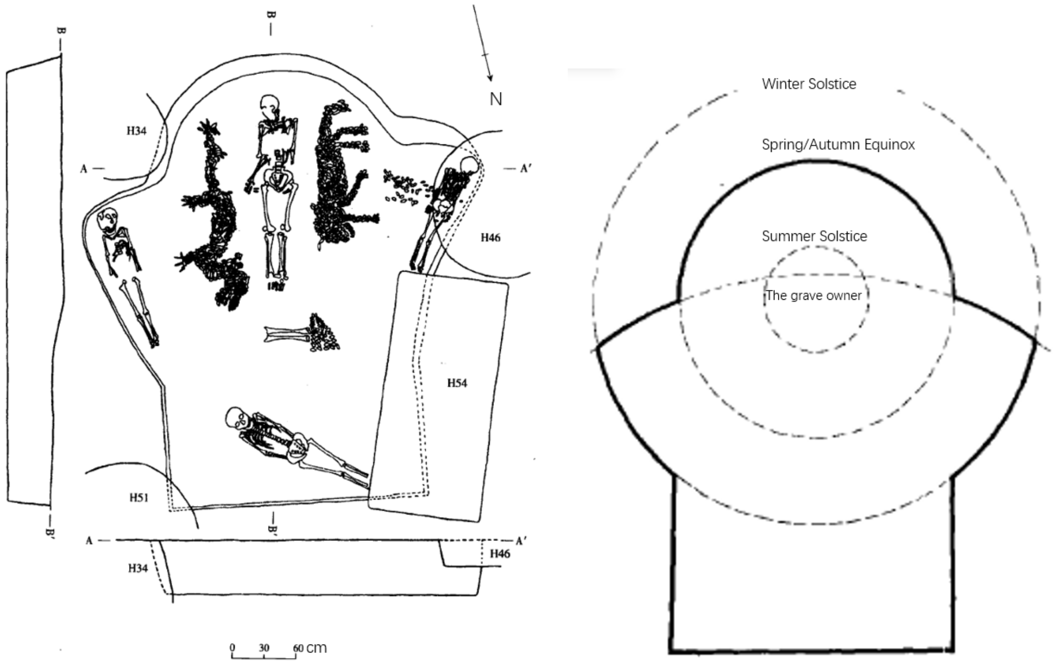



**Figure 2.3, burial structure of Tomb M45 at Xishuipo (left; CRARIHP and CRPAPC, 2012, p. 113) and diagram of Gaitian theory applied to the structure of Tomb M45 (right; Feng, 1990b).**

## 2.3 Astronomy in early China according to ancient Chinese literature

It is difficult to explain the orientation of Neolithic burials in the absence of written and oral traditions. From an astronomical point of view, there are trillions of presences in the sky, and it is unlikely that every one of them would have been attended to by the Neolithic peoples and given specific functions and meanings. It is also unlikely that all of them would have been the target of this thesis. It is dangerous to be lost in the sky because the orientation of a given burial will inevitably align with a celestial object. It can also point to what we might consider a prominent topographical feature or indeed anything else of obvious importance, but this does not mean that such an alignment was intentional. Any object in the sky or the landscape that is pointed to by a grave can easily be misinterpreted as being of significance, as was mentioned in the introduction to the early stages of the development of archaeoastronomy. The general solution in European archaeoastronomical research is to look for monuments or groups of buildings that are socially, contextually and culturally relevant, as well as formally and structurally similar, and to identify common trends in their orientation. If a pattern emerges sufficiently strongly, and especially if its significance can be appropriately statistically validated, there is reason to believe that a particular set of orientations is intentional (Ruggles, 2005, p. 320).

Within the context of Chinese culture and society, vast amounts of ancient documentary material survive. McCluskey (2015b, p. 337) has summarised that in archaeoastronomical studies, historical documents provide complementary evidence that can enrich and strengthen our interpretations of a culture's astronomical, calendrical and cosmological concepts and practices and their roles within society. However, ancient documentary evidence has its drawbacks. Falkenhausen (1993) argues that because traditional Chinese historiography centred on the concerns of rulers, propagated official court interpretations of historical events and had a strong tendency towards political moralising, scholars have generally assumed an unbroken continuity and unity of cultures, peoples and histories stretching back even to the Neolithic period, from which no writing, however primitive, survives. Archaeologists' attempts to link archaeological discoveries to events, individuals or communities known from written history and prove the validity of ideas already accepted in the literature are often unconvincing and tend to ignore different traditions, while the lives of the less privileged classes are particularly difficult to study (Falkenhausen, 1993). For example, research on the Shimao Neolithic site often links it to the content of ancient documents dating from 1500 years after the site's occupation, leaving the archaeological evidence submerged in traditional narratives and the different threads of prehistoric Chinese history confined to a single national story, which contributes to a linear view of history (Jaffe *et al*., 2022). In fact, large sites and complex polities existed simultaneously in various parts of northern China, at least during the Late Neolithic (Jaffe *et al.*, 2022).

The written evidence, however, is not to be ignored when conducting archaeological research, considering China's vast historical record and the centrality of historical texts to Chinese culture (Falkenhausen, 1993). Rather, the texts should be used judiciously, with attention also paid to the evidence provided by other disciplines, including not only archaeology but also fields such as environmental studies and geography. Therefore, it warrants repeating that in the context of Chinese archaeology, even though we do not know for the moment whether the celestial targets mentioned in post-Neolithic written records were attended to in the Neolithic period, they at least offer a clue as to what may have been considered important, meaningful or useful. It is possible that such celestial objects were noticed only by some Neolithic societies and not others, or indeed that they were not granted significance in the Neolithic period at all, but this thesis aims to explore the possibility that they might.

The stars have shifted over millennia due to the precession of the equinoxes (Snowder, 2024). This has inevitably had an effect on the 28 mansions, as well as on the circumpolar stars; for example, some stars no longer appear in the circle of perpetual apparition, and the positioning of the 28 mansions in relation to the circumpolar stars is not constant (Needham, 1959, p. 250). Therefore, it is important to note that not only were the positions of the stars millennia ago different from what we see now, but the Neolithic stars were differently positioned from what was recorded in later ancient literature. This is another reason why ancient documents are used in this study only as clues. Because the celestial events observed in the Neolithic period did not necessarily take place in the same locations as those recorded in ancient documents, it is not certain that Neolithic peoples noticed these events or allowed them significance. Since we cannot go back in time, Neolithic sky locations can only be based on the results simulated by the application Stellarium (for more detail, see chapter 6).

The aim of this section is to summarise the celestial targets mentioned in ancient Chinese literature, thus providing possible clues for the Neolithic period. Figure 2.4, taken from

Pankenier (2013, p. xxvi), lists the archaeological and dynastic names of the different periods in early China to clarify the chronological relationship between them and facilitate easy understanding of the interrelationships in the narrative that follows. In this study, the timeline of dynasties will be used to define the scope of early China, but the discussion will refer to ancient texts up to the pre-Qin period, as the goal of this study is not to synthesise the ancient astronomical texts of early China in full.

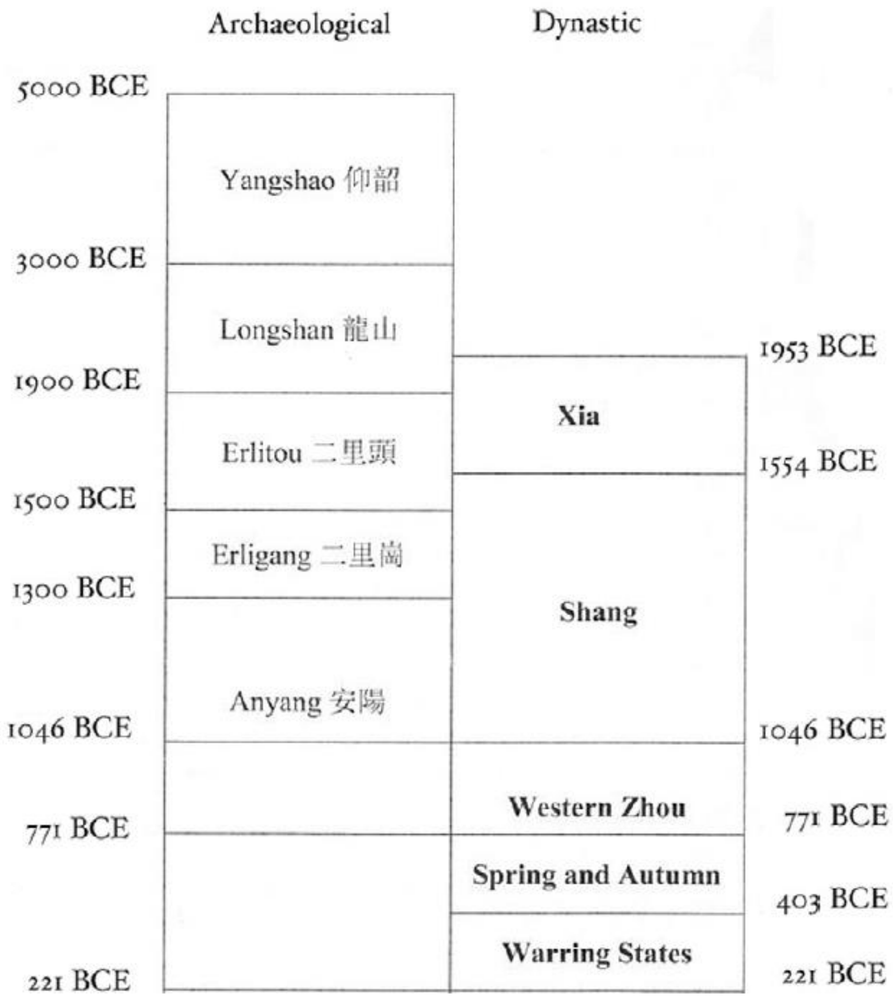



**Figure 2.4, archaeological and dynastic chronology of early China (Pankenier, 2013, p. xxvi)**

## 2.3.1 Celestial phenomena

Before archaeology was introduced into China in the 1920s by Johan Gunnar Andersson and other western scholars, the majority of astronomical research regarding prehistory in China was based on the interpretation of early texts (Pankenier, 2013, p. 5). The celestial objects observed and recorded were not only the most obvious, the Sun and Moon, but also the Five Planets, supernovas, the Milky Way and other astrological objects, such as the 28 mansions.

### The 28 mansions and 4 animal signs

The 28 mansions were established along the ancient celestial equator and governed the equatorial regions of the sky. The system also facilitates the observation and location of the paths of the Sun, Moon and planets. Hashimoto (1943) suggests that since the character 'mansion' (*xiu* 宿) is written like a hut, the mansions can be seen as temporary resting stations for the Sun, Moon and Five Planets. The line connecting them could be a measure of the Moon's motion, and the number 28 could be the average length of the basic cycle of the moon in ancient times (Needham, 1959, p. 239).

In the traditional system, the mansions can be further grouped into four animal signs, each comprised of seven mansions, matching the four colours, four seasons and four directions (Feng, 2010, pp. 351–352; figure 2.5; the relevant modern stellar names of each mansion are listed in appendix 2). The mansions surround the northern pole and Four Advisors and move in a fixed repeating order from Dragon to Tortoise, Tortoise to Tiger, Tiger to Phoenix and Phoenix to Dragon. The order could be easily concluded by observing the same point in the sky at the same time every day.

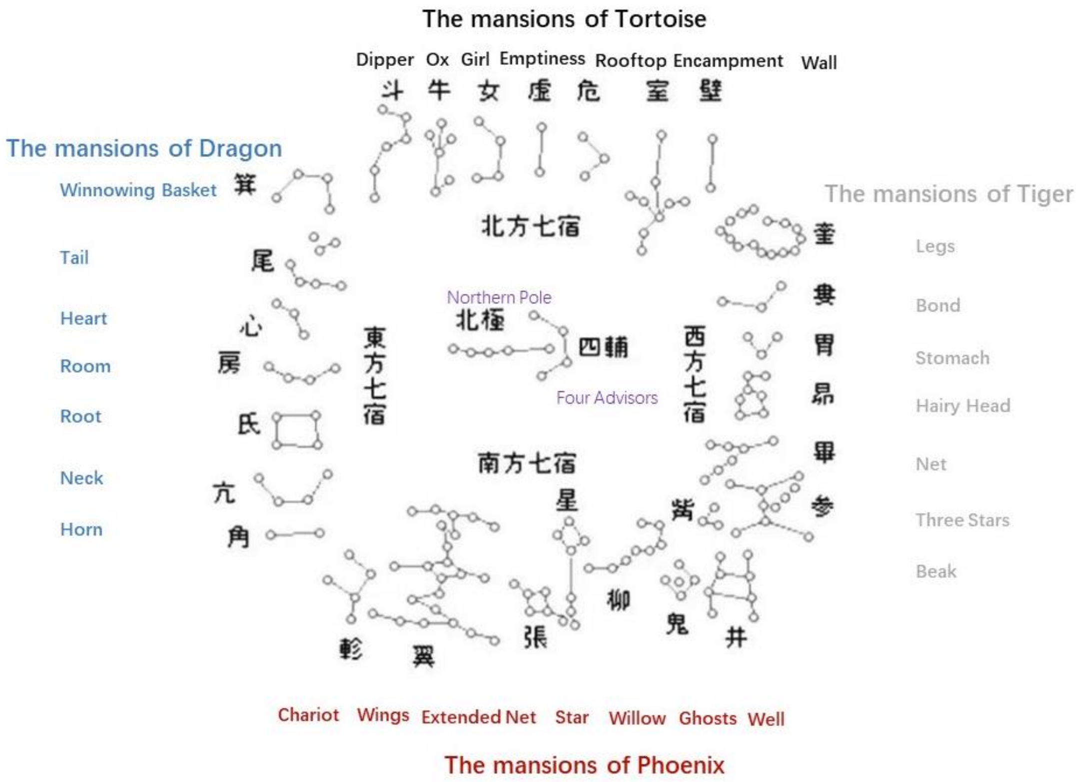



**Figure 2.5, the 28 mansions and the Big Dipper.**

Since ancient Chinese literature has been well preserved and perpetuated, the study of astronomy in prehistory relies, more than in other regions of the world, on the corresponding ancient documents. The most remarkable is the *Book of History* (*Shang Shu* 尚书), a compilation tracing ancient deeds. This is one of the earliest known documents in China, but its origins remain widely debated. The vast majority of the book consists of official documents from the government of the day, dealing with state affairs, but it also contains records of astronomy. For the section that most strongly influenced Chinese astronomers, the *Canon of Yao* (*Yao Dian* 尧典), Needham (1959, p. 245) suggests a date between the eighth and fifth centuries BC.

Zhu Kezhen (1979a, pp. 102–107) calculated from the *Canon of Yao* that there were four times at which one could observe the mansions above the horizon: twice after sunset and twice before sunrise. Half an hour after sunset or before sunrise was called *chuhun* (初昏), while an hour and a half after sunset or before sunrise was called *dahun* (大昏). Other options included observing the mansions high in the southern sky between 11 and 1 o'clock, *hunzhong* (昏中). A reason to prefer the latter is that the position of the stars is more affected by atmospheric disturbances near the horizon, whereas at midheaven, this position is much more stable (Chen, 2003, p. 9). This important change allowed the early Chinese inhabitants to improve the accuracy of their sky observations over long periods. The mansions move from east to west every night. At sunset on the spring equinox in the modern calendar, for example, in AD 2022, Tiger descends to the horizon at Tortoise's heels in the west at sunset, Phoenix and Dragon rise overnight and Tortoise rises above the horizon behind Dragon before sunrise (figure 2.6). At the autumn equinox, Dragon descends below the horizon after sunset and Phoenix rises in the east, right after Tiger, before sunrise (figure 2.7). The sign that can be observed at nightfall at the summer solstice is the Phoenix; then the Dragon and Tortoise, respectively, fly across the night sky until the Tiger rises before sunrise (figure 2.8), and the Tortoise, Tiger, Phoenix and Dragon follow the same pattern at the winter solstice (figure 2.9). The complete list of the 28 mansions is the result of continuous refinement throughout history. Nonetheless, as mentioned earlier, the stars in the sky are offset over time due to precession differences, and the position of these celestial events as we see them deviates from their position in the Neolithic period and the period recorded in the ancient documents.

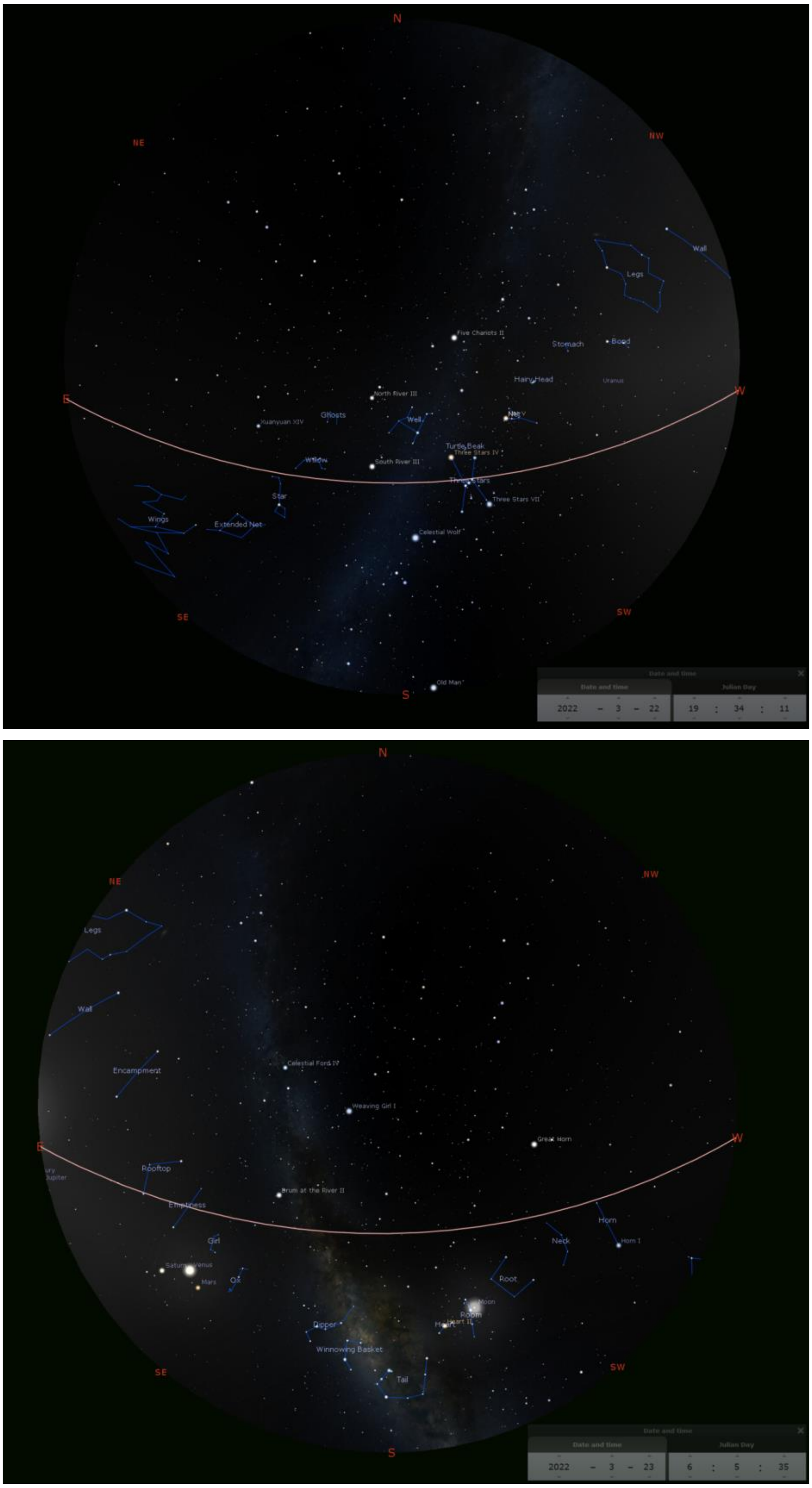
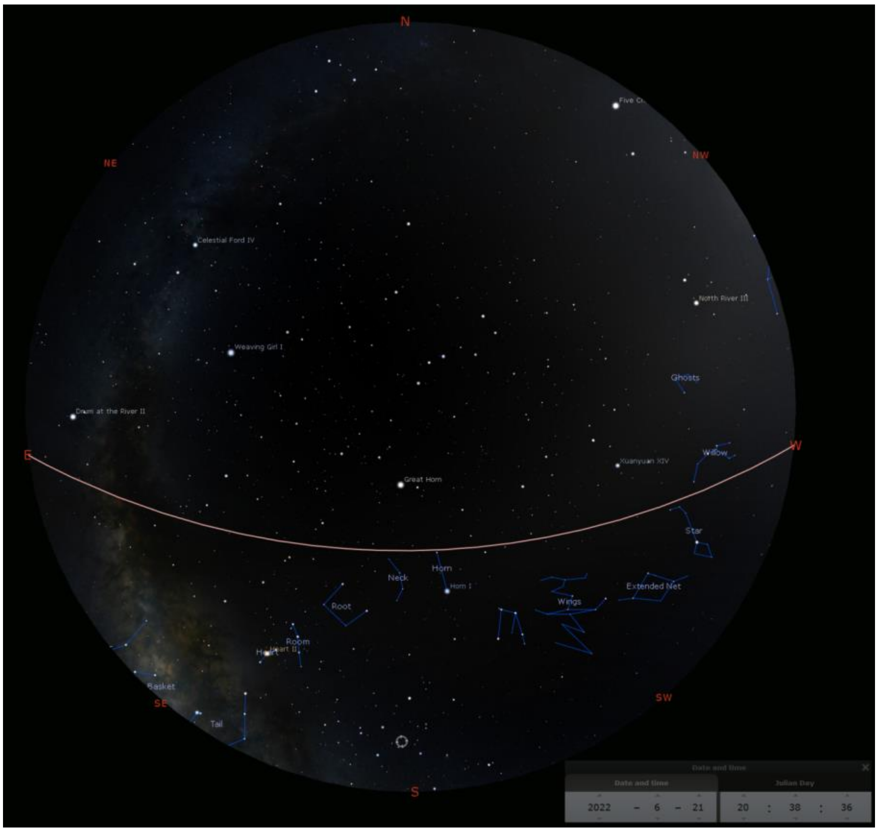



**Figure 2.6, the position of mansions at sunset on the spring equinox (top), the position of mansions at sunrise on the spring equinox (bottom) (Stellarium, 2022).**



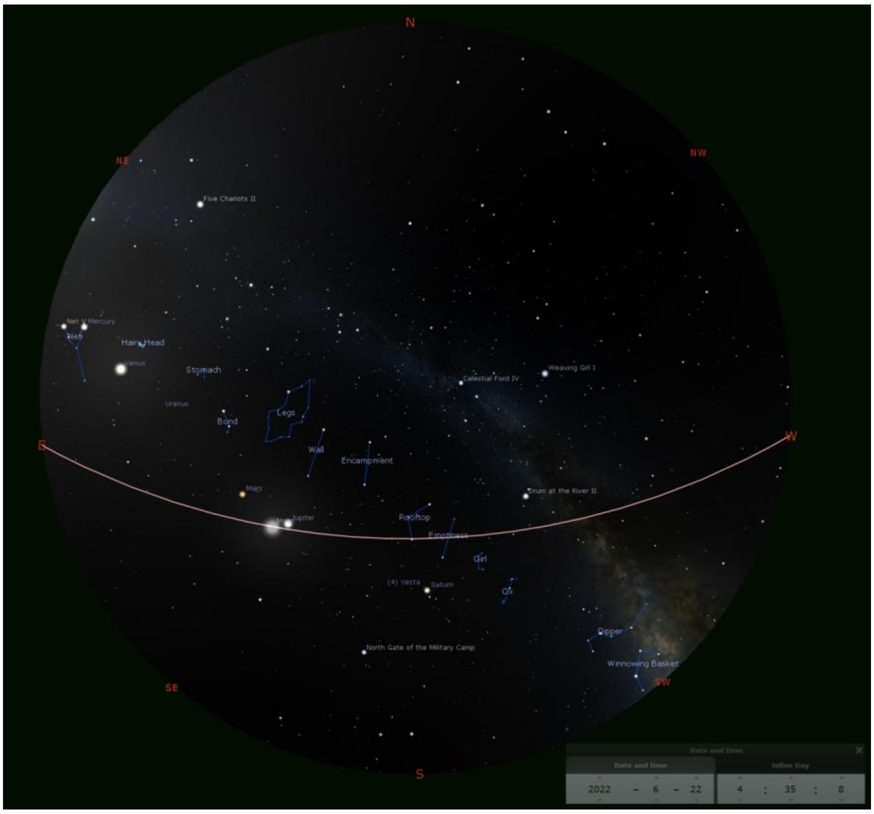



**Figure 2.7 the position of mansions at sunset on the summer solstice (top), the position of mansions at sunrise on the summer solstice (bottom) (Stellarium, 2022).**

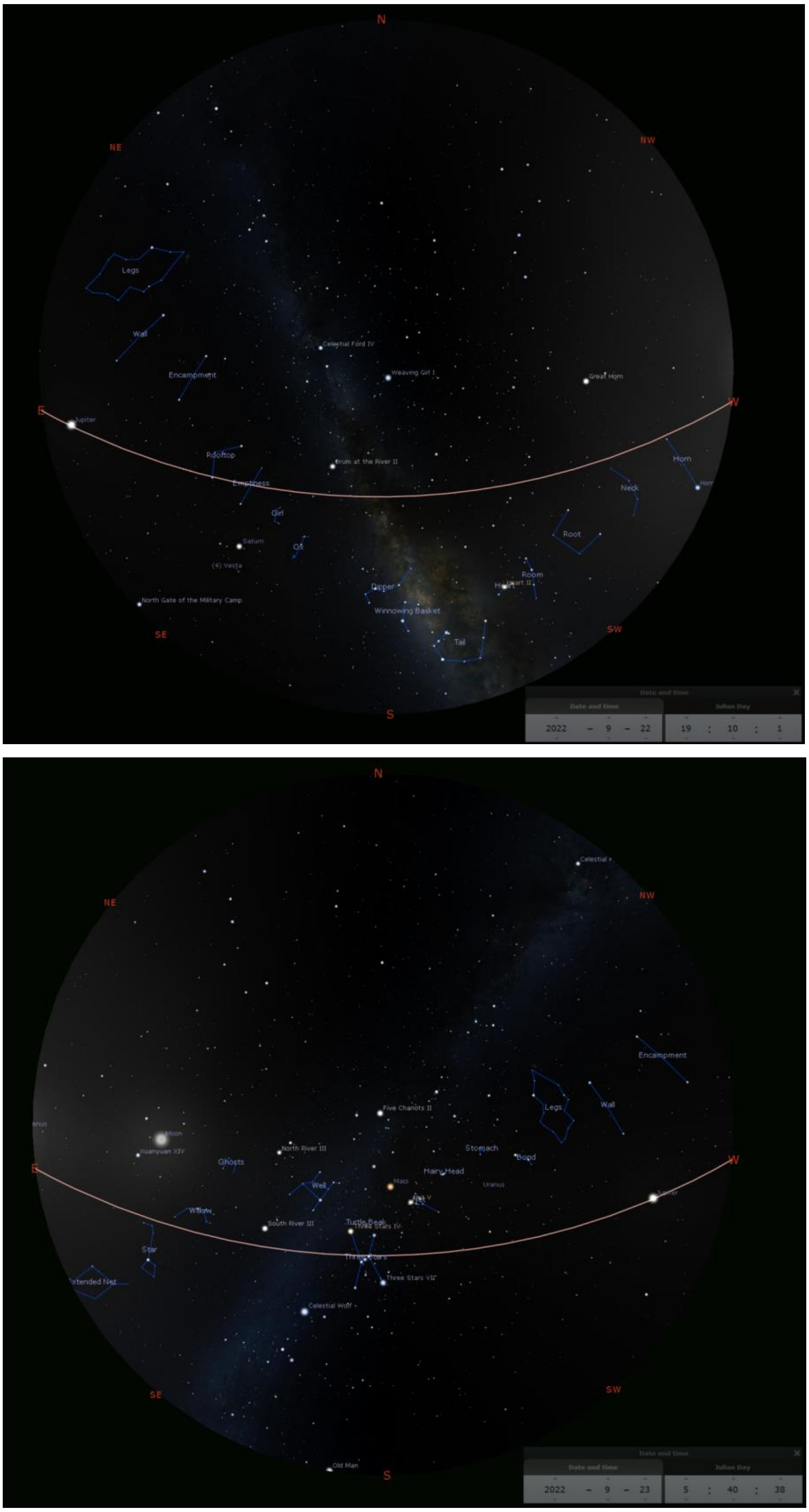



**Figure 2.8, the position of mansions at sunset on the autumn equinox (top), the position of mansions at sunrise on the autumn equinox (bottom) (Stellarium, 2022).**

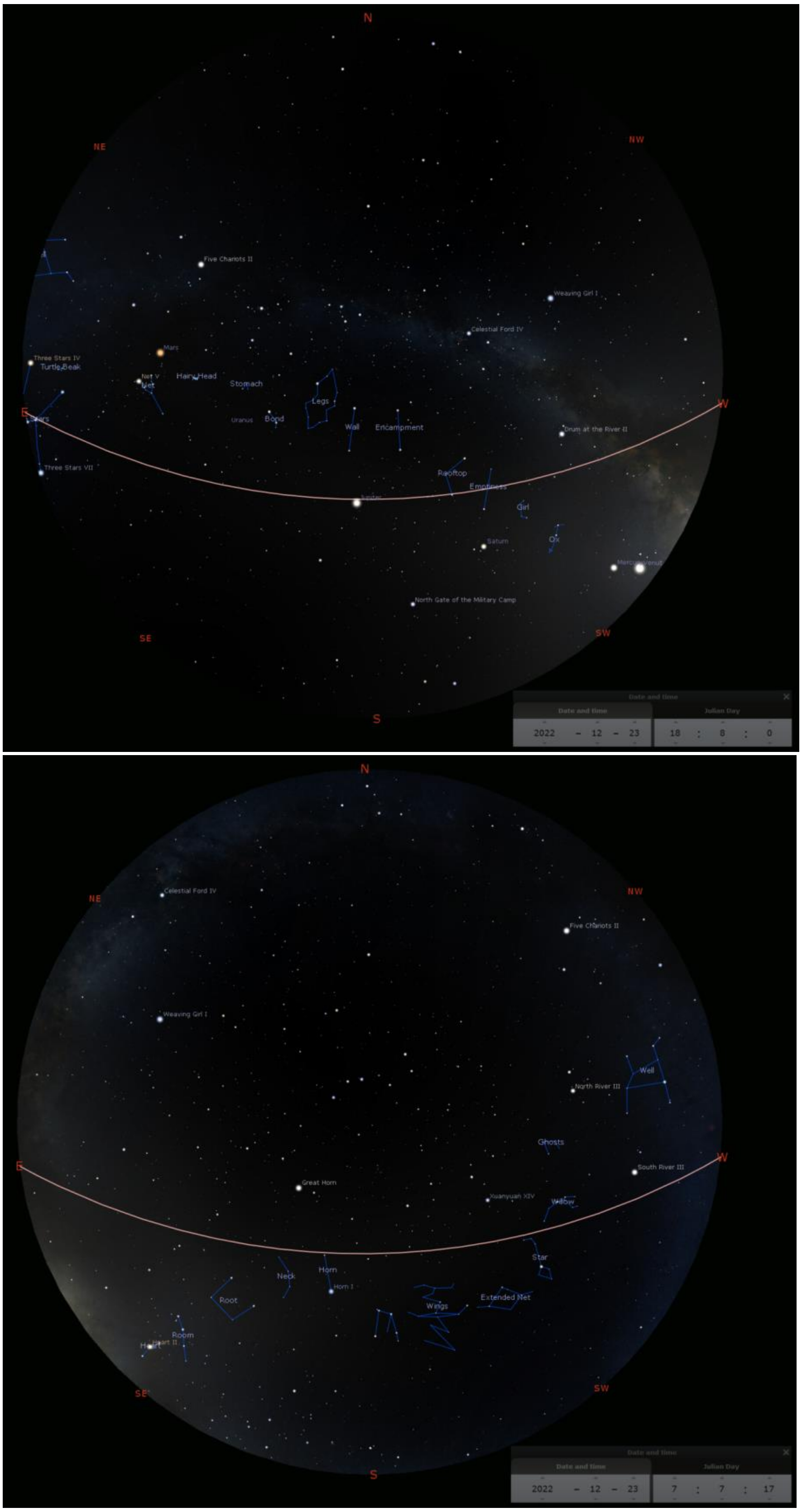



**Figure 2.9, the position of mansions at sunset on the winter solstice (top), the position of mansions at sunrise on the winter solstice (bottom) (Stellarium, 2022).**

It is difficult to determine the exact date at which the complete system of 4 animal signs and 28 astrological mansions crystallised, since this system was formed gradually and was not the product of a particular era (Zhu, 1979b, p. 245). Feng (2010, p. 409) suggests that animal signs were the earliest means of recognising the stars in prehistory, as ancient peoples observed the heavens differently from today, tending not to memorise individual stars but placing more emphasis on observing signs made up of multiple stars. The mansions may also have been associated with animal and plant figures closely related to agricultural production and daily life (Zheng, 1979, p. 96). As mentioned in the discussion of the Xishuipo tomb above, Feng Shi (1990a; 1990b) suggests that the concepts of the Dragon and the Tiger already appeared in the Neolithic period, but he does not discuss their origins in that period. Due to a lack of information, it is also not clear when the system of four animals first appeared, but Feng (2010, pp. 409–410) suggests that this was complete by the second century BC at the latest. The origin of the matching of certain mansions to the four animal signs has also been controversial for a long time. They may be related to the seasonal characteristics represented by specific mansions at *hunzhong*, as the four signs happen to correspond to the four seasons (Zheng, 1979, pp. 97–99), or the four signs may have originated from the totemic relics of different prehistoric tribes (Chen, 1992).

The origin of the 28 mansions themselves has been the subject of much debate, with scholars led by de Saussure and Shinjo Shinzo arguing for a Chinese origin and scholars led by Weber and Iijima Tadao arguing for a Western origin (Zhu, 1979b, p. 237; 1979c, p. 317). de Saussure (1930, p. 16,25,30-31,41-42) argued that the 28 Chinese asterisms had existed since ancient times, and that the consistency of the Chinese and Indian asterisms was due to the fact that the Indians had borrowed this zodiac system from the Chinese in ancient times. Needham (1959, pp. 253–254) speculates that the Indian and Chinese mansion systems developed separately in antiquity but that some connection arose at a later time when cultural contact increased considerably. However, the systems may share a common source: the Babylonian lunar zodiac (Needham, 1959, pp. 245–257). Based on the above-mentioned documentary evidence on the evolution of the mansion system, Zhu Kezhen (1979b, p. 245) initially believed that the hypothesis that ‘the twenty-eight Mansions originated in China and not from outside' was valid and that they originated in the era of primitive agrarian and nomadic societies because even without writing, there was already a need for astronomical knowledge to determine the cycle of the seasons. Qian (1983, pp. 328, 335–336) agrees that the system of the 28 mansions developed independently in China but argues that Zhu's explanation of such early origins is slightly forced. Later, Zhu (1979c, pp. 321–322) changed his view to that of an indigenous origin not earlier than the fourth century BC. Jiang (2011, pp. 255–257) argues that the origin of the two sets of ancient Babylonian celestial coordinates complicates and obscures the question of the origins of these mansion systems. With these origins too early and undocumented to be proved, it is not a problem that admits of an easy solution.

Needham (1959, p. 242) argues that it is certain that the 28 mansions system developed gradually from the middle of the Shang dynasty, since core elements of the system, such as α Hya, belonging to the Phoenix, and α Sco, belonging to the Dragon, are attested by the 14th century BC. Rao (1998, pp. 32–44), on the basis of oracle bone evidence, also suggests that people at that time already had some knowledge of the 28 mansions, especially those of the Dragon and the Tiger, observing, for example, the Heart mansion in the summer and the Three Stars mansion in the winter to determine the seasons. Similar research by Feng (2011, pp. 36–81) suggests that at least six mansions of the Dragon were acknowledged by the Shang dynasty, that the Tiger sign may have evolved from the images of the Turtle Beak and Three Stars mansions and that the Phoenix consisted mainly of the Willow, Star, Extended Net and Wings mansions, but it is not yet clear whether there are any early records of the Tortoise. Little convincing information is available, and the real meanings of some related names on oracle bones and bronzes require further research.

In the ancient texts, at least 8 of the 28 mansions are mentioned in the *Classic of Poetry* (*Shi Jing* 诗经), which was written around the eighth or ninth century BC (Needham, 1959, pp. 244–245; Zhu, 1979b, p. 244). The *Lesser Annuary of Xia* (*Xia Xiao Zheng* 夏小正), a chapter initially recorded in the Western Han *Da Dai Li Ji* (大戴礼记; Chen, 2003, p. 11), meanwhile, mentions 6 mansions, and a much more complete record of 23 mansions is found in the *Yue Ling* (月令), a chapter of the *Li Ji*, dated by Tadaru Noda to around the sixth century BC (Needham, 1959, p. 247). Chen (2003, p. 67) assumes that the Dragon sign, with all seven mansions, was well established by the Chunqiu period, while the Phoenix lacked only one mansion and the Tiger and Tortoise were more than half deficient, but their concepts were more refined than they had been during the Shang dynasty. There are also differing opinions as to when the 28 mansions were fully established, with possibilities including by the middle of the Warring States period (Qian, 1983, p. 348) and by the Han dynasty (Needham, 1959, p. 248).

According to the evidence of the oracle bones, the sign of the Dragon is relatively more detailed than those of the other three animals. The shape of the sign is very similar to the bone graph 'dragon' (*long* 龙; Wen, 1941), as shown in figure 2.10. It is therefore likely that the character for 'Dragon' is derived from the sign. The character *xia* (夏), from the Xia dynasty (figure 2.11), was also formed by the Dragon, along with several other characters, suggesting that the formation of the Dragon sign could be traced back to the Xia dynasty (Feng, 2011, p. 36). The role of the Dragon sign includes bringing rains and providing advice on the right time to plough. For example, when two stars of Tiantian (天田), which are located to the north of the Horn mansion, are seen at dawn on the eastern horizon, this heralds the beginning of the ploughing season (Rao, 1998, p. 37; Feng, 2011, p. 40). The best-known would be the Heart mansion. Feng (2011, p. 45) suggests that it is likely that the Yin people prayed to the Heart mansion were fixed around the two solar terms: the winter solstice and the 'small cold' (*xiaohan* 小寒).

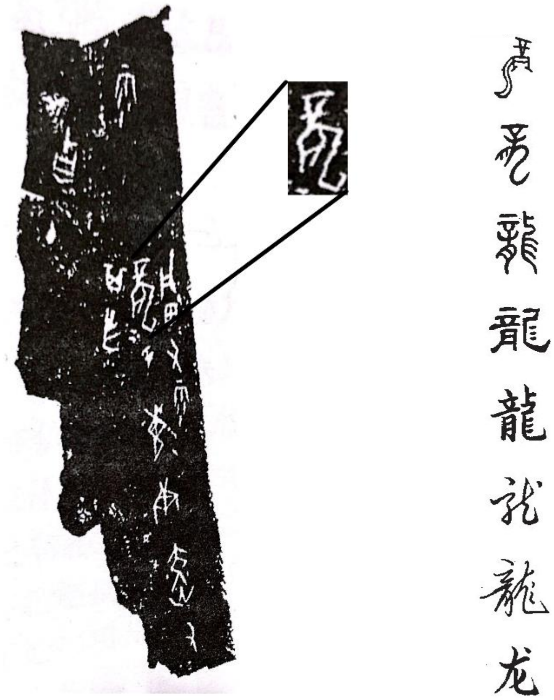


**Figure 2.10, the character of *long* on oracle bones (left; Feng, 2011, p.10) and the evolution of the character *long* and to the modern period (right; Chaziwang, 2022)**

**Figure 2.11, evolution of the character *xia* up to the modern period (Chaziwang, 2022)**

Moreover, the *qian* trigram of the *I Ching* may hide a dragon. This idea was first suggested by Léopold de Saussure in 1911. It did not impact Chinese historiography at the time, but it was taken up in a systematic study by Wen (1941). He explained that ‘hidden dragon: do no work’ (潜龙勿用) symbolises the Dragon sign at the autumn equinox, based on the interpretation of the character ‘dragon’ (龙). In 1985, Shaughnessy suggested that the (2)-dragon appearing in the fields and (5)-soaring dragon in the sky were the astrological signs of the Qin and Han dynasties at the spring equinox in February and the summer solstice in May in the Xia calendar. Chapter 6 will return to this idea and to Shaughnessy’s (1996) suggestion that the *qian* and *kun* trigrams together were a complete calendar record for the year. Moreover, Pankenier (2013, pp. 45–55) has arranged the hexagrams formed by the *qian* and *kun* trigrams to correspond with the changing position of the Dragon constellation in the sky, presenting an image not unlike that proposed by Shaughnessy and forming a more complete record of the constellation’s host-focused calendars (see section 6.4). The *qian* trigram has been similarly explored in other disciplines, such as ethnoastronomy (Chen, 1973) and Chinese medicine (Qin, 1991a; 1991b; Song, 2001). Due to space constraints, however, these will not be described here.

Based on the primitive symmetry of asterisms, de Saussure (1930, p.14-15) found that the two constellations (Scorpio and Orion), which is *Xin* (心宿) and *Shen* (参宿) in the Chinese sky culture, had already been in use before the formation of the twenty-eight asterisms. People at that time (before about the 27th century BC) marked March in spring and September in autumn according to the symmetrical heliacal rising or setting on the horizon of this pair of asterisms for related rituals (de Saussure, 1930, 21-28).

In addition to the above interpretations, other relevant and important elements are recorded in the *Canon of Yao* that:

> [Yao] then commanded Xi and He, in reverence to August Heaven, to “calendar” (track) the [astral] signs, Sun, Moon, stars, and seasonal asterisms, so as to respectfully bestow the seasons on the people; to host the rising sun, and regularly arrange the initiation of affairs in the east; to take leave of the setting sun, and regularly arrange the completion of affairs in the west; to regularly attend to [the Sun’s] change [of direction] in the north; to regularly attend to [the Sun’s] southward displacement and reverently [mark] the solstice . . . The day being of medium length and the asterism being Bird [α Hya], he thereby determined mid-spring; the day being longest and the

> asterism being Fire [α Sco], he thereby determined mid-summer; the night being of medium length and the asterism being Ruins [β Aqr], he thereby determined mid-autumn; the day being shortest and the asterism being Topknot [7 Tau], he thereby determined mid-winter (translated by Pankenier, 2013, pp. 31-32).

The story is that the emperor Yao sent four officers, Xi Zhong (羲仲), Xi Shu (羲叔), He Zhong (和仲) and He Shu (和叔) to the east, south, west and north, respectively, to observe the four stars Bird (鸟), Fire (火), Ruins (虚) and Topknot (昴) in the southern midheaven to determine the spring and autumn equinoxes and summer and winter solstices. However, uncertainty about the exact time and location of the observations and the identification of the stars referred to have caused the absolute chronology of the four stars to remain a subject of debate until today (Chen, 2003, pp. 8–9). The star subject to the most speculation of the four is the most conspicuous one of the four animal signs, e.g. α Sco, as the star Fire. In addition, the Xi Zhong and He Zhong of the text were also responsible for the observation of and ritual response to the sunrise and sunset, respectively, but the details are difficult to trace. Needham (1959, p. 246) concludes that what can be ascertained from the text is that four particular stars were already being used systematically in this period to determine the seasons, as well as to determine the position of the Sun among the fixed stars on solstices and equinoxes.

## The Sun

As mentioned above, Xi Zhong and He Zhong were responsible for the observation and ritual observance of sunrise and sunset, respectively, which leads Feng (2011, p. 31) to argue that at least sunrise and sunset on the equinoxes and solstices were attended to at that time. Records of the sunrise and sunset on a particular mountain can also be found in the *Classic of Mountains and Seas* (*Shan Hai Jing* 山海经), which may have been used by the ancients to determine the seasons. These records included the position of the Sun on an axis between Ju Ling Mountain (聚灵山) in the east and Ri Yue Mountain (日月山) in the west at the vernal and autumnal equinoxes (Chen, 2003, p. 9). Accordingly, other Sun positions corresponded to other times of year. Observations of stars following regular paths occurred at least as early as the period to which the Taosi burial described above is dated, as Pankenier (2013, p. 144) argues that it is unlikely that the Taosi 'shaman', who observed the sunrise and sunset on a daily basis, would have ignored these variations in the sky, especially those of the Dragon constellation.

An even more definitive record and dating of the observation of sunrise and sunset is encoded on the oracle bone no. 290 from Huayuanzhuangdong (花园庄东) at Yinxu (Wu, 2014; figure 2.12). This refers to a specific day called *zhinan* (至南), the day on which the sunrise reached its southernmost point, with a general observation error of no more than two or three days per year. If the southernmost and northernmost points at which sunrise occurred and the southernmost and northernmost points at which sunset occurred were marked and the two sets of points connected (sunrise to sunrise and sunset to sunset), the east–west axis would be formed by connecting the midpoints of the two lines. We might ask why this was not simply identified by marking the sunrise and sunset on the equinoxes. Chen (2003, p. 140), however, suggests that the southernmost and northernmost points of sunrise and sunset might be identified more precisely than the exact equinox day.

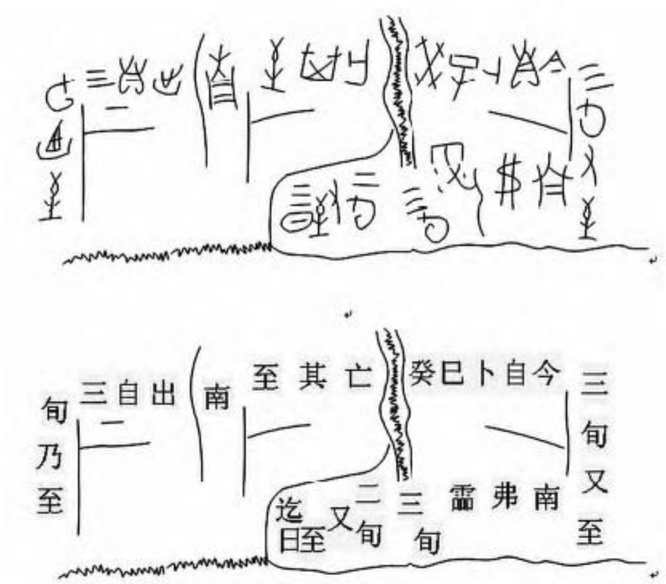



**Figure 2.12, copy (top) and translation (bottom) of oracle bone no. 290 from Huayuanzhuangdong at Yinxu (Wu, 2014).**

In addition, observations of solar eclipses are recorded in the *Book of History* and the *Classic of Poetry* (Needham, 1959, p. 409). There are also six lunar eclipses and one solar eclipse recorded by the Shang dynasty (Dong, 1945; 1950; 1952; Liu, 1945), identified from oracle bone inscriptions.

### The Moon

Relatively few accounts of lunar elements have been deciphered. Chen (1936) indicates that the oracle bone character *su* (夙) is in the shape of a man kneeling in prayer to the Moon and hence a reflection of lunar rituals. There are also records of solar and lunar eclipses recorded on oracle bones. Needham (1959, p. 232) argues that observing the position of the moon relative to the 28 mansions at the time of each full moon was one of the earliest methods of determining the seasons, making the full moon an important day in early rituals. Pankenier (1986; 1992) suggests that the Moon's gradual waxing and waning were described by simple dichotomies from the Neolithic period, as in the case of the growth and decline cycle of the plant, *li cao* (历草), that may have originated in the Archaic period (earlier than the Han dynasty). Further subdivision of the pattern of moon phases occurred in the mid-Han dynasty, and a four-part model subsequently developed. Schafer (1977) has concluded that the Moon and Sun are the *yin* and *yang* components of the human soul, respectively. When the Moon is half-lit, it stands for the life of the soul in its embryonic state. After around five days, the Sun's light helps promote the Moon's growth to its peak, a stage that corresponds to the growth of the *yang* soul after a week of inactivity following the birth of a newborn baby. Pankenier (1986), after confirming the meaning of the character *po* (魄) in excavated oracle bones, argues that the concept of the Moon as the *yin* part of the human soul was centuries older. Gradually, during the Warring States and Han periods, the principle that the Sun's rays make the Moon shine was recognised, and a series of analogies with human growth were developed.

### The celestial pole and circumpolar stars

In addition to the above celestial phenomena, there is another, belonging to the northern sky, that should not be ignored. Zhu (1979b, p. 249) suggests that the nine stars of the Big Dipper were visible at the latitude of the Yellow River basin from 6000 years ago to 3600 years ago and that they remained visible on the horizon all year round. With the rotation and revolution of the earth, the Big Dipper appears to rotate around the northern celestial pole, and the changing of the seasons can be mapped onto the different points of its handle and head (Feng, 2010, p. 125). The circumpolar stars revolve around the northern celestial pole throughout the year, as if the emperor of heaven were travelling in his chariot, indicating the progression of time in the world (Feng, 2010, p. 126). The North Star (the nearest star to the pole at any given moment in time) was described by Needham (1959, p. 230) as the basis of Chinese astronomy. The vast bureaucratic–political agrarian state system was like the stars in the sky, involuntarily revolving around the emperor (also called *di* 帝 in Chinese; Needham, 1959, p. 230).

The character *di* is not only commonly found in oracle bones (figure 2.13) but can also be drawn in the sky by connecting the lines (figure 2.14; Yu, 1996; Pankenier, 2013, p. 106; for an account of how to draw it, see below for the record in the *Zhou Gnomon Arithmetic Classic*). The focus on due north can also be found in the royal architectures and cemeteries of the Xia, Shang and Zhou. The most remarkable example is the Shang centre of power of Yinxu at Anyang, of which the palace, tombs and city walls were all arranged according to longitudinal axes aligned on the pole (Pankenier, 2004; 2013, pp. 98–99). In the Late Shang oracle bones, there appear references not only to the emperor's manipulating natural forces such as wind and rain but also to the gods of the four directions' and the Big Dipper's bringing bountiful harvests and undoing natural disasters (Pankenier, 2004). Pankenier argues that for the Shang people, the residence of the emperor was at the centre of the heavens, from which the control of the universe emanated, and the Shang dynasty acted as a symbolic centre, from which dynastic inspiration radiated in all directions. Thus, in the early Bronze Age, when the Shang dynasty was established, at the latest, the power of the emperor was equated with the axis of heaven. By the time of the dynasty's decline, the ancestors of the Shang royal family had also been equated with the supreme god. Given this affinity between secular rulers and the supreme god, the northern celestial pole may have been understood to be the prototype of the early Chinese emperors in the sky, authorised by the laws of the universe (Pankenier, 2004).

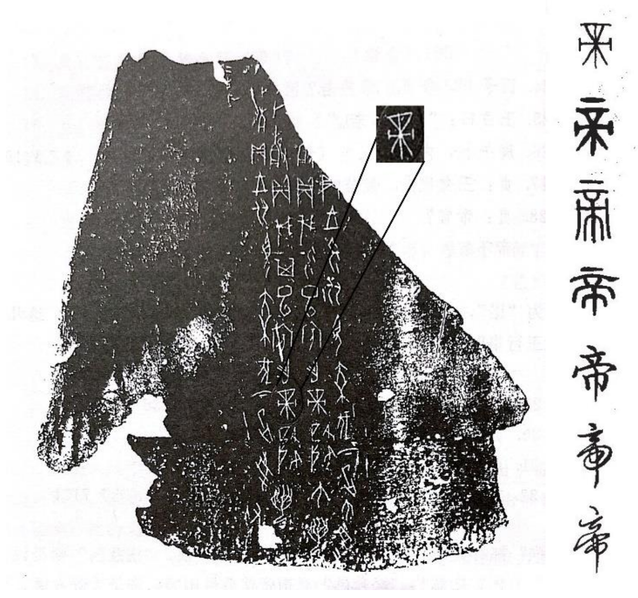


**Figure 2.13, the character of *di* on oracle bones (left; Feng, 2011, p. 10) and the evolution of the character *di* up to the modern period (Chaziwang, 2022).**

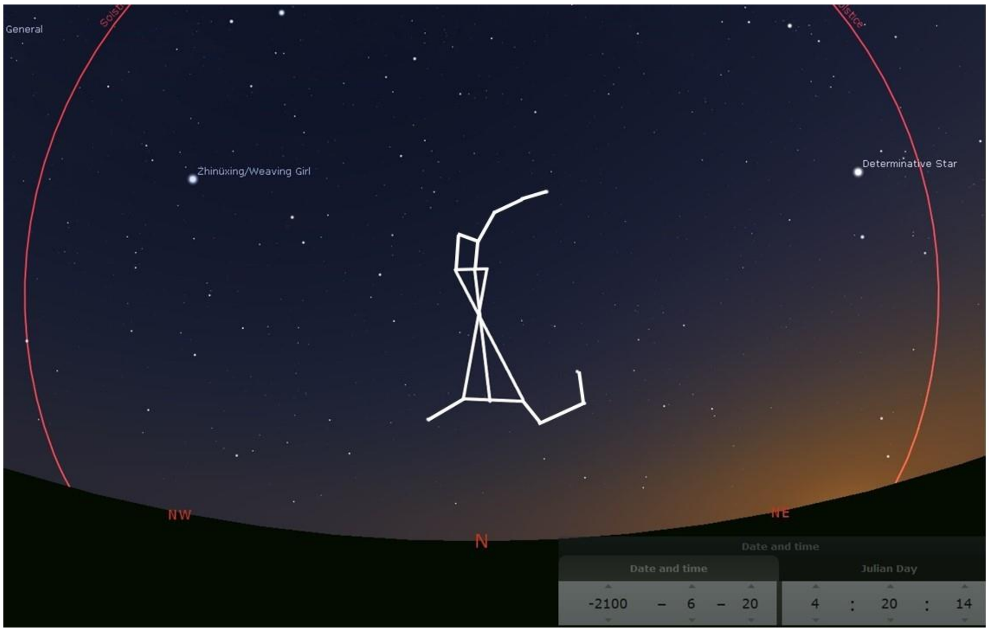



**Figure 2.14, star chart showing the character *di* superimposed and linking stars on opposite sides of the celestial pole, as described by Pankenier (2013, p. 105; made in Stellarium, 2022).**

It should be noted, however, that the northern celestial pole and the North Star are separate concepts. The northern celestial pole, in astronomy, refers to an immovable point in the northern sky at a given time upon which the movements of the stars are centred. It is, therefore, an imaginary and fixed point. In prehistoric times, when people made astronomical observations, they might designate the star closest to this imaginary point as the North Star and judge the position of the true celestial pole with the help of their observations of it. A record of how to orientate oneself by the North Star and the north pole survives in the *Zhou Gnomon Arithmetic Classic*:

> To fix the pivot of the north pole, the centre of the Xuan Ji (璇玑) [i.e., Dipper], to fix the centre of north heaven, to fix the excursions of the [north] Pole [star]. At the winter solstice, at the time when the Sun is at You (酉) [LT 17–19], set up an eight-chi gnomon, tie a cord to its top and sight [along the cord] on the large star in the middle of the North Pole [constellation = ζ UMa]. Lead the cord down to the ground and note [its position]. Again, as it comes to the light of dawn, at the time when the Sun is at Mao (卯) [LT 5–7], stretch out another cord and take a sighting with your head against the cord. Take it down to the ground and note [the positions] of the two ends . . . The [line of] separation of the two ends fixes east and west, and if one splits [the distance] between them in the middle and points to the gnomon it fixes south and north (translated by Pankenier, 2013, p. 108)

When the true north–south and east–west lines were constructed, ancient observers would have an accurate quadratic orientation axis, allowing them to calculate the length of *Xuan Ji* (Chen, 2003, pp. 139–142; Cao, 2020).

### The planets

The planets are an important part of the celestial system, and although the exact planetary records in the oracle bones are, as yet, inconclusive, the planets are bright enough to attract human attention, as are their apparent variations in position between the stars (Feng, 2011, p. 84). The exploration of the *sui xing* (岁星, perhaps referring to Jupiter), as recorded on oracle bones and bronze inscriptions (Feng, 2011, p. 84), provides an example, though as these explorations are not relevant to the purpose of this research, they will not be described here.

According to the records in the *Kai Yuan Zhan Jing* (开元占经 - 卷 31 引石氏), when Mars (*yinhuo* 荧惑) lies in the Heart mansion, this event is called *yinhuo shouxin* (荧惑守心), a sign that something very sinister will happen. Although Wu (2009) argues that most of the historical accounts of this celestial event are either forged celestial records in order to correspond with personnel, or misidentified.

The Five Planets (Mercury, Venus, Mars, Saturn and Jupiter) constitute the most spectacular assemblage of planets and are of extraordinary significance in the celestial history of early China. The appearance of this assemblage was recorded in documents of the Han dynasty, during which period they appeared three times, as well as in the Xia dynasty (1953 BC), the Shang dynasty (1576 BC) and the Zhou dynasty (1059 BC), although the second of these records is inaccurate (Pankenier, 1995). This suggests that the ancient Chinese people already attached great importance to the phenomenon of the Five Planets as a sign from the supreme god and that it gradually evolved into an indicator of kingship legitimacy (Pankenier, 2013, pp. 36–37). By the same token, the shaman and his successors at the Taosi site would also have noted that the conjunction of the five stars occurred at the longitude of the star Markab in February 1953 BC (Pankenier, 2013, pp. 144–145).

### Other stars

In addition to those stars mentioned above, there are variable stars, novae (recorded as 'guest stars' after the Han dynasty; Needham, 1959, p. 425), and supernovae. For example, Dong (1945) found a record of a nova on a Yinxu oracle bone dated to around 1300 BC. Feng (2011, p. 81), however, defines both novae and supernovae as variable stars, which in the Chinese astronomical tradition are called guest stars.

### The Milky Way

The Milky Way is also recorded in the documents, termed the Sky River or Silvery River. While the analogy between the Yellow River and the Milky Way was repeated in subsequent *yin–yang* and Five Elemental Phases doctrines, explicit assertions that the Milky Way is a celestial analogue of the Yellow River are rare in Warring States astrological literature, leading Pankenier

(2013, p. 278) to conclude that the reasoning involved was either self-evident or too esoteric for the time. The earliest documents that mention the Milky Way and its location as a seasonal indicator are the *Shi Jing* and the *Lesser Annuary of Xia*. In the Spring and Autumn period, a set of field allocations was proposed (Zheng, 1979, p. 100), and in late Warring States and early Han-dynasty literature, astrological material can be found based on field allocations in which the Milky Way corresponds to the Yellow River and the 28 mansions correspond to their 12 earthly counterparts (Pankenier, 2000; 2005). Pankenier (1995; 2005) suggests, however, that this system of field allocation was enhanced and standardised over time, with its core dating back to the second millennium BC. This core lies in the relationship between the four animal signs and the four directions on earth, as well as, possibly, the four seasons and the colours they represent.

During the Qin and Han dynasties, the Milky Way was thought to be a potential gateway from heaven to earth or from earth to heaven. Mythological figures that appear during this period include Fuxi, holding a square, and Nvwa (女娲), holding a compass, with their serpent or dragon tails twined in an intimate embrace. Speculation as to their significance varies, with some believing that they represent *yang* and *yin*, the Sun and the Moon, respectively. The sinuous tails of Fuxi and Nvwa also suggest the trajectory of the Milky Way and are reminiscent of the Milky Way and the stars that move with the seasons (Pankenier, 2013, p. 394).

### 2.3.2 Cardinal direction

The text in *the Canon of Yao* also references the names of the four divinities, or winds from four directions, which are Xi (析) in the east, Yin (因) in the south, Yi (夷) in the west and Ao (隩) in the north. This is not only recorded in the *Canon of Yao*; Feng (2011, p. 281) argues that it is confirmed in the *Classic of Mountains and Seas* and the oracle bones. The *Classic of Mountains and Seas* conceives of its material as the mountains of the centre plus the mountains of the four directions, suggesting that the concepts of the four directions and the centre existed at a very early stage.

The original concept of two directions from the sun may have corresponded to a binary understanding of the seasons. In Yu's (1996, p. 124) interpretation of oracle bone characters, it was not until the *Canon of Yao* that the four directions were combined with the four seasons, meaning that before that time, only two seasons were recognised, spring and autumn. This persisted until the late Western Zhou dynasty, when spring and autumn were subdivided to add summer and winter, creating the four seasons. However, Li Xueqin (1989) argues that the presence of the god of wind, who presided over the four directions, on oracle bones provides evidence that the concept of the four directions existed already during the Shang dynasty. Hu Houxuan (1941; 1956) not only systematically identified the names of the winds of the four directions from the oracle bones but used the names of the four directions to reflect the climatic characteristics of the four seasons. Although Yang (1954) suggests that Hu did not correctly verify all of the wind names, this does not detract from Hu's inspiration. Hu (1944) also suggested that the Shang people formed a system of five directions on top of the four directions, that is, a system centred on the Shang, with the south, east, west and north making up the remaining four directions. Therefore, he judged that the formation of the five-direction system might be closely related to the formation of the political–geographical centre. Building on this view, Allen (1991, pp. 76, 100–102) further argues that the five-direction system is derived from the character *ya*, indicating the four directions and the centre (mentioned in section 1.2). Zheng (1984) interprets the names of the gods of the four directions mentioned in the *Canon of Yao* as corresponding to the growth characteristics of plants at different times of the year, while the winds of the four directions reflect the changes between the spring and autumn equinoxes and the winter and summer solstices. He suggests that this is a system of four seasons invented by the Shang people to determine the calendar and leap months, meaning that the Shang dynasty not only already had the concept of the four directions but also extended it from space to time and combined it with phenological changes so as to memorise it.

In addition to the system of four directions, a system of four dimensions (northeast, northwest, southeast and southwest) is attested. Based on the analysis of archaeological sites, Wang Renxiang (2011) argues that in the Three Dynasties period, the second of these systems is commonly found in the Ancient Shu and other non-central regions of China, at locations such as the sites of Furongyuan and Sanxingdui. Xu Fengxian (2019, p. 158) pushes this back to the Middle to Late Neolithic period in China, specifically 3500 to 3000 BC, for instance at Yaoshan and the Huiguanshan altar in the Liangzhu culture and Dongshanshou in the Hongshan culture. There should be both astronomical and geographical reasons behind this change (Wang, 2011).

Further to the concept of direction as judged according to the Sun, the *Lesser Annuary of Xia* mentions that the centre around which the Big Dipper (part of Ursa Major in modern sky culture) moves was regarded as the central immovable point, with the direction of the handle indicating the season. The handle points east at nightfall at the spring equinox, south at the summer solstice, west at the autumn equinox and north at the winter solstice; likewise, for a given month, one could determine the expected direction of the handle. The chronology of this Xia calendar has been debated, with the problems encountered fundamentally the same as those of the *Canon of Yao* (Chen, 2003, p. 9).

Buildings and tombs in the Central Plains were mostly facing east until the Han dynasty. After the Eastern Han dynasty, this orientation changed to facing south (Yang, 2003; Zhou, 2022). The reason for the relatively late understanding of north and south is thought to lie in the fact that sunrise and sunset constitute intuitive experiences, empirically integrated into daily life, whereas the concept of north and south requires more careful observation of weather patterns and a degree of abstract thinking (Qiu *et al.*, 1962, p. 85; Song *et al.*, 1983, p. 431) or the identification of particular signs (Liu, 1980, p. 15).

In the aspect of ethnography, many scholars believe that among the Han and numerous other ethnic groups, the concept of orientation, which predates the concept of the four directions, began with the notion of east and west introduced by the sunrise and sunset (Liu, 1980, pp. 13-16; Zheng, 1980; Song *et al.*, 1983, p. 431; Mei and Yan, 2001). This is particularly likely because the pattern of day and night will not only have affected productive activities but also have evoked cognitive contrasts, such as light and darkness, *yin* and *yang*, and life and death (Mei and Yan, 2001). Aerdingfu (2001), however, offers a slightly different perspective through his observations of the concept of orientation among the northern peoples (those of the Altaic language family). He argues that the earliest references to today's 'east' and 'west' were framed objectively in terms of the Sun. Later, they were referred to as 'front' and 'back', then 'south' and 'north', before finally the directions of sunrise and sunset were termed 'east' and 'west', all of which involve orientation centred on the subject individual and dependent on the physical position of differently orientated persons.

Recent studies of the ethnic minorities of China have shown that some peoples do not employ the concept of four cardinal directions, such as the Jingpo (景颇族) and Ewenke (鄂温克族). These groups have an impressive memory for concrete locations, including mountains, woods and river bends (Xu, 2019, pp. 157–158). They refer to our east and west as the directions of sunrise and sunset; as north and south cannot be judged based on the observation of the Sun, different peoples have used different methods to identify them, referring, for example, to the origin of a river, deep in the desert or where it is cold (Qiu *et al*., 1962, p. 85; Liu, 1980, p. 15; Song *et al.*, 1983, p. 431; Aerdingfu, 2001). As a result, it is likely that there were substantial differences in how various ethnic groups of the past conceived of north and south.

# Chapter 3 Methodology

## 3.1 Introduction

As outlined in the previous chapter (Section 2.1.1), traditional archaeoastronomy tends to focus on empirical analysis, such as measuring the precision of alignments between archaeological sites and celestial bodies, and verifying whether ancient peoples possessed the capability for astronomical observation. However, with the evolution and influence of archaeological theory, post-processualism, for instance, places greater emphasis on the diverse interpretations of astronomical phenomena across different cultures and groups, as well as how these phenomena were shaped by social power, religious beliefs, and individual experiences. For example, the astronomical alignment of a site might not only serve as a calendrical tool but could also be linked to myths, rituals, and social hierarchies. Additionally, scholars examine how these power dynamics are reflected in the structure and use of sites, as astronomical knowledge might have been monopolised by elite groups, becoming a discursive tool for controlling time, seasons, and rituals, thereby consolidating power. Post-processualism also cautions against imposing modern scientific logic onto ancient peoples, advocating instead for the reconstruction of ancient perceptual frameworks through cognitive archaeology and phenomenological methods. In recent related studies, there has been growing interest in how ancient astronomical practices might be embedded within mythological, ethical, and ecological relationships.

It is widely acknowledged that we cannot directly observe the astronomical concepts and ideas of past peoples, but we can attempt, to some extent, to understand their astronomical practices by adopting their cognitive frameworks. For instance, by simulating the environments in which ancient peoples observed celestial phenomena (such as light-pollution-free night skies or specific topographical perspectives), we can gain insights into how their perceptions of the surrounding world were integrated with their daily lived experiences.

The basic role of archaeoastronomy is first to assess the ‘astronomical facts’ that inform us of what the sky was doing at a given time and then to consider the ‘historical’ or ‘anthropological facts’ that may show whether these phenomena were observed and how they may have shaped aspects of human life (Iwaniszewski, 2015b, p. 316). Aspects of the material record that may relate to archaeoastronomy can be classified primarily into structural orientations, light-and-shadow phenomena and symbol counts (Iwaniszewski, 2015b, pp. 317–318; Ruggles, 2015a, pp. 359–366; 2015b, pp. 376–380). This evidence, however, should not be viewed in isolation, as it is all too possible to be misled by coincidences, but should be interpreted from multiple perspectives, taking into account the social context, culture, modes of subsistence and surrounding natural environment, as mentioned in the section 2.1.1. the development of archaeoastronomy. Sims (2010b) argues, from a broader perspective, that archaeoastronomy may be the bridge that connects the four fields of anthropology, namely archaeology, social anthropology, linguistics and biological anthropology, which merge and mutually underpin the exploration of past peoples' views of the cosmos. To conduct this exploration effectively, in addition to traditional statistical approaches, we must apply Monte Carlo modelling, landscape phenomenology, the consideration of embodied experience and virtual 3D modelling; together, these constitute an important set of techniques to explain the social and cultural significance behind celestial alignments (Sims, 2010b).

Additionally, while the primary approach to archaeoastronomy has been to study individual sites or clusters of similar sites constructed in the same period, González-García and Costa-Ferrer (2011) have experimented with diachronic studies of a specific geographical area based on 'a long archaeological sequence' to see whether the evolution of or fundamental changes in customary orientation patterns coincide with inferences made from physical evidence of cultural change. Henty (2022, p. 193) suggests that this type of archaeoastronomical approach may help to explain, from an entirely new perspective, the cultural and material transitions of concern to many archaeologists. It is with this in mind that the scope of this study encompasses China from the Early to the Late Neolithic (see chapter 4 for more details).

In terms of research methodology, Ruggles (2015a, p. 354) concludes that archaeoastronomy, much like archaeology as a whole, must be interpreted by the social sciences on the basis of 'facts' established using the 'hard' scientific method whenever material evidence is involved. In recent years, the methods and associated tools of archaeoastronomical research have also evolved with theoretical advances, allowing for better exploration using the "hard" scientific method. (for more details, see Henty, 2022, pp. 193-194).

For the reasons given above, this thesis will focus on archaeological evidence and astronomical calculations based on burial orientation statistics, supplemented by mentions of astronomical targets in written records close to the Neolithic period and ethnoastronomical literature, which will serve as potential clues to determine the intention behind burial orientation choices. It attempts to take a comprehensive view of the Neolithic inhabitants' possible conceptions of life, death and the cosmos by integrating the natural environments in which they lived, their corresponding ways of life and the symbolic meanings of motifs found on the excavated objects.

This chapter is, therefore, divided into three main sections. The first delineates the region, the selection of sites and the data collection process, identifying the targets of study. The data collected will include cultural background, geography, subsistence, information about cemeteries and related burial customs. The second section presents the selected sites on a map to give a macroscopic view of the geographical relationship between the regions and zooms in to compare the surrounding landscape of each site. The third section describes the refinement of the collected burial orientation data and the use of skyscapeR to refine the significant sky range based on these data, as well as listing the astronomical objects that appear in this range. The relationship of these potential astronomical targets with burial orientation and the landscape contexts surrounding burial areas is then modelled using Stellarium for the corresponding chronological period. Finally, this relationship will be discussed in its social and cultural context, not only in terms of astronomical factors but also in terms of analysing the potential roles of other natural factors, such as mountain ranges and monsoons. The ultimate aim is to build a primer that presents the available scientific and technological methods and tools to offer a basis for future research.

## 3.2 Site selection and data collection

It would be arbitrary and inappropriate to analyse the motives behind the orientation of burials based on the orientation of the burials observed at several sites. It is possible that the burial orientation of the same culture changed in different periods, or that burials of the same culture in different regions was orientated in different directions, or even different cultures in the same region chose different burial orientation directions. Therefore, it is necessary to select multiple cemeteries to investigate the burial orientations from different regions, cultures, and chronology.

In order to select sites suitable for this thesis, the first step is to review all published Neolithic sites from *Atlas of Chinese Relics* from each province. This provided a broad understanding of the Neolithic period in China. The data for this atlas was collected during the Second National Relic Survey, conducted by the Provincial Administration for Cultural Heritage between 1981 and 1989. The survey results were systematically organized by county using a unified format and mapping standard, and subsequently published by province. The atlas covers 23 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions. During this period, Chinese archaeology developed its own theoretical and methodological framework, leading to clearer classifications and definitions of prehistoric cultures. For instance, the *Archaeological Discovery and Research Series of Chinese Relics in the 20th Century* summarized archaeological achievements of the century and elaborated on significant Neolithic cultures, forming a broad framework for many of the cultures discussed in the appendix.

The second step was to narrow down the range of potential research sites based on the Neolithic sites listed in the *Atlas of Chinese Relics*. Appendix 2 provides a brief overview of the cultural development processes for each province and region, along with approximately 186 sites. These sites were preliminarily selected because archaeologists deemed their excavated remains to be typical of the local culture and representative of its characteristics. To ensure a balanced representation, sites from the early, middle, and late Neolithic periods were included within each province, avoiding an overemphasis on any single period and ensuring the study captured the evolution of cultural practices over time.

Each selected site features a relatively intact cemetery, with excavation materials indicating continuous use over at least one cultural period. This allows for the observation of cultural evolution within the region. Some cemeteries, such as Chengtoushan, were used across three or more cultural periods, though the number of burials from each period may vary. This variability is acceptable, as not every period is expected to yield an equal number of burials. Such cemeteries enable comparisons of cultural differences and variations over time. Since burial orientation is the primary focus of this study, preference was given to sites with centralized burial arrangements, as scattered burials make it difficult to study the corresponding sky and landscape features.

Despite the extensive excavations conducted since the Second National Cultural Heritage Census, many sites lack published final excavation reports. Therefore, the availability of comprehensive reports became a crucial criterion for further site selection. These reports must include detailed burial data, such as grave types, orientations, burial positions, and grave goods.

Due to time and space constraints, the initial list of 186 sites was further refined to be more suitable for this study. Additional criteria were applied to ensure the selected sites were geographically distributed across different parts of the same province, avoiding overconcentration in one area. This approach prevents an excessive focus on sites with similar attributes at the expense of understanding cultural developments in other regions. Since burials are the central focus of this thesis, priority was given to sites with cemeteries of significant size, reflecting the burial practices of the majority of the settlement's inhabitants. However, the required number of burials varies by region due to differing climatic and geographical conditions. For example, the Taosi site in the Yellow River region, with its favourable living conditions, yielded 1,412 burials, while the Qugong site on the Tibetan Plateau, with harsher conditions, produced only 29 burials. These regional variations are elaborated in Chapter 4.

In addition, fully published excavation reports are also essential  as they provide the necessary burial data. Reports that include information on sex, age, and social status are preferred. When multiple sites in the same region and culture meet these criteria, preference is given to the one that is better protected and easier to locate, rather than the one that has been severely damaged by human activity and could be used again by people after the site has been backfilled. This is because the latter sites are difficult to relocate and even more difficult to pinpoint the location of their cemetery. Furthermore, sites with precise location descriptions in their excavation reports and those easily identifiable on satellite maps are prioritized, as this reduces calculation errors and enhances the accuracy of the study (which will be explained in section 3.3.1).

A final, non-essential but informative criterion is the site 's potential association with astronomical elements. This is relevant because the study aims to compare how prehistoric groups used celestial phenomena to express their beliefs. For example, the Taosi site, which features a large cemetery and an astronomical observatory, and the Lingjiatan site, where grave goods with possible astronomical significance were found (Wang, 1992 and 2006; see Section 7.5.5 for further references), were prioritized. Ultimately, 18 Neolithic sites met all these criteria. Basic information about these sites, including chronology and burial customs, is compiled in Excel and presented in Table 3.1, with detailed tables provided in Appendix 3.

| |
|---|
| Site |
| Chronology |
| Dates of excavations |
| Landscape and geography |
| Phases |
| Numbers of buildings |
| Building shape(s) |
| Kiln(s) |
| Pit(s) |
| Altar |
| Ceramics |
| Stone tools |
| Bone, antler, mussel, tooth tools |
| Jade artefacts |

| |
|---|
| Wooden tools |
| Staple food |
| Number of burials |
| Burial types |
| Burial position |
| Number of grave goods |
| Position of grave goods |
| Burial custom |

**Table 3.1, site information gathered from excavation reports.**

At the time of writing, the third national archaeological survey (conducted from 2007 to 2011) in China has recently been published (GOV, 2012). However, the publication of these results is incomplete, with some provinces either not yet releasing their findings or only providing partial data. Additionally, the methodologies employed by these provinces that have published their surveys vary significantly. For instance, some provinces only documented new sites discovered since the second survey, while others organized their findings by city or district, releasing reports in stages. Alternatively, some provinces categorized their results thematically, focusing on topics such as Water Conservancy Facilities, Ancient Burials, The Grand Canal, and Red Revolution. Thus, the primary source of information for the sites used in this research remains the second national archaeological survey, with the third survey serving a supplementary role by filling in gaps left by the previous survey.

## 3.3 Display site

### 3.3.1 Site location

Due to the fact that in recent years, to better protect archaeological artefacts and minimise human-induced damage, excavation reports in China are no longer permitted to provide precise latitude, longitude, or detailed topographic maps. As a result, determining the exact coordinates of a site or even its cemetery based solely on excavation reports is challenging. Most reports include only a simplified sketch map to indicate the general location, accompanied by textual descriptions of the surrounding geography, as well as the physical and climatic characteristics of the village, county, or city where the site is located.

Burial plans in these reports vary in detail. For example, the Qingliangsi report provides a diagram of the entire cemetery, but it includes only minimal map-related information, such as the indication of "north" and the size of the diagram. However, it is unclear which reference for "north" the excavators used when creating the plan. In contrast, the Lingjiatan report illustrates the relative locations of burials excavated each year, but it lacks a comprehensive diagram of the entire cemetery.

To address these limitations, a three-way correction method is employed, combining the sketch maps from excavation reports with Baidu Maps and Google Earth. This approach allows for the calibration of site locations by comparing them with the surrounding terrain. Baidu Maps is particularly useful because it is the most widely used web mapping service in China, offering realistic satellite imagery, street maps, and street views. It also provides more accurate information about nearby villages/rivers/mountains, which helps identify terrain features not represented in the site sketch maps from the excavation reports. However, the coordinate system of Baidu Maps is BD-09, which adds further obfuscation to GCJ-02 coordinate system. GCJ-02 is the national coordination system used in China, and it is developed from WGS 84 (BMOP, 2021). This means that entering the same coordinates in Google Earth and Baidu Maps will yield different locations. Nonetheless, this discrepancy does not hinder the study, as Baidu Maps is used only to confirm site locations identified on Google Earth, not to provide coordinates. Its extensive local place name and street data make it invaluable for verifying specific locations.

In selecting sites for this study, preference was given to those that are relatively easy to locate on maps. For instance, the excavation report for the Lingjiatan site includes a brief contour map (Figure 3.1) and describes the site's approximate location in Hanshan County, Anhui Province. The report details the surrounding landscape as follows:

"The Lingjiatan site is mainly located on the north bank of the Yuxi River and around the villages of Lingjiatan and Jiazhuang. It is 5 kilometres from Taihu Mountain in the north and directly connected to the Yuxi River beach in the south……There is a mountain called 'Tushan', 4 kilometres to the northeast of the site……the highest elevation in the northern part of the site is 26 metres above sea level, and the elevation of the southern part is 6.7 metres above sea level……The Lingjiatan site is like a sleeping Buddha, with its head resting on the Taihu Mountain and its feet on the Yuxi River (APICRA and HCCRMO, 1999, p. 4)."

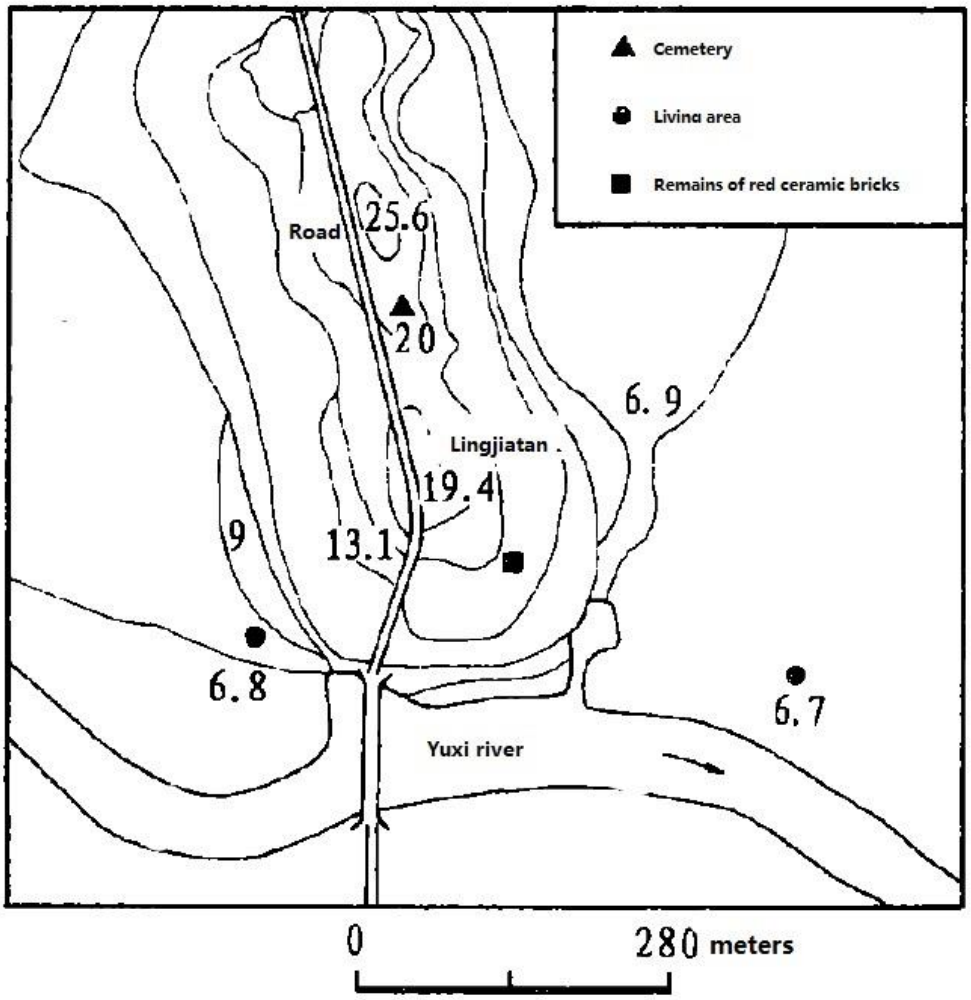
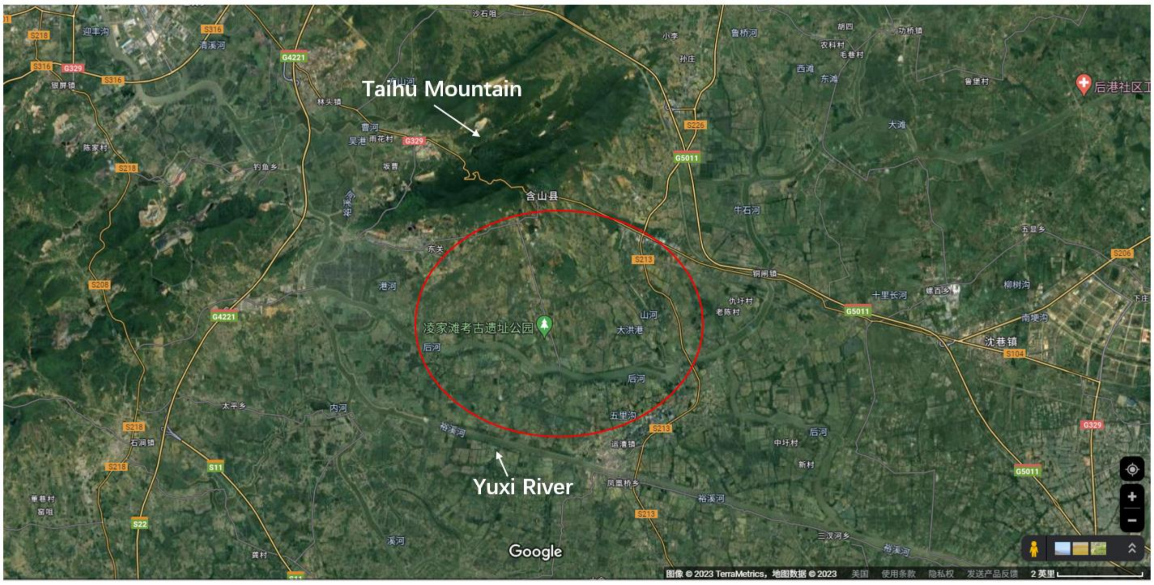



**Figure 3.1, partial layout of Lingjiatan in contour map (APICRA and HCCRMO, 1999).**

Using these details, the site's approximate location (circled in red) was identified on a 2 mile scale satellite map of Google Earth (figure 3.2 above), and confirmed with Baidu map (figure 3.2. below). The site has been developed into a heritage park, which further facilitated pinpointing its exact extent. Zooming further into a 1000 foot scale on Google Earth (figure 3.3 above), revealed the hill resembling a sleeping Buddha, as described in the report. This is also confirmed by Baidu Maps (figure 3.3 below), despite minor discrepancies in road layouts and the Lingjiatan archaeological site park are a little different on the two maps. This does not affect the ability to confirm the location of the site as well as to find the cemetery. Then, based on the contours provided in figure 3.1, the highest point of the hill, near the center of the "sleeping Buddha," was identified as the approximate location of the cemetery. By clicking on that point it is possible to read the coordinates of the location, as indicated in the figure 3.3 Google map (above). While this may not represent the exact centre of the cemetery, the margin of error is within 100 meters, and the surrounding landscape view remains consistent. Given that the cemetery is an area rather than a single point, selecting coordinates near its centre is acceptable for the purposes of this study.



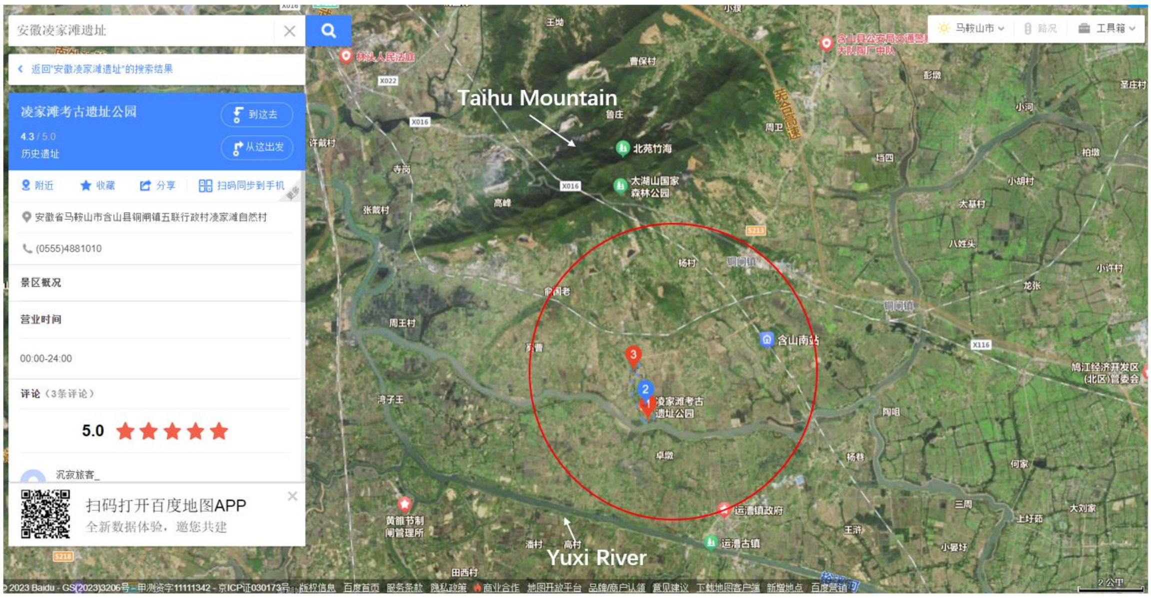




**Figure 3.2, example of finding the Lingjiatan site on 2 mile scale of Google Earth (2023) (above) and Baidu Maps (2023) (below).**

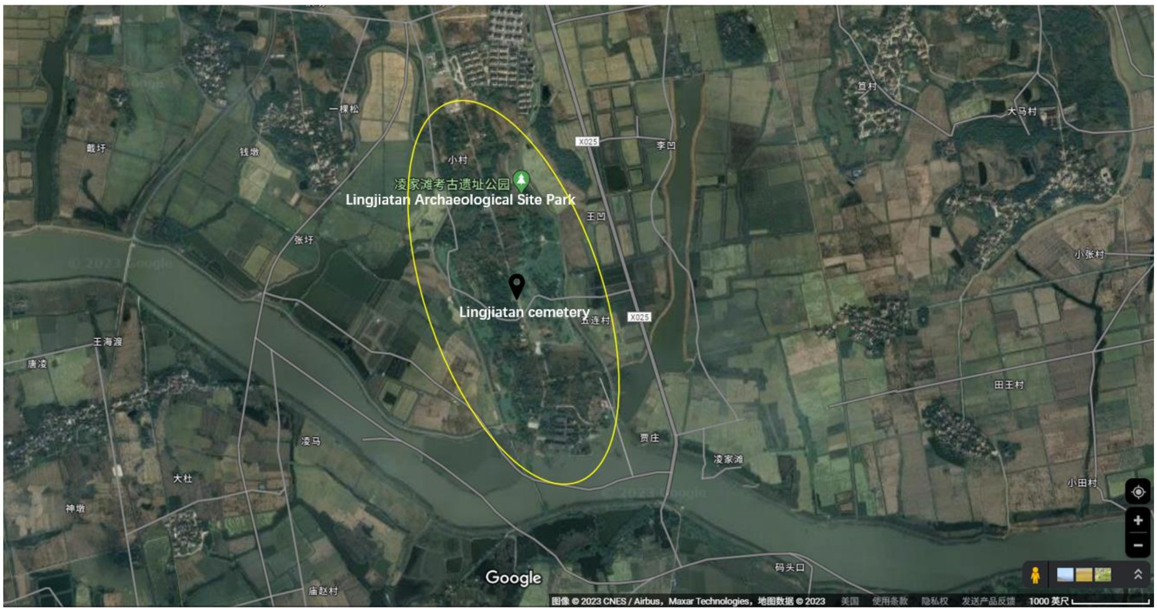




**Figure 3.3, example of finding the Lingjiatan cemetery on 1000 feet scale of Google Earth (2023) (above) and 200 metres scale of Baidu Maps (2023) (below).**

Most of the software and base maps used in ArcGIS for this research are based on WGS 84 coordinate system. This ensures that coordinates derived from Google Earth can be accurately imported into ArcGIS. The reason for choosing WGS84 as the coordinate system is because different maps from various platforms may use varying arc of the earth surface, this caused the elevation of every mountain in different maps is varied, as the original sea level is all different. For example, each archaeological institute in China has its own base maps of each site with nearby areas. This is surveyed and mapped unified by a higher authority under confidentiality agreement. The coordinate system that they employ is different from WGS84. While these maps may show elevations differing from those on Google Earth due to the use of different Earth arcs, the actual heights remain the same. For example,  a mountain listed as 203 meters on an institute's map will also be 203 meters on Google Earth, with a negligible margin of error (less than 1 meter).  This consistency ensures that the elevation data used in this study is reliable and does not affect the calculations.

Therefore, to maintain data consistency and simplify calculations, this study relies on maps based on the WGS 84 coordinate system. This also explains why specific coordinates from archaeological institutes were not sought: they are often confidential and, even if available, are not based on WGS 84, making them incompatible with this study's methodology.

### 3.3.2 Spatial distribution of regions in ArcGIS

To display the seven regions and the position of the Yellow River and Yangzi River (detail are provided in Chapter 4), a World Hillshade map from ArcGIS Online (Esri, 2023) is required as the basemap (figure 3.4). The World Hillshade map artistically represents elevation through hillshading, making it an ideal backdrop for displaying topographic, hydrological, and other geographic features (Esri, 2023). Therefore,  this map can serve as the foundation for visualizing the locations of all regions and their underlying terrain. The decision to use the World Hillshade map instead of the 30m or 90m digital elevation map (DEM) was necessitated by the unavailability of publicly shareable DEM maps within China, likely due to copyright restrictions. By using ArcGIS Online, this approach avoids potential copyright issues while enabling a clear comparison of geographic differences between regions. It also effectively demonstrates the approximate orientation of burials relative to surrounding mountains and rivers, as detailed in Chapter 5. A more precise method for analysing burial orientations in relation to nearby mountains will be discussed in the following section, rendering the use of 30-meter or 90-meter DEMs unnecessary for this part of the study.

**Figure 3.4, thumbnail of World Hillshade map in ArcGIS Online (Esri, 2023).**

The reason for choosing ArcGIS rather than Google Earth is because the latter includes modern structures in its altitude data, whereas ArcGIS provides a basemap free from artificial constructions. Additionally, this study avoids depicting China's national frontiers on maps due to ongoing international disputes in certain areas and the lack of consensus on their representation. Furthermore, modern political boundaries are irrelevant to the Neolithic period and do not impact the research.

The cemetery plans from excavation reports could not be directly imported into Google Earth or ArcGIS because most reports provide only simplified diagrams of cemeteries or partial burial layouts without contour lines or any geographic information, or even not provide any diagram of the cemetery. There are several types of diagrams in these excavation reports, such as the Qingliangsi report includes a schematic map of the entire cemetery (Figure 3.5), but it offers limited information, such as a "north" indicator and scale, without specifying the reference for "north." Similarly, the Lingjiatan report illustrates the relative locations of burials excavated annually (Figure 3.6) but lacks a comprehensive map of the entire cemetery. These limitations make it challenging to align the diagrams with actual burial locations or scale them accurately. Consequently, this study relies on the coordinates derived using the method described in Section 3.3.1, effectively simulating the perspective of an observer standing within the cemetery and viewing the surrounding landscape.

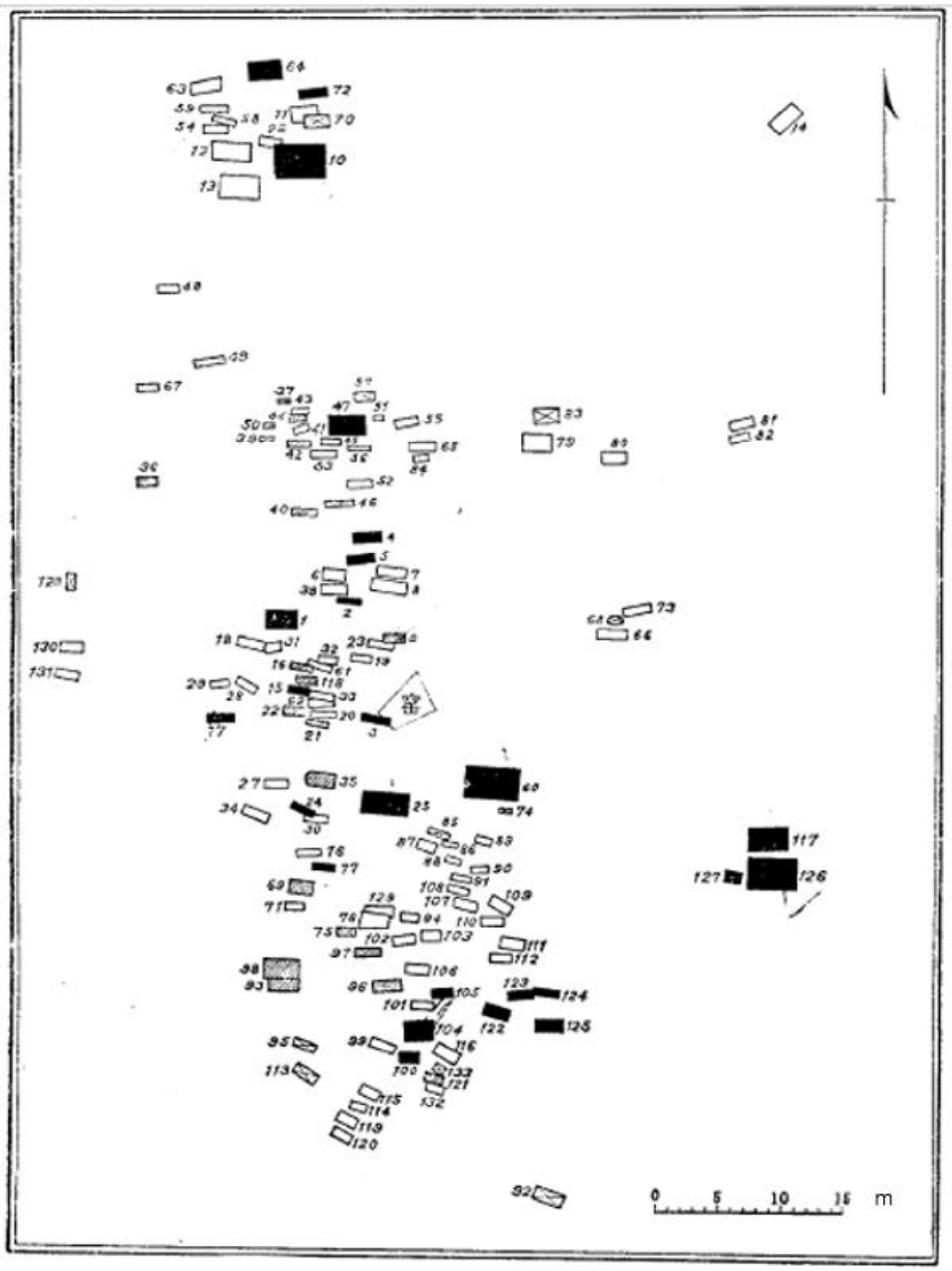



**Figure 3.5, burial distribution at the Qingliangsi cemetery (SPIA, YMWCH and RCATCH, 2016).**

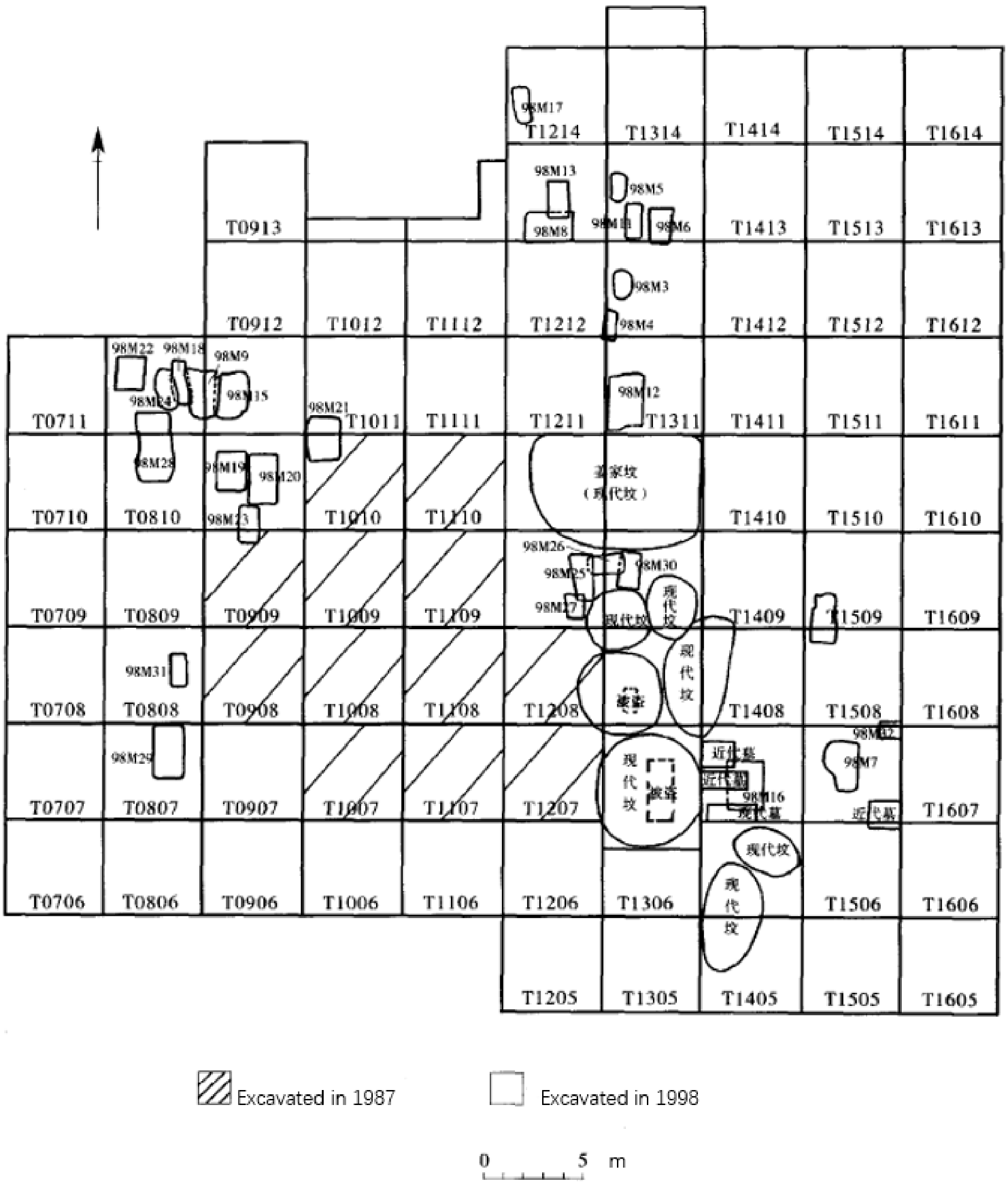



**Figure 3.6, diagram of partial excavated trenches in 1987 and 1998 (APICRA, 2006).**

## 3.3.3 Surrounding landscape of sites in HeyWhatsThat

The reason for providing HeyWhatsThat's (2022) in addition to ArcGIS is that this website supported by Google Earth. It provides a 360° panoramic sketch of the visible landscape from a specific observation point, labeling nearby mountain peaks. The website calculates the horizon where you are at, the surface of the Earth visible from where you are standing, the line-of-sigh profile between you and the distant mountain peaks, and other relevant visualisation data (HeyWhatsThat, 2022). This tool allows for quicker and more effective categorization of burial orientation ranges in relation to the surrounding landscape, offering readers an intuitive visualization without relying solely on ArcGIS terrain maps. For example, figure 3.7, illustrates the landscape around the Xipo cemetery, with green tracings representing the closest landscapes, purple indicating the farthest, and blue showing intermediate distances. In addition, as mentioned above, HeyWhatsThat also provides calculations of elevation and altitude from the observation point to any part of the surrounding landscape. How the calculation is done will be explained later. In addition, the landscape package for the simulation in the stellarium can be downloaded from this platform.

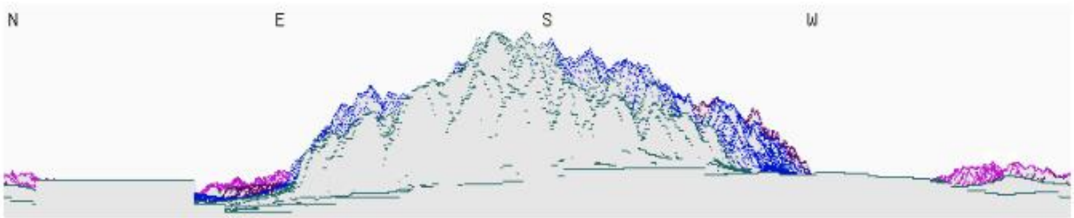



**Figure 3.7, surrounding landscape at the Xipo cemetery, with two yellow brownish lines indicating the grave orientation range (HeyWhatsThat, 2022).**

## 3.4 Data analysis

### 3.4.1 Uncertainty of Grave Measurement

In accordance with the *Field Archaeology Protocol* (SACR, 2009), all burial information was recorded in detail and systematically during the excavation. Take burial M2137 from Wangyin site as an example (figure 3.8), the most common method of measuring the orientation of a burial is set two lines on the top and bottom of the burial's edges (blue lines), and connecting their middle points (green line). The orientation of the connected middle points is the orientation of the grave, which is 104°.

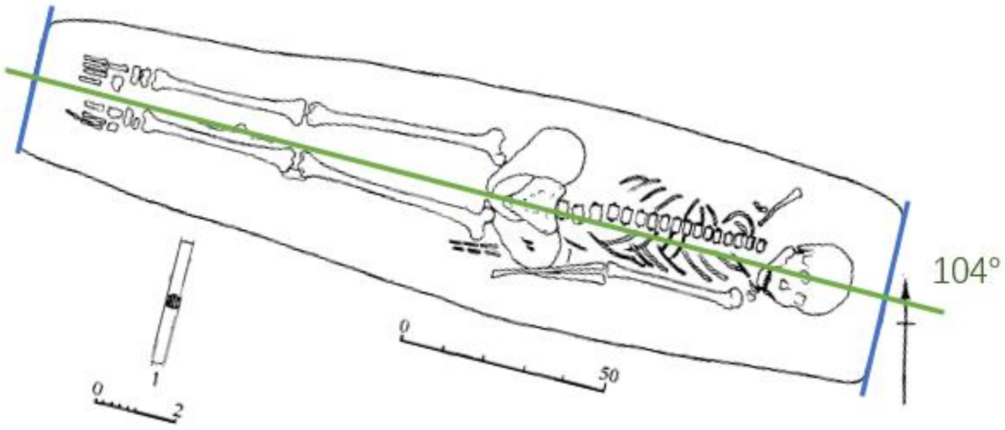



**Figure 3.8, burial M2137 at Wangyin, illustrating the method for measuring orientation.**

It is worth noting, however, that early excavations often relied on manual compasses, which may not have provided the same precision as modern electronic compasses. Factors such as the size of the compass reading surface, ease of reading, and the patience of the person taking measurements could introduce minor errors. As a result, the orientation angles recorded in excavation reports may have inaccuracies, potentially ranging from 1° to 2° or more. Even modern electronic compasses are not infallible, as their accuracy can be affected by battery life or nearby magnetic interference, such as from mines. For instance, Taer Mountain, a huge mine to the east of the Taosi site, could significantly impact compass readings. While electronic compasses offer advantages such as resistance to shock, compensation for stray magnetic fields, and integration with other electronic systems (Institute of Semiconductors CAS, 2018), archaeologists often use simple, readily available compasses during excavations. These measurements, even when taken with GPS, may not meet the precision required for astronomical analysis, as their primary purpose is often different. Therefore, this study applies a 2° reading error to the burial orientation data provided in excavation reports.

Although the common method of grave orientation measurement is elaborated above, some early excavators may have measured the orientation based on different reference points such as the pit’s or coffin’s orientation, while others measured the orientation of the grave owner’s body, For example, the skeletal remains in southern tombs were often largely eroded, sometimes the excavators might have recorded the orientation of the grave pit or coffin instead of the body. Thus, the orientation of burials in different conditions may have been determined by different comparators. We should also avoid the inertia of thinking that the ancients only pointed in the only direction by the orientation of the head. For instance, the Pre-Modern Ainu hunters in Japan oriented burials based on the direction of the feet rather than the head, as discussed in Chapter 7.

According to Silva (2020), uncertainty in orientation measurements arises from the lack of clarity about what the ancient people were aligning their burials toward—whether it was the body, coffin, grave edges, or other features. Ideally, all possible orientation lines should be measured to determine a range of possible orientations. However, due to the large number of burials included in this study and time constraints, it is impractical to remeasure every burial. Instead, at least three graves from each period at each site were remeasured using a more comprehensive approach. For example, burial M1 from the Xipo site (figure 3.9) originally recorded an azimuth of 275° in the excavation report. After accounting for a 6° uncertainty from measurement and a 2° reading error, the total uncertainty is 8°. The highest uncertainty value from the three remeasured graves was selected to ensure data reliability. A complete list of uncertainties for all 18 sites is provided in the recording forms (Appendix 5).

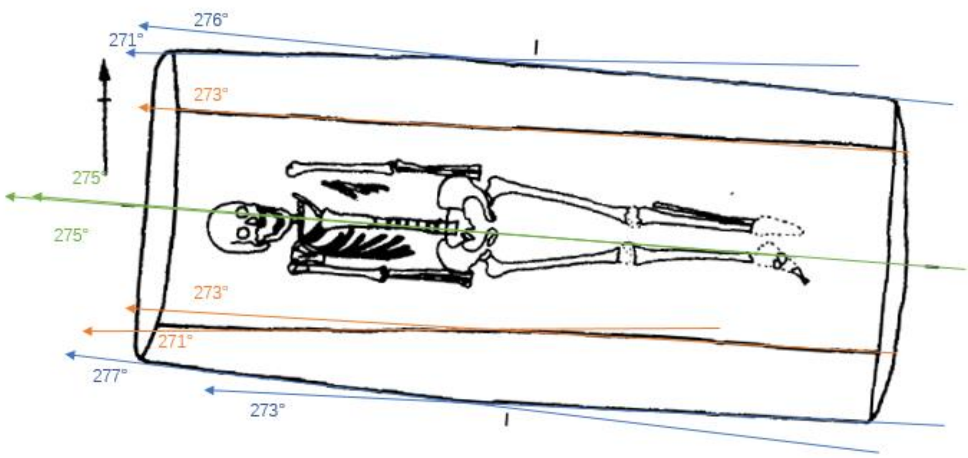


**Figure 3.9, uncertainty measurement of the burial M1 at Xipo.**

### 3.4.2 Magnetic Azimuth and True Azimuth

All grave orientations were measured using compasses, which rely on magnetic north. Magnetic north refers to the direction of the Earth's magnetic north pole, which is distinct from the geographic north pole. The magnetic north pole is approximately 1,500 km away from the geographic north pole and shifts over time (Tallergao, 2010).

For astronomical analysis, magnetic azimuth must first be converted to true azimuth, which is based on true north. True north is the north of the earth in the geographic sense, the point where all the longitude lines on a map or globe convergence. Because the position of the Polaris varies very little, thus, it was measured out from the position of the Polaris, which differs by about 1 degree. The true north is also a fixed point with minor movement (Jones, 2022).

Excavators typically use magnetic north because measuring true north accurately requires satellite technology, which was not widely available in earlier excavations. Even modern GPS devices used in archaeology often record angles based on magnetic north. However, the azimuth that provided by Stellarium, ArcGIS and Google Earth use true north, necessitating the conversion of magnetic azimuth to true azimuth for this study.

True azimuth (A) is the clockwise angle from true north to the target direction line, while magnetic azimuth (Am) is measured relative to magnetic north. Magnetic declination (δm) is the angle between magnetic north and true north, which is positive when it is east of true north and negative when it is west, and it varies by time and location (NOAA, 2023). The measurement of magnetic declination was searched on National Centres for Environmental Information (NOAA), calculated based on IGRF (1590-2024) model (NOAA, 2021). In comparison to World Magnetic Model (WMM) (2019-2024) and Enhanced Magnetic Model (EMM) (2000-2019), IGRF is the only one provides data for periods before 2000AD. It will be calculated on the year that the burials and houses were mainly excavated, in terms of the description in excavation reports. Magnetic compensation for the target direction is to reduce the magnetic declination to the west and increase it to the east (A=Am+δm).

After calculating the true azimuth for all burials at each site, the result were organised as shown in table 3.2 for further analysis, which will be explained later. A complete list of magnetic and true azimuths for all burials at the 18 sites is provided in the recording forms (Appendix 4).

| Chronology | No. | Magnetic Azimuth(°) | Magnetic Declination | True Azimuth (°) |
|---|---|---|---|---|
| The Dawenkou period | 1 | 90 | 6.53° W | 83.47 |
| The Dawenkou period | 2 | 97 | 6.53° W | 90.47 |

**Table 3.2, burial orientation, position and type of each site, compiled from excavation reports.**

### 3.4.3 Calculating Declination (δ)

To align true azimuth with the corresponding position in the sky, a celestial coordinate system is required, which includes declination. This declination is distinct from magnetic declination and refers to the angle between a celestial object and the celestial equator (Walker, 2019). The celestial equator is defined as 0°, with positive declination values in the northern celestial hemisphere and negative values in the southern hemisphere. For example, the north celestial pole has a declination of +90°, while the south celestial pole is -90°. In this study, the declination range calculated from the true azimuth range of graves at each site helps identify potential celestial targets within that range.

Declination is calculated based on three factors: true azimuth direction, latitude of observation (φ) and altitude angle. The calculation of altitude angle is also an essential step before we calculate declimation, detail is refed to Walker (2019). As shown in figure 3.10, ho is the altitude of the grave's location, hz is the target landscape's altitude, D is the horizontal distance between the grave and target landscape. Following the formula of tangent below, altitude angle of hs could be calculated.

$$hs = \tan^{-1}\frac{hz - ho}{D}$$

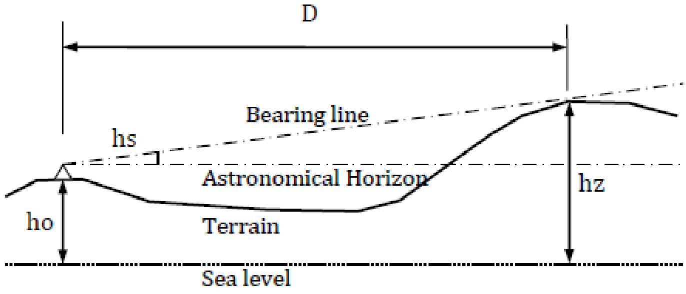



**Figure 3.10, schematic of altitude (hs) and the formula for altitude calculation (Walker, 2019).**

The formula for declination calculation (Ruggles, 2015c: 461) is provided below, A latitude in the southern hemisphere would require to be negative, but since China is in the northern hemisphere, it is positive. As also shown in figure 3.11, Ruggles' formula for azimuth angle is abbreviated as A, while hs is used in here for consistency.

$$\sin \delta = \sin \varphi \sin h + \cos \varphi \cos h \cos hs$$

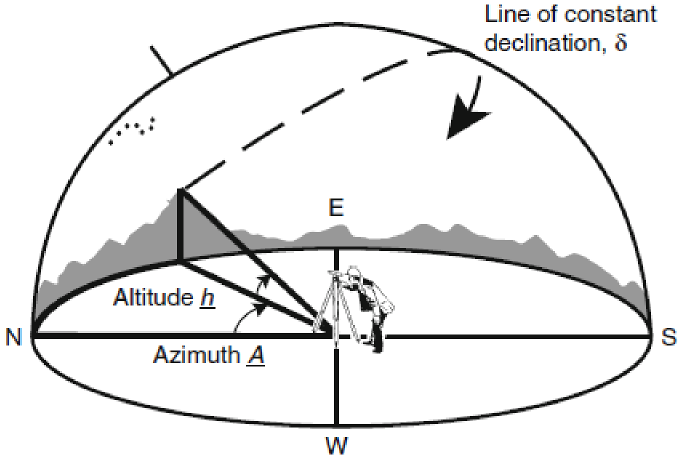



**Figure 3.11, schematic of the declination of a horizon point (Ruggles, 2015c: 461).**

### 3.4.4 Estimating altitude and elevation in HeyWhatsThat

By importing the coordinates of each selected site into HeyWhatsThat, the elevation and the altitude of the surrounding landscapes from the location of coordinate can be automatically calculated. For instance, setting the coordinate to Xipo site generates an apparent horizon in all directions (figure 3.12). By specifying an azimuth of 262° (indicated by the yellow-brown line), the altitude is calculated as 3.02°, and the height of the landscape in this direction is detailed in the accompanying table (figure 3.12). It is important to note that the satellite map used by HeyWhatsThat are sourced from Google Earth, which may have minor discrepancies from actual conditions. The further the horizon, the greater the potential error, resulting in altitude angle calculations with an error margin of approximately 1.5° to 2°.

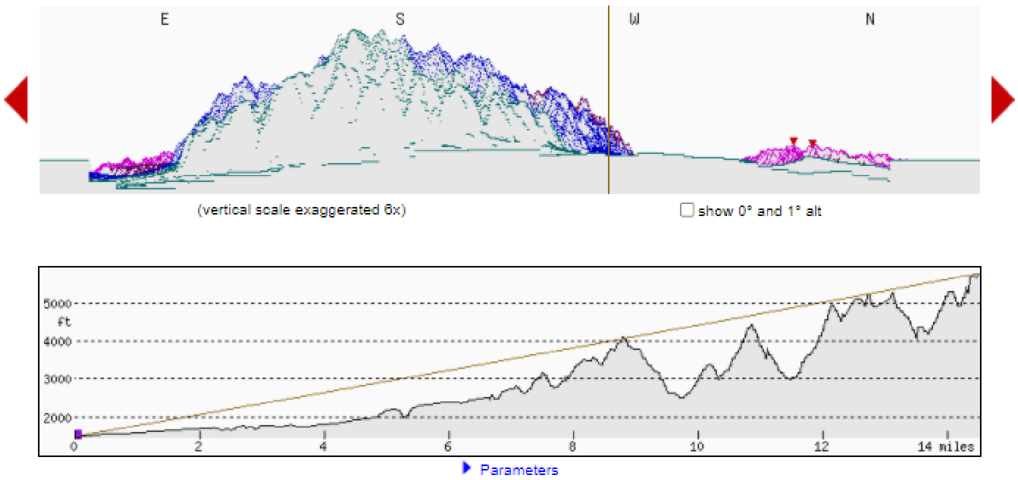



**Figure 3.12, example of HeyWhatsThat functionality (HeyWhatsThat, 2022).**

## 3.4.5 Estimating possible celestial targets from skyscapeR

In recent decades, the astronomical targets that most frequently be measured are the four cardinal directions, the two solstitial axes, the arc of the Sun between the solstices, the arc of the Sun climbing in the sky (from the azimuth of the winter solstice to due north), the major lunar standstills, the rising/setting of brightest stars (Magli, 2016, p. 46), i.e. the Big Dipper or the North Star. Slightly less obvious targets, if there are historical/cultural reasons for them.

The skyscapeR package, an R-based tool, was used to analyse and visualise the data collected and calculated above. This tool enables researchers to reduce, visualise and analyse data for skyscape archaeology, archaeoastronomy and cultural astronomy (skyscapeR 2022; Silva 2022a). It incorporated altitude data from HeyWhatsThat to calculate the declination (δ) and modelled the true azimuth and declination of grave orientation as a probability distribution, visualising them using summed probability densities (SPD) (Silva 2020b). This allowed a significance test to be made, where the SPD of grave orientations were compared against the expected distribution, under the assumption of random orientation (the null hypothesis). Only orientations that peak outside of the 95% confidence envelope of the null hypothesis are considered statistically significant, allowing a narrower range of data to be highlighted as the focus for potential alignment targets. For example, the blue curve part above on the grey part (highlighted by green in the bottom) is the significant burial orientation range that will be used in next step of analysis (figure 3.13). A further use of skyscapeR was to automatically find celestial events corresponding to this significant range. These potentially included sunrise or sunset on specific dates, lunar extremes and stars. The calculated results and potential celestial events and celestial targets are listed in appendix 6.

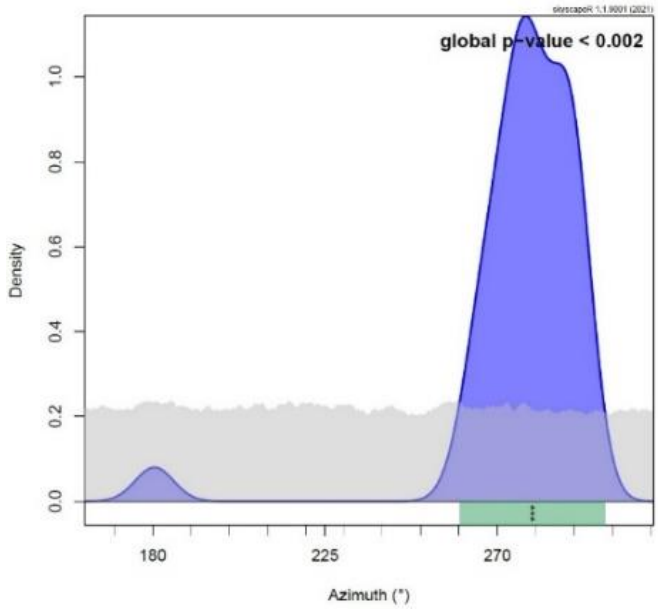



**Figure 3.13, SPD of the significant burial orientation at Xipo cemetery.**

### 3.4.6 Observing Potential Celestial Targets in Stellarium

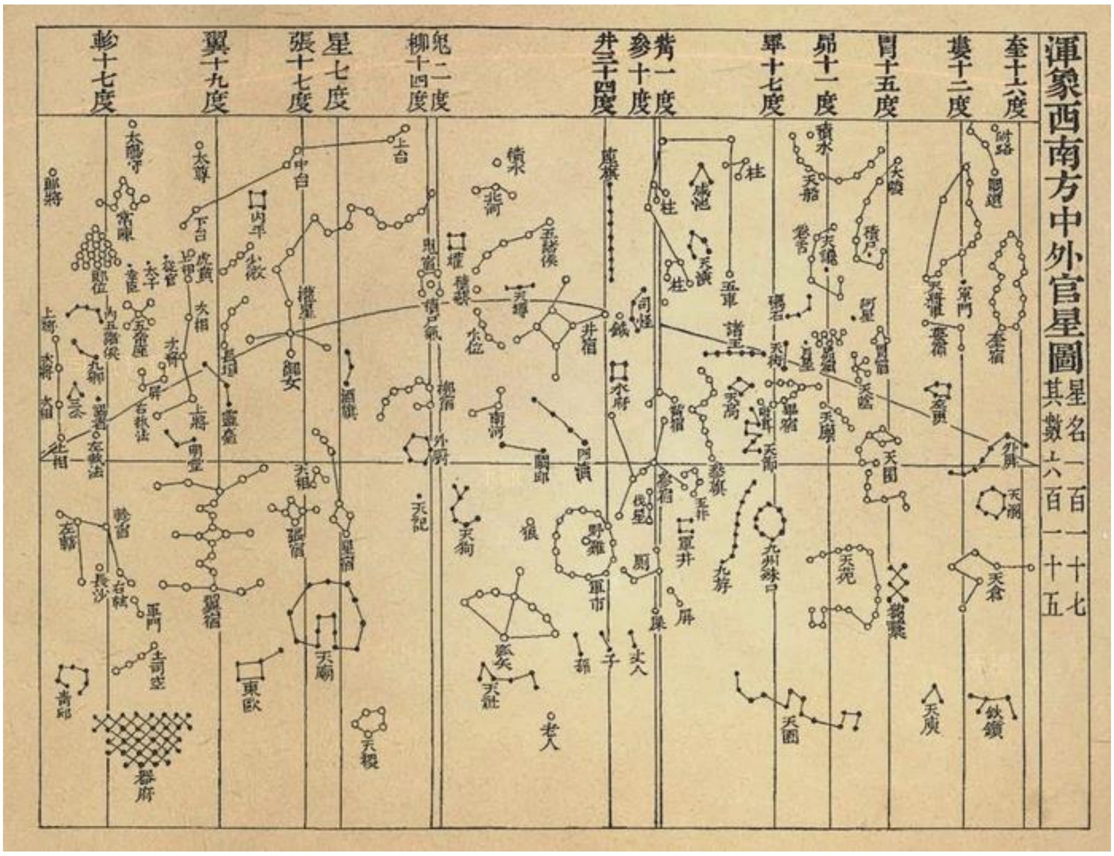
Stellarium is a simulated astronomical observatory software that provides detailed simulations of astronomical phenomena, including sunrise/sunset, moonrise/moonset, constellation images, equatorial coordinates, horizon coordinates. It is particularly useful for visualizing potential celestial alignments and targets from specific prehistoric periods (Stellarium, 2022). More convenient observation requires a plug-in which is called Archaeolines, to emphasis the azimuth range, declination range, solstices and equinox alignments. This software is therefore suitable for running prehistoric period simulations of potential celestial phenomena derived from skyscapeR to give an intuitive visualisation.

By integrating the landscape model from HeyWhatsThat with Stellarium simulations, a reconstructed view of the combined skyscape and landscape is created. This allows for the visualization of potential astronomical alignments and archaeological lines from the perspective of a person standing at the site. It should be noted that Stellarium uses the Julian calendar for all dates prior to AD 1582, so 11 minutes and 14.8 seconds were added to each year. (Stellarium 2022). For example, at the Xipo site in 3100 BC, the spring equinox therefore occurred on 16th April and the autumn equinox on 17th October. At the Qingliangsi site in 2030 BC, the spring equinox was on 7th April.

Since this research focus on the Neolithic period, the exact dating of each site is provided by the excavation reports, which typically provide absolute dates from carbon dating and relative dates from artifact typologies. Stellarium can only provide analogue results for a particular day and moment in a particular year, so the middle year of the chronological range was taken as a compromise in this research. The movements of the fixed stars themselves are not as variable as those of the planets, but rather regular, so the results are not too different either before or after the year. And the burial orientation is a range, not a point, so the need for numerical precision is not as high compared to studies such as Stonehenge.

In addition, some sites may have long period of time with multiple cultural periods, so the excavation report further divided their chronology. This research also follows this division, and data analyses were done separately for each sub-chronology. For example, the Jiangzhai site is divided into the Banpo phase (5000-4300 BC) and the Shijia phase (4300-4000 BC), so the results of astronomical calculations are performed separately for each phase to improve accuracy and avoid conflating cultural influences on burial orientations.

To align the analysis with Chinese skyscape traditions, the Chinese Medieval skyculture is applied, based on *Xing Yi Xiang Fa Yao* (新仪象法要) star map (figure 3.14 top and bottom), 28 Mansions are extracted as important references. The marker star in each of the 28 Mansion used to measure the distance and position between the 28 Mansions. This was the standard for determining longitude in the ancient Chinese equatorial coordinate system. This map, dating back to AD 1052, includes 283 Chinese constellations and 1,464 stars, each with English translations (Stellarium, 2022). Despite being thousand years away from the period that this thesis focuses on, this is as close as stellarium can come to providing skyculture.



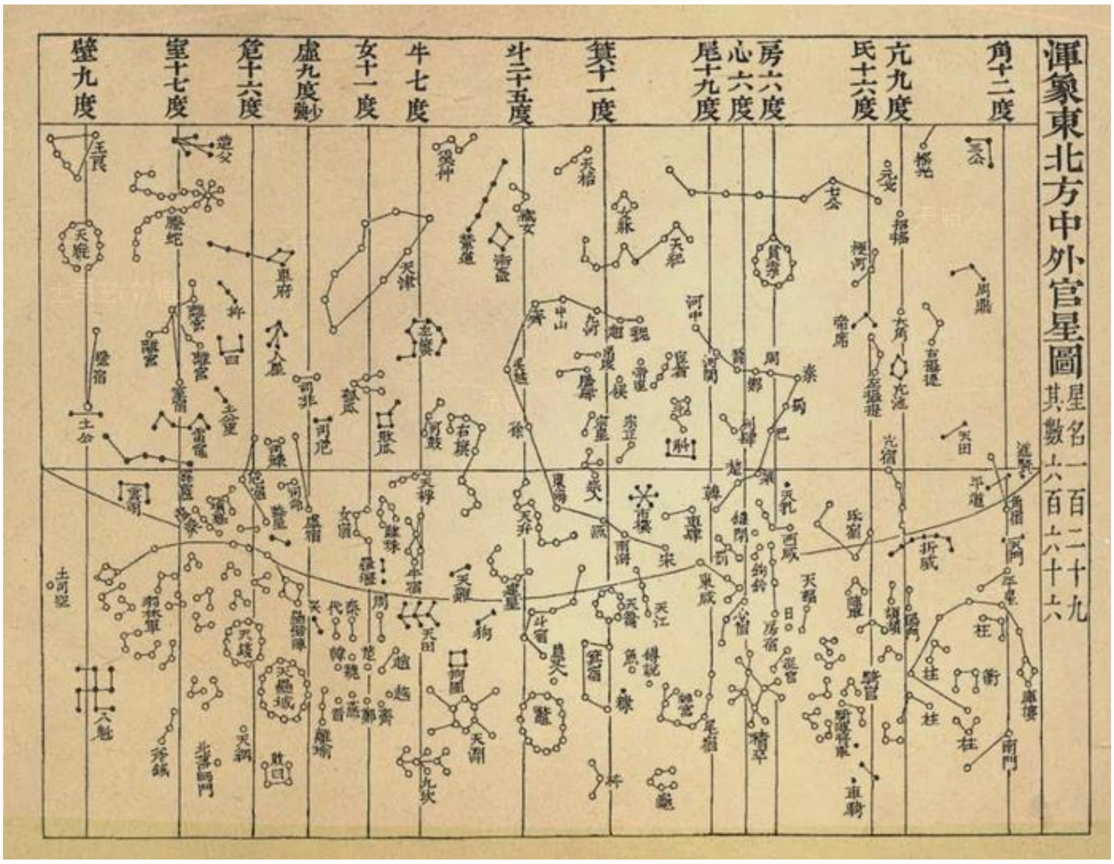



**Figure 3.14, Xing Yi Xiang Fa Yao star map made by Su Song in AD 1088 (top and bottom)(Stellarium, 2022).**

Observing the stars is more complex than observing the sun. For example, when is the best time to make observations? Where in the sky? According to Zhu (1979)'s calculation result that described in Chapter 1, the optimal times for observing the Mansions are twice after sunset and twice before sunrise, separated by 0.5 hours (Chuhun, 初昏) and 1.5 hours (Dahun, 大昏). Another method involves observing mansions on top of the southern sky at 23 to 1 o'clock, this is called Hunzhong (昏中), when atmospheric disturbances near the horizon are minimized. Prehistoric people likely transitioned from observing stars on the eastern and western horizons to focusing on the southern midheaven over time (Chen, 2003, p. 9). One possible way of observing the midheaven is to focus on a location in the sky indicated by an artefact or artificial construction, although graves were unlikely to have such a function. This research therefore considered observation of celestial targets on the horizon for 0.5–1.5 hours before dawn and after sunset.

By linking the simulation results with the landscape model from HeyWhatsThat, a comprehensive view of the combined skyscape and landscape is reconstructed. Potential astronomical alignments and archaeological lines are then added to reproduce the potential astronomical images visible at the selected ranges from the point of view of a person standing on the site. For example, at the Xipo cemetery, mansions, astronomical alignments and landscape are marked on the western horizon, providing a visual representation of what a person standing at the site would have seen (figure 3.15). Simulations for all 18 sites, including views at four optimal times on both the eastern and western horizons, are provided in Appendix 7.

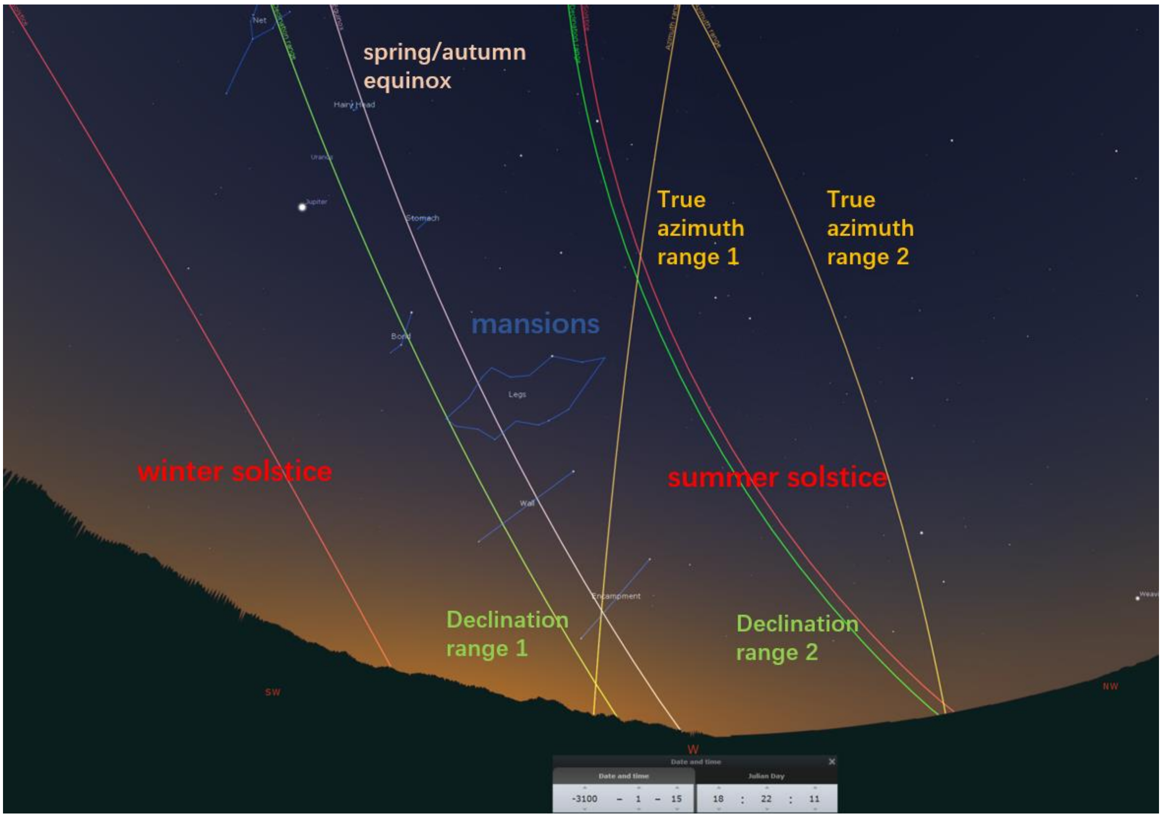



**Figure 3.15, simulation of skyscape and landscape at Xipo (Stellarium, 2022).**

## 3.5 Summary

After an initial screening of approximately 200 Neolithic sites in China, data from 18 sites were selected as providing a relatively comprehensive overview of the various regions, periods, and cultures of the Neolithic period in China. Astronomical calculations converted the data of burial orientations provided by the excavation reports into a corresponding range of sky coordinates, allowing potential astronomical targets within this range to be circled. These candidate celestial objects are the targets that will be discussed in this thesis in order to further reason about the Neolithic people's concepts of life, death, and cosmology by determining their relationship to the culture behind each site and the way of life of its inhabitants.

Before discussing the concepts of life, death and cosmology, a more detailed description of the archaeological material is needed to construct the specific details of the 18 sites. In Chapter 4, the geography of each region of China, and the main ways of subsistence of the inhabitants will be described in detail. Each site will also be targeted, with a detailed description of the structure of the site, the social structure, the arrangement of the burials, and the burial practices. The special feature of this study is that it establishes the likely astronomical 'facts' through scientific and technological means, while at the same time exploring the possible sky cultures behind the burial orientations observed by taking their social and cultural contexts as clues. This avoids our becoming lost in the billions of possibilities in the sky or in any natural features that may stand out on the horizon.

Research dominated by structural orientations has specific drawbacks (Ruggles, 2015a, p. 361; 2015b, pp. 376–380). From the data presented in this thesis, its shortcomings can be set out as follows. Firstly, due to time and space constraints, in some regions, only one site was selected for study, such as the Qugong site in Tibet and the Shixia site in the south, which may affect the validity and cultural relevance of the results. Secondly, the exclusive focus on the range of major burial orientations may cause us to overlook other factors that may be equally relevant to any astronomical associations and significance. This also relates to Ruggles' (2015a, p. 361) observation that 'human behaviour is seldom absolutely consistent, no matter how strong the protocols governing it', a point that renders its interpretation difficult to think of in the same way as solving a physics problem or mathematical equation.

In this regard, Ruggles proposes that a data-driven approach is best seen as the first step in a long process of integrating archaeoastronomy with other archaeological data so as to better understand all aspects of the archaeological sites in question. This study can, therefore, only provide an initial approximation of the relationship between burial orientation and astronomy in Neolithic China. At this stage, it will only be possible to interpret the situation to a limited extent, and there remain incomplete aspects of perspective, which are likely to be questioned or confronted by entirely different views in the future. The door must be left open to these future interpretations, which will emerge with further relevant research.

# Chapter 4 Site selection

## 4.1 Background to the development of the Neolithic period in China

In 1987, Wenming Yan indicated, based on his examination of Chinese Neolithic culture, that the geographical characteristics of China had led to a state of relative isolation from the outside world, and that despite contact with neighbouring prehistoric cultures in certain border areas, it had been difficult for external influences to affect the basic characteristics and direction of development of the main body of Chinese prehistoric culture. Nevertheless, Chinese culture did not originate from a single source but from many regions, and the cultural landscape within which it developed was varied. Relative development across this landscape was also uneven, with cultures more developed in places with more favourable natural conditions, such as the Central Plains. Yan (1987) argues that this difference in cultural development also fluctuated over time. Since the relevant cultures were adjacent to one another and mutually influenced one another over a long period, there are, to a certain extent and within a given range, some common factors in development.

In summarising the situation in Neolithic China, Su (2004) proceeds from a not entirely dissimilar perspective, that of the development of agriculture, the division of labour and differentiation of society and the combination and reorganisation of zones. He argues that the dry agricultural zones of northern China, centred on the Central Plains, and the paddy agricultural zones centred on the Yangzi River basin (both agricultural forms will be introduced in section 4.1.3) were not isolated from each other but influenced each other and interacted in complex ways. The development of productive forces such as the emergence of new fields of labour and technological advances led to a division of labour in society and increasing specialisation. After the initial development of agriculture, the three main economic and cultural zones that had formed due to differences in natural geography were rearranged, further complicating the social vista. These three zones were the paddy rice zone of central and southern China, the dry agricultural zone of the north and southern northeast and the hunter-gatherer zone of northern northeast China, Inner Mongolia, Xinjiang, Qinghai and Tibet. By 4000 BC, the further development of agriculture and population growth led to a wave of migrations that caused a second major mingling of cultures. A third regrouping of cultural zones took place during the Longshan culture (Su, 2004).

IACASS (2010) also follows a similar perspective on the origins of Neolithic Chinese civilisation and the Neolithic cultural context, supported by more detailed and extensive data. Shelach-Lavi (2015), on the other hand, focuses on the natural environment by comparing landforms, climates and vegetation in different regions, as well as the lifestyles, religious beliefs, technologies, symbols, customs and traditions that evolved as a result. Through this lens, he explores the constant interaction between regions and societies and the development of common cultural elements, ultimately leading to the formation of a unified political entity. He demonstrates that intra- and interregional variation was a prominent feature of the Neolithic period in China.

Geographically speaking, although China's present-day terraced topography and landforms and the corresponding hydrothermal distribution have been in place since the Quaternary Period, differential tectonic uplift and sinking have continued to take place, along with other geomorphological changes, such as the erosive accretion of rivers, the elongation of lakes and the contraction of sandy areas (IACASS, 2010, pp. 50–51). These changes would have affected the Neolithic peoples' preferences for settlement sites and the range of their activities, and this may, in turn, have had an impact on their cultural identities. It is difficult, however, to explore such landscape changes during the Neolithic period, and the changes that have occurred since render it hard to obtain a true picture of regional settlement patterns (IACASS, 2010, p. 51).

The origins and development trajectories of Neolithic cultures were varied and uneven under the specific geographic conditions within China, but these cultures formed a relatively unified network of intrinsic connections, featuring constant interaction and integration between regions and societies. It is not the focus of this study, however, to explore the changes in landscape, climate and vegetation across the Neolithic period, nor to examine regional settlement patterns and specific interactions between cultures and societies. The purpose of this chapter is to provide cultural and social context as a reference point for the ensuing exploration of the underlying sky culture and cosmology behind burial orientation. Therefore, this chapter will present a general overview of the geomorphological systems and climatic variations seen in different regions of Neolithic China and briefly describe the patterns of subsistence activity developed there under the influence of local environmental conditions. The 18 sites selected for research will also be introduced.

### 4.1.1 Regional division

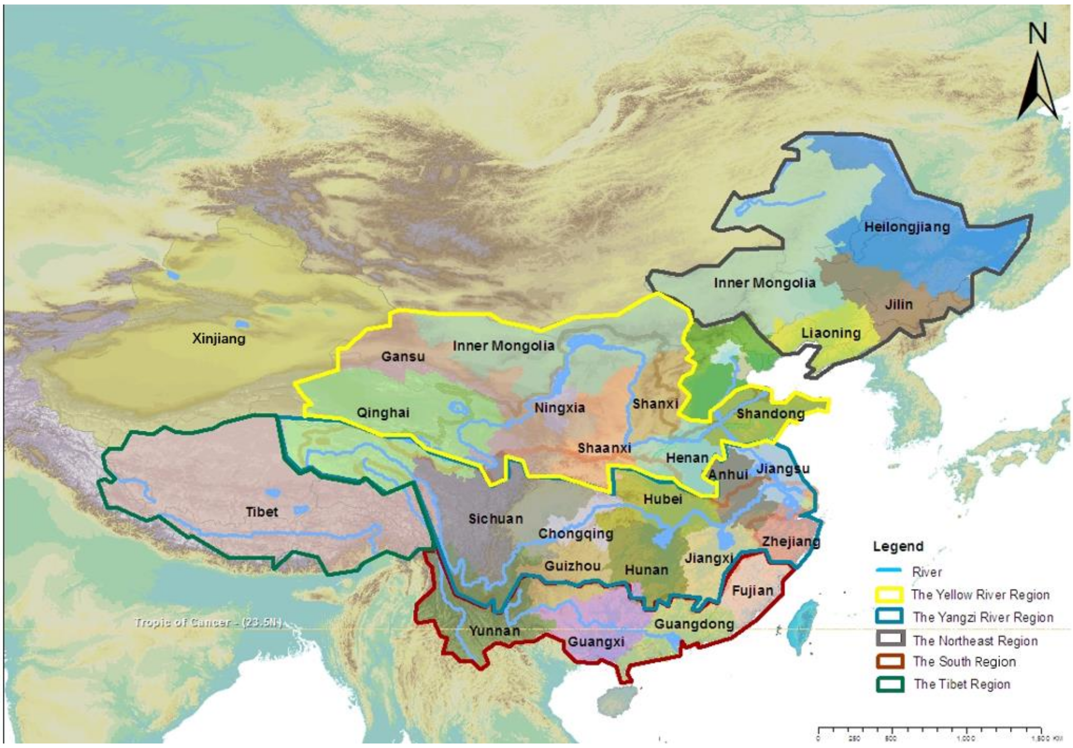
The division of China into drainage basins is one of the fundamental features of the modern hydro-meteorological forecasting service. Exactly how this is done depends on various factors. The principles of first-level watershed division may depend, for example, on spatial continuity, historical continuity, geopolitical considerations and the principle of geomorphic attribution (Zhang *et al.*, 2010). Four main approaches are applied to manage the country's complex water system: the first is based on hierarchical basin management, the second on stream network distribution, the third on maintaining both the integrity and hierarchy of natural river systems and the fourth on the attributes of rivers within a basin. These four schemes differ greatly in the methods and results of river system classification. To take the first-level river basins as an example, not all are consistent in quantity and spatial distribution, but the Yellow and Yangzi Rivers are relatively consistent, with the Huai, Zhu and Liao Rivers smaller and more geographically limited.

Regarding the classification of altitude zones in China, we can roughly summarise that Tibet and the upper reaches of the Yellow River are high-altitude zones (with an average altitude of around 4000m above sea level), which include mostly steep, high mountainous areas. The middle reaches of the Yangzi and Yellow Rivers are medium-altitude zones (1000–2000m above sea level), where the terrain is most complex, with a mixture of mountainous, plateau and basin topography. The lower reaches of the Yangzi and Yellow Rivers and the south are low-altitude zones (less than 500m above sea level), where many branches of rivers flow from the west to join the sea in the east and where the sediment they carry is deposited, creating large alluvial plains and hills (IACASS, 2010, p. 28). Due to the influence of topography and monsoon weather patterns, low-altitude zones are humid and rainy, medium-altitude zones are arid or semi-arid and high-altitude zones are cold and dry. Yan (1987) deduces from this that the most suitable areas for human activity are distributed primarily in the low-altitude zones and where the low- and medium-altitude zones meet, that is, in the mid-latitude zones with four distinct seasons, which include the middle and lower reaches of the Yellow River and the middle and lower reaches of the Yangzi River, among other areas.

In the Neolithic volume compiled by IACASS (2010), the geographical division of China in the Neolithic period is determined by the state of cultural development and the accumulation of archaeological data; in the Early Neolithic period, for example, the discussion focuses on southern and northern China. In the Middle Neolithic, it is divided between the Yellow River basin, the north, the Yangzi River basin and the south. In the Late Neolithic, the geographical divisions became more detailed, with the text divided between the upper and lower Yellow River, the north and south Yan Mountains and the northeast, Inner Mongolia and neighbouring areas, the middle and lower Yangzi River and the delta, and the south. Finally, at the end of the Neolithic, the geographic divisions are further refined according to the remains of different cultures.

Yan (1987) divides Neolithic China into six cultural regions, presenting a flower-like centripetal structure by taking as a key factor the natural geographical conditions in different parts of the country. The Central Plain is the ‘flower heart’. The Shandong region, the Yan-Liao region (the southern part of the northeastern cultural region, including the Yan Mountains and the areas around the Bohai Sea, important for the Hongshan culture), the Gan-Qing region (Gansu and Qinghai), the middle reaches of the Yangzi River and the Jiang-Zhe region (Jiangsu and Zhejiang) are the five petals. Each of these regions has its own developmental characteristics, while at the same time being linked to varying degrees.

As mentioned above, Yan (1987) and Shelach-Lavi (2015) argue that different ecological environments have different effects on the direction of their inhabitants’ economic activities and the formation of various cultural characteristics. At different levels of productivity, people adapt, utilise and transform their natural conditions differently, adjust the direction of their economic activities in response to changing environmental conditions and engage in material and cultural exchanges with other groups. On the basis of this argument and with the goal of discussing and comparing the distribution of burial orientations, this thesis will divide China's Neolithic cultures into the Yellow River and Yangzi River regions, the northeast, the south and Tibet (map 4.1). As there is no selected site in the northeast region, so the relevant information of this region is described in Appendix 2. Xinjiang, Hainan and Taiwan are not included, because their Neolithic cultural remains are too scarce to support their study. The Yellow River basin is further divided into its upper, middle and lower reaches, and the Yangzi River basin is divided into its middle and lower reaches. Details of the division will be explained in sections 4.2 (the Yellow River) and 4.3 (the Yangzi River). Although some regions' Neolithic cultures are very diverse, for the sake of clarity of purpose and in consideration of limitations of space, descriptions of the main cultures of each region have been collated in appendix 2 to provide an idea of cultural exchange and evolution.




**Map 4.1, regional division of China (Esri, 2021).**

### 4.1.2 Chronological division

The Neolithic period in China is divided by Yan (1987) into the Early, Late and Chalcolithic periods. He further divides the Early period into early and late phases. The early phase of the Early Neolithic runs from around 9500 to 8000 years ago. Stone tools of this period were made in the traditional manner of the Palaeolithic, and most of them were unifacial. Pottery was widespread but scarce and of coarse texture. Modes of livelihood were dominated by hunting and gathering, although domestic animal husbandry existed. Sites belonging to the late phase of the Early Neolithic are distributed over almost all of eastern China in the area where the low- and medium-altitude regions meet. Their dates range from around 6000 to 5000 BC or as late as 4500 BC. By this time, millet and rice agriculture had already developed in the Yellow River and Yangzi River basins, respectively. The Late Neolithic period is dated to around 5000 to 3000 BC (Yan, 1987). Agriculture was further developed and the increase in population led to the emergence of larger groups of settlements. Another important feature is the emergence of coloured pottery in the Yellow River basin, Liao River basin and Yangzi River basin, all of which saw considerable development. Finally, the Chalcolithic period (3000 BC to 2000 BC) was characterised by manifold achievements in handicrafts and new developments in building technology. In addition, the accumulation of wealth led to a clear economic gap in societies, and social status also became more strongly differentiated, a development especially strongly reflected in burial practices.

Liu and Chen (2012) propose a different chronological division, focusing more on changes in subsistence patterns, that is, agricultural development, alongside social development. From this perspective, the Early Neolithic period (7000–5000 BC) focuses on sedentism and food production, the Middle Neolithic (5000–3000 BC) on the emergence of social inequality and the Late Neolithic (3000–2000 BC) on the rise and fall of early complex societies.

Su (2004) distinguishes two periods: the Neolithic, dominated by the cultures of the Yellow and Yangzi River basins, from about 10,000 to 3500 BC and the Chalcolithic from 3500 to 2000 BC.

Cultures from surrounding regions such as the northeast, Gansu and Qinghai, southeast and south China and the southwest have also been discussed and compared separately, though not included in this cultural chronological sequence. The Neolithic volume compiled by IACASS (2010) does not provide a specific chronological division of the Early Neolithic, although it does provide a detailed description of cultures in each region during the Neolithic period. The authors conclude that the appearance of pottery marks the beginning of this period. The Middle Neolithic is broadly classified as covering from 7500 or 7000 to 5000 BC. The chronology of the Late and terminal Neolithic is classified as 5000 to 3000 BC and 3000 to 2000 BC, respectively, based on the cultures in the geographical regions mentioned in 4.1.1.

Since this study is concerned with burial orientation and possible sky cultures, for the purposes of the following descriptions and comparisons, three phases are distinguished, in broad agreement with the mainstream dating of the Neolithic. These phases are based on differences in the rate of development of the collected burial data and the cultures to which they belong. The Early Neolithic runs from 7000 BC to 5000 BC. During this period, Neolithic cultures emerged in the Yellow River and Yangzi River basins. The Middle Neolithic is dated from approximately 5000 to 3500 BC. At this time, cultures in the Yellow River basin rapidly flourished and extended into neighbouring areas, even affecting cultures in the Yangzi River region; meanwhile, the cultures of the middle and lower Yangzi River extended their influence northward. Also during this period, the cultures of the Huai River basin came into contact with and mixed with those of the Yellow River basin. Finally, the Late Neolithic or Chalcolithic period runs from 3500 to 1500 BC. This is based on the relatively late cultural development of the Huai River basin and the Tibetan region (e.g. the Qugong culture). At this time, the cultural pattern evolved from one featuring two or three main cultural groups with numerous variants into a much more diverse cultural landscape. Since cultures developed more rapidly in regions at low and medium altitudes, such as the Yellow River basin, which entered its next phase in approximately 2000 BC, the actual cultural development of the sites for consideration will be set out by region in the following introduction. Figure 4.1 places the major cultures concerned in a geographical and chronological framework to facilitate cultural comparisons when discussing burial orientation.

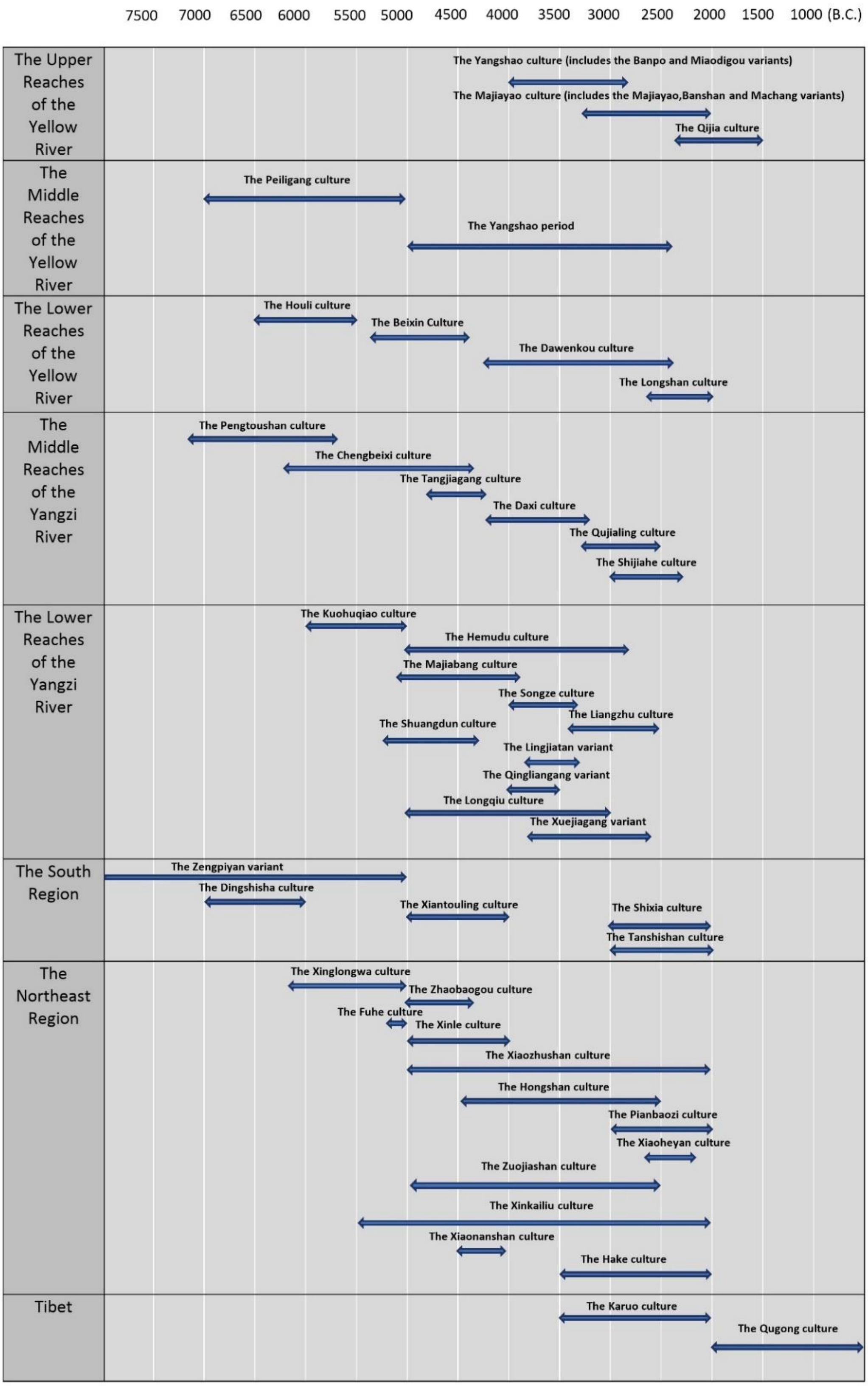


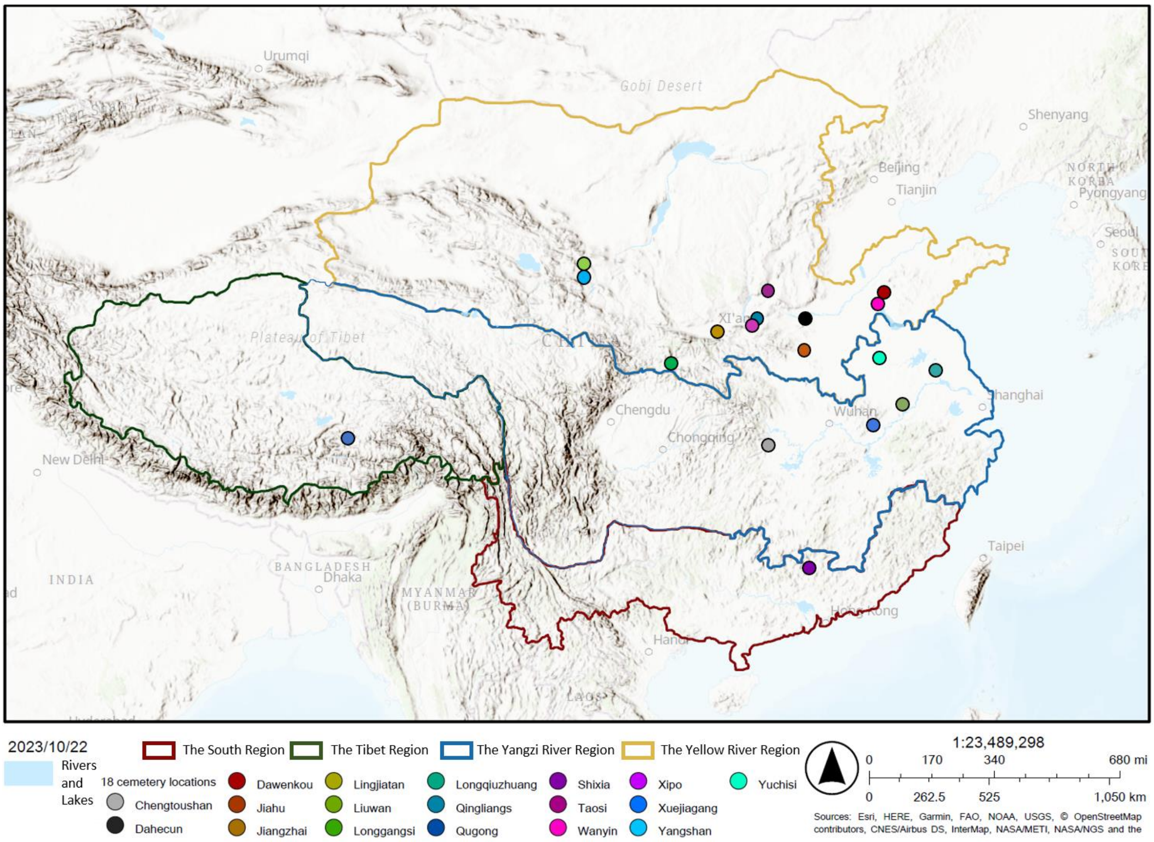

**Figure 4.1, timetable of the Neolithic cultures in China.**

### 4.1.3. Introduction of selected sites

As described in Chapter 2 Methodology, in order to understand the astronomical beliefs and world view behind prehistoric inhabitants' activities, we need to reconstruct the social complexity that provided a framework of understanding for the belief system, especially concerning high status behaviours and cognition. Astronomical belief seems to be relevant to past people's daily life, but it is hard to explore the evidence from people's routine activities. Therefore, archaeological evidence is not only collected from the material assemblages, but also the from settlement and cemetery structure and the landscape context. The settlement data mainly focus on the structure of the settlement, relationship to the surrounding landscape, as well as sacrificial remains. The description of the cemeteries mainly concerns the structure, the class of graves, burial types, positions, orientations, grave goods and special burial customs.

Apart from the basic information of the sites , such as chronology, location and site type, etc., the sites will be elaborated in several aspects below. Initially, the landscape surrounding, whether the site was built face to the south? Whether high mountains or rivers around? Was it located so as to allow the inhabitants to observe some special celestial phenomenon? Do differences in the type of geography also affect the observational preferences of local people? For example, people living in the mountains versus those in the plains. The lifestyle is also concerned to be important evidence in discussion, for instance, farming or hunting-gathering. Prehistoric farming behaviour was largely influenced by factors such as weather. It was also associated with the development of the calendar, which is also related to sun or moon. And perhaps not only the observing habit, but also the celestial and calendrical concerns of the hunter-gatherers were entirely different from those of the farming people. Also, if in the Late Period some occupants changed from a staple diet of millet to rice, this change in diet may also have affected their burial customs, or if they migrated from the Yangtze to the Yellow River cultural sphere, that may have had some cultural impact, even if the change was minor. Information of burials is the key in this thesis. The information includes burial distribution, burial customs and burial classifications. The next one is sacrificial evidence, such as pits arranged inside or nearby a cemetery, or animal pits or urn burials under houses-. It is a prominent feature of Chinese Neolithic sites, as Chinese archaeologists believe that these evidences directly relate to the sacrificial behaviours which is also reference for us to investigate the underlying belief system. Therefore, it is necessary to know whether there is an altar or sacrificial pit, or any sacrificial remains are found. Finally, there is the material assemblages, such as ceramics, stone tools, bone and jade. The development of manufacturing techniques is related to people's understanding of the cosmology, this is especially shown in the specific forms or motifs.

The sites selected for this thesis are arranged according to region and chronology as follows are Jiahu, Jiangzhai, Longgangsi, Dahecun, Xipo, Taosi and Qingliangsi in the middle Yellow River; Dawenkou and Wangyin in the lower reaches; Yangshan and Liuwan in the upper reaches; Chengtoushan in the middle Yangzi River; Lingjiatan, Xuejiagang, Yuchisi and Longqiuzhuang in the lower reaches; Shixia in the southern region; and Qugong in the Tibet region (map 4.2 and figure 4.2). The cultures involved there according to the region and chronology distribution are the Jiahu variant, the Yangshao culture (including the Banpo, Shijia, Miaodigou variant), the Longshan culture, the Taosi variant, the the Dawenkou culture, the Majiayao period (including the Banshan, Machang variant) in the Yellow River; the Tangjiagang culture, the Daxi culture, the Qujialing culture, the Shijiahe culture, Longqiuzhuang variant, the Lingjiatan variant, the Xuejiagang variant in the Yangzi River; the Shixia culture in the south region and the Qugong culture in Tibet. A detailed description of these cultures can be found in appendix 2. More site information of the selected 18 sites are attached in appendix 3. Unfortunately, although some sites may have been further excavated in recent years and significant discoveries are also published in brief reports, the data used in this study is based on the final publication of the excavation monographs and remains from subsequent excavations will be mentioned in the following content but will not be counted in the later analysis, because the final data is not published yet.




**Map 4.2, the 18 Neolithic sites in China studied in this PhD.**

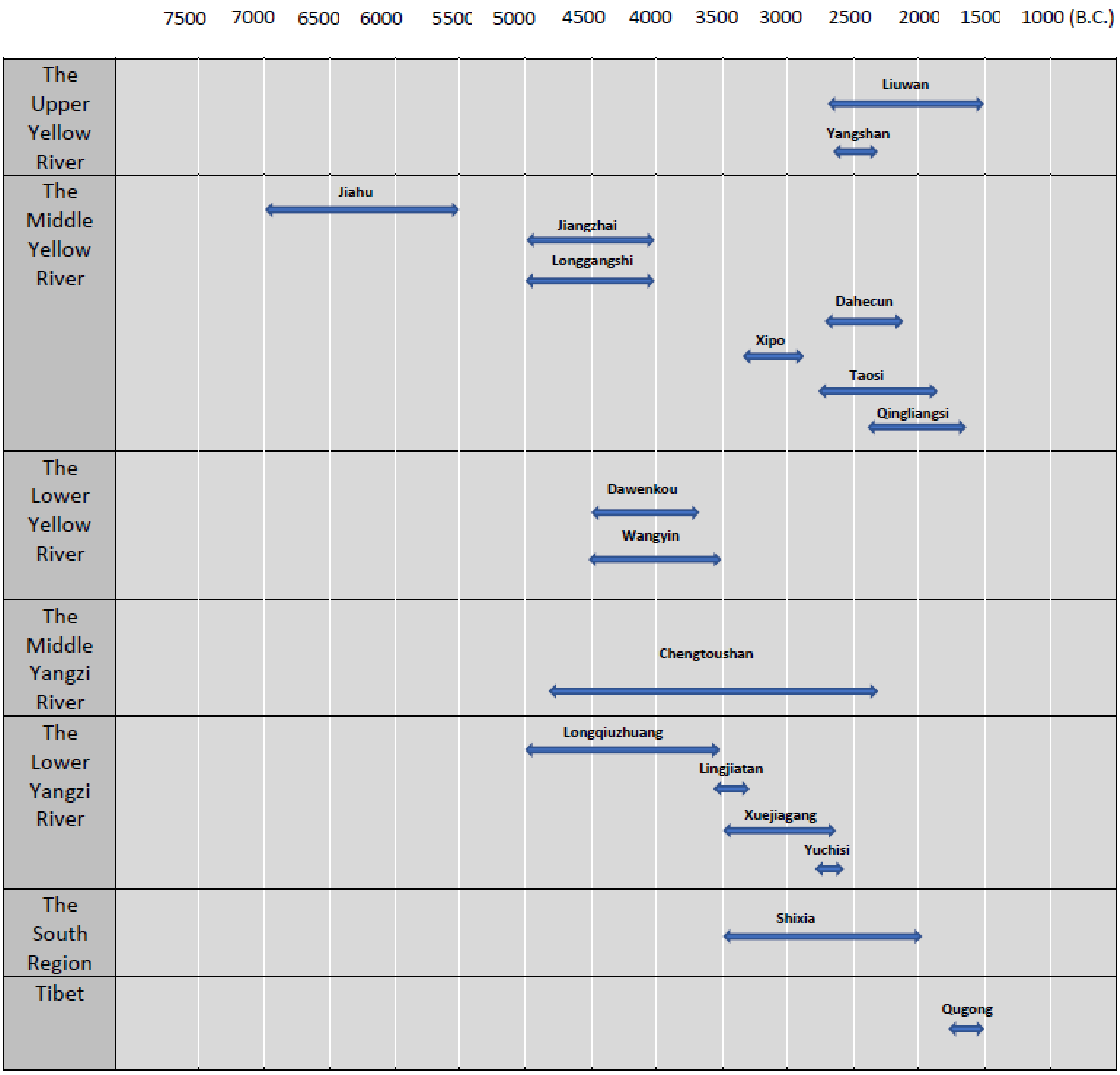


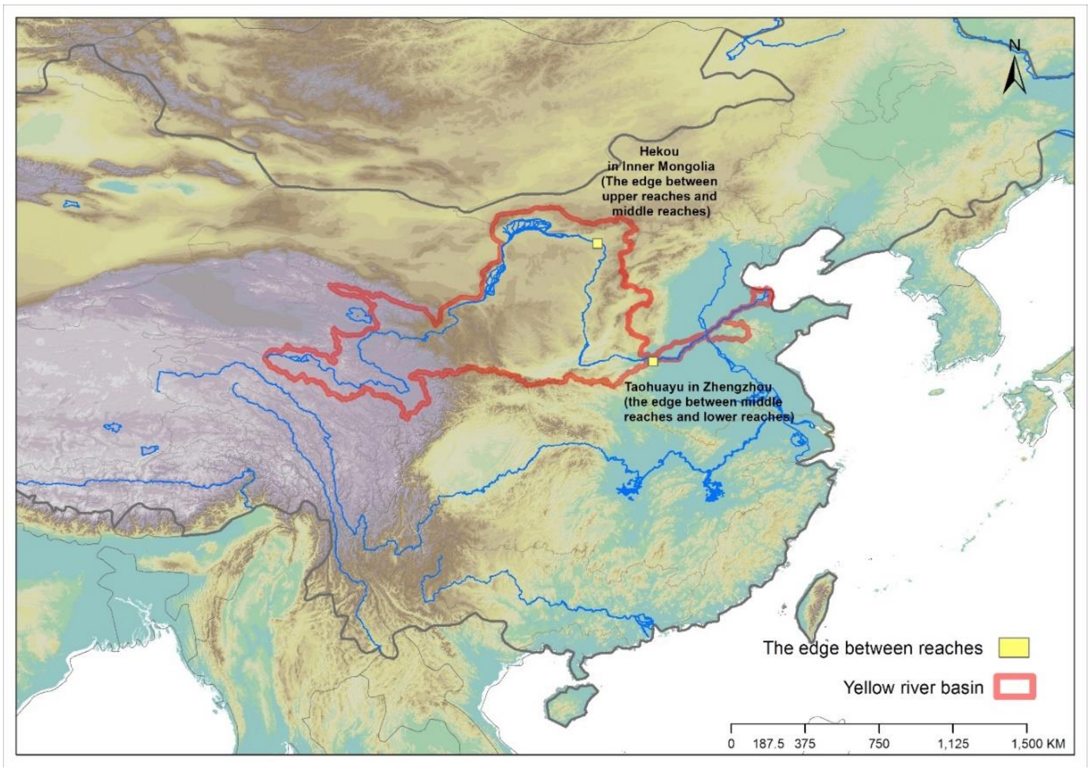

**Figure 4.2, timetable of selected 18 Neolithic sites.**

## 4.2. the Yellow River

The Yellow River basin is divided into three regions by the Yellow River Conservancy Commission: the upper, middle, and lower reaches (Map 4.3). The upper reaches span from Guide County in Qinghai to Hekou Town in Inner Mongolia, encompassing the provinces of Qinghai, Sichuan, Gansu, Ningxia, and Inner Mongolia. This region, with an average elevation above 4,000 meters, is characterized by snow-capped mountains, glacial landforms, and the northeastern Qinghai-Tibet Plateau. The upper Yellow River region experiences low annual rainfall and temperatures, and its high mountainous terrain is less conducive to farming. The mountain ranges in this area, running predominantly east-west, include the Qilian, Kunlun, Bayankara, Tanggula, Gangdis, Himalayan, and Hengduan Mountains.

The middle reaches extend from Guide County to Mengjin County in Henan, covering Inner Mongolia, Shaanxi, Shanxi, and Henan provinces. The elevation in this region ranges between 1,000 and 2,000 meters, featuring diverse landscapes such as the Taihang Mountains, Baiyu Mountain, Hetao Plain, Ordos Plateau, Loess Plateau, Qin Mountains, Yin Mountains, Helan Mountain, and Lang Mountain. The Jin-Shaan Basin, comprising the Fen River Basin (including the Yuncheng and Linfen Basins) in Shanxi, the Wei River Basin in Shaanxi, and the Linbao Basin in Henan, contains some of the most concentrated Neolithic cultural layers. This basin, located at the intersection of the middle and lower Yellow River, served as a buffer zone between the plateau and the plain. It is believed to have been the most developed area of the middle Yangshao culture, which later spread throughout the middle Yellow River region (Zhang, 1996; Dai, 1998). Today, Shaanxi, Shanxi, and Henan provinces still use this area as a central junction for their boundaries. The region has one main entrance/exit, connecting to the Yiluo River Valley in the east, where the middle Yellow River flows into the North China Plain.

The lower reaches stretch from the Taohua Valley in Henan to the Bo Sea, covering Henan and Shandong provinces. This region is characterized by low and flat topography, forming part of the North China Plain, one of China’s three major plains. The elevation is mostly below 50 meters, with a gentle slope from west to east, featuring flooded inclined plains, alluvial plains, lacustrine plains, and marine plains. As the Yellow River enters the alluvial plain, its wide and flat riverbed leads to significant sediment deposition, raising the riverbed 3–5 meters above the surrounding ground. The region is intersected by numerous rivers, including the Yellow, Huai, Hai, and Luan Rivers. The Yellow and Huai Plain, formed primarily by sediment from the lower Yellow and Huai Rivers, is a low-elevation plain with few hills, except in the Xuzhou area. The central Shandong region features hills such as Tai Mountain, Lu Mountain, and Qi Mountain, along with various intermontane basins. Due to the dense network of river branches and lakes, as well as frequent historical flooding, the river itself is less visually prominent in this region compared to others.




**Map 4.3, boundaries of the upper, middle, and lower reaches of the Yellow River and the outline of the Yellow River basin (Esri, 2021).**

During the Neolithic period, northern China transitioned from millet-based agriculture to a more diversified farming system. The semi-arid and semi-humid climate of the region, characterized by low rainfall, led to the development of dry farming, which relied on natural precipitation rather than irrigation. The Yellow River basin, dominated by grassland vegetation with scarce forests, saw early agricultural practices involving slash-and-burn techniques. Farmers would burn the land after cultivation and move to new areas, allowing the soil to regain fertility. This practice necessitated frequent relocation of settlements to sustain agricultural production (An, 1988; Reng, 2005).

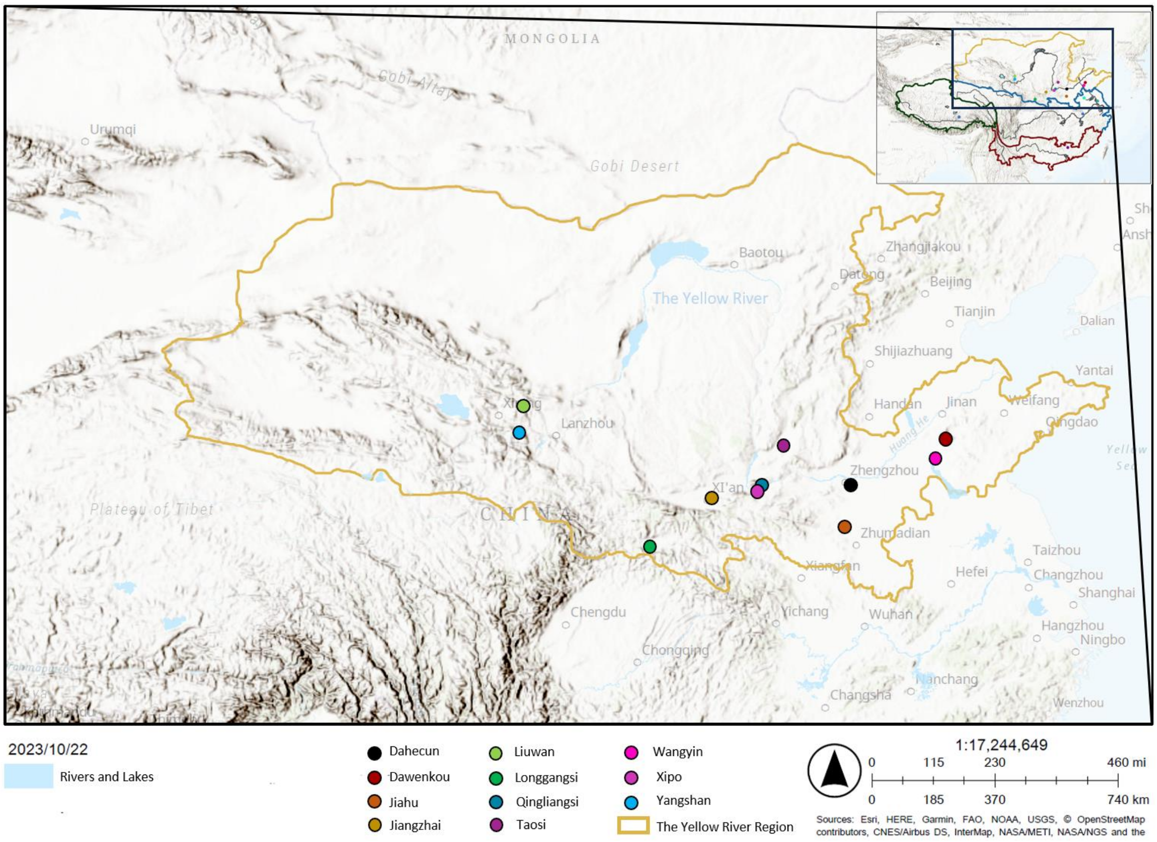
In the upper Yellow River region, agricultural development began earlier and was more advanced than in Tibet. The climate became drier after 6 ka BP, with increasing aridity from 5 to 3 ka BP, though it remained predominantly warm and humid (An, Feng and Chen, 2003). This climatic shift drove the southward migration of prehistoric sites and a transition from farming to pastoralism (An, Feng and Chen, 2003). Specifically, during the warm period of Majiayao, the agricultural economy was highly developed, especially during the Machang phase, when economic life reached an unprecedented stage of prosperity. Although not a complete replacement, it became an important means of supplementing food in addition to the primitive hunting economy (dogs, pigs and sheep) (Duan, 2012). However, by the Qijia culture period, pastoralism had grown, while agriculture declined. Wheat, barley, and oats were introduced to north China from West Asia in the Late Neolithic and Early Bronze age (Crawford, 2006, p. 78–80; Flad, *et al*. 2010; Lee, *et al.* 2007; Shelach, 2015, p. 92).

The complex topography of the MYellow River and the relatively dry, water-scarce climate compared to the Yangzi River valley led to a diversity of subsistence practices. During the early Neolithic, at the beginning of the Holocene Warm period, fishing, hunting and gathering economies dominated. However, the discovery of farming tools indicates the gradual development of millet-based agriculture (Qin, 2012). This marked a shift from a hunting-gathering economy to a farming-dominated subsistence model (Dai, 2016). Domesticated animals, primarily dogs and pigs, played a key role in food production, with pigs also serving as status symbols. Cattle, sheep, and goats were also domesticated, though their origins remain unclear, possibly originating in northern China or introduced from West Asia (Flad, *et al.*, 2007, p. 192-3).

In the late Neolithic of MYellow River, the climate as a whole began to dry out, but cultural development and population growth contributed to an acceleration in the development and spread of agriculture. Dry farming became widespread, with regional differences diminishing as crop remains became more uniform (Zhang, *et al*., 2010). Foxtail millet replaced broomcorn millet as the primary crop, though the latter remained significant. The rice economy in the Middle and Lower Yangzi River underwent a second expansion, expanded to almost the entire Yangshao culture area (Qin, 2012), including the UYellow River region , providing a complementary alternative to dry farming. The introduction of new crops, such as wheat, soy, and rice, diversified agricultural production and increased yields, while reducing risks (Yuan, *et al.,* 2020). Planting and livestock farming complemented each other, were interdependent and closely linked (Zhao, 2018). For example, fallow fields used to raise pigs for foraging and fuel collection, while cattle and sheep were able to more efficiently convert field weeds and grasses into meat, hides, wool, milk, traction, manure and dung fuel (Yuan, *et al.,* 2020).

The LYellow River region, characterized by plains and high precipitation, experienced climatic fluctuations between 8,000 and 4,000 years BP, with a generally warm climate, especially from 8,000 to 6,000 years BP (Zhang, 2000; Jin and Liu, 2002, Huang, 2018; Li and Gao, 2019). This favourable climate and topography supported agricultural development. In the context of the beginning of the Holocene Great Warm period in the early Neolithic, the early Dawenkou culture primarily cultivated millet, though rice, introduced through exchanges with the Jianghuai region, gained limited popularity (Luan, 2004). As the advance of the Great Warm period and further warming and wetting of the climate, the rice economy retreated to the Middle and Lower Yangzi River, and the Yellow-Huai region shifted to a millet-based economy (Qin, 2012). Early domesticated animals included pigs and dogs, with cattle and goats appearing later.

By the late Neolithic period, fishing, hunting, and gathering became supplementary to the rice economy (Guo, 2000). With a long and stable settled farming life, the socio-economy reached a new level. By the time of the Longshan culture, coinciding with the Middle Holocene cooling event, saw further expansion of the rice economy despite increasing aridity and temperature drops. This expansion integrated rice into the agricultural systems of more areas, particularly in the southeastern lower Yellow River region (Luan, 2004). The degree of reliance on the rice economy varies from region to region due to geographical location, at least in the southeastern of LYellow River, where the rice economy is more clearly based on a mixed farming economy of rice and drought with the integration of wheat and beans (Jin, 2001; Qin, 2012).



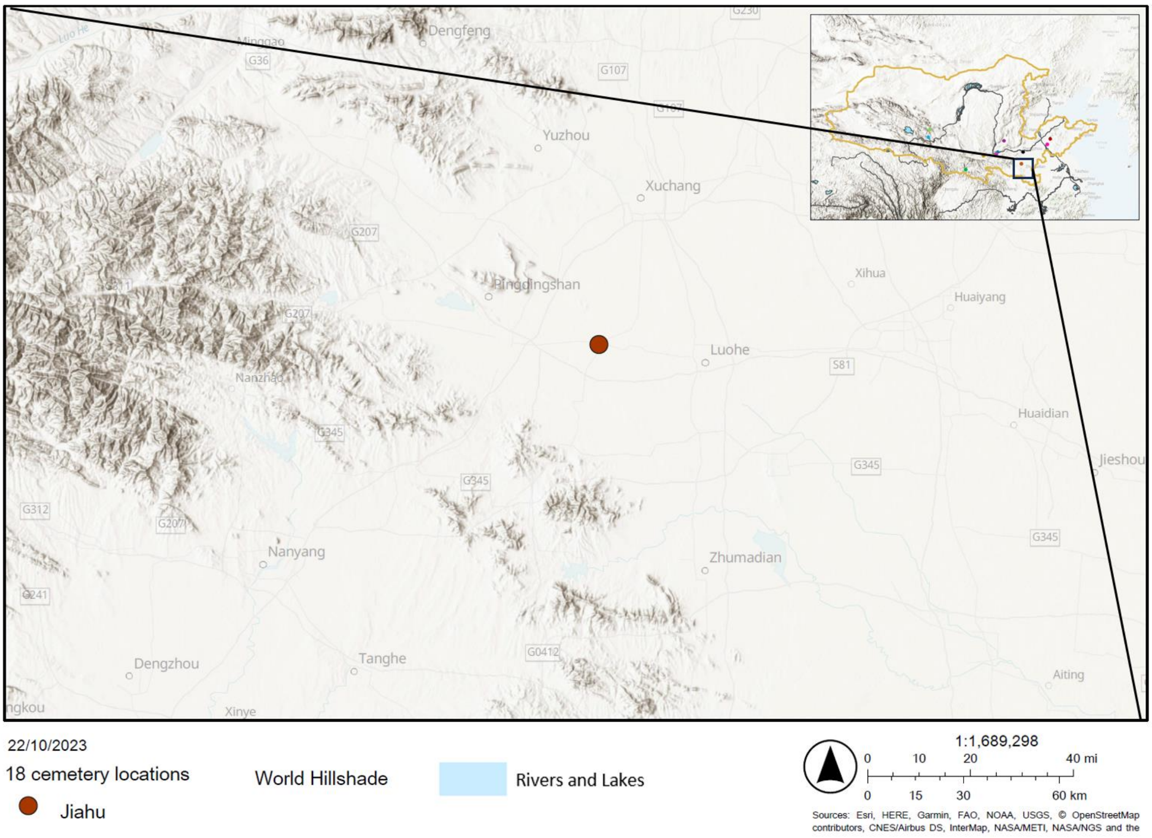

**Map 4.4, the selected Neolithic sites in the Yellow River region.**

The map 4.4 above presents the selected eleven Neolithic sites in the Yellow River region. These include Liuwan and Yangshan in the UYellow River, Jiahu, Jiangzhai, Longgangsi, Xipo and Longqiuzhuang in the MYellow River, and Dawenkou and Wangyin in the LYellow River region.

### 4.2.1 Jiahu in Henan

Jiahu was excavated between 1987 and 2013 (HPICRA, 1999; HPICRA and USTC, 2015; Yang*, et al.,* 2017) dates to 7000–5500 BC and is associated with the Jiahu variant of the Peiligang culture. The site is further divided into early (7000–6500 BC) and middle to late (6500–5500 BC) phases based on ceramic evidence (HPICRA and USTC, 2015, p. 558) Geographically, it is located in central Henan Province, Jiahu lies at a cultural crossroads, not far from the middle and lower reaches of the Yellow River, the Yangzi River, and the Huai River basin. The surrounding landscape consists primarily of plains and rivers, with distant mountains visible on the horizon.

Excavations uncovered 543 burials, 32 urn burials, 471 pits, 61 houses, 13 animal pits, and 12 kilns (figure 4.3) (Feng, 1989; HPICRA and USTC, 2015; Yang, *et al.,* 2017). Research into the interaction between Jiahu and nearby contemporary sites, such as Guozhuang in Wuyang (舞阳郭庄), Shigu, Shuiquan and Zhongshanzhai focuses on shared ceramic assemblages and cultural characteristics (Yin, 2014).




**Map 4.5, Jiahu**

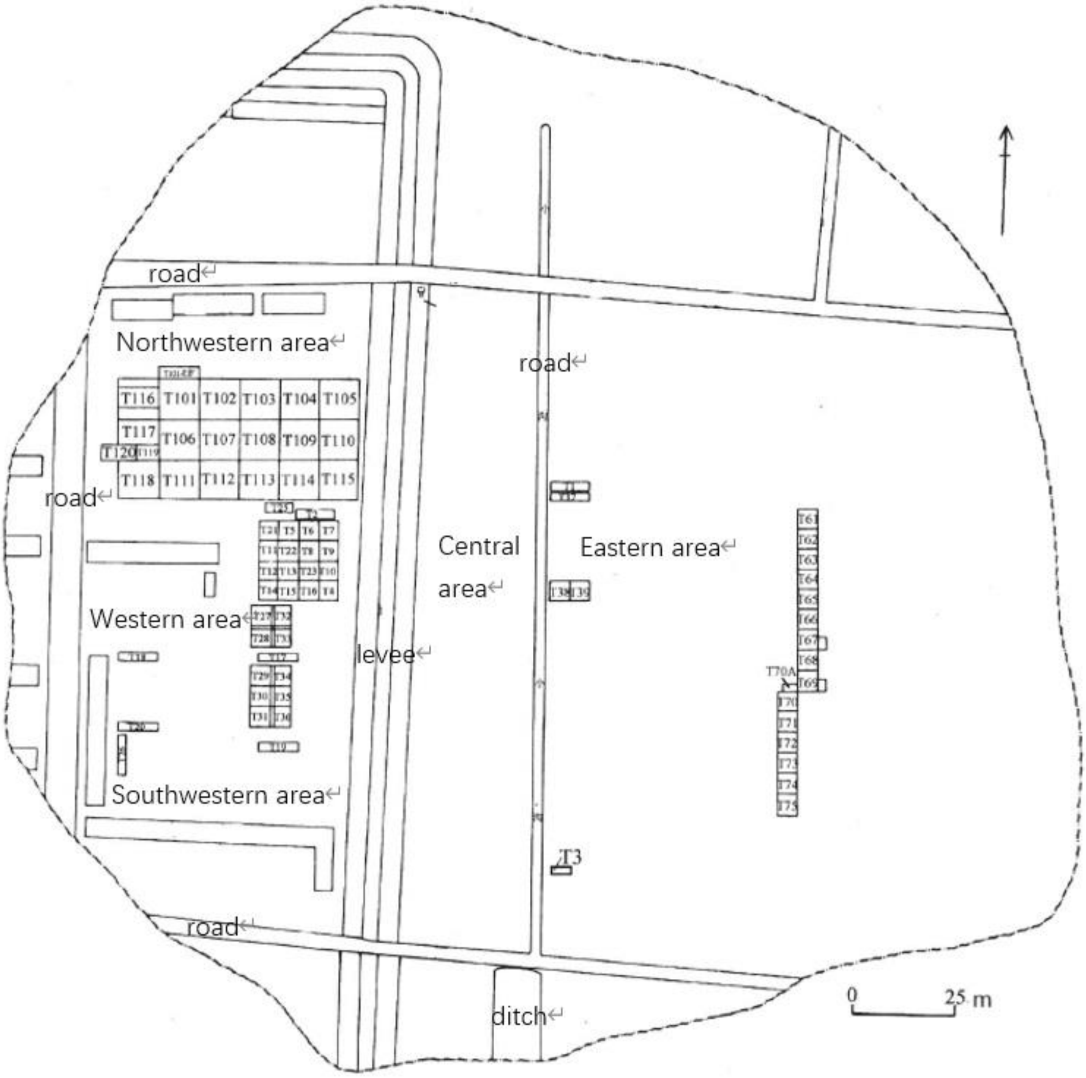



**Figure 4.3, layout of Jiahu site and excavation areas (HPICRA and USTC, 2015, p. 16).**

Jiahu provides abundant material evidence for understanding early Neolithic culture in China. While mainstream archaeology considers Jiahu a variation of the Peiligang culture, its cultural identity is more complex than initially suggested by ceramic evidence alone. Situated in a region of cultural exchange, Jiahu exhibits similarities with surrounding cultures. For instance, the discovery of rice and carbonized rice seeds aligns Jiahu's agricultural practices more closely with the Neolithic cultures of the Yangzi River and Jiang-Huai regions, likely due to similar climatic conditions (Zhang and Wang, 1998). The site also yielded a rich variety of animal remains, including buffalo, yellow cattle, goats, deer, wild pigs, fish, tortoises, and mussels.

A total of 446 graves were documented in the excavation reports. In the early phase, 51 burials were concentrated in the western part of the site, interspersed with living areas, while 6 additional burials were found in the central area. During the middle to late phases, 389 graves were evenly distributed across the western, central, and eastern parts of the site, indicating a spatial separation of living and burial areas. The burial trend at Jiahu shows a progression from west to east, with early graves mingled among houses and later graves clearly segregated into cemeteries, living areas, and manufacturing zones.

While most pits at Jiahu served as rubbish, storage, or borrow pits, a few contained unusual assemblages that may hold special significance. For example, pit H502 yielded materials not found in other pits but similar to those in graves, suggesting a possible ritual or symbolic function (figure 4.4).

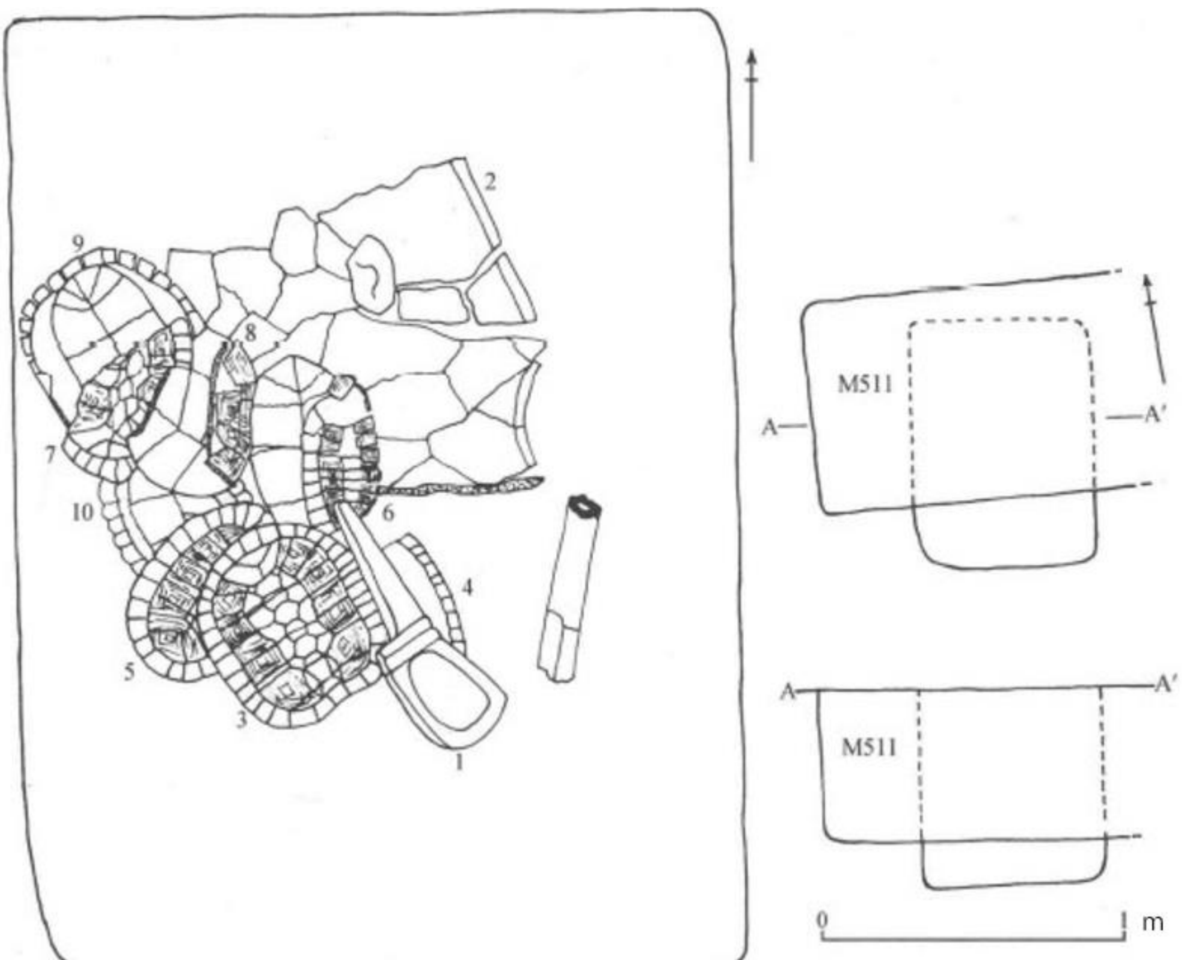


**Figure 4.4, pit H502 containing 1. Fork-shaped object, 2. Chikou pot, 3-10. Tortoise shells (HPICRA and USTC, 2015, p. 69).**

There are approximately 6 groups are identified in the first excavation, though only partially explored. Preliminary analyses of skeletal remains provided information on sex and approximate age, but detailed statistical analysis remains incomplete. Early Jiahu burials were predominantly primary extended inhumations, while middle-phase burials became more varied, with an increase in secondary burials. By the late phase, single secondary inhumations became more common. Grave pits were mostly rectangular, with only M376 featuring a stepped design. Burial orientations were primarily westward (230–320°), with 194 graves oriented between 266–275° and 146 precisely at 270°, indicating a high degree of consistency.

Of the 349 graves excavated in the first six excavations (HPICRA, 1999), 236 of them were primary burials with a single inhumation (单人一次葬), 2 were primary burials with multiple inhumation (多人一次葬), 42 were secondary burials with a single person (单人二次葬), and 13 were with remains of multiple inhumations (多人二次葬), 31 were collective burials consisting of both primary and secondary inhumations (一次葬与二次葬的合葬), 11 were incomplete primary burials where most of the skeletons were removed to other graves, this is called *Qianchuzang* (迁出葬) in Chinese. Finally, 14 graves of them lacked clear burial positions. There is a different use of the terms multiple burial and collective burial between the Chinese terminology and the British. All burials with more than one person are called *hezang* (合葬). Multiple burial means a primary burial multiple persons (一次葬合葬), collective burial means secondary burial with multiple persons (二次葬合葬) or the burial contains both primary buried person and secondary buried person (一次葬与二次葬的合葬).

Among the 236 primary single inhumations, the majority (123) were in an extended position (figure 4.5 left). That including two arms cross above abdomen(24) (figure 4.5 middle); single arm at a certain angle (25) (figure 4.5 right); missing or repositioned skulls (14) (figure 4.6 left and middle); missing limbs (24) (figure 4.6 right); slightly disturbed upper bodies (16); prone position (8) (figure 4.7 left); and single curved leg (2) (figure 4.7 middle). Two multiple burials were also found, one containing two individuals (figure 4.7 right), and the other three, the latter likely coincidental.

There are 42 graves with secondary burial of a single individual. It could be divided into three ctegories: 1) bones arranged in a skeletal shape with some missing (4, all from the middle phase); 2) bones piled around the skull (15) (figure 4.8 left); and 3) bones placed randomly (13) (figure 4.8 middle). All secondary multiple inhumations at Jiahu fell into the third category (figure 4.8 right). The 31 collective burials combining primary and secondary inhumations were divided into two conditions: 1) skulls and limbs collected and piled in a corner or beside the primary inhumation (figure 4.9 left); and 2) only a few limb bones placed beside the primary inhumation (figure 4.9 middle). The 11 *qianchuzang* burials were subdivided into two groups: 1) only skull, limb bones, and pelvis removed; and 2) all bones removed (figure 4.9 right). Additionally, 14 graves were severely damaged.

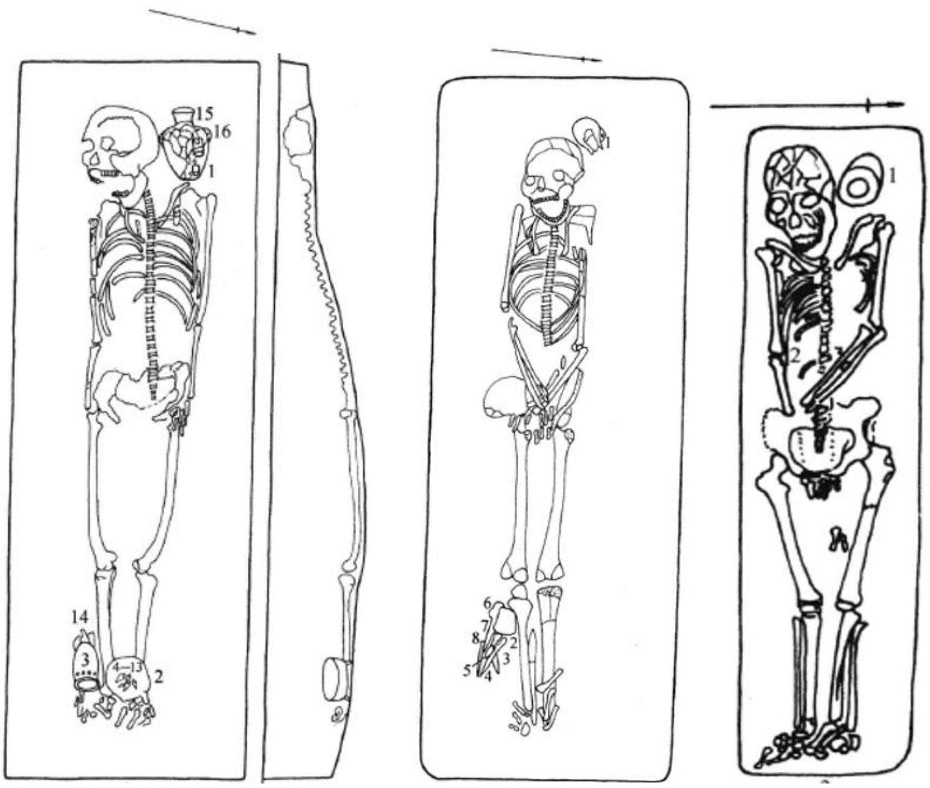



**Figure 4.5, burial M22 (left), primary extended single inhumation (1. Ceramic kettle, 2. Basin-shaped tripod, 3. Pot, 4-13 bone arrows, 15. stone axe, 16. Stone chisel); burial M60 (middle), primary extended single inhumation with hands crossed above the abdomen (1. Kettle, 2.**

**Grinding stone, 3-5. Bone dagger, 6-8, bone awls); burial M206 (right), primary extended single inhumation with one arm at an angle (1. Kettle, 2. *yaxiao*) (HPICRA, 1999, p. 153, 161, 167).**

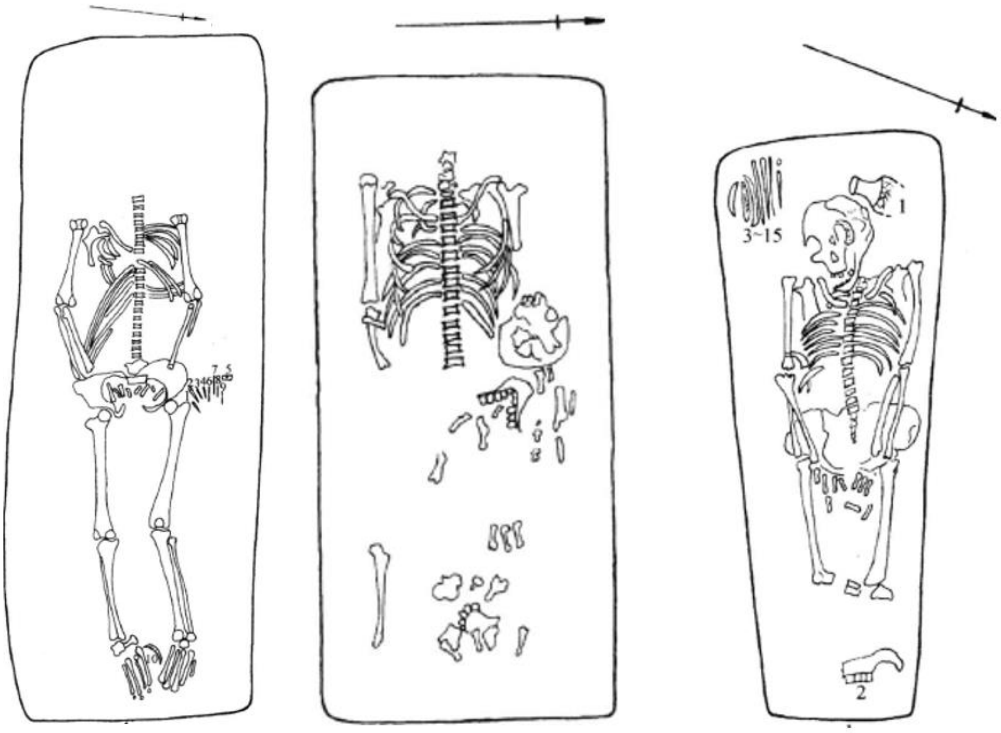



**Figure 4.6, burial M115 (right) primary single inhumation lacking a skull (1-4, 6-9. Bone needles, 5. Square-shaped stone pendent, 10. *yaxiao*); burial M105 (middle), primary single inhumation with a repositioned skull; burial M113 (right) primary single inhumation with missing lower limbs (1. Kettle, 2. Pig lower jawbone, 3. Grinding stone, 4-6, bone awls, 7. Bone dart, 8.11.14. yaxiao, 9. Shell, 10.13. bone needles, 12. Tooth ornament, 15. Bony plate) (HPICRA, 1999, p. 173-175).**

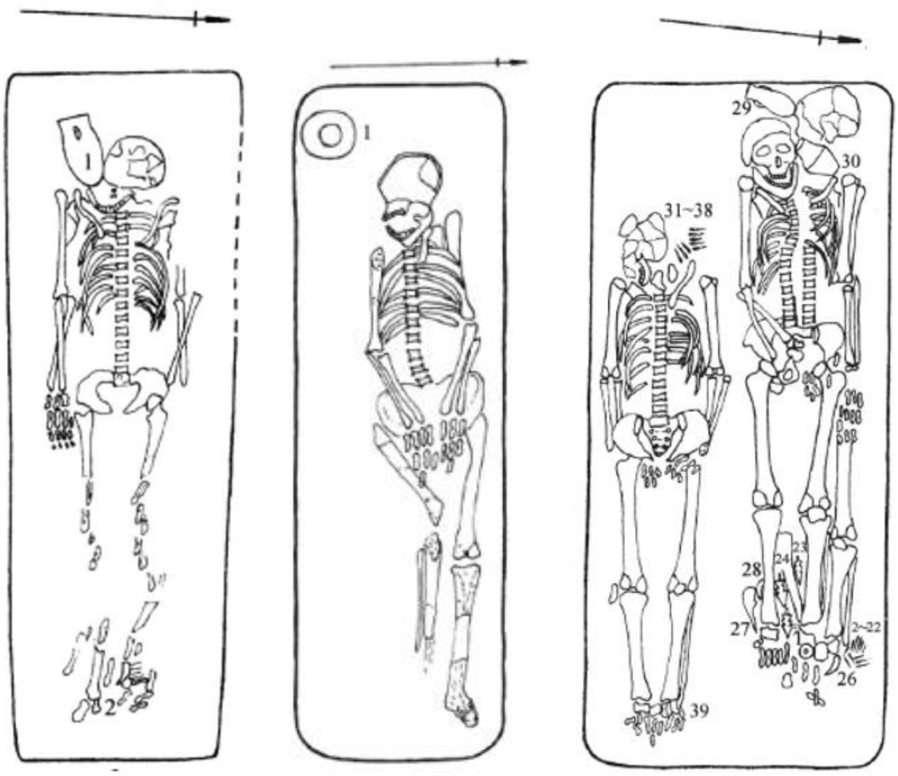



**Figure 4.7, burial M303 (left), primary burial with a prone inhumation (1. kettle, 2. *yaxiao*); burial M222 (middle), primary burial with an extended inhumation and one leg curved (1. kettle); burial M353 (right), primary burial with two extended inhumations (1. Ceramic spindle whoral, 2-22, 31-38. Bone needle, 23-24. Bone arrow, 25. Bone dart, 26, 28. Yaxiao, 27. Bone awls, 29-30. Kettle, 39. stone raw material) (HPICRA, 1999, p. 180-182).**

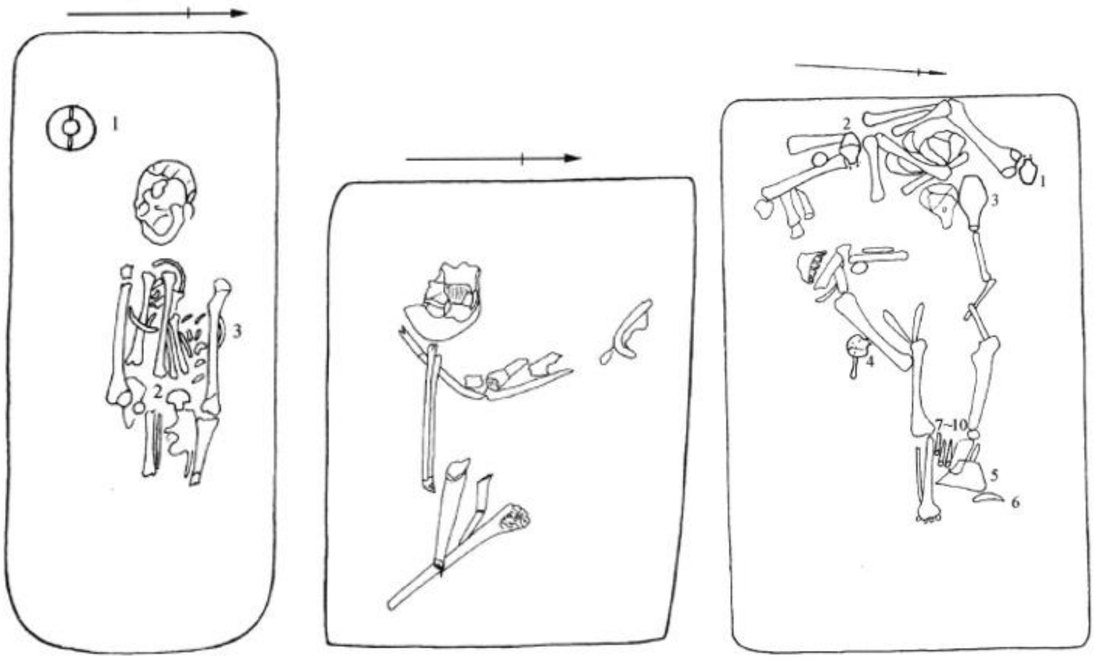


**Figure 4.8, burial M330 (left), secondary burial with a single inhumation in condition 2 (1. Kettle, 2. Handle-shaped stone object, 3. yaxiao); burial M19 (middle), secondary burial in condition 3; burial M281 (right) secondary burial with remains of more than one inhumation (1-4 kettles, 5. Millstone, 6. Yaxiao, 7-9. Bone daggers, 10. Bone needle) (HPICRA, 1999, p. 183-187).**

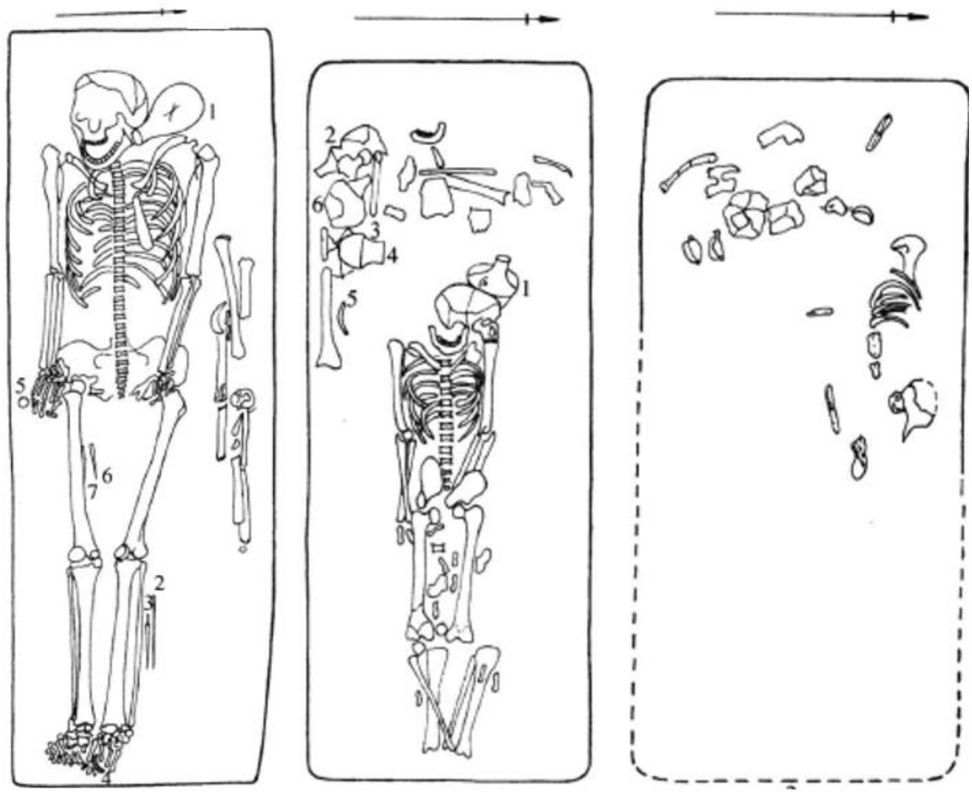



**Figure 4.9, burial M35, collective burial with one primary inhumation and one secondary inhumation (1. Kettle, 2. Bone awl, 3.6. bone dart, 5. Stone bullet, 7. Bone arrow); burial M352 (middle), a collective burial with one primary inhumation and more than one secondary inhumation (1-6. kettles); burial M288, a *Qianchumu* (HPICRA, 1999, p. 189, 195, 197).**

Grave goods were commonly found at Jiahu. Ceramics were relatively scarce, with most graves containing only one ceramic kettle, even in multiple-person burials where each individual had one kettle. Stone tools were also less abundant compared to other Peiligang culture sites, with axes and grinding stones being the most common. In contrast, bone tools and unworked animal bones were more numerous than ceramics and stone tools. The most frequent bone tools included arrows, fish darts, yaxiao (牙削), and needles, followed by daggers and awls. A few graves contained bone flutes, fork-shaped objects, handles, tooth ornaments, long bony plates, spears, and knives. Yaxiao, made from water deer tusks, were likely used as scrapers in daily life. Animal remains, such as pairs of tortoise shells, pig lower jawbones, and antlers, were also found in some graves. Zhang (2009) noted that the number of grave goods in single burials typically ranged from 1–4 in the early phase, 0–6 in the middle phase, and 0–3 in the late phase. By the middle and late phases, the distribution of grave goods began to show a pyramidal pattern, suggesting the emergence of social stratification.

Beyond the typical grave goods (one kettle, one bone needle, and one water deer tusk), bone and animal tooth tools were more prevalent than ceramics and stone tools. These assemblages can be categorized into three types:

Type 1: 25 graves contained pairs of tortoise shells, bone flutes, or fork-shaped objects (figure 4.10).

Type 2: 36 graves included everyday tools such as yaxiao, needles, awls, and daggers.

Type 3: 34 graves contained hunting and fishing tools, such as yaxiao, arrows, and fish darts, predominantly found in male graves.

The Type 1 assemblage is particularly significant at Jiahu, as it has not been identified in other prehistoric Chinese cultures. The function and symbolic meaning of these objects remain unclear. Small stones of various colors and shapes were often placed inside tortoise shells, which frequently had perforations on both sides, possibly to bind the front and back shells together (figure 4.11). Some tortoise shells and bone tools bore engraved symbols. Fork-shaped objects, often found above tortoise shells, may have formed part of a composite implement or served as a gnomon when paired with bone flutes (Wang and Zhang, 2008; Hu, 2013; Zhang and Zhao, 2015). The bone flutes, made from red-crowned crane ulnas, typically had 2–8 holes and were sometimes engraved with rhomboid patterns (figure 4.12).

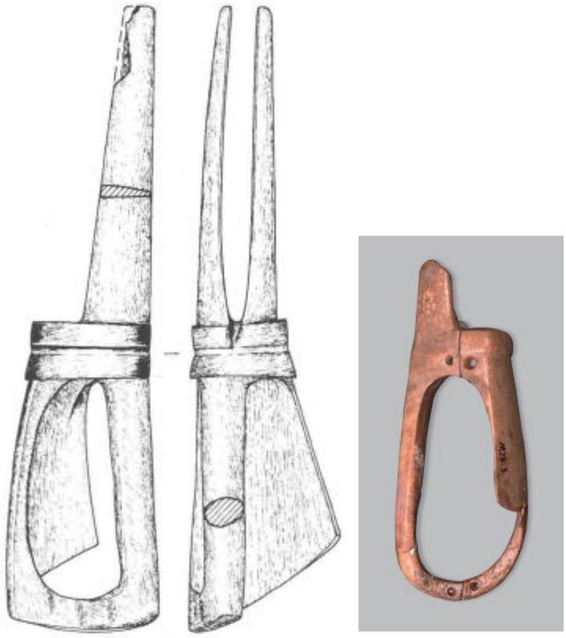


**Figure 4.10, fork-shaped object from 2001 (left) and in 2013 (right) (HPICRA and USTC , 2015; Yang, *et al.,* 2017).**

**Figure 4.11, tortoise shells contain small stones and fragments, found in 2001 (HPICRA and USTC, 2015).**


**Figure 4.12, three bone flutes (Yang, *et al.,* 2017).**

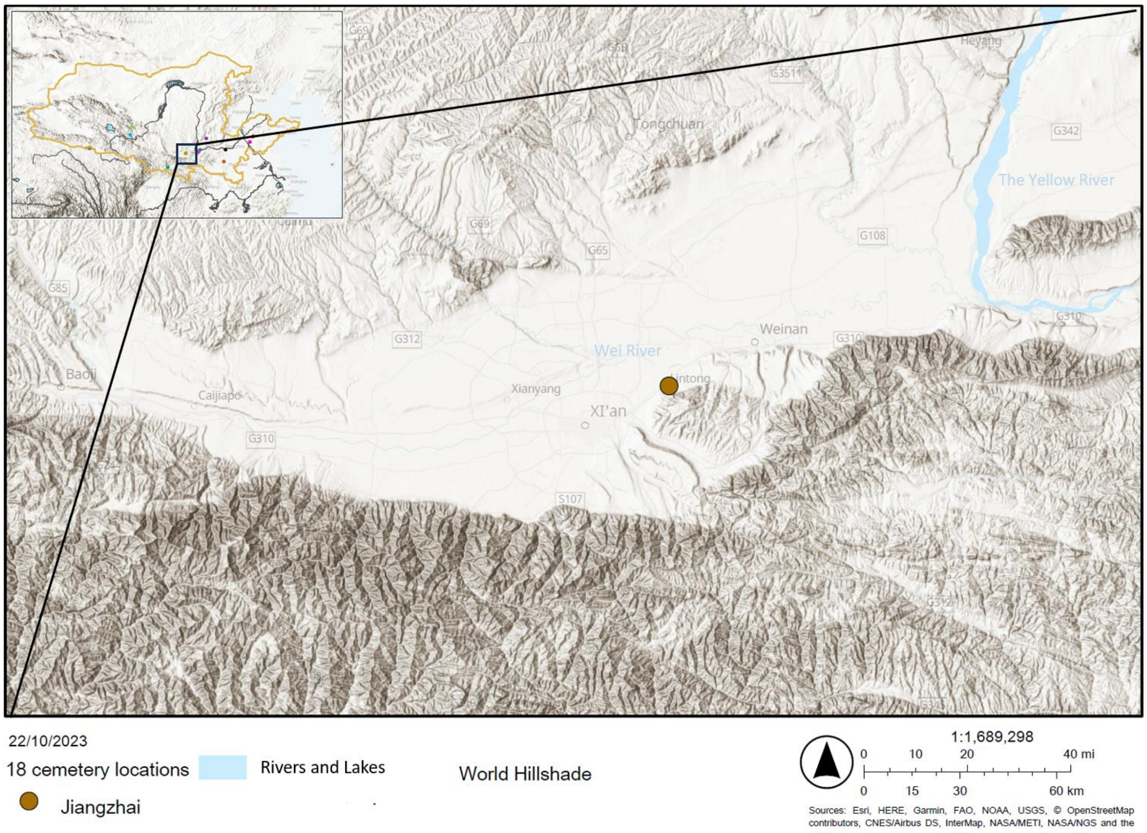
Featured associated with specific genders could be represent by numbers and types of grave goods, as well as its material assemblages. For instance, the proportion of male graves that contain hunting, farming, fishing equipment and special tools is higher than that of females in the early period, while, females have slightly more daily supplies, such as cooking vessels than males (Zhang, 2009). This pattern persisted into the middle phase, though some female graves included more farming tools, manufacturing tools, and ornaments. By the late phase, males still dominated in the variety of grave goods, but some females had relatively more ceramics and daily supplies. These findings suggest that Jiahu males played a primary role in most activities, while females were more involved in agriculture, ceramic production, ornament making, and spinning.

In addition, Graves containing tortoise shells, fork-shaped objects, and bone flutes were almost exclusively male, with only two female graves containing bone flutes and two graves containing individuals of both genders (HPICRA, 1999, p. 145-150; Wang and Zhang, 2008; Zhang, 2009). Meanwhile, burials have the assemblage of type 1 contain abundant other funerary goods were classified as middle- to high-status burials (Zhang and Zhao, 2015).

In terms of burial customs, the practice of burying tortoise shells and water deer tusks is more commonly associated with the Dawenkou culture. Fork-shaped objects have also been found in both Dawenkou and Longqiuzhuang cultures (Zhang and Zhao, 2015). Additionally, Jiahu's burial orientation, primarily westward, differs from the north-south orientation typical of most Peiligang culture cemeteries. These differences reflect distinct cultural connotations, making it challenging to definitively classify Jiahu within a specific cultural framework or determine its origins.

### 4.2.2 Jiangzhai in Shaanxi

Jiangzhai is located at the confluence of the Wei River and Lin River (map 4.6 and figure 4.13). The site spans five phases of the Yangshao and Longshan periods, making its burial customs more complex than those of nearby contemporary sites. The 1st phase is Banpo (5000 to 4300 BC); the 2nd is Shijia, dated between 4300 and 4000 BC; the 3rd is Miaodigou (4000 to 3500 BC); the 4th is Xiwangcun (3500 to 2800 BC); the 5th is Keshengzhuang (2800 to 1900 BC) and is the only one belongs to the Longshan period (Peterson and Shelach, 2012). The site is separated into three parts: settlement, cemetery and kiln site, with the cemetery located outside of the settlement ditch.




**Map 4.6 Jiangzhai.**

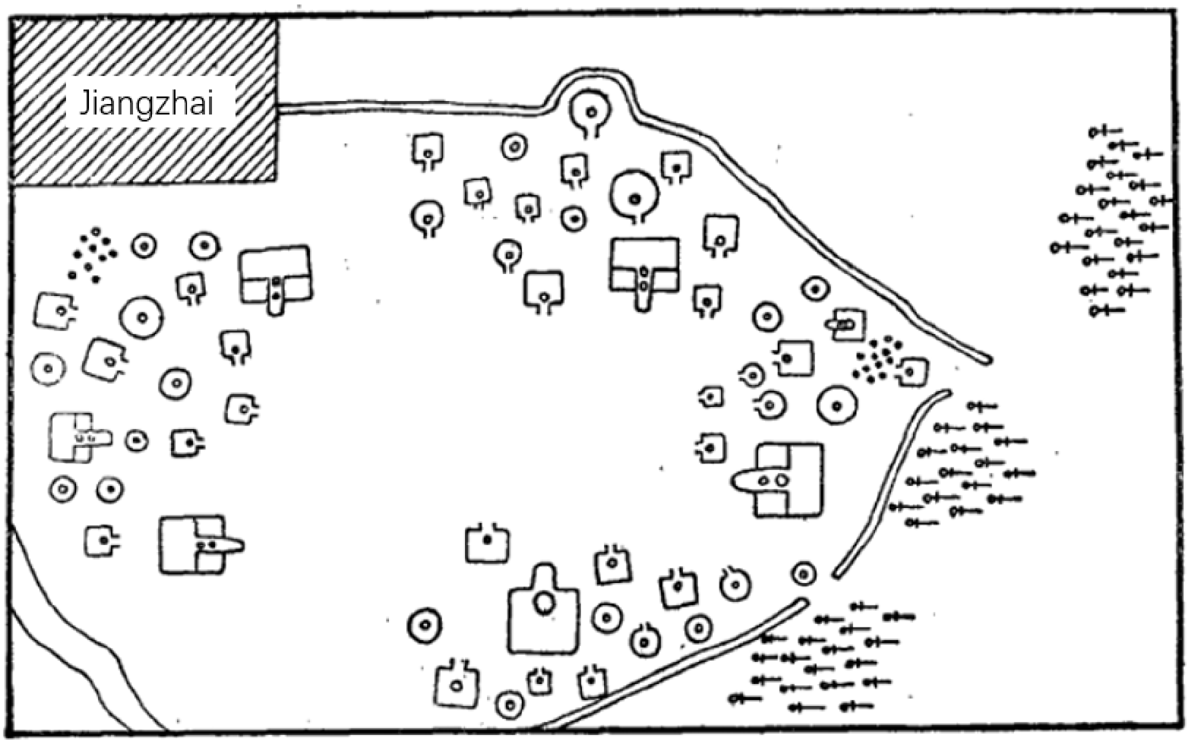


**Figure 4.13, Layout plan of Jiangzhai site (Gong, 1981).**

A large square in the central living area was interpreted by excavators as a space for feeding domestic animals. However, He (2006) argued that the abundance of animal bones found everywhere except the cemetery suggests it may have been a ritual site. He also proposed a possible link between the westward orientation of burials and the setting sun.

The agricultural production tools found at Jiangzhai indicate that farming was relatively primitive in the early phases, though livestock rearing was more developed than at other contemporary sites (Peterson and Shelach, 2012). The animal bones excavated show that pigs, deer, and sheep were the main domesticated animals. By the later phases, agricultural and food processing tools dominated, highlighting the importance of farming for survival.

A total of 685 burials were identified at Jiangzhai, including 313 urn burials, not all of which were located in the cemetery. In the 1st phase, 154 graves were distributed in the east, northeast and southeast of the cemetery (figure 4.14-16), while 20 graves and approximately 200 urn burials were found in the living area (Zhao, 1996). Those urn burials were arranged in a specific rule, 129 of them were buried vertically, 37 faced west, 13 northwest, 13 southwest, 2 east, 2 south and 6 unknowns. Some of the urns were perforated, and very few even have a small piece of pottery fragment to cover the hole. In the Shijia phase (2nd phase), 294 graves were identified, including 103 urn burials, most of which were located in the central cemetery. The Xiwangcun phase (4th phase) had only 1 grave and 3 urn burials near houses, while the Keshengzhuang phase (5th phase) included 6 graves and 1 urn burial, also near houses. This study focuses on the Banpo and Shijia phases.

Primary burials with single extended inhumations were most common in the Banpo phase, but secondary burials with multiple inhumations became prevalent in the Shijia phase. Secondary burials were arranged in two ways: 1) skulls placed in the center with limbs on either side and other bones between them; or 2) all bones placed east of the skull in a west-east orientation, as seen in Burial M169 (figure 4.17). Burial orientations were primarily westward (including southwest and northwest). In the 1st phase, skeletal remains included 68 males, 51 females, and

25 unidentified individuals. The Shijia phase yielded approximately 1,117 males, 683 females, 107 unidentified individuals, and 34 children. However, not all skeletons were sexed or aged, and some classifications were inconsistent, such as categorizing individuals under 15 as male, female, or children, limiting further analysis.

A unique burial custom involved the excision of four toe bones from some primary single inhumations, which were then placed in a clay pot. This practice was also observed at the Banpo site in Xi'an. Ceramic wares were the most common grave goods, followed by stone tools, bone tools, and animal remains. A few graves (M27, M88, M90, M165) contained pairs of pig or deer mandibles. In Burial M147, the occupant's face was covered by a *bo* (a type of vessel), and few graves contained cinnabar.

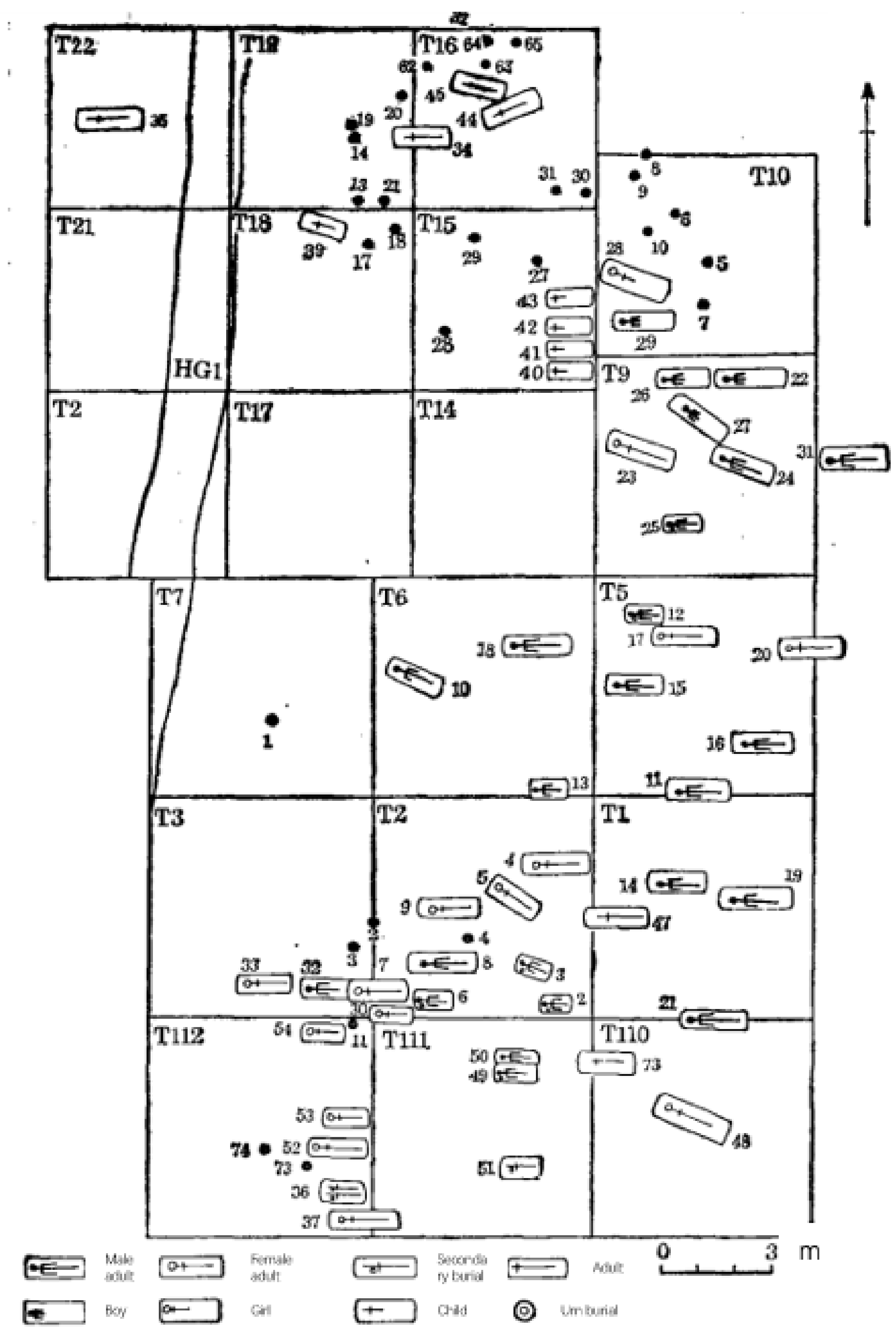



**Figure 4.14, layout of burials in the east cemetery (Zhao, 1996).**

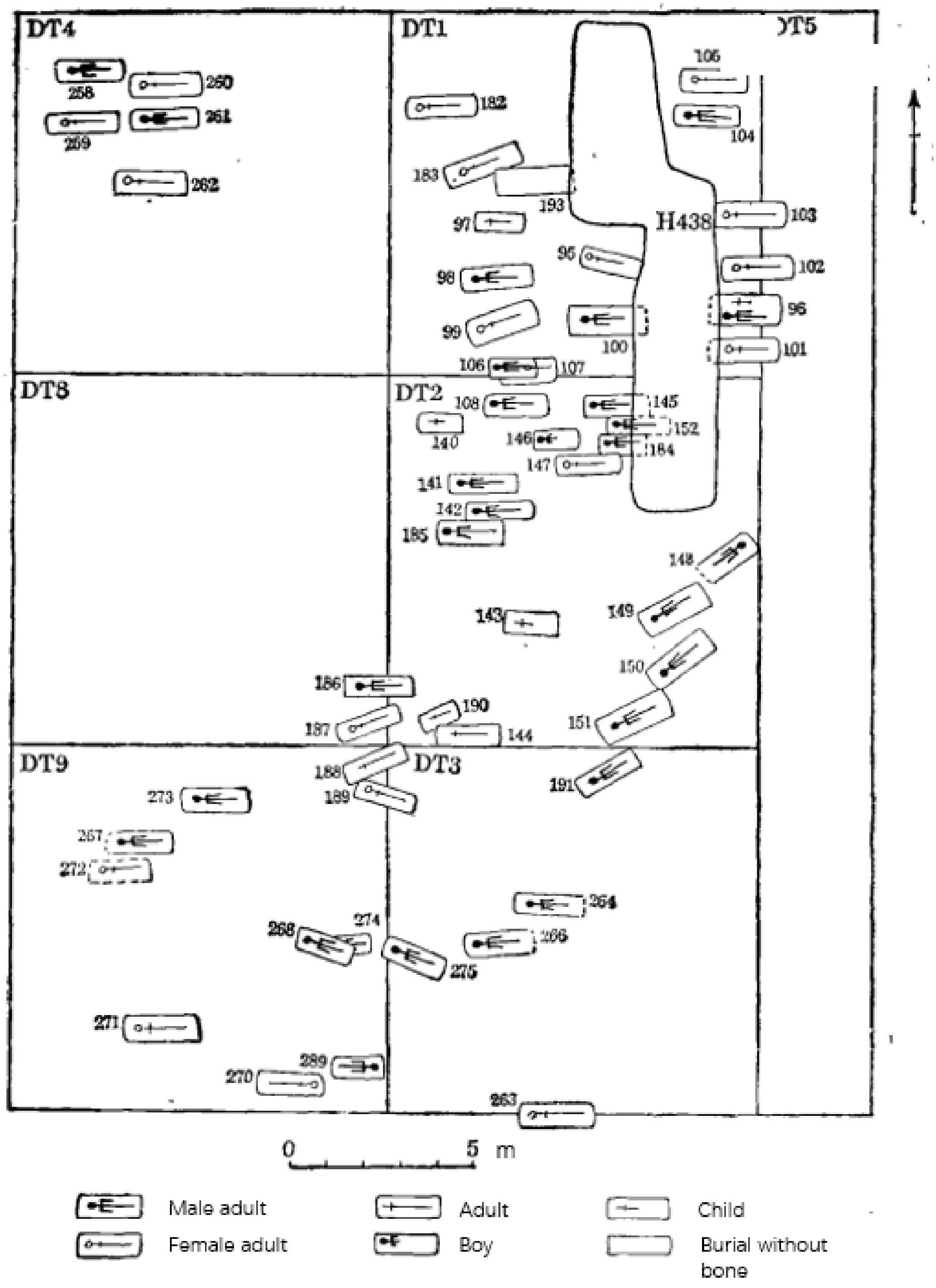



**Figure 4.15, layout of graves in northeastern cemetery (Zhao, 1996).**

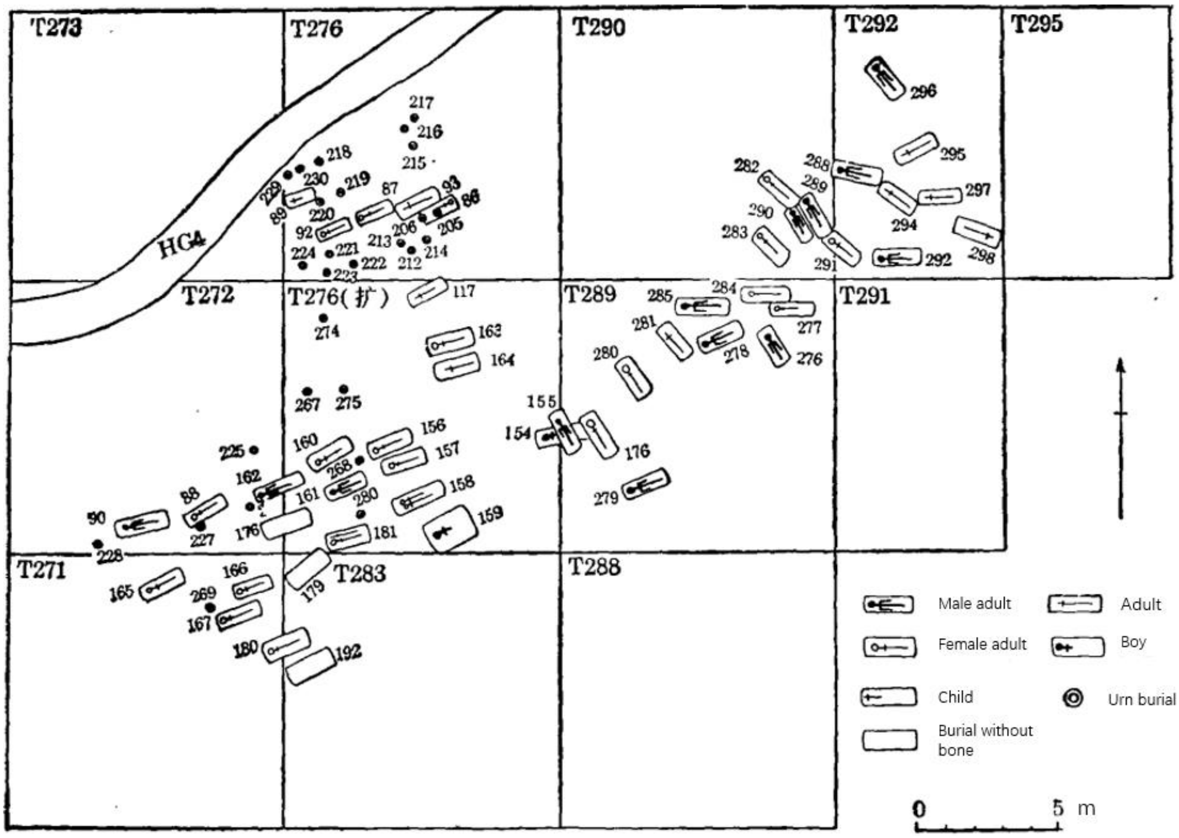



**Figure 4.16, layout of graves in the southeast cemetery (Zhao, 1996).**

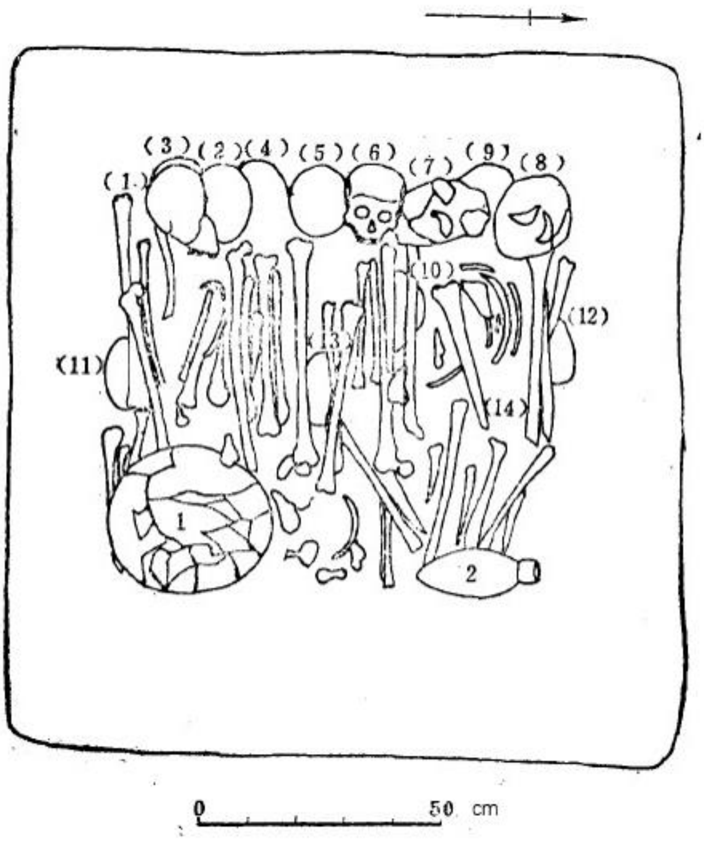
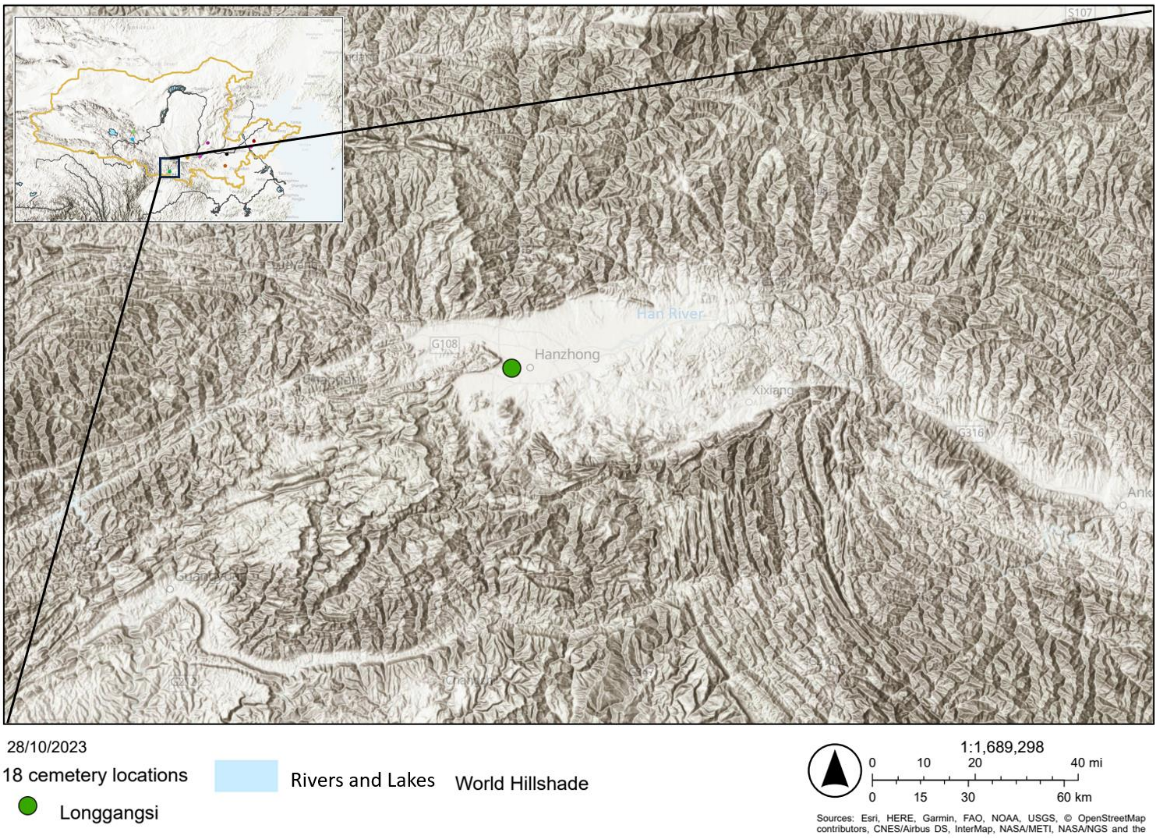



**Figure 4.17, burial M169, secondary burial with multiple interments (XBM, SPIA and LCM, 1988, p. 168).**

### 4.2.3 Longgangsi in Shaanxi

Longgangsi is a cemetery located on the east of the Longgang hill, approximately 50 meters east of the Longgang temple. The site is situated near the Han River to the east and Liang Mountain, about 5 miles to the northwest (map 4.7 and figure 4.18). The cemetery spans two significant cultural periods: the Laoguantai (5000 to 4500 BC) and the Banpo phase of the Yangshao (4500 to 4000 BC). A total of 7 Laoguantai graves and 423 Yangshao graves, including 14 urn burials, were documented in the report. 9 pits from the Laoguantai period and 158 pits from the Yangshao period were discovered. As shown in Figure 4.19, these pits were distributed around the cemetery and primarily contained ash, charcoal, ceramic fragments, and red-burned earth. Some pits also yielded crop remains, stone tools, and ceramic vessels. Li (2000) suggested that these pits may have been used for ritual activities by the kin community, though other possibilities, such as the disposal of burial-related waste, cannot be ruled out.




**Map 4.7, Longgangsi.**

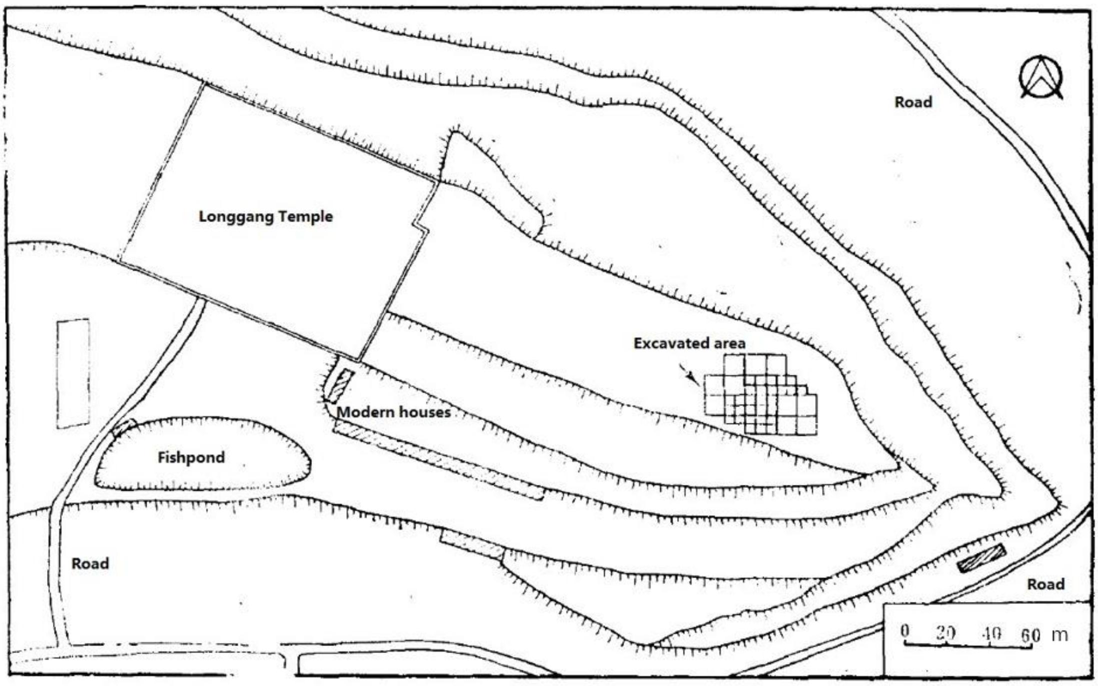



**Figure 4.18, the location of Longgangsi (SPIA, 1990, p. 2) .**


**Figure 4.19, distribution of a portion of burials and pits at Longgangsi (Liu, 2000).**

Longgangsi is located in the subtropical Hanzhong Basin, a region well-suited for agriculture. The discovery of plant remains, including millet, legumes, and park seeds, in the Banpo phase pits indicates the cultivation of drought-tolerant crops during the Yangshao period, alongside the collection of wild plants for food. Animal remains unearthed at the site, similar to those found at Jiangzhai and Beishouling, suggest comparable natural landscapes across these regions. Hunting played a significant role in the socio-economic life of the time, serving as the primary source of meat. The presence of pigs, cows, goats, and chickens also highlights the development of livestock breeding (SPIA, 1990, p. 180- 181).

In the Laoguantai period, all 7 graves were secondary burials with single inhumations, oriented either northwest or north. Six of these graves contained more than two grave goods, typically placed near the feet or lower legs. During the Yangshao period, 384 graves (93%) contained single inhumations, including 23 secondary burials; 12 graves (3%) had multiple inhumations, comprising 4 multiple burials and 8 collective burials; 14 were *Qianchuzang* (where most of the primary burial was removed); and 14 were urn burials. The extended position was the most common burial posture, though approximately 78 skeletons were missing bones, such as the right arm, hands, feet, or left hand (figure 4.20). Natural decay or later disturbance was largely ruled out as the cause. About 90% of the graves were oriented northwest, particularly between 305° and 320°. Urn burials were intentionally perforated, with some urns having their bottoms completely removed.

The burial customs of the Laoguantai and Banpo phases show consistent continuity. In the Laoguantai period, 6 of the 7 graves contained more than two grave goods, typically placed near the feet or lower legs. The Banpo phase is further divided into early, middle, and late sub-phases. All 7 graves from the early Banpo phase contained grave goods, totaling 108 objects. Approximately 92% of the middle-phase graves (148 out of 161) contained 1,586 objects, while 173 out of 255 late-phase graves contained 598 objects. The average number of grave goods per grave decreased slightly in the late phase compared to the earlier phases. Ceramic vessels were consistently the primary funerary objects, reflecting the comprehensive development of Yangshao ceramics. Grave goods were typically placed near the feet or lower legs, with a few near the arms, legs, or heads. Tortoise shells were found in the graves of one female and two males, positioned near the waist or feet, as seen in Burial M102 (figure 4.20). Water deer tusks or tusk-shaped objects were often found in the hands of the deceased. Notably, female graves contained more bone daggers than male graves.

Although the gender and age of the skeletons were determined, and some trends in gender and occupation were identified, a detailed classification linking gender, age, social status, and occupation remains lacking. The relatively stable burial practices during the early and middle Banpo phases suggest an egalitarian society at Longgangsi (Liu, 2000). However, the emergence of multiple-person burials (including both males and females) in the late Banpo phase indicates the beginning of changes in kinship relations.

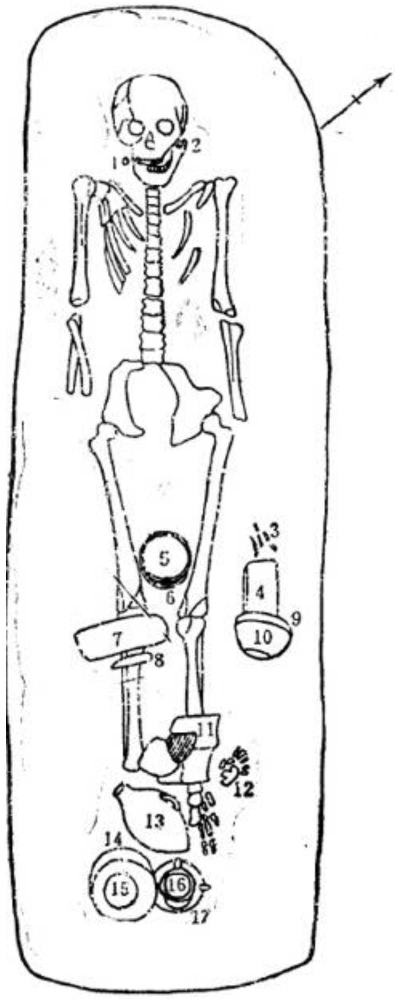
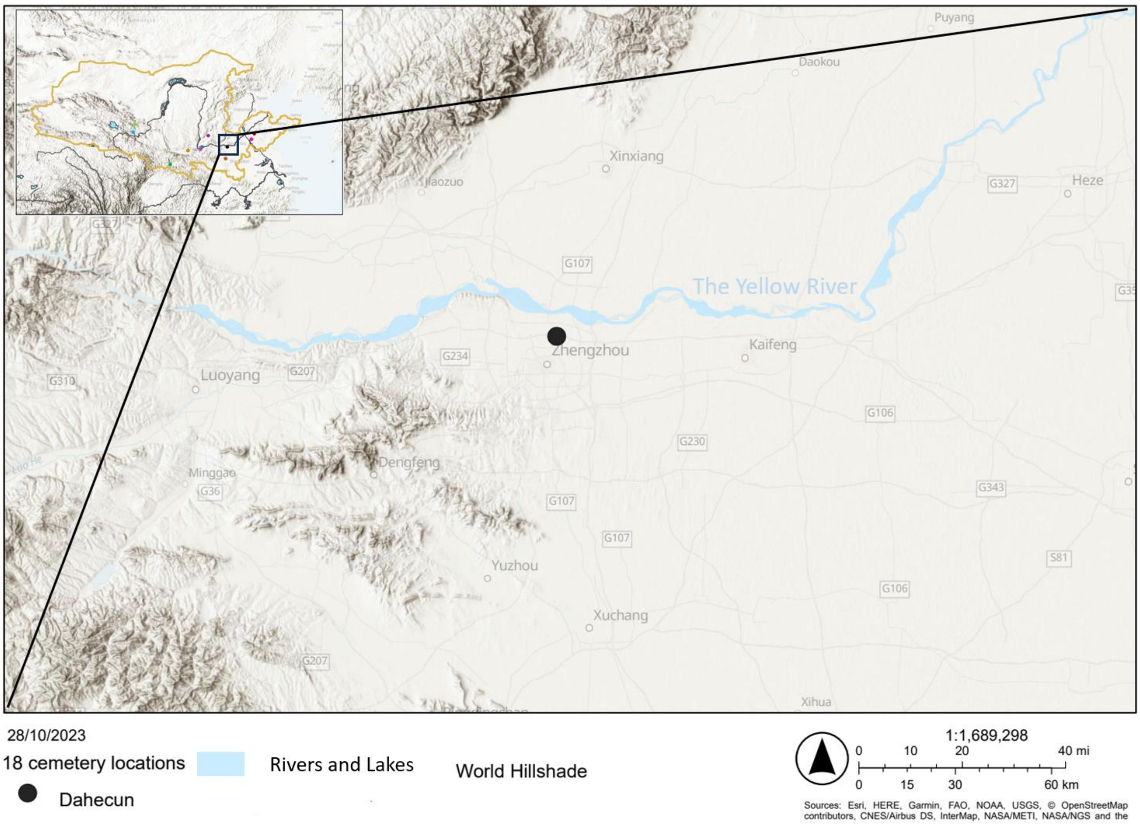



**Figure 4.20, burial M102 in Longgangsi. 1-2. Calaite pendants, 3. Tooth made ornament, 4 and 8. Millstones, 5,6,14,15. Bo, 7. Stone shovel, 9,10,16. Bowls, 11. Ceramic fragment, 12. Tortoise shells, 13. Bottle with a pointed base, 17. Pot with four lugs (SPIA, 1990, p. 72).**

### 4.2.4 Dahecun in Henan

Dahecun is a large site spanning over 40 hectares, located on a hill approximately 2.5 miles south of the Jialu River and 7.5 miles from the Yellow River (Map 4.8). An ancient river once flowed through the site, dividing it into eastern and western sections. The Neolithic remains at Dahecun include both Yangshao (4800–2400 BC) and Longshan (2400–2100 BC) periods, with the Yangshao period further divided into seven phases: the earlier three phases and the later four phases. This extended occupation makes Dahecun one of the longest continuously inhabited Neolithic sites in the region.




**Map 4.8, Dahecun.**

The Yangshao period, which spans nearly 2,400 years, yielded 45 houses, 156 pits, 124 graves, 168 urn burials, and several ditches. Notably, eight complete pig skeletons were discovered in various pits. These pigs were intentionally killed and positioned on their backs, prone, or on their sides, with one pig buried alive and its limbs tied. Six of the pigs were arranged with their heads facing southeast, suggesting a deliberate and ritualistic placement. The Longshan period remains include 2 houses, numerous pits, 60 graves, and 3 urn burials.

In the earlier phases of the Yangshao period (first three phases), agriculture was underdeveloped, and fishing and hunting were the primary subsistence activities. The animal bones unearthed were particularly abundant, accounting for half of the total excavated relics, and most of them were barbecued. By the fourth and fifth phases, agricultural productivity improved, as did ceramic and tool production, though fishing and hunting remained dominant.

The sixth phase saw a significant increase in the variety and quantity of household utensils, with coloured pottery reaching its peak in both quantity and complexity. Intricate patterns, including depictions of the sun, corona (figure 4.21), moon, constellations, and comets, suggest a connection to agricultural practices and primitive calendrical systems (ZICRA, 2001, P. 593 and 598). Social productivity continued to rise in the seventh phase, accompanied by the expansion of private ownership and growing social inequality (ZICRA, 2001, P. 594).

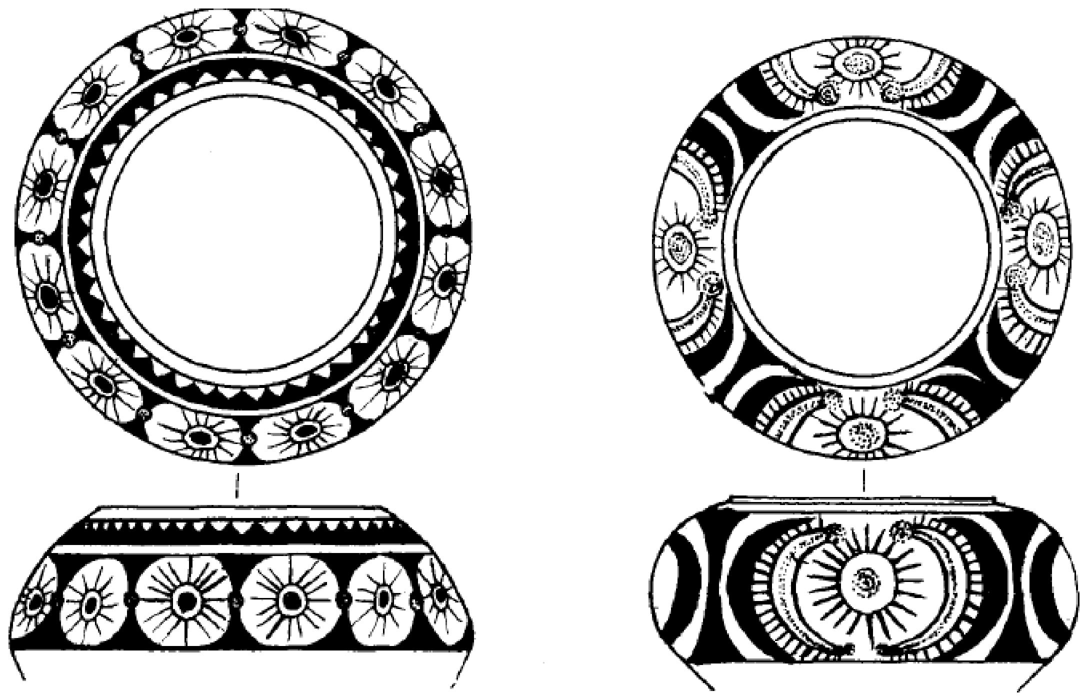


**Figure 4.21, pattern of sun (left) and pattern of corona (right) on ceramic surface (ZICRA, 2001, p. 597).**

All graves at Dahecun are primary burials with single inhumations, almost exclusively in an extended position. Other positions, such as flexed or seated, were found in pits rather than graves (figure 4.22). Some Longshan graves contained only the upper half of the body, possibly deliberately truncated before burial. Grave orientations, documented only for the late Yangshao (2700–2400 BC) and Longshan periods, varied by phase and area (figure 4.23). For example, graves in Area IV were oriented south, while those in Area I faced east. Although the sex and age of the skeletons were recorded, no further classification or generalization was provided. Grave goods were rare in both periods. A distinctive feature of the Longshan period was the burial of perforated tortoise shells in pits alongside human and animal bones (figure 4.24). Urn burials were primarily located in the cemetery, with a few found near houses.

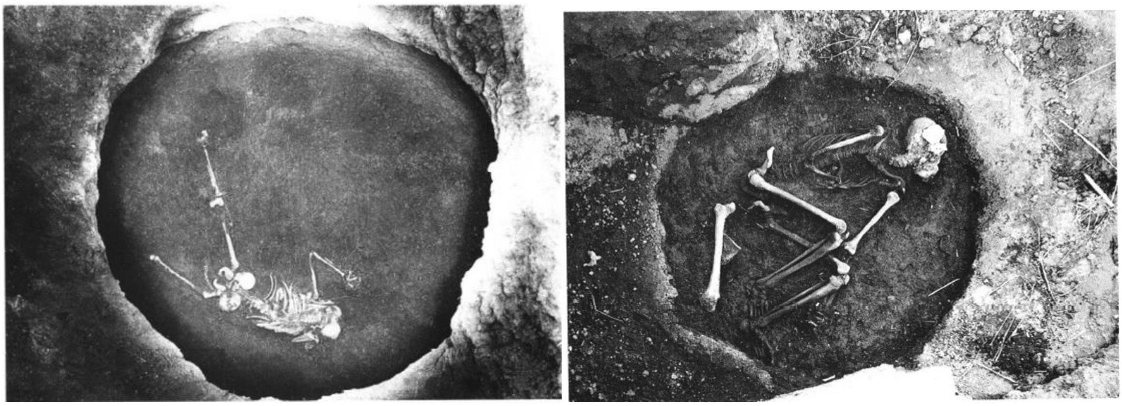


**Figure 4.22, burial M20 (left) and M94 (right) are both human skeletons buried in pits in the Longshan period (ZICRA, 2001, p. image 135).**

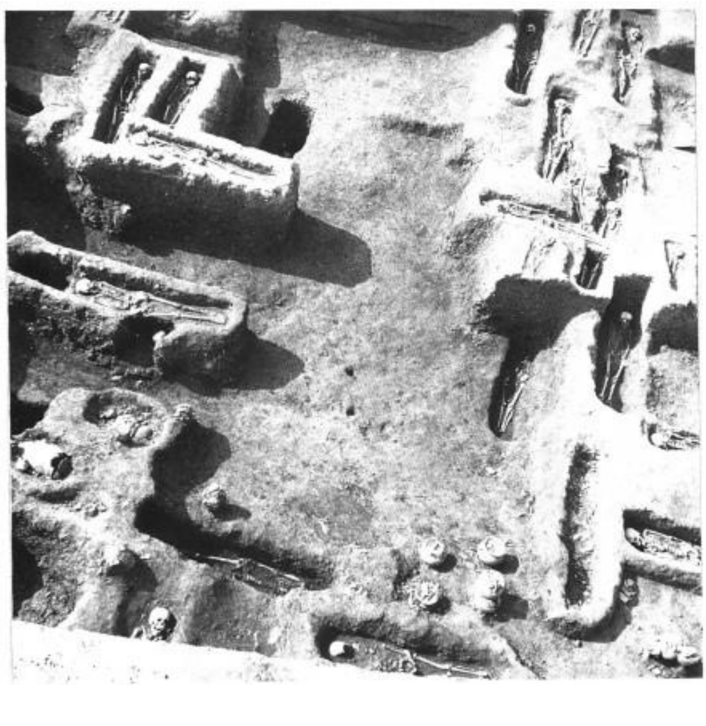


**Figure 4.23, grave excavation in the late Yangshao period at Dahecun (ZICRA, 2001, p. image 63).**

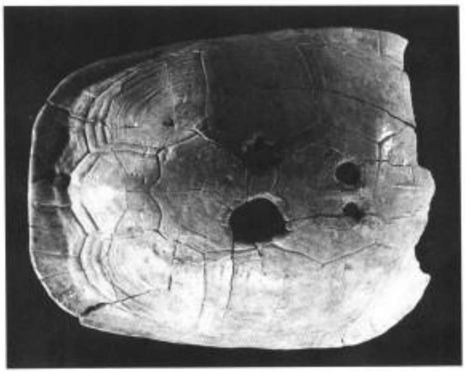
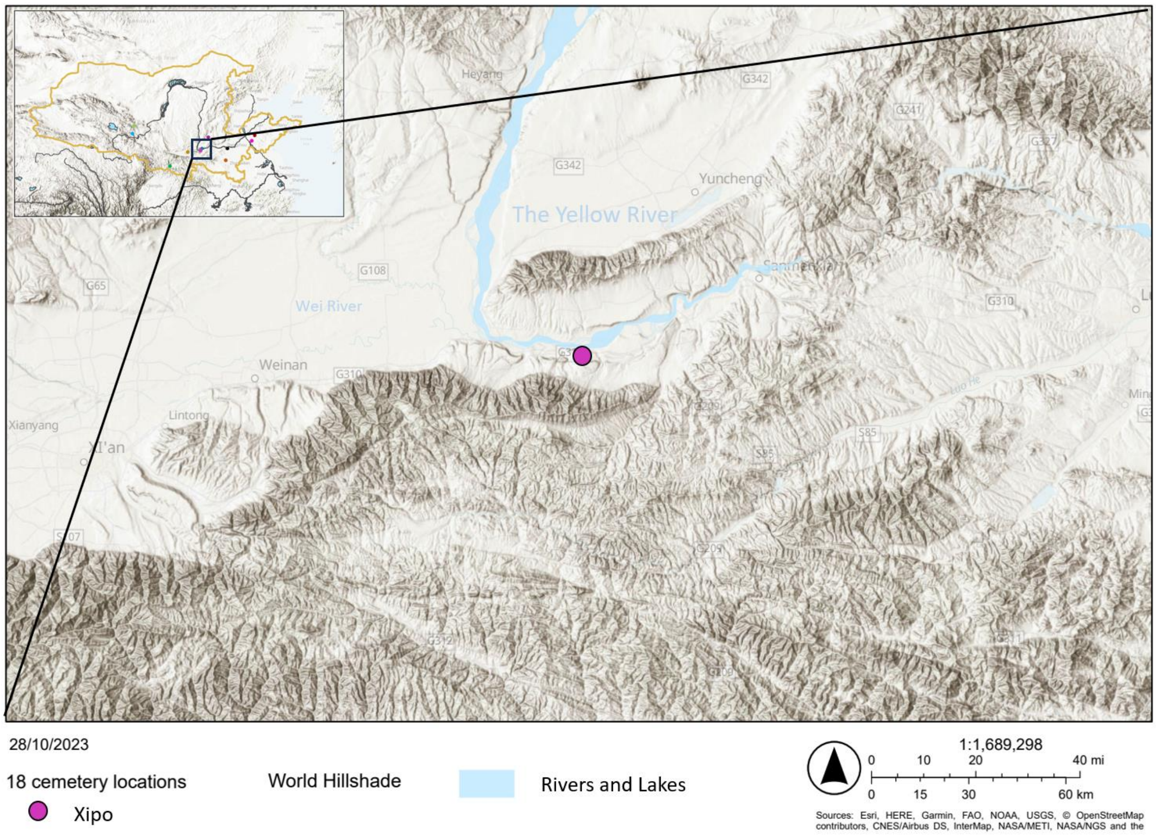


**Figure 4.24, perforated tortoise shell from pit H170 (ZICRA, 2001, p. image 153).**

### 4.2.5 Xipo in Henan

Xipo is located in the Henan province, between the Fufu river and the Linghu river in Lingbao city (map 4.9). The site, located at an elevation of 455–475 meters above sea level, thrived between 3300 and 2900 BC (IACASS and HPICRA, 2010, p. 281). A total of 34 graves associated with the Miaodigou variant were discovered in a single cemetery on the southern side of the site, outside the residential area (figure 4.25). Notably, most Miaodigou variant sites in Henan exceeding 10 hectares are concentrated in Lingbao City, suggesting that Xipo, with its oversized houses and burials, may have served as a regional core site during this period (HITIACASS, *et al.*, 2005).




**Map 4.9, Xipo.**

Isotopic analysis of 31 human remains from the Xipo cemetery indicates that millet was the staple food, while domesticated pigs and wild deer were the primary sources of meat. Further analysis of age groups reveals distinct dietary patterns: the youth (under 20 years old) consumed less meat and fewer C4 plants; the middle-aged group (30–45 years old) with larger burials likely had greater access to meat; and the elderly (over 45 years old) relied more heavily on millet-based C4 plants. The fact that both pigs and dogs were primarily fed C4 plants suggests that agriculture was developed on a significant scale, not only to meet the dietary needs of the population but also to sustain livestock breeding (IACASS and HPICRA, 2010, p. 202-209).

Through meticulous excavation and analysis, the funerary rituals at Xipo have been reconstructed. These rituals encompassed all activities from the moment of death until the grave was sealed, including instances where graves were reopened for secondary burials (IACASS and HPICRA, 2010, p. 282-287). The process reflects the Xipo people's solemn and reverent approach to burial practices. For example, hairpins found in graves M14, M17, M18, and M19 suggest that the deceased may have had their hair combed before or after death. Additionally, the positioning of the skeletons—with elbows close to the ribs, hands near the legs, and feet tightly curled—indicates that the bodies were bound shortly after death, despite the ample burial space. While the specifics of the shrouds remain unclear due to the decay of organic materials, it is hypothesized that a period of ritual activities preceded the final burial, but unfortunately, it is difficult to deduce the exact duration and behaviour. Finally, the graves were then sealed with soil, and the integrity of the burials suggests that the interval between death and burial was relatively short, except for the secondary burial M11. The excavators propose that the orientation of the graves, aligned with the sunset at the time of death and burial, would not have differed significantly  (IACASS and HPICRA, 2010, p. 287-290).

Excavators indicate that graves were arranged in rows from west to east in the cemetery,  with most concentrated in the northern section and seven smaller graves located in the southeast corner (IACASS and HPICRA, 2010, p. 267, 281-2). The majority were primary burials with single extended interments, though one secondary burial (M11) contained the remains of a child and a female. Regardless of burial type, the graves were oriented west-east, with the skulls positioned at the western end and all graves aligned between 265° and 295°.

A distinctive feature of Xipo burials is the stepped grave structure, exemplified by burial M27 (figure 4.26), this particular structure was built with additional step on two sides of the deceased, but mostly lacked the slabs on two sides. Some graves also featured a pit near the feet, the shape of which became a standard for burial specifications. M27, for instance, was covered with 16 wooden slabs, all originally lined with linen. Grave goods, when present, were placed near the body (particularly jade or stone *yue*) or in the foot pit (primarily ceramic vessels). A notable but unexplained feature is the presence of small stones in some graves, either in the burial chamber or the foot pit. The most common ceramic assemblages included *fu* and stove sets, kettles, *gui*-shaped objects, and *bo*. Other grave goods included rings, *yue*, and a few bone tools placed near the body. The *yue*, a flat stone tool resembling an axe, evolved from a utilitarian object to a symbol of military power during the middle and late Neolithic periods in China, adopted by the military aristocracy or élites of a community (Fu, 1985; Yuan and Wang, 1988).

Its placement near the head or chest of the deceased underscores its significance as a marker of social hierarchy (Fu, 1985). While some cultures determine burial orientation based on the direction of the face or feet, at Xipo, the placement of grave goods at the foot end and the upward orientation of the faces suggest that the head marked the primary direction of orientation.

Evidence of cultural exchange and influence is also evident at Xipo. For example, the tooth extraction custom observed in burials M27 and M8, characterized by the loss of premolar teeth and the closure of the foramen, originated in the Beixin culture (北辛文化) in Shandong and later developed in the Dawenkou culture (大汶口文化) (Yang Shiting, 2005; Zhang and Wang, 2018). Additionally, large-mouth vats found in M8 and M27 are typically associated with the lower Yellow River and Jianghuai regions (between the lower Yellow River and the lower Yangzi River) (IACASS and HPICRA, 2010, p. 278). Despite these external influences, the burial practices at Xipo remained remarkably consistent over its 400-year occupation, indicating that external cultural impacts were relatively limited.

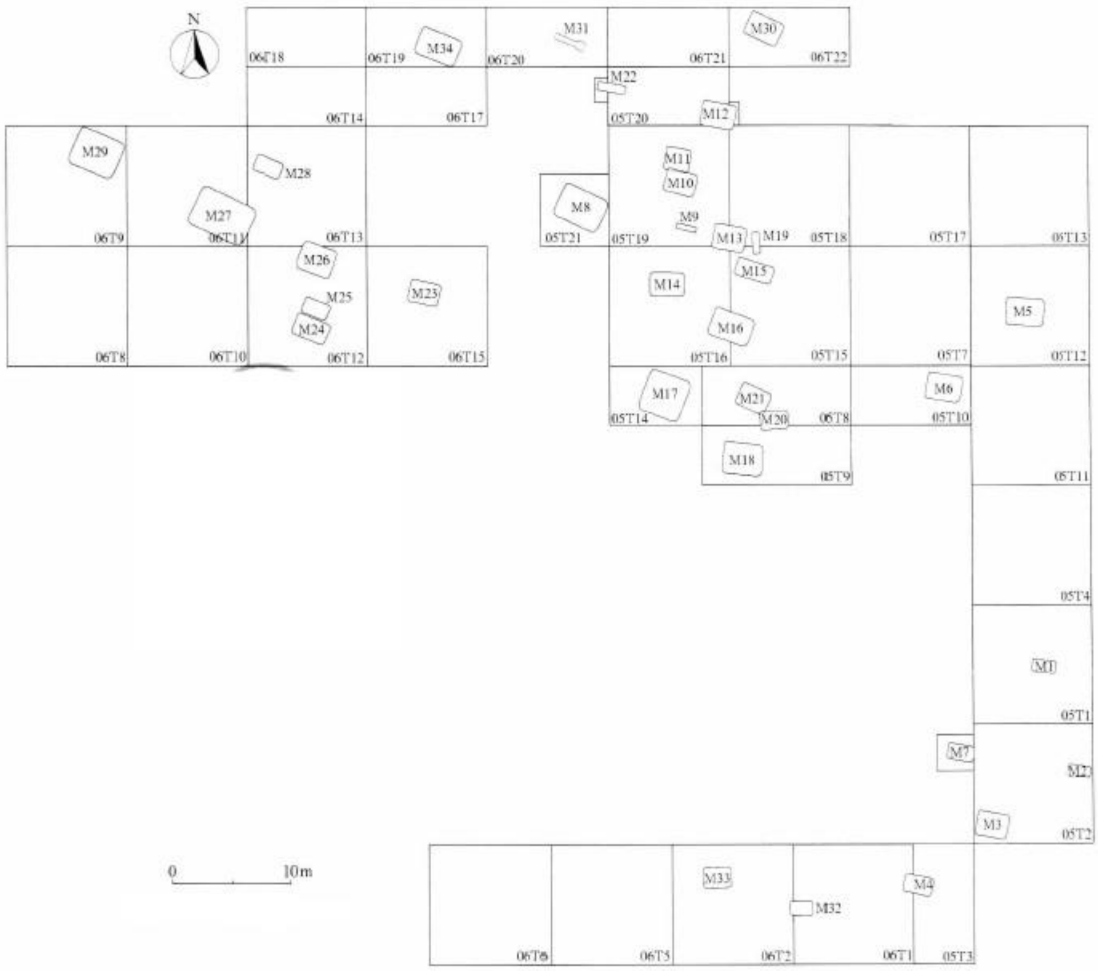



**Figure 4.25, plan of Xipo cemetery (IACASS and HPICRA, 2010, p. 15).**

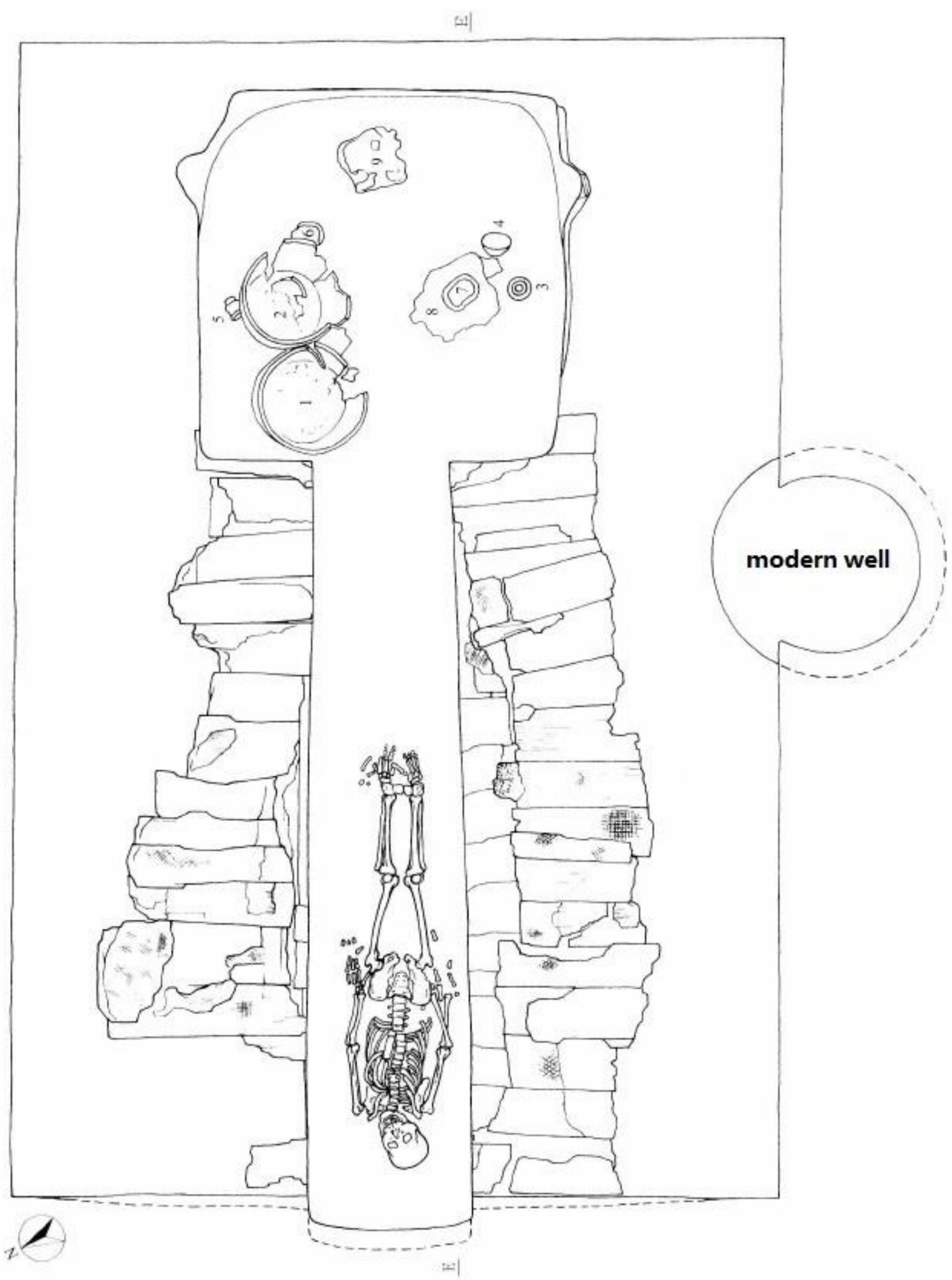
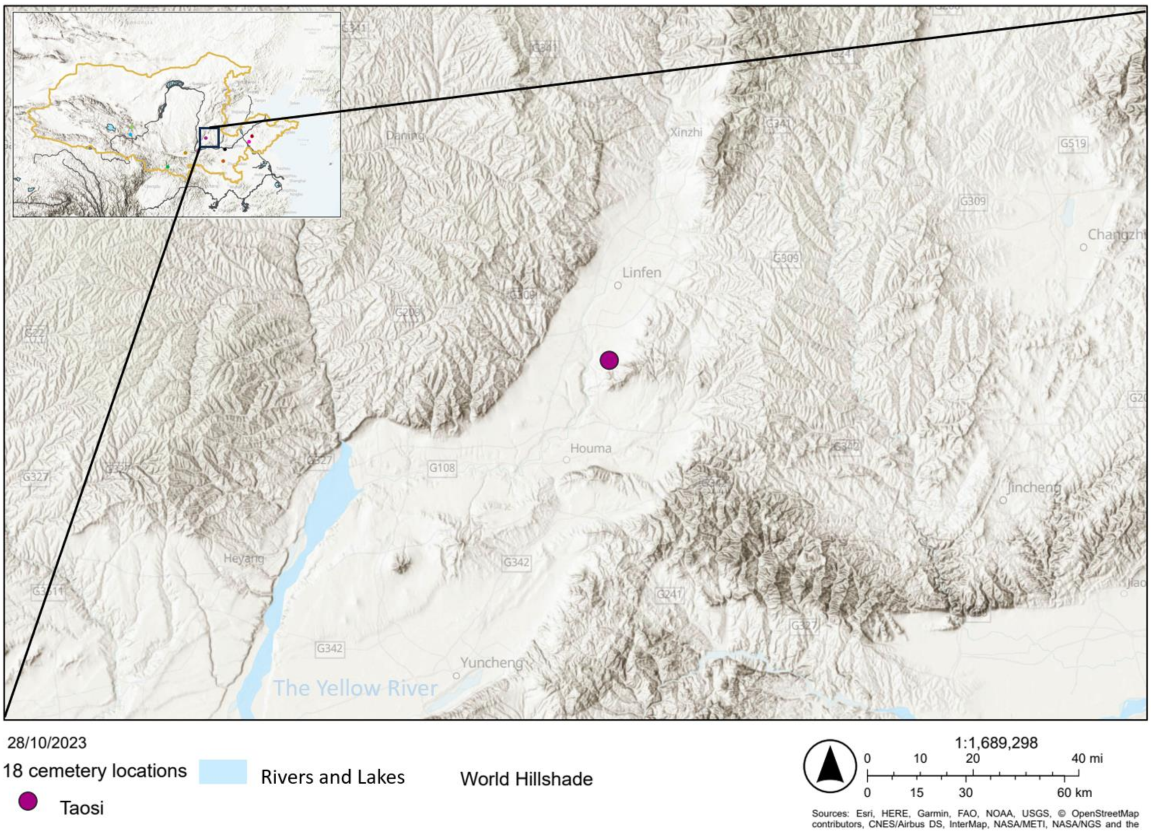



**Figure 4.26, burial M27 at Xipo, 1-2. Large-mouth vat, 3. Kettle, 4. Bo, 5. Gui-shaped object with lid, 6, 9. Gui-shaped object, 7. Fu, 8. Oven (IACASS and HPICRA, 2010, p. 86)**

## 4.2.6 Taosi in Shanxi

Taosi is one of the most advanced Late Neolithic sites in Shanxi Province, with its occupation spanning from the second phase of the Miaodigou period during the Yangshao era (2800–2700 BC) to the Taosi phase of the Longshan period (2300–1900 BC). Geographically, the site covers approximately 400 hectares, bordered by the Fen River to the east and situated 7 kilometers southeast of Taer Mountain (map 4.10). Although excavations at Taosi were conducted between 1999 and 2017, only the findings from 1978 to 1985 have been fully published. Consequently, this research primarily relies on the 1978–1985 excavation reports, while also referencing significant discoveries from later excavations that have been briefly reported. Figure 4.27 illustrates the excavation layout of the Taosi site based on a recent brief report (He and Gao, 2018).




**Map 4.10, Taosi.**

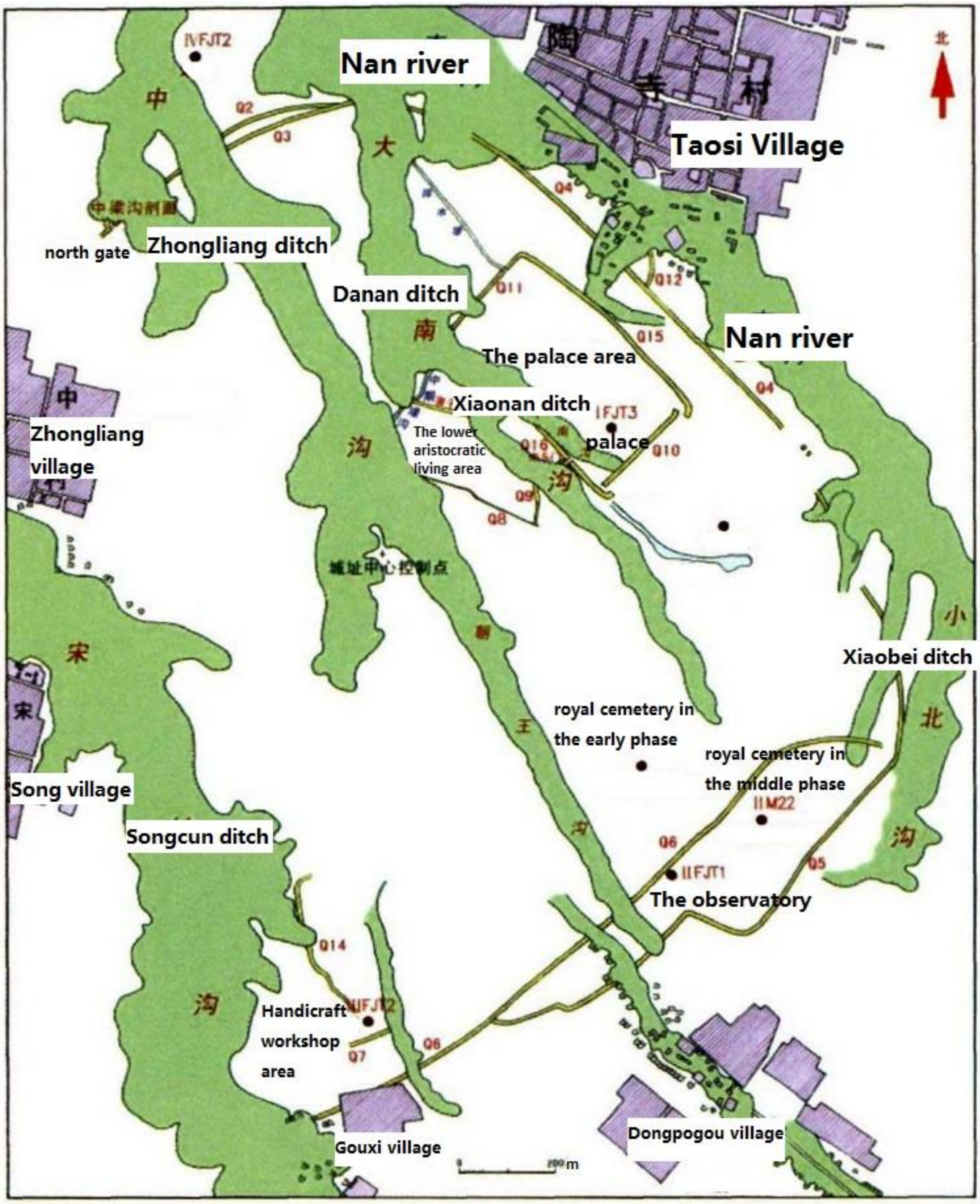



**Figure 4.27, excavated areas at Taosi site (He and Gao, 2018).**

The residential area from the Miaodigou phase lies beneath the early Taosi phase and includes 17 houses, 78 pits, 1 kiln, and 1 urn burial. However, the archaeological features and artifacts suggest no clear continuity between the two phases (He and Gao, 2018). Instead, the early

Taosi phase appears to have diverged from the Miaodigou tradition, developing independently while incorporating elements from neighboring cultures. During the Taosi phase, the site evolved from a small settlement of 20 hectares in the early phase (2300–2100 BC) to a large settlement exceeding 300 hectares in the middle phase (2100–2000 BC) (He and Yan, 2002; He and Gao, 2018). By the late Taosi phase (2000–1900 BC), the site was significantly reduced and resembled other contemporary settlements in the region.

The early Taosi phase residential area yielded 17 houses, 11 ceramic kilns, 1 lime kiln, 133 pits, 2 ditches, 33 burials, and other features. The houses include semi-subterranean, ground-level, and kiln-style structures (He and Gao, 2018). Burials from this phase are predominantly small, primary interments with single extended skeletons. Most heads were oriented northeast, with two exceptions facing northwest and one southwest. Grave goods were rare, and three additional individuals were found in pits.

Agriculture and livestock rearing during this phase reflect increasing sophistication, serving as the material basis for social progress. Excavated cereal remains include large quantities of millet and corn, as well as traces of southern crops such as rice and barley. Domesticated animals were primarily pigs and dogs, with the introduction of yellow cattle and sheep (Chen, *et al.,* 2012).

The Taosi cemetery, excavated before 1985, is located on a slope west of Taer Mountain, with its southeast side elevated relative to the northwest. This elite cemetery from the early Taosi phase contains 1,379 graves, 70 of which remain unexcavated. Most burials are primary interments with single extended skeletons, predominantly adults. Ten secondary burials were identified, including M2373, which contained two individuals. Additionally, five *Qianchuzang* (graves where most of the primary burial was removed) and 11 empty graves were found, without bone remains and grave good. Over 1,000 graves are oriented southeast (120–140°), aligning with the highest peak of Taer Mountain. This orientation persists in local burial practices today, with descendants burning paper money  (a type of money only for the dead people, this is a tradition in China since ancient time) during the Hanshi festival at a mountain to the southeast.

Graves were categorized into large, medium, and small burials based on size and grave goods. Large burials feature spacious pits, coffins, and ceremonial objects such as ceramic plates with dragon motifs, drums, and *Qing* (磬). Medium-sized burials may include used *Yue* (ceremonial axes) but lack elaborate ceremonial items. Over 90% of the graves are small, lacking coffins and grave goods. Of the 1,309 excavated graves, more than 96% contained no ceramics, while 16.8% included stone or jade artifacts, and 27 had wooden objects. Over 80% of the graves had only a few or no grave goods. Musical instruments were exclusively found in large graves, with drums placed to the left of the feet or in the left corner, often accompanied by crocodile bones. *Qing* were placed beside drums, and small round tables near the skulls held drinking vessels. Zu (俎) were typically found with cooking utensils, often accompanied by a stone knife. *Yue* were placed near the femurs, and pig skulls, ribs, or limb bones were also present in some graves. The disparity between large and small graves is striking, as exemplified by burials M3288 and M2172 (figure 4.28 left and right).


**Figure 4.28, burial M3288 (left), constructed with stones (IACASS and LCRBSP, 2015: 419); stepped burial M2172 (right) contains 1. Wooden table, 2-3. Wooden gu, 4. Zhefu basin, 5. Zhefu pot with lugs, 6. Zun, 7. Bottle, 8. Kettle, 9. Small pot with lug, 10. Pot-shaped tripod with lug, 11-14. Dou, 15. Gui, 16. Yuanfu pot, 17. Basin-shaped jia, 18-19. Large-mouth pot, 20, 33. Qianfu basin, 21-23. Pig bones, 24. Stone knife, 25. Wooden zu, 26. Wooden spoon, 27. Vat-shaped object, 28, 37. Bone dagger, 29. Wooden object, 30. Wooden bowl, 31. Zun-shaped jia, 32. Oven, 34. Shovel, 35, 36. Wooden dou with a high handle, 30. Yue. 58 pairs of pig mandibles on the second step (IACASS and LCRBSP, 2015, p. 468).**

Unique burial customs are evident at Taosi. For instance, 34 graves contained pig mandibles, and 10 included partial or complete pig skeletons. Some individuals were buried clothed, with covered faces, or wrapped in shrouds. Large graves often featured cinnabar smeared on the remains. Four graves had stepped structures, 14 included niches, 2 had foot pits, and 2 were constructed with stones, such as burial M3288 (figure 4.28, left). Human bones were recovered from the backfill of over 30 graves, though their presence may not solely indicate human sacrifice. Additionally, four animal pits (containing sheep, deer, and roe deer) were found atop graves, suggesting that animals were buried after the primary interment.

Excavations in 2002 revealed a small walled city of about 10 hectares in the southeast of the mid-Taosi settlement. This area included an elite cemetery and an observatory dating to the middle Taosi phase. A notable discovery was burial IIM22 (figure 4.29), which contained a 17.8 cm painted pole resembling a surveyor's tool (STIACAS, SPIA and LCCRBSP, 2003; He, 2009). As discussed in Chapter 1 (Section 1.33), the pole's colored segments may have been used to measure the sun's shadow (He, 2015). In order to verify it, He recorded each length of the segments. Astronomer Yongheng Zhao calculated the shadow lengths for the Taosi site between 2100 and 2000 BC, accounting for factors such as the precession of the equinoxes and the obliquity of the ecliptic, true north, and the magnetic north. The calculations for the summer and winter solstices and the spring and autumn equinoxes closely matched the pole's segments, supporting its use as an astronomical tool.

**Figure 4.29, burial IIM22 (He, 2009).**

In terms of He and Wu (2005), Wu Jiabi (2008), Li (2014)'s investigation, Taosi is not only a cemetery, but also the oldest astronomical observatory in East Asia. The semi-circular foundation (II FJT1), discovered in 2004 and dated no later than the middle Taosi phase, was destroyed in the late phase (STIACASS, SPIA and LCCRBSP, 2004). Figure 4.30 below shows a reconstruction of the Taosi observatory, with additional details provided in Chapter 1 section 1.33. According to the displacement of the sunlight, Taosi people used the soil and shadow to determine the exact time of one year to optimise agricultural activities. In the Neolithic observatory of Taosi, sunrise in the direction of Taer mountain was observed through the narrow slits of soil column from the observation point. The sunrise on winter solstice day can be observed from the 2nd slit, the sunrise on the summer solstice day is from the 12th slit, and 7th slit is the sunrise on the spring and autumn equinox (He, 2015, p. 84-85). Relevant schematic diagram and description is shown in chapter 2.

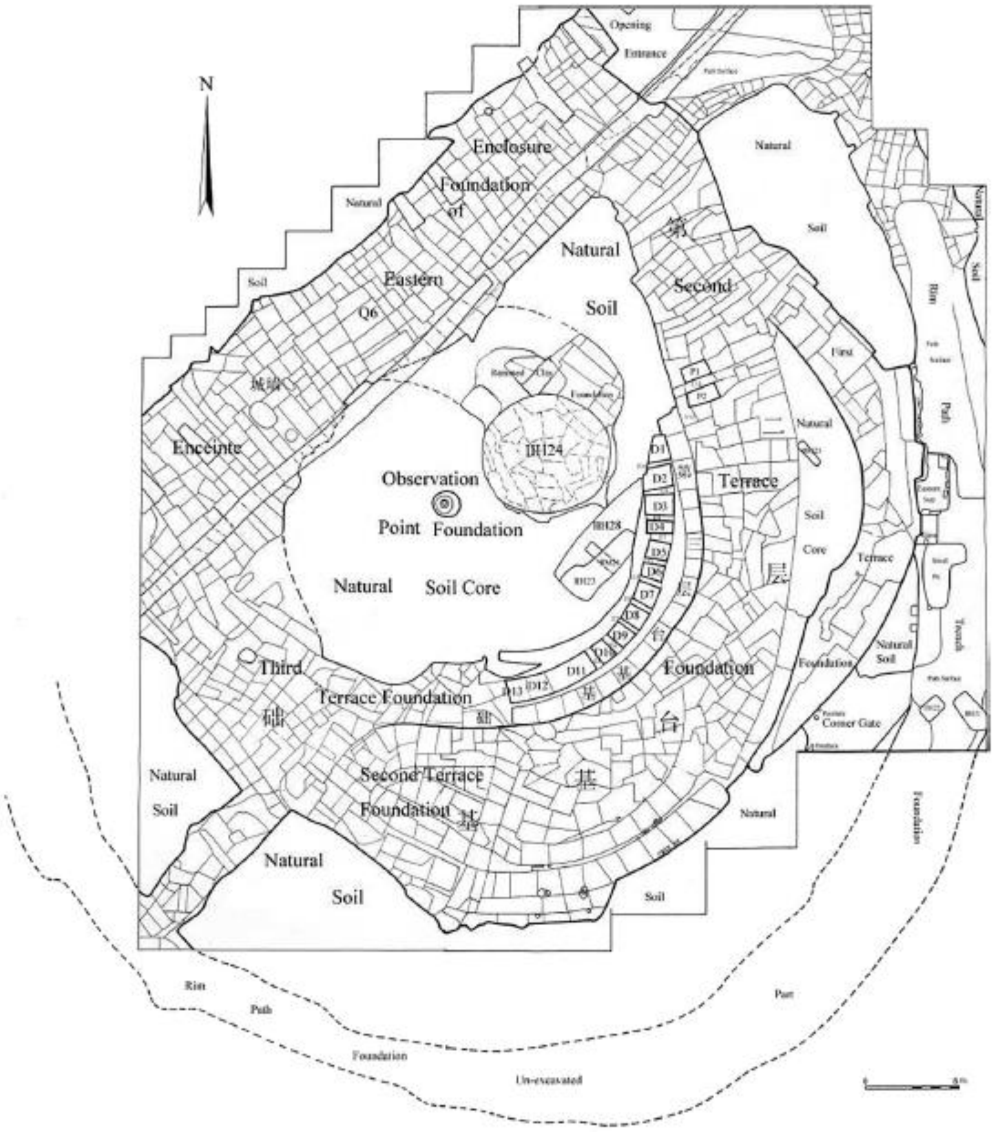
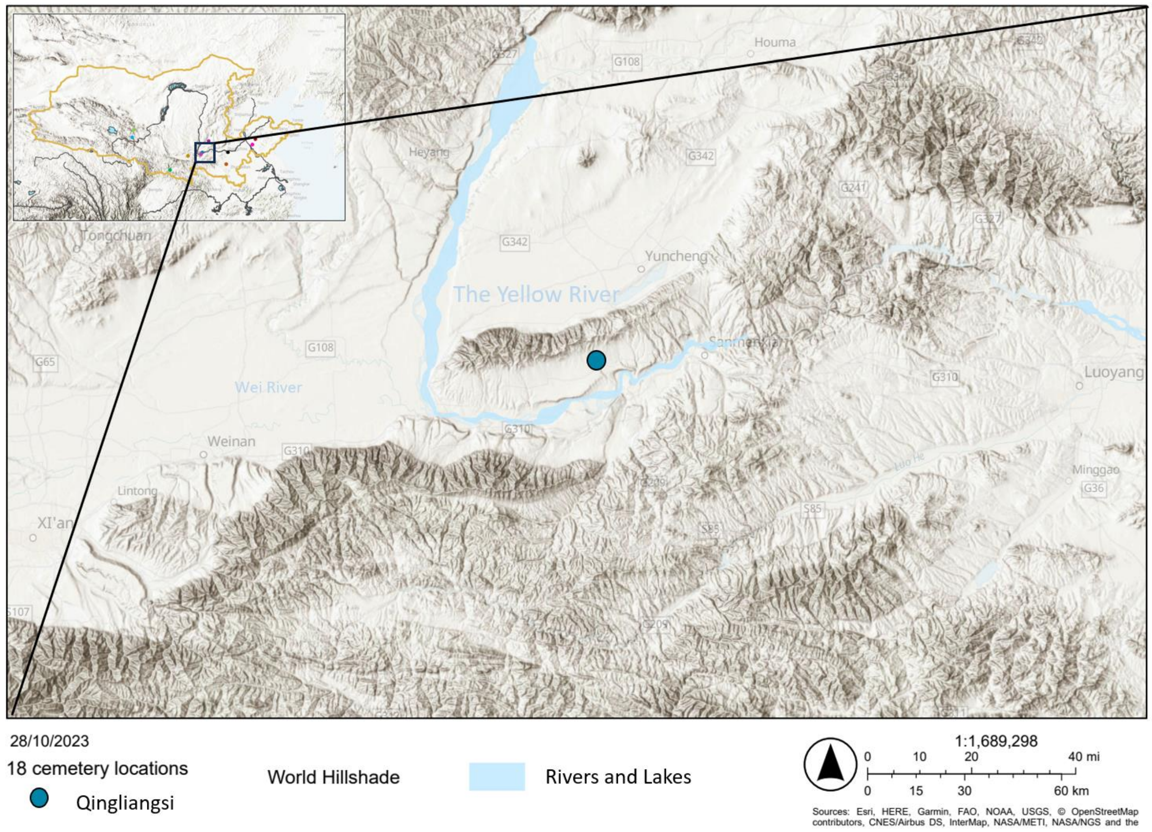



**Figure 4.30, plan of the observatory (II FJT2) at Taosi (He, 2018).**

### 4.2.7 Qingliangsi in Shaanxi

The Qingliangsi site, located in Shaanxi Province, is a cemetery situated at the foot of Zhongtian Mountain, with an elevation of 624 meters above sea level (map 4.11 and figure 4.31). The site is approximately 5 kilometers south of Ganzao Mountain and 15 kilometers north of a branch of the Yellow River. The cultural phases at Qingliangsi are divided into four periods. The first phase, associated with the Zaoshi variant (4050–3770 BC), shows no continuity with later phases, as the cemetery was abandoned until the arrival of the Miaodigou variant. Following a period of decline in the Yangshao culture, the Miaodigou variant re-emerged as dominant, spreading to surrounding regions and merging with cultures from northern and central Henan and the Wei River basin. This led to the establishment of a large cemetery for local clan members. Therefore, the 2$^{nd}$ to 4$^{th}$ phases of Qingliangsi dated to the second phase of Miaodigou and the Longshan culture (2300 to 1800 BC), represent a continuous cultural sequence and can be treated as a unified long period (SPIA, YMWCH and RCATCH, 2016, p. 360). Radiocarbon dating results indicate the following chronology: the 2$^{nd}$ phase to 2280 to 1780 BC; the 3$^{rd}$ phase is 2430 to 1700 BC; the 4$^{th}$ phase is 2040 to 1700 BC (SPIA, YMWCH and RCATCH., 2016, p. 357). The 3rd phase is particularly complex due to extensive looting and the presence of ceramics that exhibit characteristics of both the Miaodigou variant and the early Longshan culture, complicating cultural attribution. Nevertheless, excavators attribute both the 3$^{rd}$ and 4$^{th}$ to the Longshan culture (SPIA, YMWCH and RCATCH, 2016, p. 353).




**Map 4.11, Qingliangsi.**

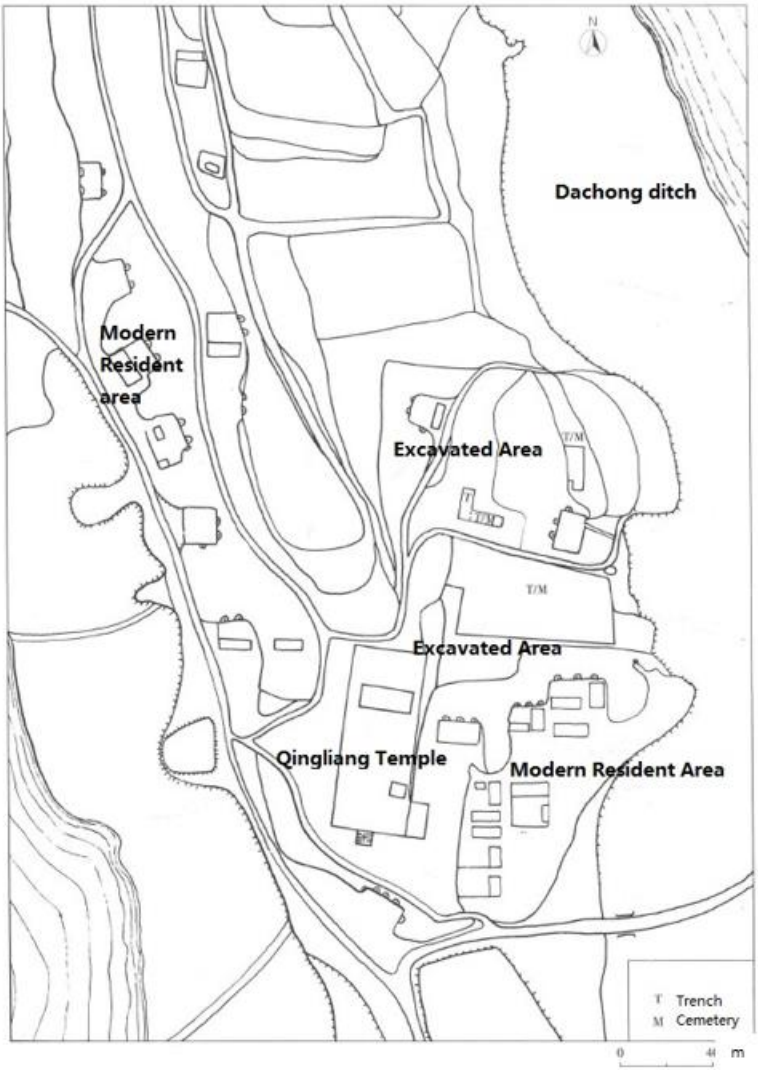



**Figure 4.31, the location of Qingliangsi (SPIA, YMWCH and RCATCH, 2016).**

Stable isotopic analysis of human remains from the cemetery suggests that gathering activities largely ceased during the second phase, with maize becoming the staple food. Livestock rearing was conducted on a large scale, making domesticated animals the primary source of meat, supplemented by limited fishing and hunting (SPIA, YMWCH, and RCATCH, 2016, p. 530). This indicates that, in addition to agriculture, livestock rearing played a significant role in the local economy, a pattern similar to that observed at Xipo. Furthermore, the amount of meat consumed correlated with burial form and the value of grave goods, reflecting social stratification. Wealthier individuals with higher status consumed more meat, highlighting significant inequality in resource distribution, akin to the situation at Xipo.

The cemetery includes 355 published graves, all of which are primary burials. The 1st phase comprises 17 burials and 7 urn burials, irregularly distributed, with most located in the western part of the cemetery and urn burials concentrated in the east. All burials were in an extended position, with varying orientations—primarily northwest, followed by northeast and north. There was little variation in the quantity of grave goods among these burials.

The 2nd phase includes 189 burials, primarily concentrated in the central and western parts of the cemetery, with a few smaller graves in the south and north. Some graves are notably large and contain multiple interments, including individuals who may have been sacrificed. For example, the individual in grave M51 was bound and placed in a kneeling position adjacent to the extended individual in M61 (figure 4.32). Burials from the 2nd to 4th phases are generally oriented toward the mountains to the west of the cemetery, except for a group of second-phase graves in the southeast, which face east. Excavators speculate that these graves may belong to a different family, though the exact reasons remain unclear (SPIA, YMWCH and RCATCH, 2016, p. 363-364).

The disparity in the quantity of grave goods is pronounced, with jade and stone objects being the most common. Many graves contained no objects at all. The placement of grave goods remained consistent throughout the site's occupation. For instance, *Yue* (ceremonial axes) and knives were placed beside the deceased or on their femurs, while *Bi* (discs) and rings were worn on the arms or wrists. Sacrificial individuals were placed in the corners of graves, never near the head or center. Pig tusks and crocodile bones were found near the head or chest of the deceased, and pig mandibles and drilled jade artifacts were also common. Some skeletons and grave goods were adorned with cinnabar. Notably, a few individuals were identified as sacrificial victims, placed in grave corners. Isotopic analysis suggests that most of these individuals were poor members of the community, with a few possibly being captured enemy leaders (SPIA, YMWCH, and RCATCH, 2016, p. 531). Additionally, the presence of crocodile bones and similarities in jade *Bi*, rings, and *Cong* (tubes) indicate ongoing cultural interactions with regions such as the Huai River basin, the lower Yangzi River, and the Yellow River (SPIA, YMWCH and RCATCH, 2016, p. 599).

The 3rd phase has 105 burials located in the southern part of the cemetery. Unfortunately, many of these graves were severely damaged by looting, with bones scattered across different graves, making their original positions unclear. Compared to earlier phases, the graves in this phase are larger, and most feature stepped structures, possibly designed to accommodate coffins, though no clear traces of coffins remain. Over half of the burials contain sacrificial individuals, a significant increase from the second phase, with some graves containing up to four victims. Cinnabar was more widely applied, sometimes covering the entire base of the grave. Although many grave goods were looted, some trends can still be identified. For example, *Yue* and perforated knives disappeared, while *Cong* became a distinctive grave good.

The last phase contains 44 graves, concentrated in the easternmost part of the cemetery. Sacrificial practices disappeared, and almost no grave goods were found.

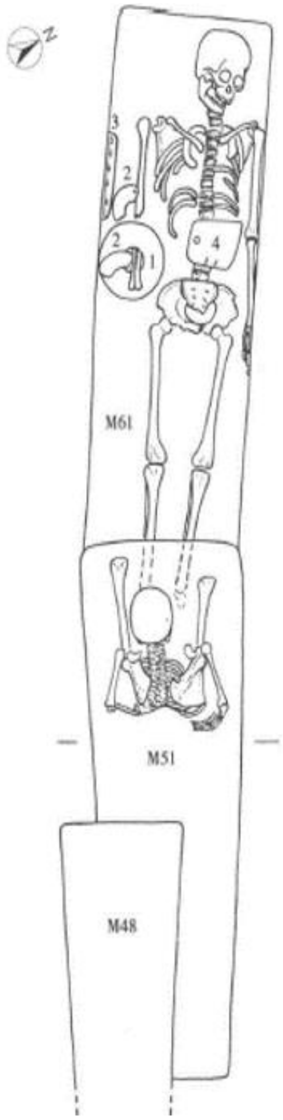
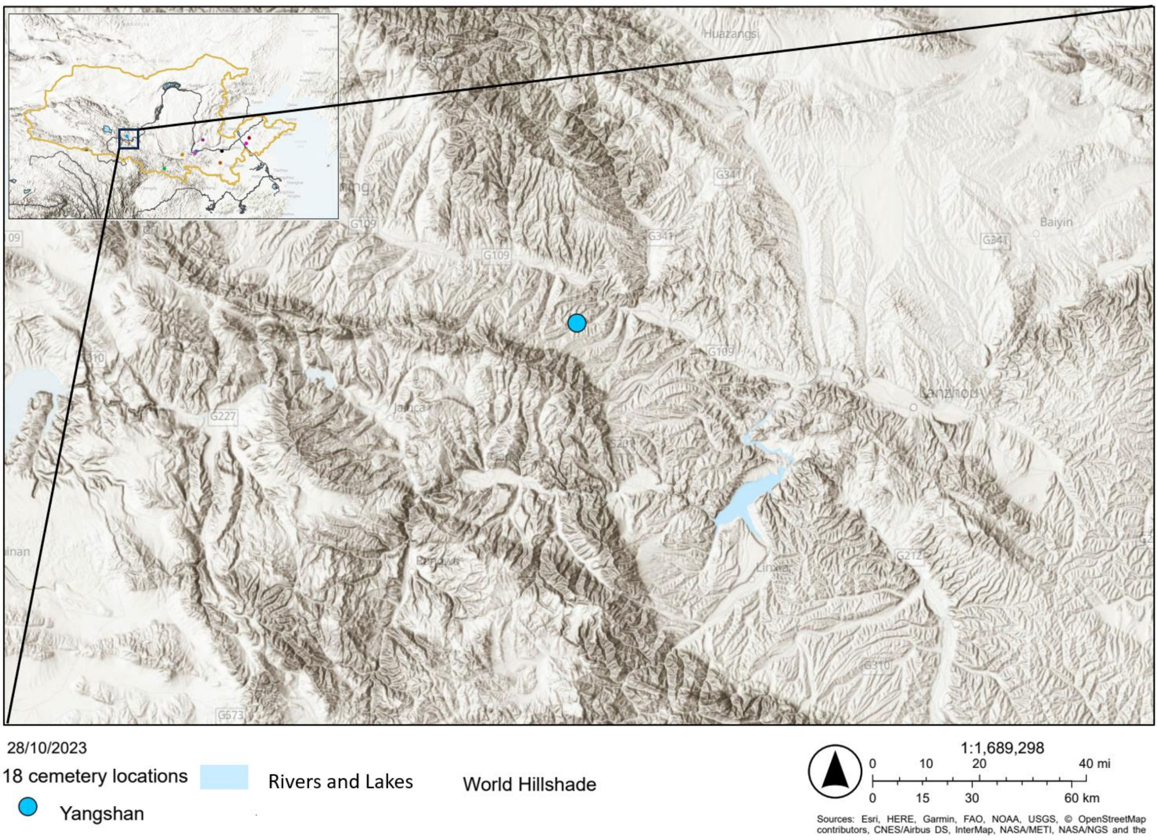



**Figure 4.32, grave M51 and M61 floor plan and M51 rear view (SPIA et al., 2016, p. 110).**

In summary, variations in burial forms, grave goods, and the presence of sacrificial individuals reflect significant social stratification and wealth inequality. Excavators suggest that one contributing factor may have been differing occupations, with some individuals potentially accumulating wealth through the exploitation and trade of salt from nearby salt lakes, facilitating interactions with other cultures (SPIA, YMWCH, and RCATCH, 2016, p. 615). However, the majority of the population remained engaged in agricultural production.

### 4.2.8 Liuwan in Qinghai

The Liuwan cemetery is situated on the north bank of the Huangshui River, north of the Liuwan Valley (ap 4.12 and figure 4.33). Although a settlement associated with the cemetery has been identified southwest of the Liuwan Valley, it remains unexcavated due to poor preservation. Consequently, the dating of the site relies primarily on grave goods from the cemetery. The site spans the Majiayao period (Banshan and Machang phases) and the Qijia period, with an estimated duration of 2655–1500 BC. While limited evidence exists to reconstruct the lifestyle of Liuwan's inhabitants, a study by Dong et al. (2013) on the ratio of agricultural to hunting tools suggests that farming had replaced hunting as the primary subsistence strategy during the Majiayao period. Millet was the staple food, and domesticated animals such as dogs and pigs became increasingly important, alongside hunted deer.




**Map 4.12, Liuwan.**

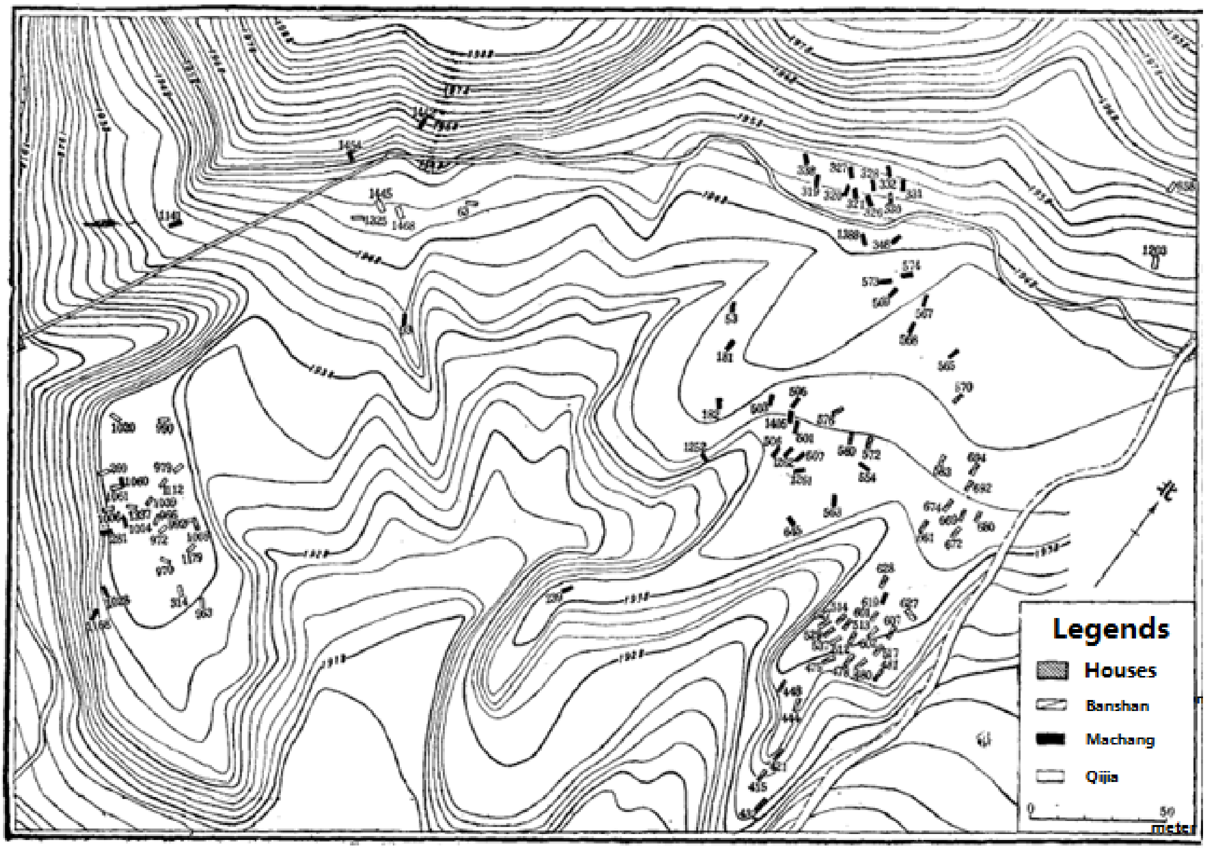



**Figure 4.33, distribution of the Liuwan burials (ATQPACR and IACASS, 1984, p. 2).**

Banshan burials are concentrated in the eastern part of the Liuwan cemetery, arranged in orderly rows along a gentle slope from the base to the top (Figure 4.33). Of the 257 graves, 74 have poorly preserved skeletons. Children were buried in the same manner as adults. Machang graves are primarily located in the central part of the cemetery, with additional clusters in the western and northeastern areas. Qijia period graves are mainly distributed on a terrace in the western part of the cemetery, with some in the central and eastern sections. These graves follow the natural contours of the terrace, either on its slope or its summit. Wooden coffins were commonly used across all burial types at Liuwan.

Burial practices at Liuwan, particularly in graves with multiple interments, are more complex than at other sites. Skeletons were often stacked in various arrangements: for example, the top skeleton extended and the bottom prone, or both extended. Burial M421, for instance, contains three male skeletons oriented at 10° (figure 4.34). The uppermost skeleton is extended, the middle one is extended but lying on its side, and the bottom one is prone. Not all multiple interments involve stacked skeletons; some are placed side by side, as seen in burial M580, which contains three skeletons, two poorly preserved and one extended male (figure 4.35). Additionally, a significant proportion of multiple interments involve individuals of the same sex.

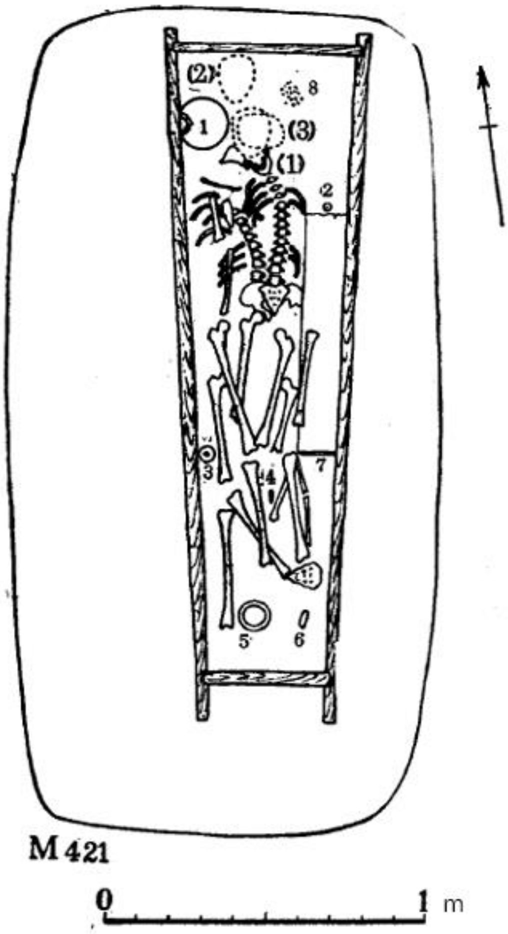



**Figure 4.34, burial M421, 1. Ceramic kettle, 2.3. ceramic spindle whorls, 4. Kallaite ornament, 5. Colour painted kettle, 6. Stone arm ornament, 7. A box for holding arrows (矢箙), 8. Beaded pendant (ATQPACR and IACASS, 1984, p. 18).**

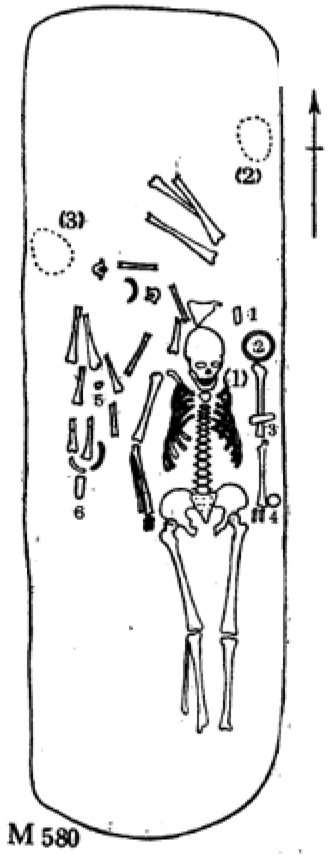



**Figure 4.35, burial M580, 1. Stone adze, 2. Chikou pot, 3. 6. Axes, 4. Stone ball, 5. Arm ornaments (ATQPACR and IACASS, 1984, p. 18).**

Some Banshan graves feature trapezoidal pits, with one side shorter than the other. Six graves (M421, 432, 433, 450, 457, 458) include an additional square or rectangular pit near the feet of the deceased, containing ceramic vessels. Slab burials, such as M433, also occur, with two slabs placed inside the wooden coffin (ATQPACR and IACASS, 1984, p. 10). Most graves are oriented north (226 graves), though a small number (31 graves) are east-west. Skeletons were placed on their backs or sides without a consistent pattern.

A high percentage of Banshan graves contain grave goods, with little variation in quantity. Of the 257 graves, 212 include grave goods: 137 contain ceramic daily-use items, 76 have stone tools, and 126 feature ornaments (108 graves have strings of beads, 26 have turquoise ornaments, 40 have bone plates). Most graves contain only 1–2 items. Ceramic vessels, often color-painted, include kettles, basins, *bo*, pots, *chikou* pots, and single-lug pots. Tools such as axes, adzes, chisels, arrows, awls, and spindle whorls were placed near the waist or arms, while ornaments were worn on the head, neck, or chest. This indicating that the dwellers of the Banshan variant were on relatively equal footing. Exceptions include adzes, bead strings, or stone balls placed in *bo* vessels, and spindle whorls found both inside and outside coffins. The abundance of ornaments, particularly bead strings and bone plaques, suggests a relatively egalitarian society during the Banshan phase.

In the Machang phase, graves include both rectangular pits (485 graves) and "凸"-shaped pits with passages (387 graves) (ATQPACR and IACASS, 1984, p. 53). Most graves are oriented north-south, though some are east-west. In "凸"-shaped graves, wooden posts or planks often block the passage. Burial M1262 features a color-painted kettle placed in front of a row of stone slabs (Figure 4.36). Multiple interments remain complex, though stacking skeletons is less common than in the Banshan phase. For example, burial M1268 contains two extended skeletons oriented at 105°, while M1060 includes six overlapping skeletons oriented at 315° (figure 4.37).

The percentage of Machang graves with grave goods remains high, though the quantity varies significantly. Of the graves, 945 contain ceramics, 382 have tools, and 144 include ornaments. Two graves contain pig mandibles. The number of grave goods per burial ranges from a few to nearly 100, with 10–20 being typical. Ceramic wares were found on two sides of deceased or put on top of coffin lid. Stone axes, chisels, adzes, knives were placed beside wrists or waists or necks, a few of them were put beside feet or on top of coffin lid. These ceramics were mostly decorated on the surface, the patterns are extremely varied, some of them even present special simples, as shown in the figure 4.38. Then, spindle whorls were found beside heads, wrists, or in ceramic wares. Bone awls and arrows were put wrists or femurs. Turquoise ornaments and strings of beads were worn on heads, necks or chests. In addition, bone chisel were put beside heads.

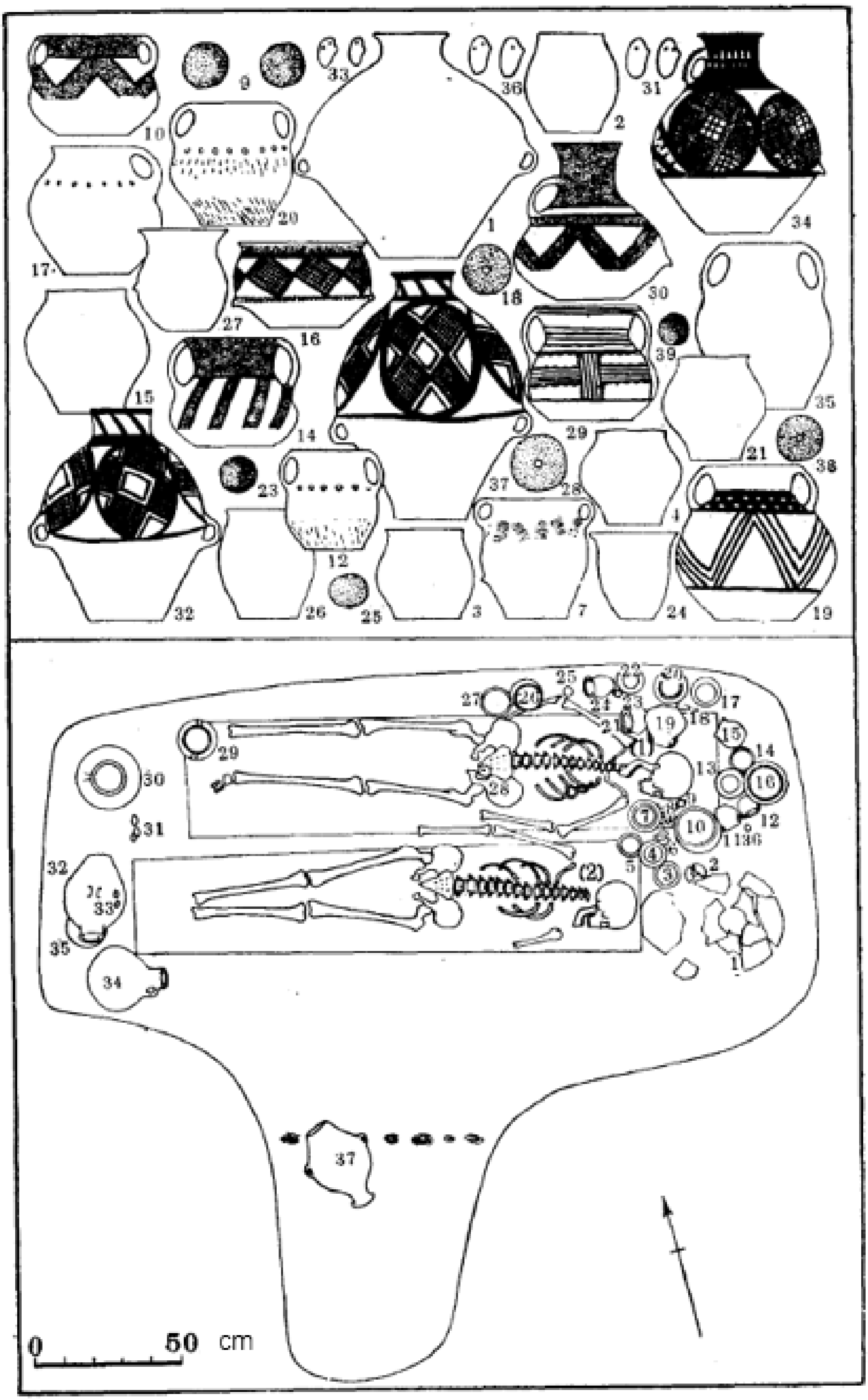

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**Figure 4.36, burial M1262, 1. Colour painted urn, 2-6. 8. 15. 21. 22. 24. 26. 27. Chikou pots, 7. 11-13. 20. 25. Pot with double lugs, 9. 23. 25. 39. Ceramic balls, 10. Chikou pot with double lugs, 14. 19. 29. Colour painted pot with double lugs, 16. Basin, 17. Pot with single lug, 18. 28. 38. Ceramic spindle whorls, 30. 34. Long neck kettle, 31. 33. 36. Mussels, 32. 37. Colour painted kettles (ATQPACR and IACASS, 1984, p. 70).**

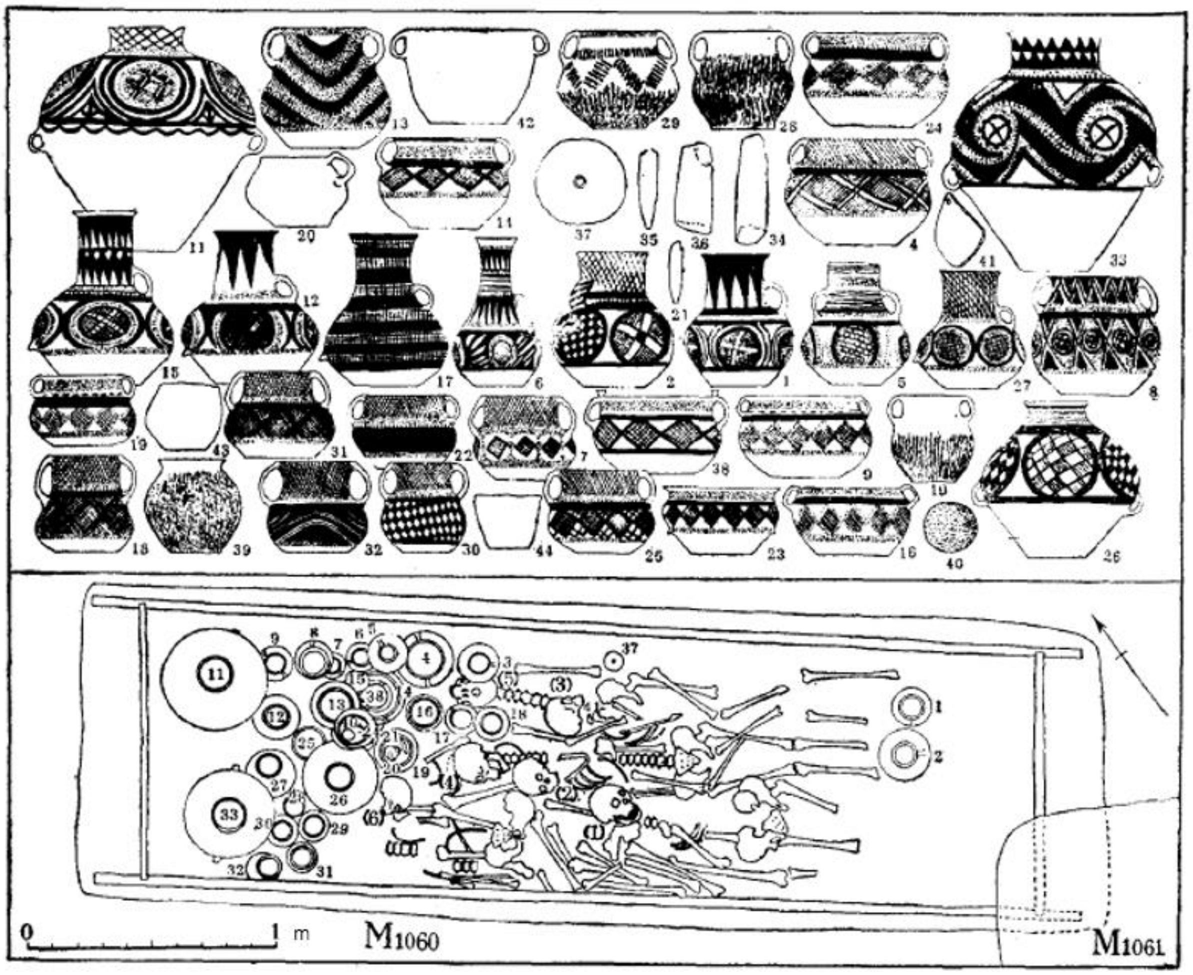



**Figure 4.37, burial M1060, 1. 2. 5. 6. 12. 15. 17. 27. Long neck kettle, 3. 4. 8. 9. 14. 16. 19. 24. 38. Chikou pot with double lugs, 7. 13. 18. 22. 25. 30-32. Colour painted pot with double lugs, 10. 28. 29. Pot with double lugs, 11.13. colour painted urn, 20. Pot with a single lug, 21. 35. Stone chisel, 23. Basin, 26. Colour painted kettle, 34. 36. Stone axe, 37. Ceramic spindle whorl, 39. Chikou pot, 40. Stone ball, 41. Turquoise ornament, 42. Pot with double lugs, 43. 44. Cup (ATQPACR and IACASS, 1984, p. 82)**

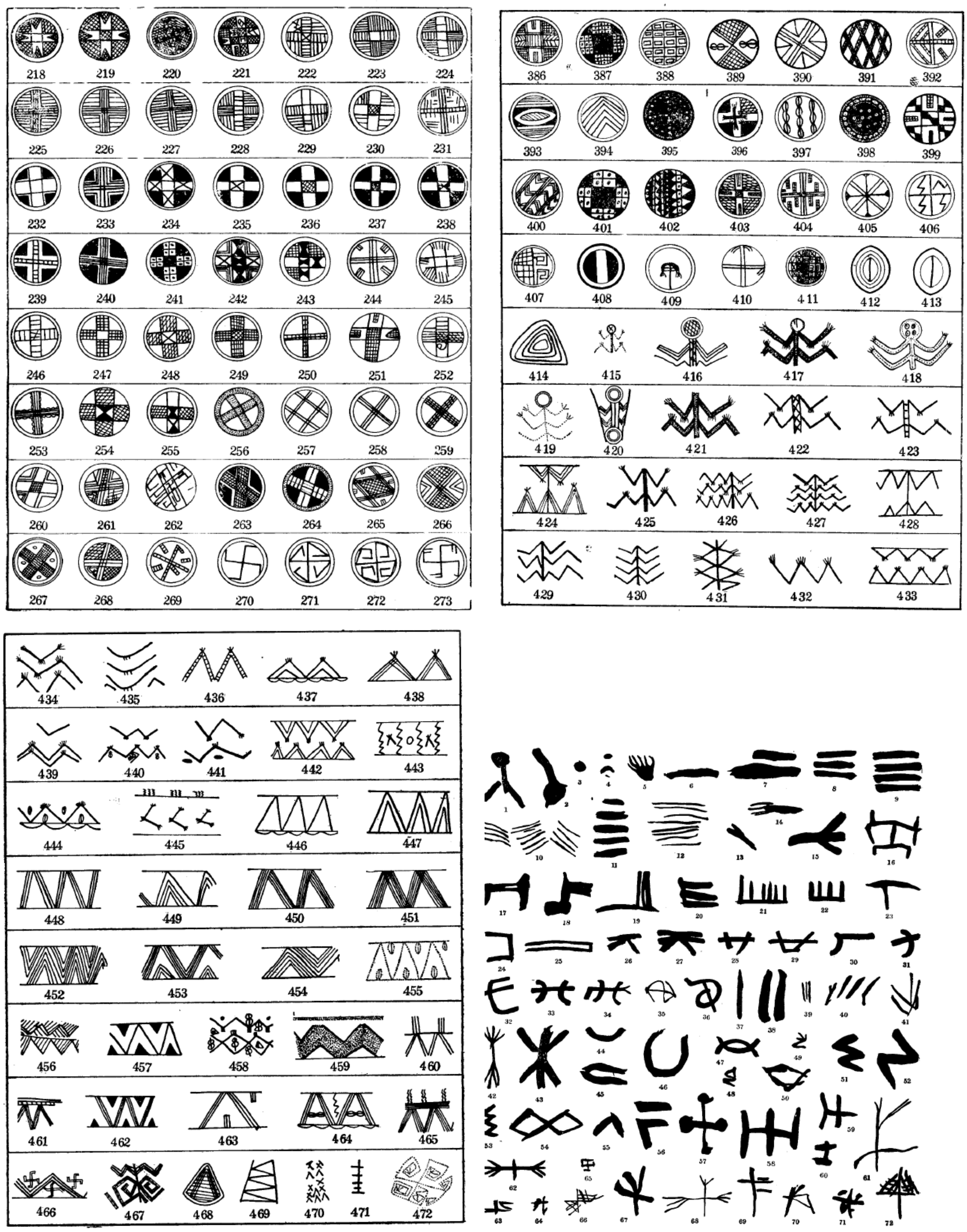



**Figure 4.38, partial patterns and symbols on artefacts in the Machang variation (ATQPACR and IACASS, 1984, p. 138-152).**

In the Qijia period, grave pits are similar to those of the Machang phase, with 318 rectangular pits and 48 "凸"-shaped pits (ATQPACR and IACASS, 1984, p. 170). Graves are predominantly north-south oriented, with those on the terrace slope facing its centre. New features include stone blocks added to grave bases (e.g., M1004), large slabs at grave ends (e.g., M960), and rows of stone blocks and wooden posts blocking passages (e.g., M972) (figure 4.39). There are more burial positions in this period than in the Machang phase, , including dismembered skeletons, as seen in M392 and M397, where skulls were separated from bodies at different angles (figure 4.40). Separation of heads and bodies, or inversion of the skull does not seem to be an uncommon phenomenon, as a result, it also occurred in graves with multiple interments. In the dismembered interments, the buried individual’s hands were placed obliquely at the waist, as if tied, and the lower limbs cut of and placed upside down between the two femurs.

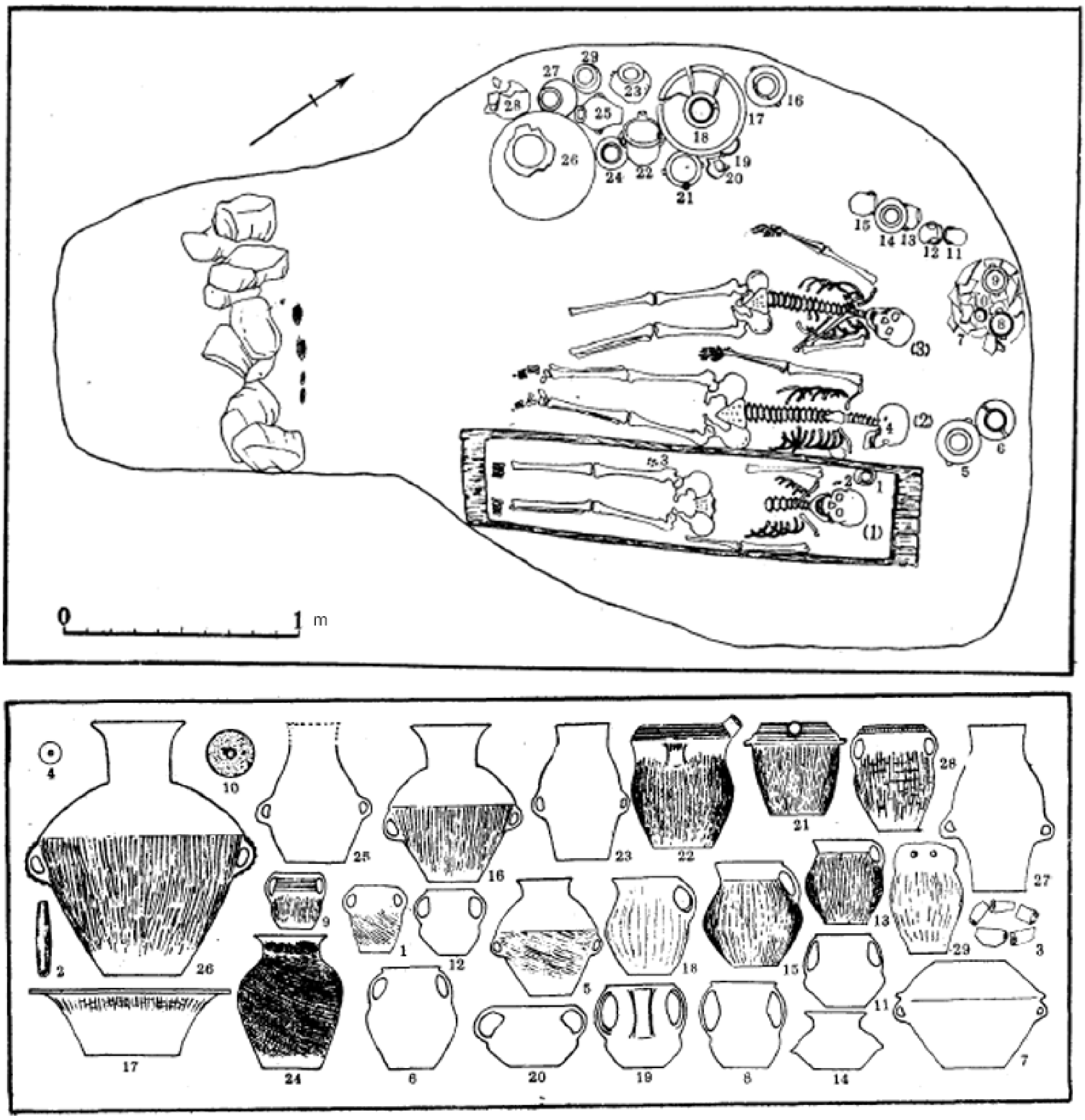


**Figure 4.39, burial M972: 1. 6. 9. 20. Pot with double lugs, 2. 3. Turquise ornaments, 4. A string of beads, 5. 16. 26. High neck pot with double lugs, 7. Liankou urn, 8. 11. 13. Pot with double large lugs, 10. Ceramic spindle whorl, 13.15. 18. Pot with single lugs, 14. Zhefu pot, 17. Basin, 19. Pot with triple lugs, 21. 22. 28. Pot with a mouth, 23.22. 28. Kettle, 24. Chikou pot, 29. Owl-faced ceramic pot (ATQPACR and IACASS, 1984, p. 189).**

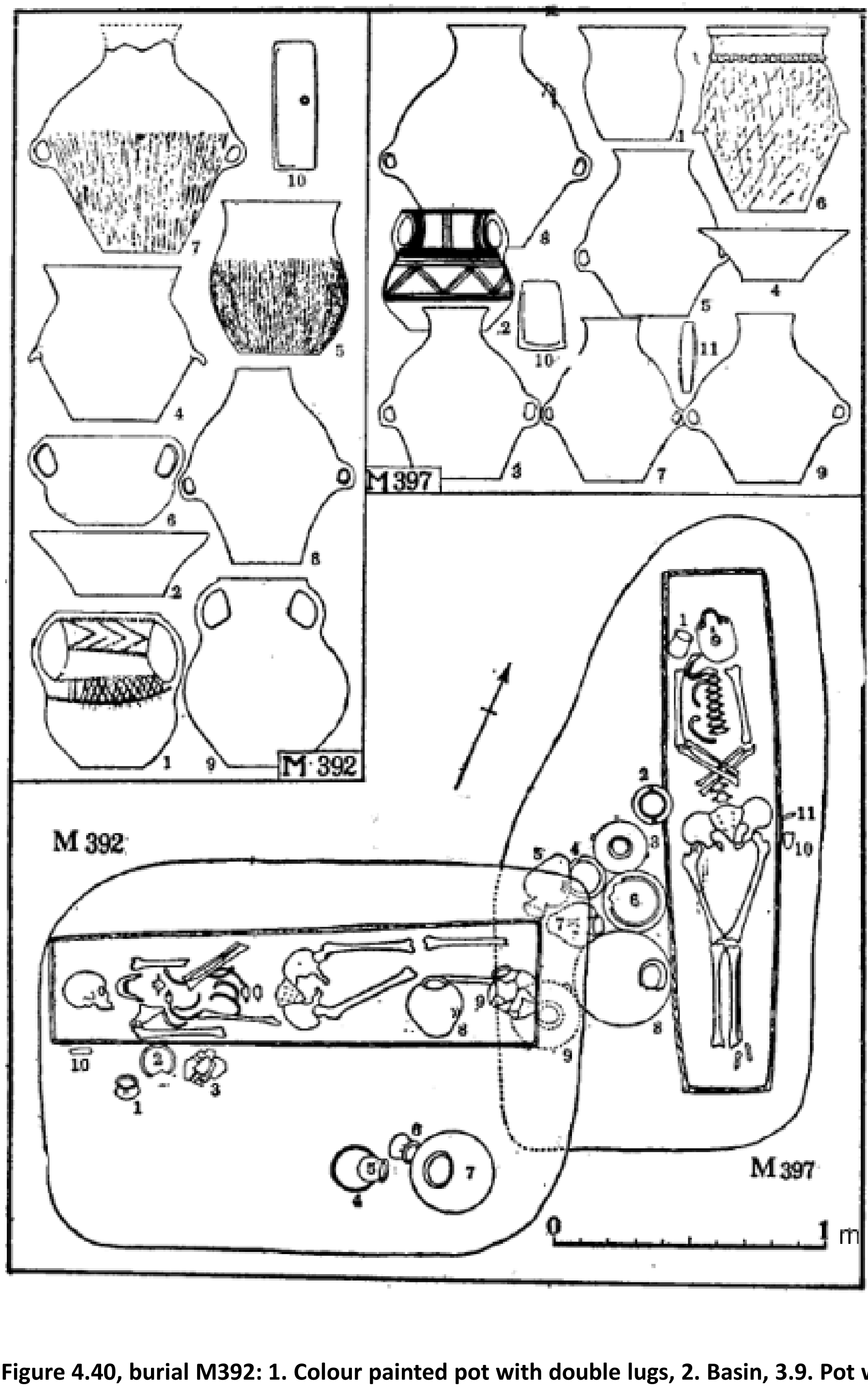



**Figure 4.40, burial M392: 1. Colour painted pot with double lugs, 2. Basin, 3.9. Pot with double lugs, 4. Zhefu pot, 5. Chikou pot, 6. Pot with two lugs, 7. High neck pot with double lugs, 8.**

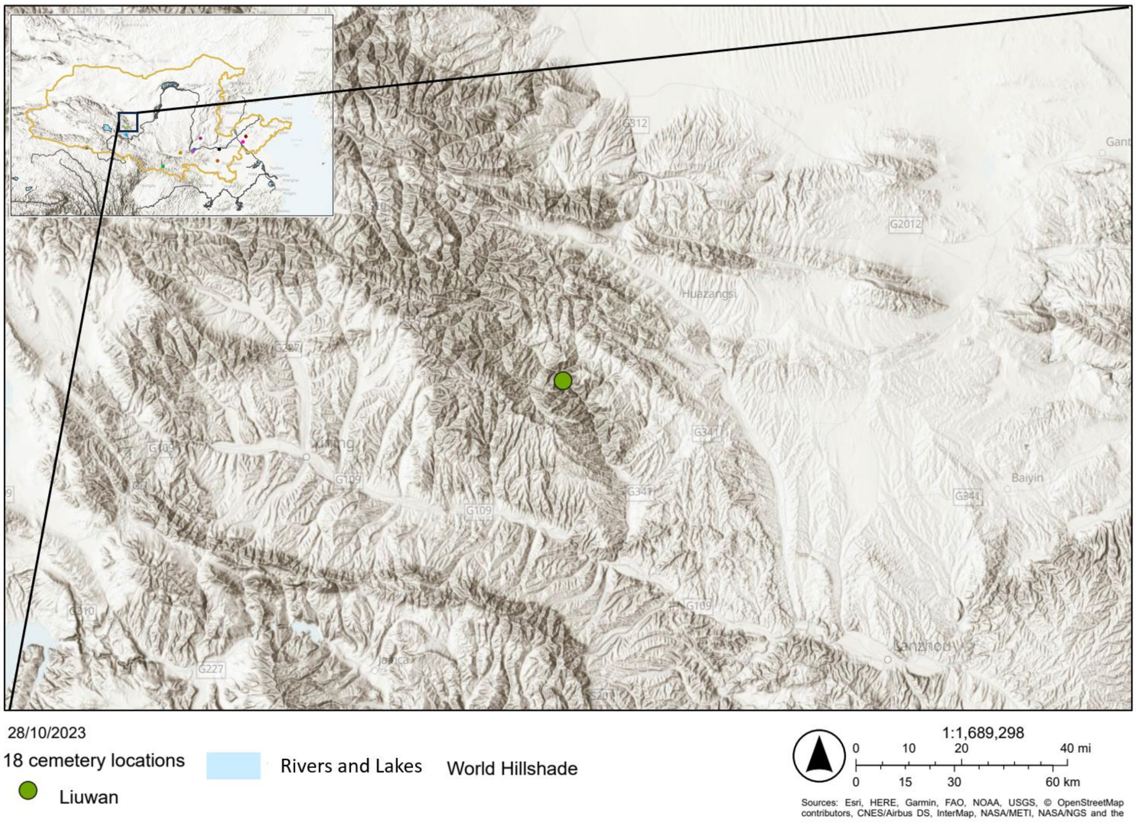
**Kettle, 10. Stone knife. M397: 1. Zun, 2. Colour painted pot with double lugd, 3. 5. 7-9. Kettle, 4. Basin, 6. Urn, 10. Adze, 22. Chisel, 12. Knife (ATQPACR and IACASS, 1984, p. 174).**

Grave goods remain abundant in the Qijia period, with only 42 of 366 graves lacking objects, 295 graves contain ceramics, 128 graves contain manufacturing tools, 31 graves contain ornaments. 4 graves contain over 20 ceramic wares; 120 graves have 2-4 ceramic wares. Ceramic wares were mostly found on the western or southern side of the chamber or near feet, but small wares such as *Chikou* pots and pot with double lugs usually found near heads. manufacturing tools, such as stone axes, adzes, chisels were pit near head or arms, or outside the coffin, or between two legs. Bone arrows and stone balls were put beside waist or near ceramics, Bone needles were placed near fingers. ceramic spindle whorls were put inside ceramics or on the rim of ceramics. Ornaments were worn on neck, chest, or somewhere else. One turquoise ornament was found inside a skeleton's mouth.

In summary, wooden coffins were widely used at Liuwan, reflecting advanced mortise and tenon jointing techniques. Both adults and children were buried similarly, and "凸"-shaped pits with passages were common. During the Banshan phase, stacking skeletons in multiple interments was prevalent, though this practice declined in the Machang phase. Flexed burials, often associated with more grave goods, may indicate higher social status. The Qijia period introduced greater variability in burial positions and practices. The increasing disparity in grave goods and burial sizes from the Banshan to the Qijia periods suggests growing social stratification and wealth inequality.

### 4.2.9 Yangshan in Qinghai

Another significant Neolithic site in the UYellow River is Yangshan. The Yangshan cemetery, dating to the Banshan phase (2655–2330 BC), is located on a valley slope, with the Songshi River to the east, separating the site from Yin Mountain (figure 4.40). Maantiao Mountain lies to the northwest, and Yanchi Ditch is situated to the northeast. The site, at an elevation of 2,200 meters above sea level (map 4.13), comprises 218 excavated and recorded graves. The cemetery is simpler in structure compared to Liuwan, divided into western and eastern sections (figure 4.41). In the western part, graves in the south are oriented west, those in the north and adjacent to the south face south, and central graves are oriented north. In the eastern part, orientations are less consistent: southeast graves face west-east, while those in the north, northwest, and west face north, and those in the northeast and southwest face south.




**Map 4.13, Yangshan.**

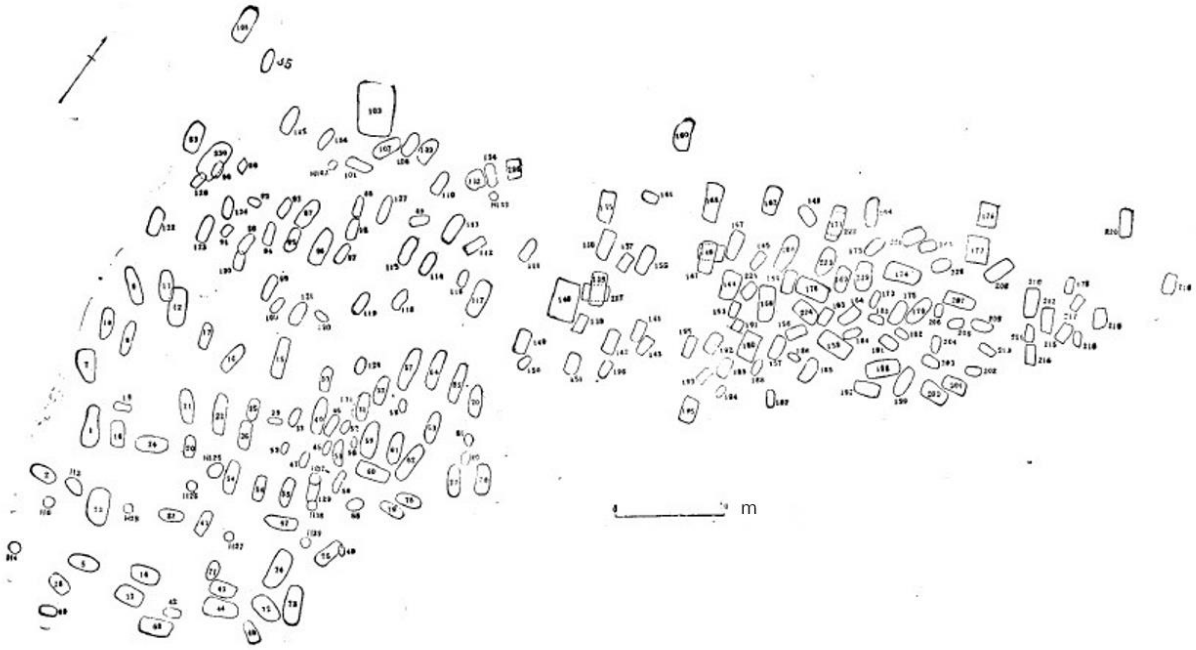



**Figure 4.41, distribution of graves and pits at Yangshan cemetery (AIQA, 1990, p. 4).**

Of the 156 graves containing human remains, 94 are primary burials (70 single and 24 multiple interments), and 62 are secondary burials (51 single and 11 collective interments). Among single interments, 43 are prone, 20 are flexed to one side, 6 are prone and flexed, and only 1 is extended. The positions in multiple interments are more varied, with combinations such as two individuals flexed toward each other (figure 4.42) or two prone individuals (figure 4.43).

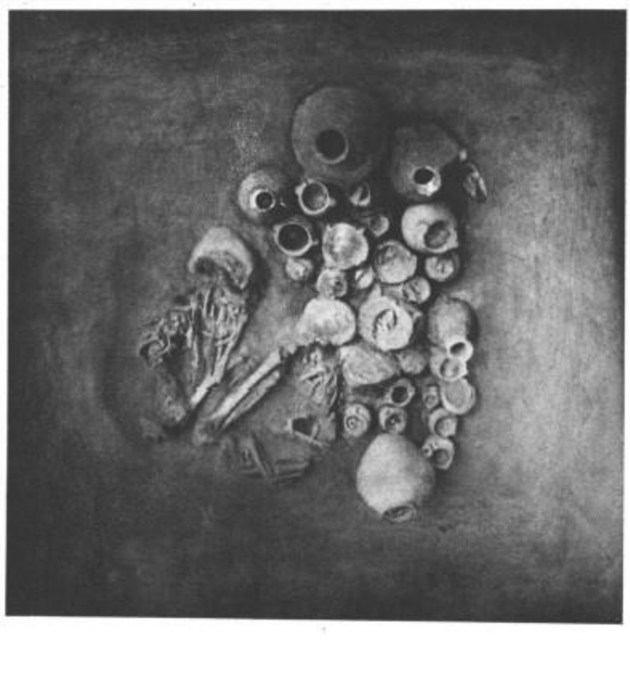


**Figure 4.42, burial M176, showing two individuals flexed to each other (AIQA, 1990, p. image IX).**

**Figure 4.43, burial M68, containing two prone individuals (AIQA, 1990, p. image VIII).**

The maximum number of grave goods in a single grave is 52. Ceramic wares are found in 115 graves, manufacturing tools in 191, and ornaments in 16. Grave goods are typically concentrated near the head, feet, or sides of the body. Ceramics are placed as described, tools are often near the waist or arms, and bead strings are worn on the neck or chest. Burned animal bones are found in a few graves, and 32 graves contain oval or rectangular stones placed near the head, pelvis, or feet. Additionally, 63 graves contain only grave goods, with no human remains. Despite variations in grave size and the number of objects, disparities are not extreme. However, graves M23, M60, and M147 stand out due to the presence of ceramic drums, possibly ritual objects, and lighter stone axes that may have had ceremonial or symbolic significance. These graves also contain other finely crafted objects, suggesting their occupants held special status, possibly as leaders or ritual specialists (AIQA, 1990, p. 143).

In the southwest of the cemetery, 12 additional pits were explored. Five contain burned traces and ceramic fragments, four hold domestic and wild animal bones and stones (e.g., pit H4,

Figure 4.44), one contains both, and two are empty. The ceramic fragments appear deliberately broken and scattered, and the presence of animal bones without human remains suggests these pits may have had sacrificial significance.

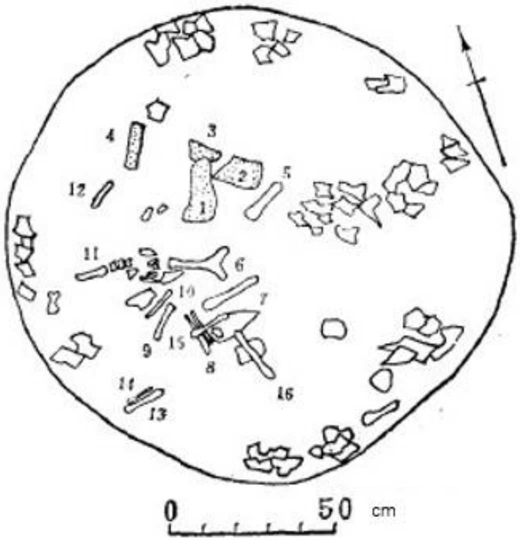
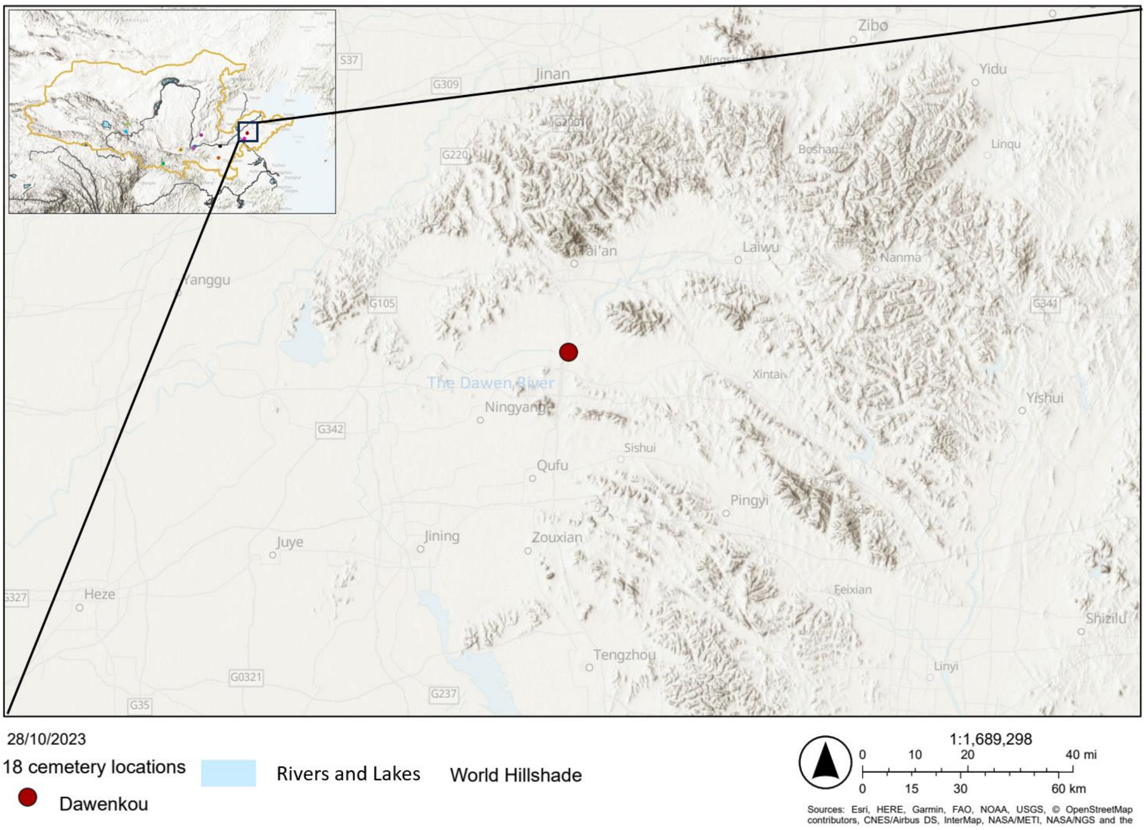



**Figure 4.44, pit H4, 1-4 stones, 5-16 fragments of animal bones (AIQA, 1990, p. 55).**

Most evidence of production and daily life comes from grave goods, though descriptions are limited. The division of labor is not yet evident, as most graves contain agricultural tools, grain processing tools, water vessels, spindle whorls, and other textile implements, indicating a self-sufficient natural economy (AIQA, 1990, pp. 139–140). The presence of hunting and livestock breeding tools in the pits further suggests these activities complemented farming.

### 4.2.10 Dawenkou in Shandong

Dawenkou is one of the most representative sites of the Dawenkou culture, encompassing two cultural periods: the Beixin phase (4520–4150 BC) and the Dawenkou phase (4150–3700 BC). Excavations by the Shandong Provincial Institute of Cultural Relics and Archaeology began in 1959. The site is located on a plain formed by sediment from the LYellow River, near the sea. Culai Mountain, part of the Taishan range, lies to the northeast, while the Dawenkou River divides the site into northern and southern sections (Figure 4.45). The northern part is 2 meters higher than the southern, and mountains surround the site to the east, south, and north.




**Map 4.14, Dawenkou.**

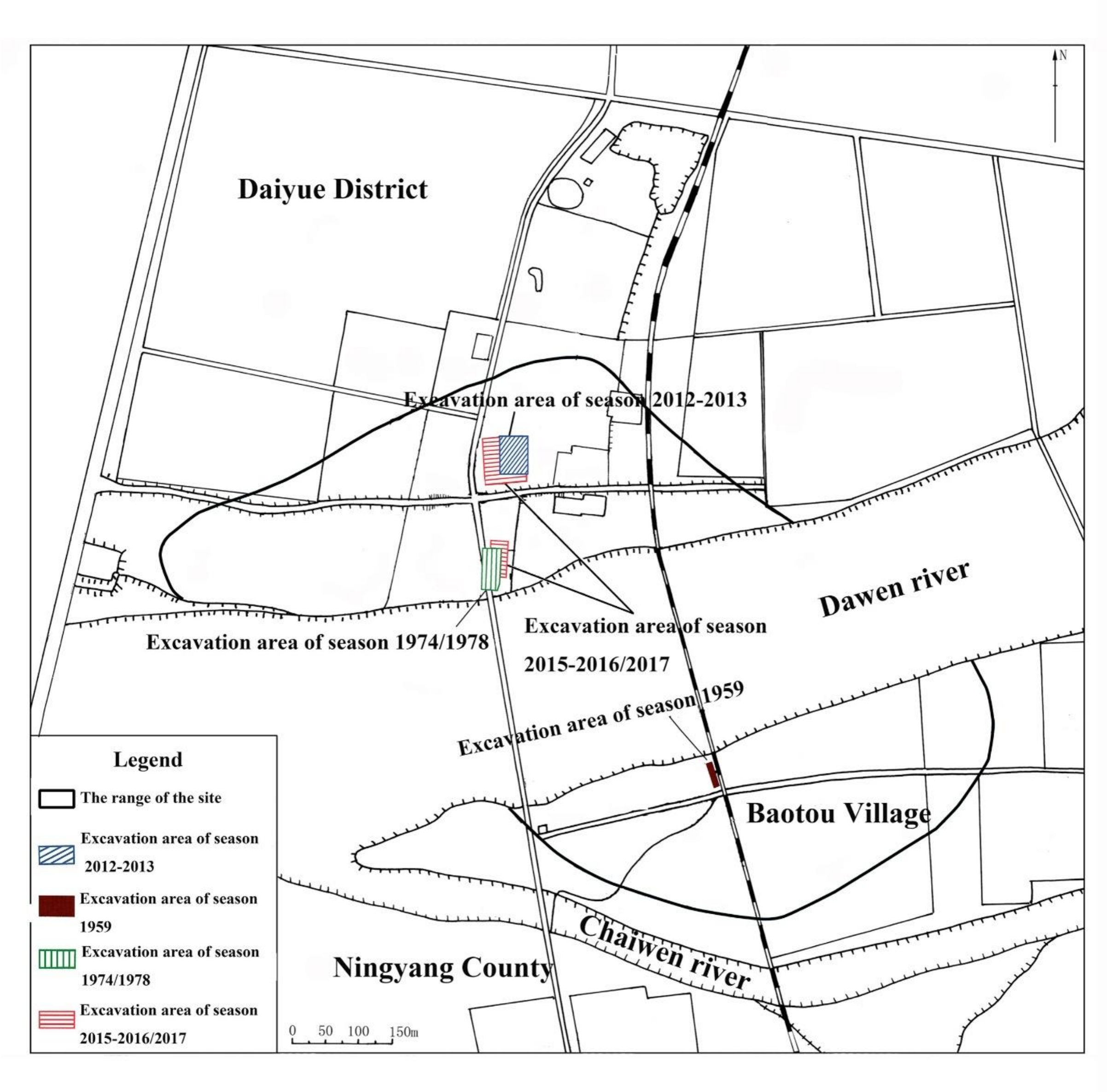



**Figure 4.45, plan of Dawenkou site (Chen, *et al.,* 2019).**

As consumption may change in different phases, this may cause the changes in graves. The stable isotope analysis indicates that the Dawenkou people consumed large amount of C4 plants, i.e. millet over time, though C3 plants such as rice were also present. By the late phase, individuals in higher-status graves consumed foods with higher nitrogen isotopic values (Chen, *et al.*, 2019). The frequent appearance of high-stemmed cups in graves suggests they may have been used for wine, implying surplus grain production (SPACR and JM, 1974, p. 121-2). In addition, based on the plant and animal remains, it is concluded that the climate in the area where the Dawenkou culture was distributed was warm and humid, which was very favourable for primitive agricultural production, with temperatures about 2° higher than today (SPACR and JM, 1974, p. 122). On the basis of the development of agriculture, livestock rearing, mainly pig rearing, also developed, with pig bones found in over one-third of graves, and chicken bones were also found. Cattle and sheep and dog bones unearthed at contemporary sites such as Liulin (SPACR and JM, 1974, p. 122). Therefore, the variety of domestic animals at that time was already relatively rich.

The cemetery consisted of 10 Beixin graves and 179 Dawenkou graves. Beixin graves are primarily single extended burials, except for M1017, where a flexed female is buried alongside a flexed infant. Dawenkou graves are mostly oriented east-southeast (85–130°), with exceptions like M128 (south) and M45 (west). This situation also caught Underhill (2000)'s attention, she suggests that the varying orientations may align with seasonal sunrise positions (figure 4.46). Additionally, other popular speculations were mentioned in the previous chapter-the Dawenkou culture section. The arrangement of burials in the Dawenkou period is more varied than in the Beixin period, with occupants placed in wooden coffins. Of 143 primary single interments, 116 are extended, 12 are extended on one side, 1 is prone, and 1 is flexed.

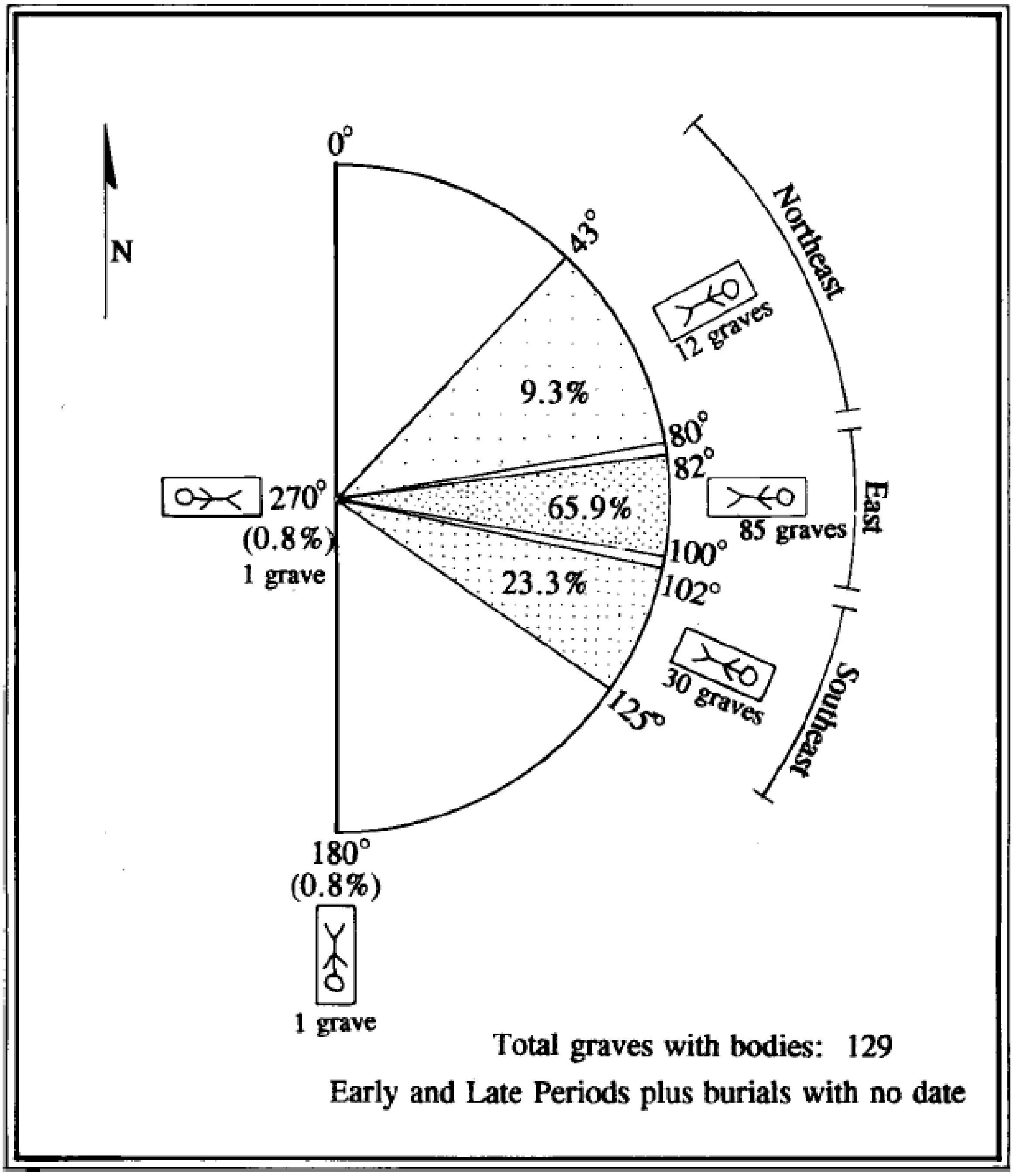



**Figure 4.46, the orientation of graves at Dawenkou (Underhill, 2000).**

Furthermore, 3/4 of the Beixin graves lack coffin, though 2 graves were surrounded by stone slabs in a rectangular shape. Several large stone slab were placed as a cover stone on top (figure 4.47). 1/3 of the graves contain no grave goods. In contrast, Dawenkou graves show significant inequality in the quantity and quality of grave goods, with some containing over 180 items. 8 graves are empty, 11 contain tortoise shells, 52 have pig heads or lower mandibles or limb bones beside grave owners' feet. WWater deer tusks and pig teeth are held in hands, while stone shovels, axes, bone spears, tortoise shells, and perforated antler objects are placed near the waist. Spindle whorls are often found between the knees. Notable burial customs include the extraction of upper lateral incisors and artificial deformation of the occipital bone.

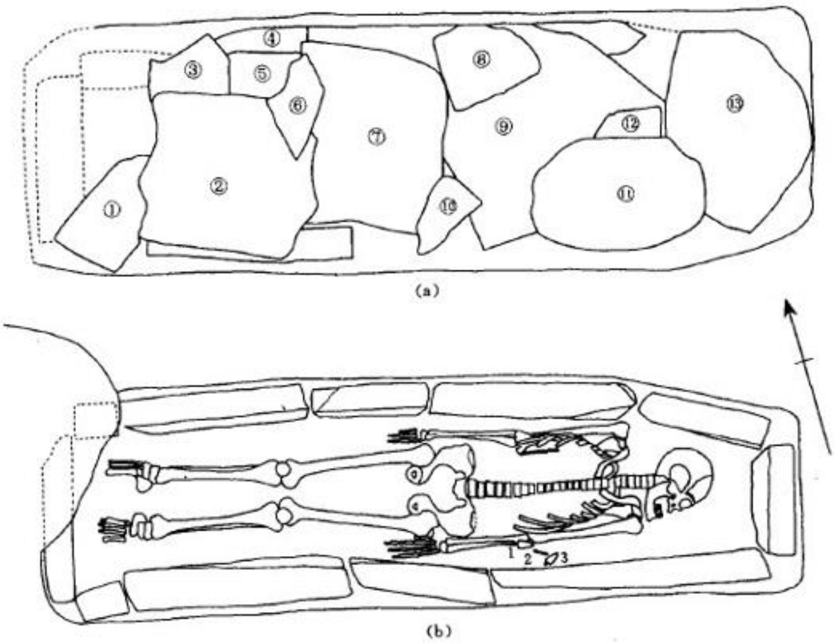
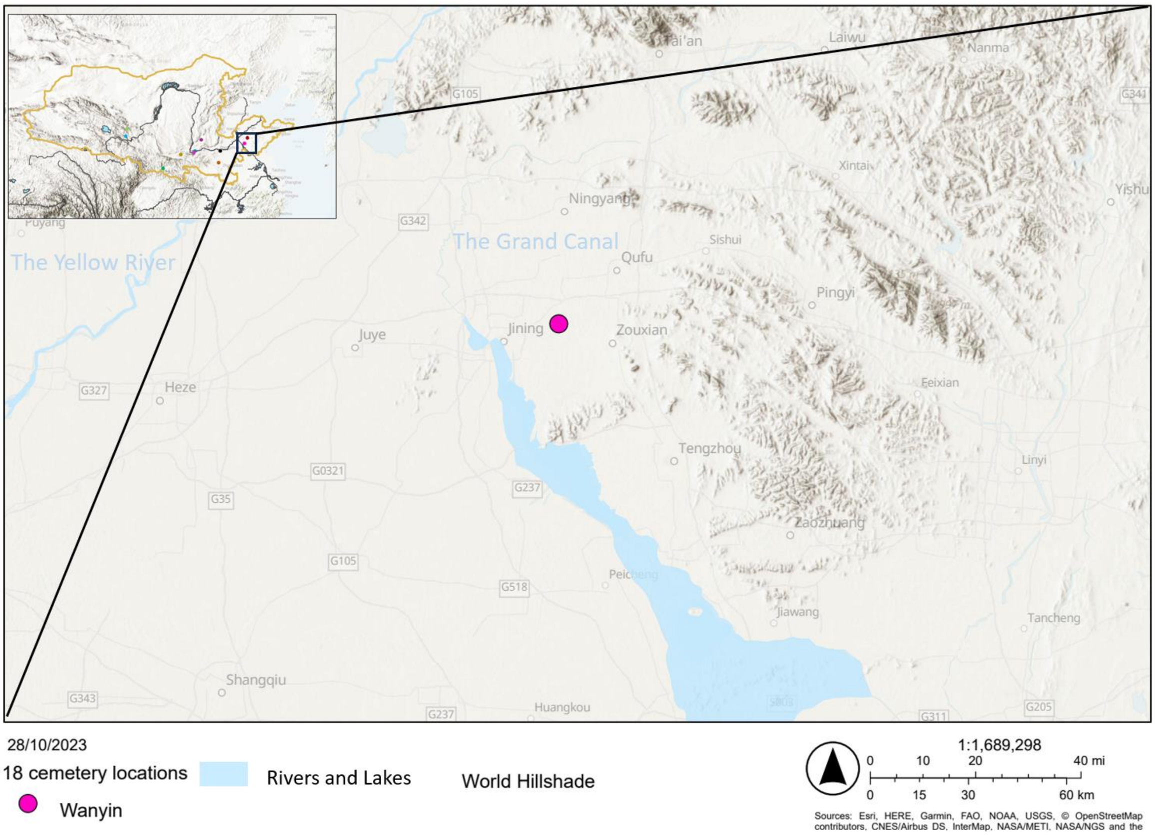



**Figure 4.47, burial M1011 Beixin grave, 1-3. arrows (SPICRA, 1997, p. 34).**

### 4.2.11 Wangyin in Shandong

The site of Wangyin is attributed to both the Beixin and Dawenkou periods (4500–3500 BC), although remains from the Beixin phase are scarce. The site is located 12.5 miles southeast of the Wangyin Valley (map 4.15) the site is stratified into three layers corresponding to the Dawenkou culture: early (4300 to 4000 BC); middle (4000 to 3700 BC); late (3700 to 3500 BC). A ditch to the north, possibly an ancient river, borders the site, which sits approximately 1 metre above the surrounding terrain. While the cemetery is distinct from the residential area, with burials concentrated centrally, traces of houses, pits, and a few burials found along the western, southern, and northern edges suggest some overlap between living and burial spaces.




**Map 4.15, Wangyin.**

Based on excavations at the Banpo site, Zhu (IACASS, 2000, p. 306) estimated that the average annual temperature in the Xi'an region around 4000 BC was approximately 2°C higher than today. This suggests that the inhabitants of Wangyin, like those at Dawenkou, enjoyed a natural environment conducive to agricultural development. Although no crop remains have been discovered, the scale of the cemetery and house foundations indicates that the early Wangyin population had transitioned to a sedentary agricultural lifestyle, moving beyond slash-and-burn practices. The presence of stone shovels further supports the adoption of hoe-ploughing techniques. Livestock rearing, particularly pig farming, was also well-developed, with remains of cattle, buffaloes, dogs, and chickens also identified (IACASS, 2000, p. 307). Additionally, the discovery of aquatic animal remains, such as turtles, fish, and shells, alongside less common species like wolves, foxes, tigers, bears, and crocodiles, points to a well-developed fishing and hunting economy.

The cemetery contains 899 burials, a higher number than most contemporary sites, with a concentrated distribution. The central area holds 696 burials, while 89 are in the western area, 43 in the southern area (figure 4.48), and 71 in the northern area (figure 4.49). Stratified by layers, the early phase includes 121 graves, the middle phase 376, and the late phase 402. Over time, burials expanded in all directions. Burial types are varied, including primary single interments (732), primary multiple interments (31), secondary single interments (33), secondary multiple interments (65), and *Qianchuzang* (where most of the primary burial has been removed) (38). Most graves are oriented eastward, with 94% aligned at approximately 90°. The predominant burial position is single extended (707), followed by flexed (8), extended on one side (6), flexed on one side (4), prone (5), and flexed and prone (2), the latter possibly resulting from post-depositional pressure.

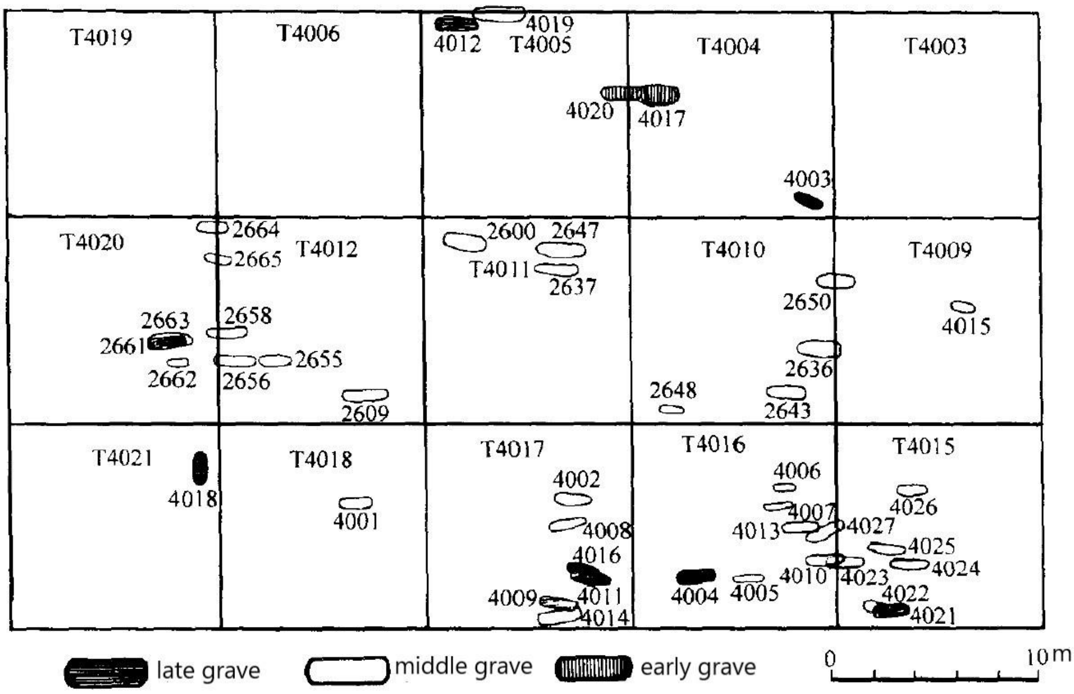



**Figure 4.48, burial distribution in the southern area of the Wangyin cemetery (IACASS, 2000, p. 150).**

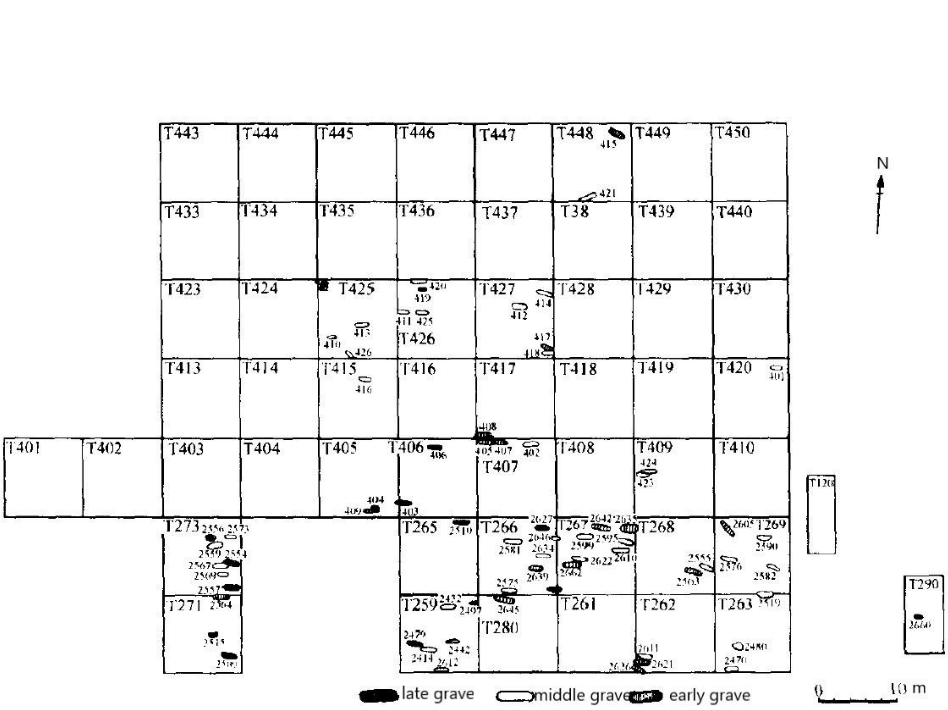


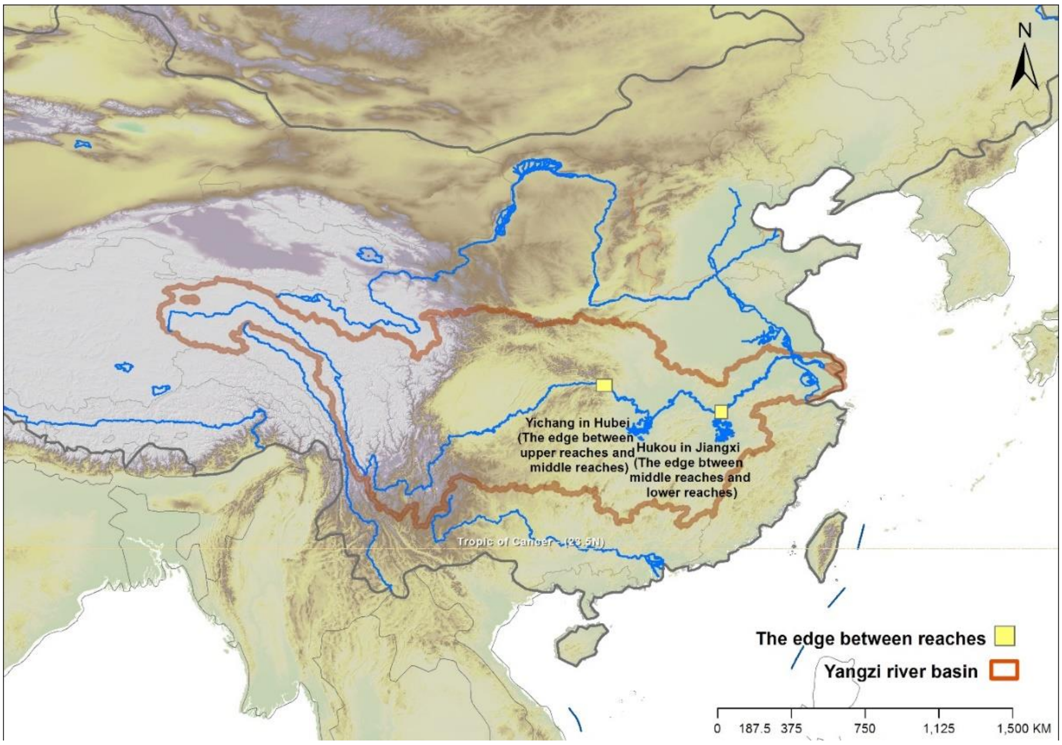

**Figure 4.49, burial distribution in the northern area of the cemetery (IACASS, 2000, p. 150).**

A notable feature in the central cemetery area is the presence of red-burned soil mixed into grave backfill. Other distinctive burial customs include the inclusion of tortoise shells, some perforated and burned, containing bone cones. These tortoise shells are found exclusively in male burials. Additional practices include artificial deformation of the occipital bone, the placement of small balls in the mouth (possibly from childhood), and the extraction of upper lateral incisors during sexual maturity.

## 4.3 The Yangzi River

The Yangzi River basin spans 1.8 million square kilometres and extends approximately 6,300 kilometres in length. It is divided into three regions (map 4.16): the upper, middle, and lower reaches. The boundary between the upper and middle reaches is marked by Yichang in Hubei, encompassing Qinghai, Tibet, Sichuan, Yunnan, Chongqing, and Hubei. Key geographical features include the Qinghai-Tibet Plateau, Hengduan Mountains, Yunnan-Guizhou Plateau, and Sichuan

Basin. The middle Yangzi River stretches from Yichang to Hukou in Jiangxi, covering Hubei, Hunan, and Jiangxi. This region transitions from the Jiangnan Hills to the Hanjiang Plain, Dongting Lake basin, and Poyang Lake basin. The lower reaches extend from Hukou to the East Sea estuary in Shanghai, encompassing Anhui, Jiangsu, and Shanghai. This area is characterised by lower elevations and less hilly terrain, featuring Tai Lake, Chao Lake, Shuiyang River, Qingyi River, Huaiyang Hills, Zhemin Hills, Cao Lake basin, and the Yangzi River delta, which connects to the Huai River basin and Hangjia Lake basin.




**Map 4.16, the boundaries between the Upper, Middle and Lower Yangzi River and the overall extent of the Yangzi River basin (Esri, 2021).**

Agriculture in the Yangzi River basin evolved from a single economic form in the early Neolithic period to a diversified system integrating fishing, hunting, gathering, and farming. Rice, resistant to flooding, became the cornerstone of paddy farming, known as rice agriculture. Advances in agricultural tools and drainage techniques enhanced rice farming's significance as a staple food source, though fishing and hunting remained important (IACASS, 2010, p. 786). The Yangzi River basin, on the other hand, is mostly covered with forest vegetation and people tend to use slash-and-burn methods, i.e. cutting down trees and weeds and burning them to ashes to create cultivated fields. More details on the subsistence practices of the various regions of Neolithic China will be exposed in the upcoming sections.

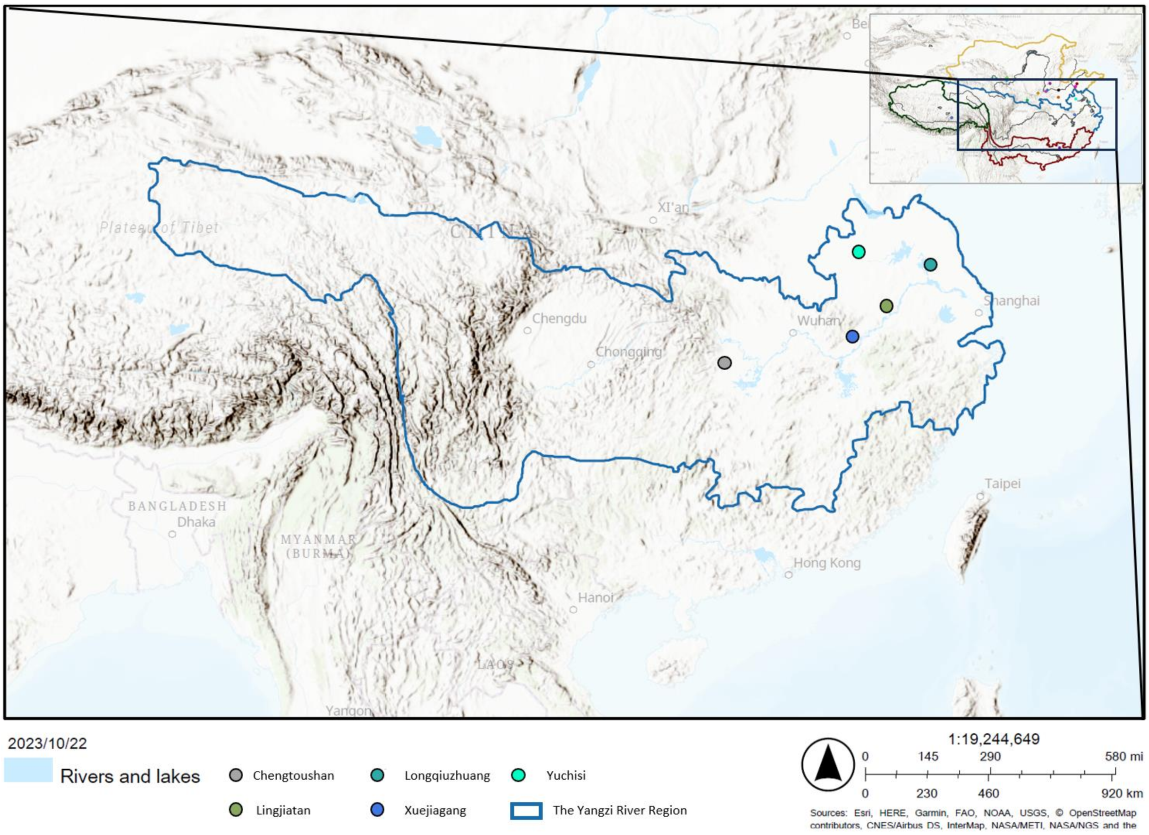
From the Late Pleistocene, the middle Yangzi River region developed a dense water network of rivers, lakes, and marshes, ideal for rice cultivation (Guo, *et al.*, 2016). The Liyang Plain is an alluvial and sedimentary plain and a transition zone, lies at the transition from the Wuling Mountains to the Dongting Lake basin, through which the middle and lower Li river flow through from west to east. Its southeastern terrain, ranging from 50 to 160 metres above sea level, supported early human habitation (Guo, *et al.*, 2016). Chengtoushan is located on the eastern edge of the Liyang Plain and this edge is sharded with Dongting Lake basin. The north-south trending Wuling Mountains lie on the south-west-northern border of the Liyang Plain. Then, the Yangzi River in the northern edge of the Liyang Plain. The Liyang Plain is considered one of the earliest centres of rice cultivation, evidenced by rice remains at Pengtoushan and intentionally designed paddy fields from the Tangjiagang culture (Pei, 1989). Climatic analysis indicates rising temperatures until 6,500 years ago, followed by a warm and rainy period around 6,000 years ago, and fluctuating temperatures between 5,000 and 4,500 years ago (Yin, 2003). These conditions influenced prehistoric cultures, with rising temperatures creating large lakes that reduced habitable space and slowed site growth.

The Daxi culture flourished during the first warm period, strengthening the agricultural base and increasing site numbers. The Shijiahe period marked a second warm phase, further advancing agriculture and productivity (Yang et al., 2015). The transition from fishing and hunting to agriculture occurred earlier in the Yangzi River basin than in the Yellow River region, intensifying during the Daxi, Qujialing, and Shijiahe cultures. Domestic animals included pigs, dogs, and chickens, with water buffalo bones also found, though domestication likely occurred later, around the first millennium BC (Shelach, 2015, p. 118).

The LYangzi River belong to the middle and lower reaches of the Yangzi Plain, one of the three major plains in China. It is formed by the alluvial deposits from the Yangzi River and its tributaries. Bounded by the Yellow Huai Plain and Huaiyang Hills to the north and the Jiangnan Hills and Zhejiang-Fujian Hills to the south, the region averages around 50 metres in elevation. Both Xuejiagang and Lingjiatan are situated on one of the sections called the Suwan Riverine Plain, unlike the North China Plain, features numerous branches, lakes, and small mountain ranges. As a result of its unique regime with the southwest and southeast monsoons from Pacific Ocean, these were collapses of mountainsides owing to frequent rain, and sedimentation in the low-lying terrain in the lower reaches. This environment also means that plant and animal resources were abundant, so fishing, gathering and hunting were still indispensable activities (Dai, 2008). At the beginning of the Holocene Warm period, rice gathering or initial cultivation had already occurred in the LYangzi River, with the first geographical expansion into the Jianghuai region and into the vicinity of Tai mountain (Qin, 2012). However, unstable natural conditions occasionally disrupted farming practices, contrasting with the more continuous rice cultivation in the MYangzi River.

During the middle Neolithic period (6,500–5,500 kaBP), the Jianghuai region experienced warm temperatures, flooding, and extensive lake and marsh development, resulting in relatively few sites (Zhao, Tang, and Shen, 1994; Dai, 2008). Communities adapted by shifting from millet monoculture to a mixed millet and rice farming system (Liu and Xiang, 2005).

Meanwhile, in the Majiabang culture in the LYangzi River, rice gradually developed into a relatively mature agricultural culture (Guo ang Guo, 2014a). The subsequent Songze culture integrated rice cultivation techniques from the middle Yangzi and Huai River basins, further innovating and influencing these regions (Guo and Guo, 2014b). As a result, this cultural exchange facilitated the widespread adoption of rice farming. By the late Neolithic period, interspersed zones of rice and millet cultivation emerged, shaped by climatic fluctuations and geomorphological factors (Liu and Xiang, 2005). Its formation was caused by frequent warming and cooling caused by the alternating Holocene ice ages and interglacial, in addition to geomorphological factors, which is a favourable condition for the production of rice. At the late Neolithic sites of Jianghuai a marked decrease in the number of animal bones excavated and a decline in the proportion of the fishing and hunting economy as a supplementary means of food sourcing, but remained their important economic role at this time either (IACASS, 2010, p. 794). At the same time, livestock rearing, particularly of pigs, dogs, and water buffalo, became the primary meat source.

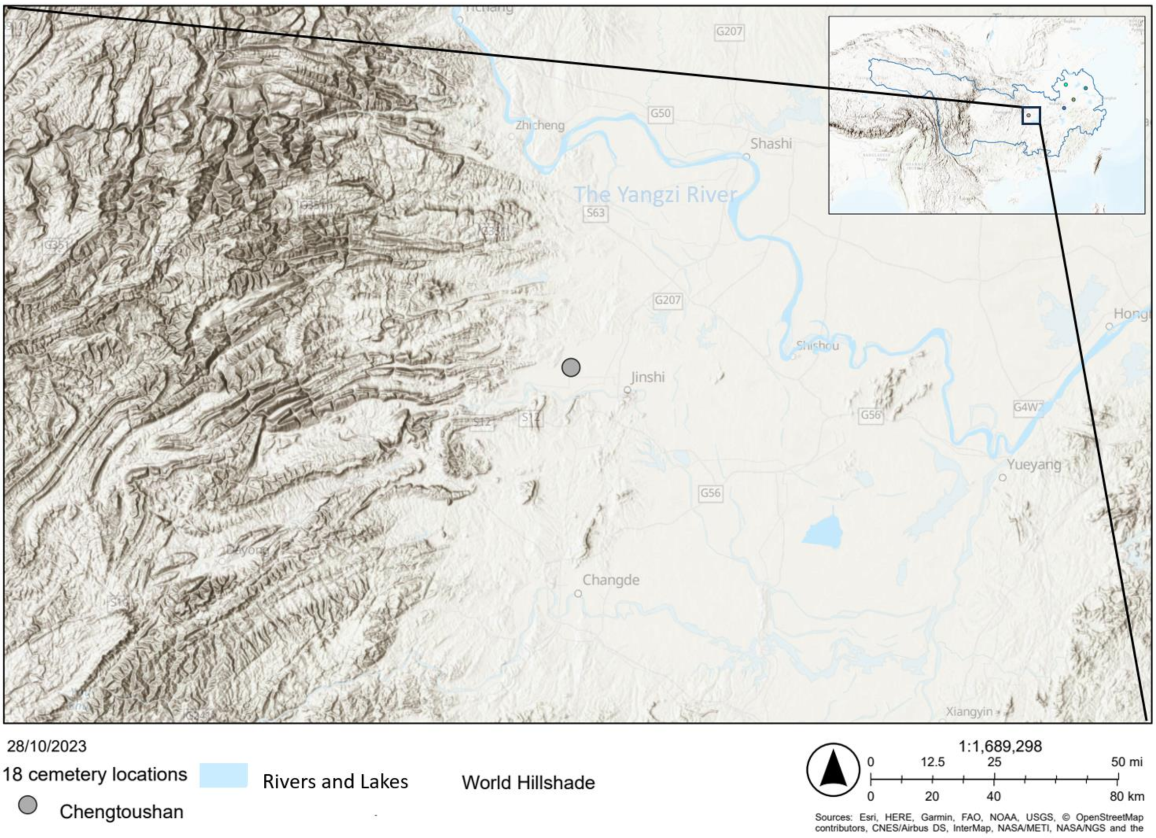



**Map 4.17, the selected Neolithic sites in the Yangzi River region.**

The map 4.17 presents the selected five Neolithic sites in the Yangzi River region, which are Chengtoushan in the MYangzi River, Xuejiagang, Lingjiatan, Longqiuzhuang and Yuchisi in the LYangzi River region.

### 4.3.1 Chengtoushan in Hunan

Chengtoushan is situated in a transitional zone between the remnants of the Wuling Mountains and the Dongting Lake basin, surrounded by mountains on three sides and open plains to the east. The site lies at an elevation of 32–35 metres above sea level, with terrain sloping gently from northwest to southeast along the river (map 4.18). Occupied from the Tangjiagang culture to the Shijiahe culture (4800–2300 BC), the site's chronology has been further refined based on pottery analysis, delineating the Daxi period to 4200–3200 BC, the Qujialing period to 3200–2500 BC, and the Shijiahe period to 2500–2300 BC.




**Map 4.18, Chengtoushan.**

The site is divided into nine excavation areas (Figure 4.50), revealing a comprehensive structure of defensive walls, a large ditch from the Daxi period, and a moat from the Qujialing period. Internal features include houses, ditches, pits, kilns, altars, and graves (HPIACR, 2007, p. 84). A north-south axis dominates the site, with most Daxi culture houses oriented north-south, a practice continued into the Qujialing and Shijiahe periods. This emphasis on cardinal directions is also reflected in burial orientations. Burial distribution varies by cultural period: two Tangjiagang burials are located in the 6th excavation area; Daxi burials are found in areas 4, 6, and 7; Qujialing burials are concentrated in area 4, with scattered interments in areas 2, 6–8; and Shijiahe burials are fewer and more dispersed, possibly indicating the absence of a formal cemetery during this period.

Paddy fields from the Tangjiagang and Daxi periods (4800–3200 BC) were discovered northeast and south of the site, respectively, alongside an irrigation system from the Tangjiagang period (Hunan Provincial Institute of Archaeology and Cultural Relics, 2007, p. 165). The inhabitants adopted a multi-faceted food procurement strategy, with rice cultivation gradually expanding, as evidenced by increased rice husk remains. Dryland farming also developed, with foxtail millet as a staple crop (Yasuda et al., 2004; Nasu et al., 2012). Rice cultivation became more widespread during the Qujialing period, both in quantity and variety.

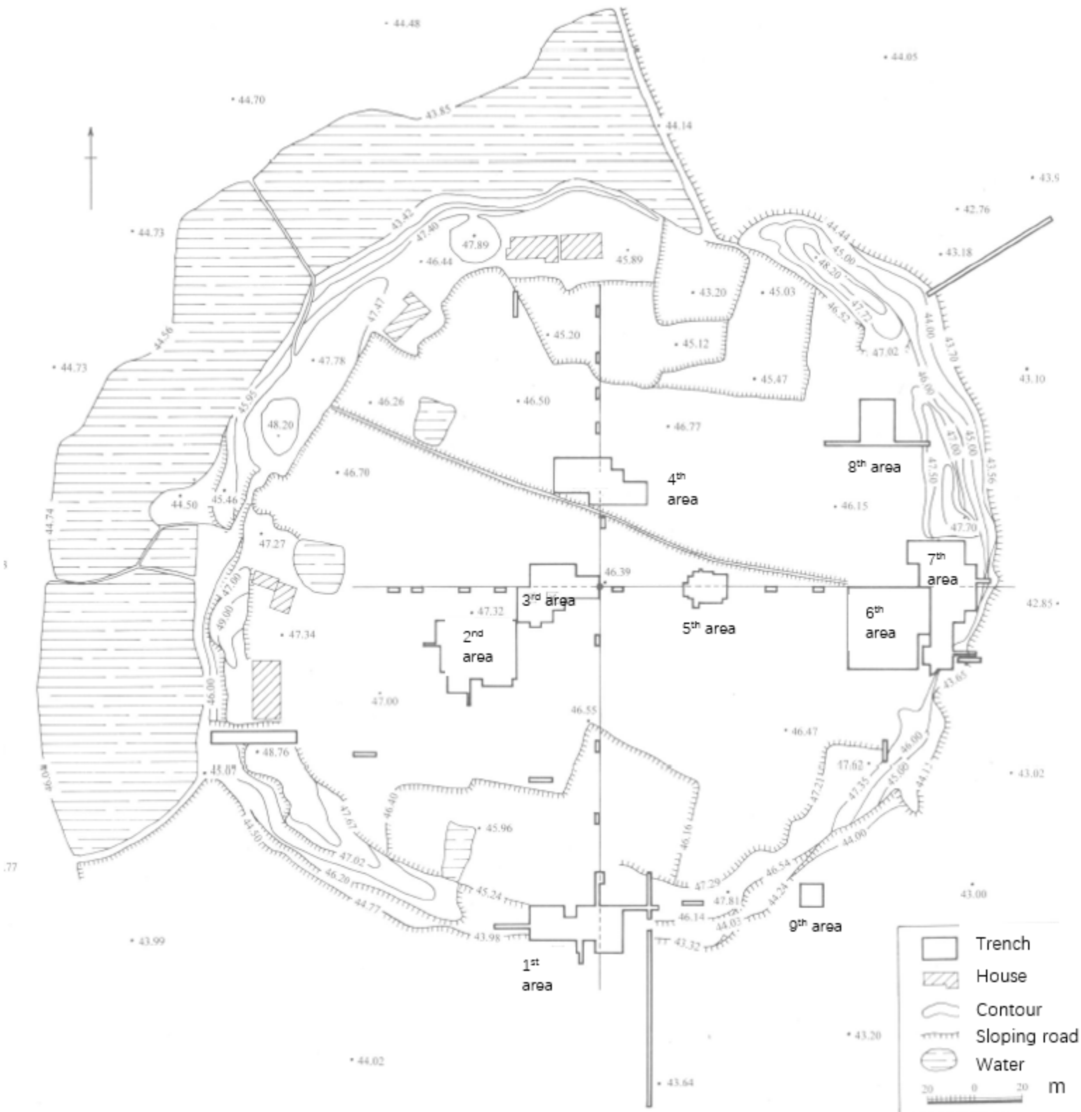



**Figure 4.50, layout of Chengtoushan showing the excavated areas (HPIACR, 2007, p. 10).**

Three Daxi culture altars have been uncovered at Chengtoushan (HPIACR, 2007, pp. 266–283). Altar 1 comprises four elements (figure 4.51):

1. 5 round pits (H011, H343–346), with stones found in H011, H345, and H346, arranged in a line aligned northwest-southeast.

2. 34 burials and 39 urn burials, including M774, the largest burial, located at the highest point of the altar. This grave, divided into north and south sections, contained an extended individual with flexed lower limbs, a deer tusk under the left leg, and an ox jawbone in the southern section. 4 smaller graves (M773, 770, 766, 751) surrounded M774, oriented southeast or east, with no grave goods.

3. 49 pits containing plant ash, ceramics, burned soil, large stones, or animal bones.

4. Accumulations of burned soil.

Altar 2 is encircled by a wall of burned clay bricks, 30 cm wide and high (figure 4.52, left). Altar 3, earlier than Altar 2, features a central pit containing burned soil (figure 4.52, right)..

He Nu suggests that the Daxi culture at Chengtoushan may have worshipped the Antares and dragon constellations. As a result, the isosceles triangle formed by pits H343, H344, and H346, containing stones, aligns with the heart mansion of the dragon constellation in star charts, possibly indicating astral worship. (Wang and He, 2024).

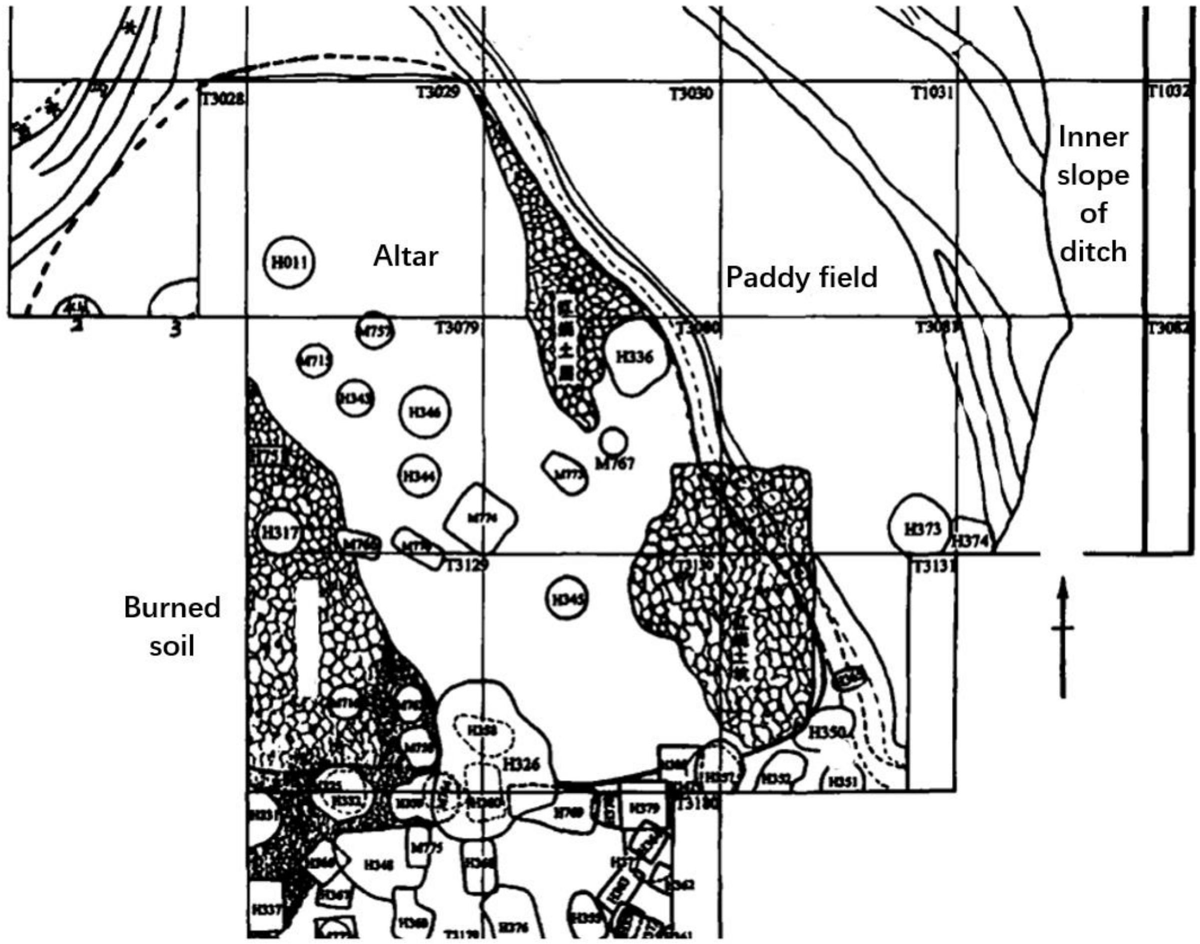



**Figure 4.51, plan of altar1 and pits at Chengtoushan (He, 1999).**

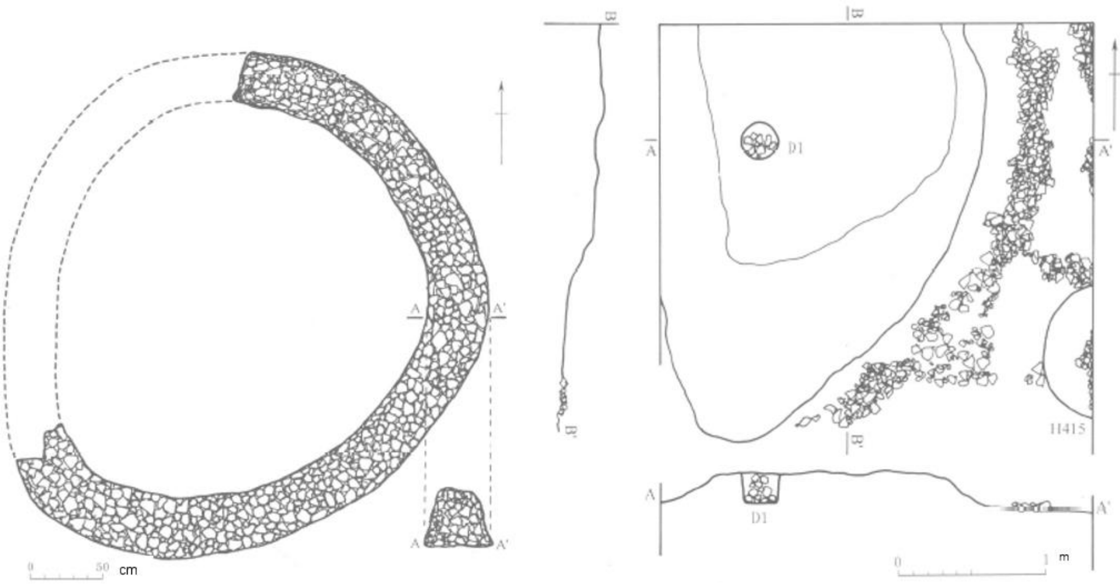


**Figure 4.52, plan of altar2 (left) (HPIACR, 2007: 283); plan of altar 3 (right) (HPIACR, 2007, p. 283).**

Most skeletons found at Chengtoushan are poorly preserved due to environmental conditions. The relatively better-preserved remains reveal that Daxi burials are often oriented southeast, with flexed positions more common than extended (figure 4.53). In these cases, pits are relatively smaller, except for a couple of pits with extended inhumations which were dug on the slope, so the skeleton lied on the slope as well, such as burial M706 shown in figure 4.54. Wealth disparities are evident in grave goods, with richer burials concentrated in the 7th excavation area, such as M678, which contained numerous objects, contrasting with adjacent flexed burials (M681–682) lacking grave goods (figure 4.55).

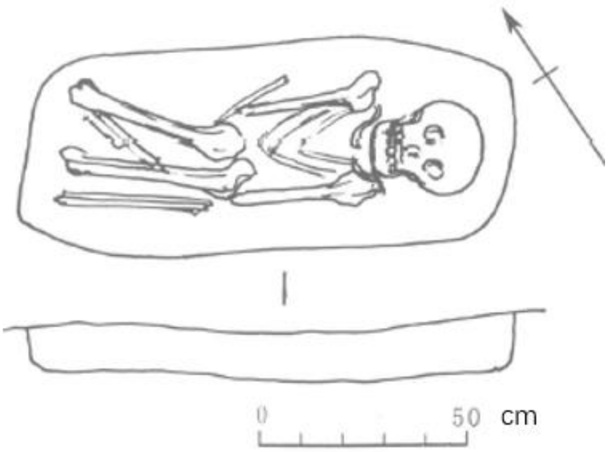



**Figure 4.53, burial M58, extended with flexed limbs inhumation, without grave good (HPIACR, 2007, p. 287).**

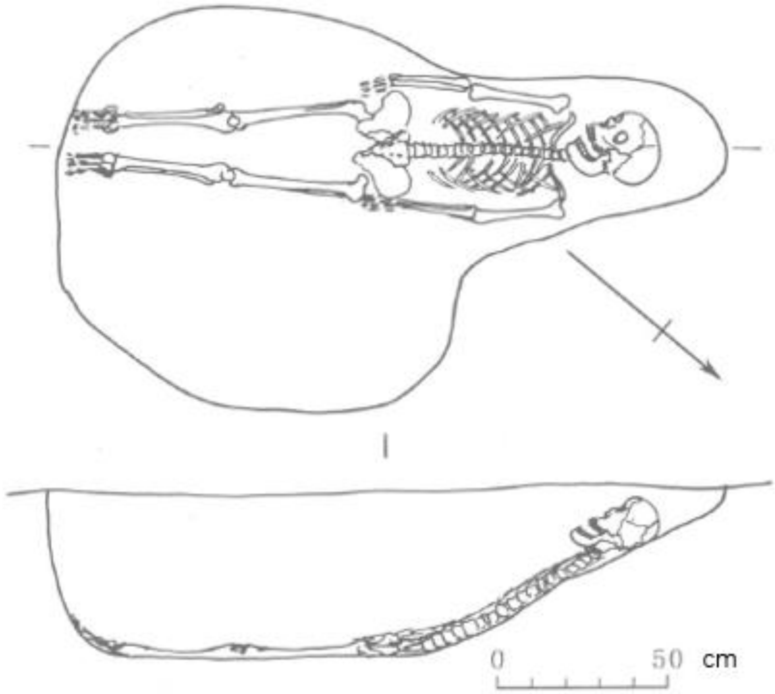



**Figure 4.54, burial M706, extended inhumation lying on a slope (HPIACR, 2007, p. 291).**

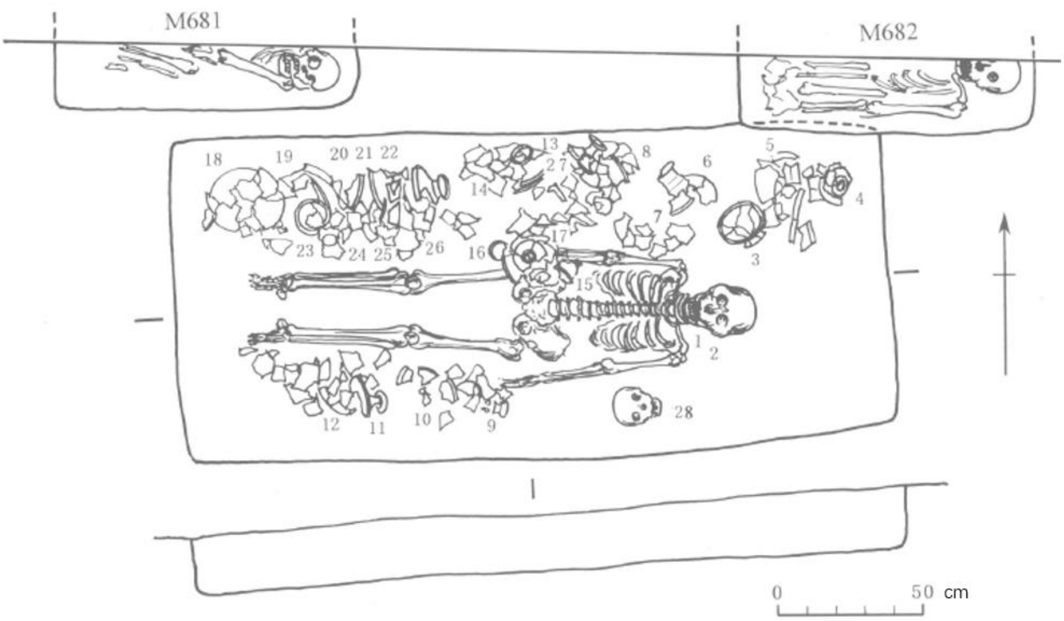



**Figure 4.55, burial M678, 681 and 682, 1-2. Jade huang, 3.9.11.12.17.20.22.24.26.27. ceramic lids, 4.6-8.10.13.14. dou, 5.15.19.25. plates, 15. Tripod, 18.21. bowls, 23. Fu, 28. A child's skull. A little cinnabar applied in the pit (HPIACR, 2007, p. 293-4).**

Qujialing burials share similarities with Daxi burials. The orientation is also variable, W-E is more frequent than others, and groups of graves (5-10 graves) are mostly directed to east. Wealth disparities increased, with some graves, such as M425, containing up to 96 items (figure 4.56). The Ming wares are mainly modelled on utilitarian wares and are modelled on their forms, mainly tripods, *dou*, pots, *gui*, jars and bottles, typically undecorated.

Tangjiagang pottery at Chengtoushan features patterns on about 50% of pieces, with white pottery dominated by nail, interlocking geometric, and short stripe motifs. Other coloured pottery, mainly black, red and ochre is less common. During the Daxi period, the proportion of black and grey pottery gradually increased, with white pottery becoming rare and 90% of the pottery undecorated. The decline in decoration and simplification of forms suggest some vessels were made specifically for burials.

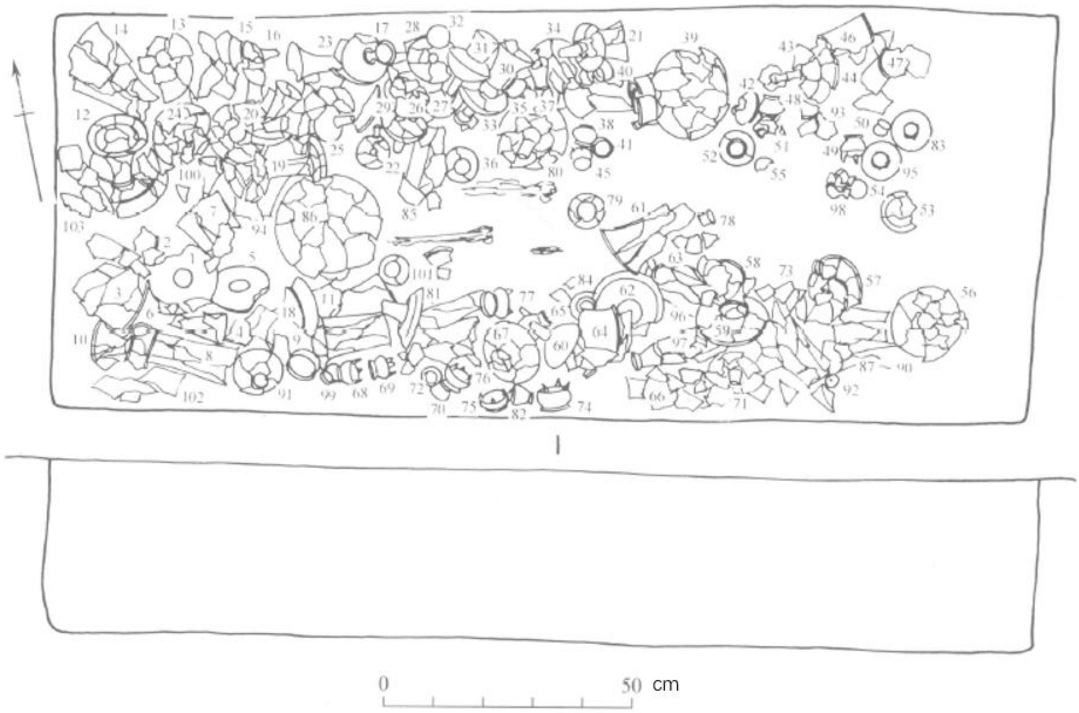


**Figure 4. 56, burial M325, 1.13.21.22.25.26.31.60.71.78.80.91. kettle, 2-4.7.15-18.27.32.33.37.42-44.54.55.63.66.73.87-90.93.94.97.100.102.103. lids, 5.8-12.14.19.20.23.28.30.46.47.53.56-59.61.62.64.67.72.81.83.85.86.95. dou, 6.24.34.39.52.79.98.**

**pots, 29.35.36.45.48.49.65.68.69.74-77.99.101. tripods, 38.50.51. zeng, 40.41.70. small pots, 82. Cup, 84. Yu-shaped object, 92. Spindle whorl, 96. Stone adze (HPIACR, 2007, p. 324).**

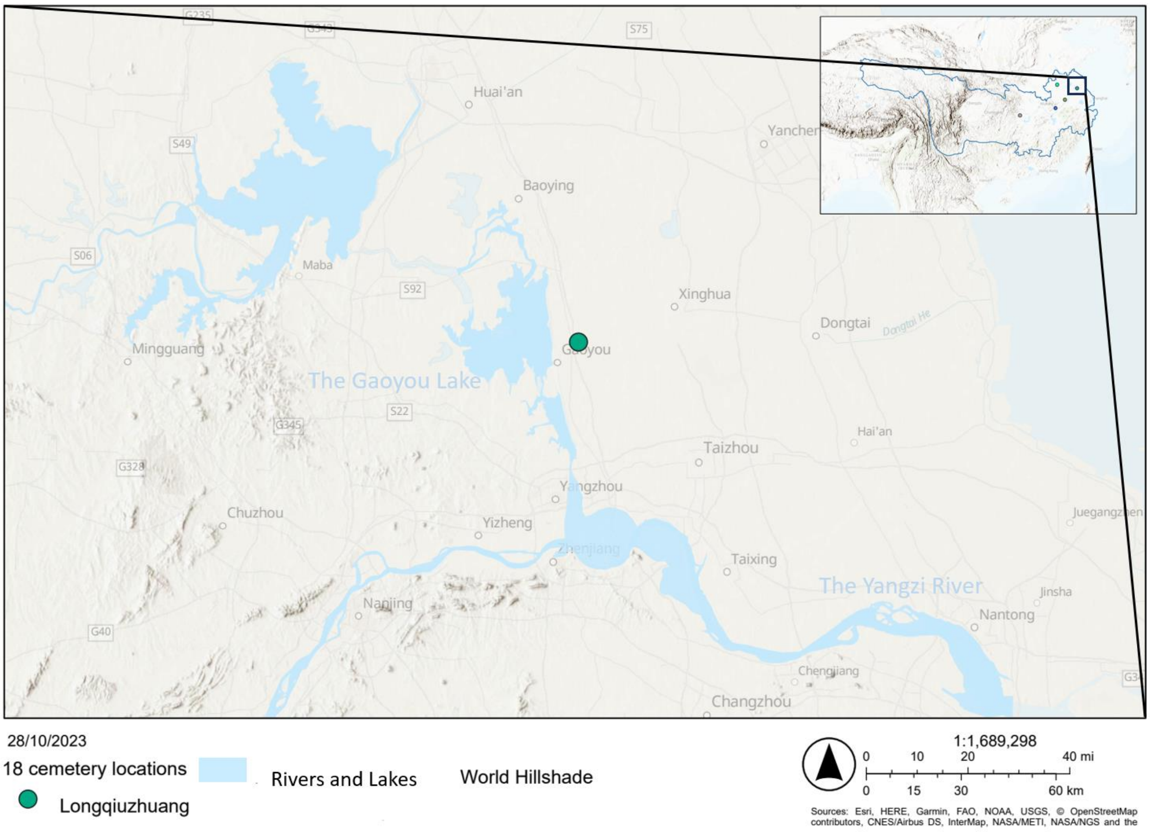
Overall, the development of Chengtoushan can be divided into stages corresponding to its four cultural periods. Initially a Tangjiagang settlement with paddy fields, houses, pits, and a few graves, it was smaller than contemporary sites like Tangjiagang and Huachenggang (Guo, 2007). During the Daxi period, defensive walls and a ditch were constructed, with activities concentrated in the west. The Qujialing period saw the expansion of walls and moats, with the core activity area shifting to the centre. By the Shijiahe period, human activity declined sharply, leading to the site's abandonment.

Burial orientations at Chengtoushan are unique, differing from both the broader cultural traditions and other sites on the same plain. According to the description of culture attributions in appendix 2, burials in the Tangjiagang culture are mostly aligned to the southeast. Daxi burials to the west (with some east and south orientations). The orientation of Qujialing and Shijiahe burials show consistent orientations within cemeteries, although different cemeteries have their own orientation preferences. According to the comparison of types, quality and quantity of grave goods from burials of different sexes, the inhabitants of Chengtoushan experienced a transition from the end of the matrilineal clan boom to the patrilineal clan, and entered the patrilineal clan commune stage in the late Daxi culture (Cao, 2007; Ding, 2014). The simplification of artefact combinations and the emergence of burial-specific items reflect the growing influence of primitive religion and ritual practices.

### 4.3.2 Longqiuzhuang in Jiangsu

Longqiuzhuang represents a characteristic Neolithic site (5000–3500 BC) of the Longqiu variant in the Jianghuai region. Situated within a fluvial landscape, the site is bounded by the Chengchong River to the west and the Longqiuzhuang Valley to the south (map 4.19). As illustrated in figure 4.57, the cemetery and residential areas, though spatially distinct, were both confined within an area demarcated by minor watercourses.

The subsistence economy at Longqiuzhuang encompassed hunting-gathering, livestock rearing, and rice cultivation. Aquatic resources such as fish, turtles, tortoises, and mussels constituted primary dietary components, while elk dominated hunted fauna (over 90%), supplemented by sika deer, roe deer, and hog badgers. Pig husbandry served as a supplementary food source, with phytolith and pollen analyses indicating rice as the staple crop, progressively displacing wild plant gathering (Tang, *et al*., 1996; Huang and Zhang, 2000).




**Map 4.19, Longqiuzhuang.**

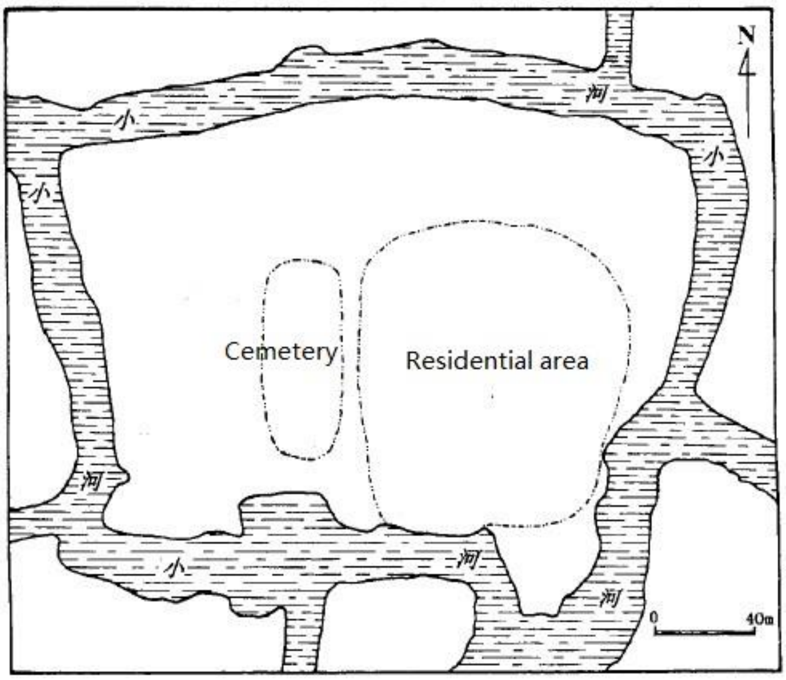



**Figure 4.57, plan of Longqiuzhuang (LAT, 1999, p. 9).**

The cemetery yielded 402 graves, predominantly primary single interments (304), with 47 primary multiple interments. *Qianchuzang* (partial removal of primary burials) is evident through missing skulls or additional cranial remains in collective graves. The graves oriented to the east, most of them concentrated at 90°, almost all graves east-oriented (70–110°). The orientation of face seems irregular. Moreover, most graves are 319 primary extended burials, 14 extended/flexed to one side, and 7 prone interments. Multiple interments (2–4 individuals) display varied orientations, for instance, burial M316 containing four skeletons with diverging alignments (figure 4. 58). Few of them are secondary burials with single interment, the grave was opened again, and the skeletons were rearranged, bones were piled up randomly. In the secondary burial with multiple interments, the number of interments can reach 10. Most of them are collective burials, showing disarticulated bone arrangements.

Over half the graves contained 1–4 grave goods, with maximum numbers exceeding 30. Marked gender disparities emerge in burial wealth: males possessed greater quantities of grave goods, including production tools and rare ornaments (bone/horn rings, beads, pendants, jade artefacts), suggesting male dominance in specific productive spheres (Xia, 2006).

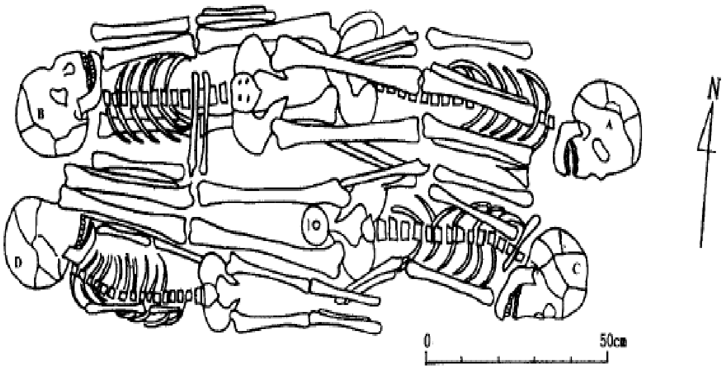



**Figure 4.58, burial M316 in Longqiuzhuang. 1 is ceramic spindle whorl (LAT, 1999, p. 124).**

Distinctive mortuary practices include the placement of perforated red clay *bo* worn on heads or on the back of the heads, or cover on feet or put between feet. Red clay bowls or *dou* were also covered on faces or on mouths, such as burial M94 shown in figure 4.59. A few burials contain pig mandibles or dog heads or dog skeletons. The excavators believe that the members of the clan within the settlement were all buried together in this clan cemetery, arranged in a certain pattern and with the same head orientation, the majority orientation is the east. This means that each member of the clan was bound by the clan system and shared religious or beliefs.



1.M94

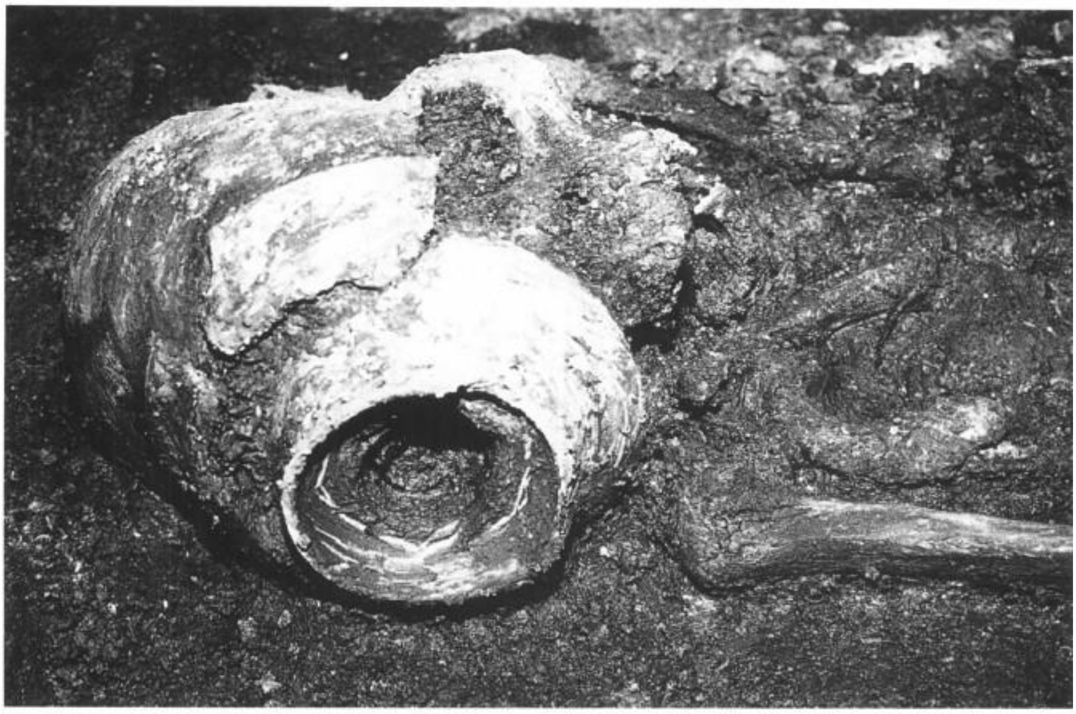
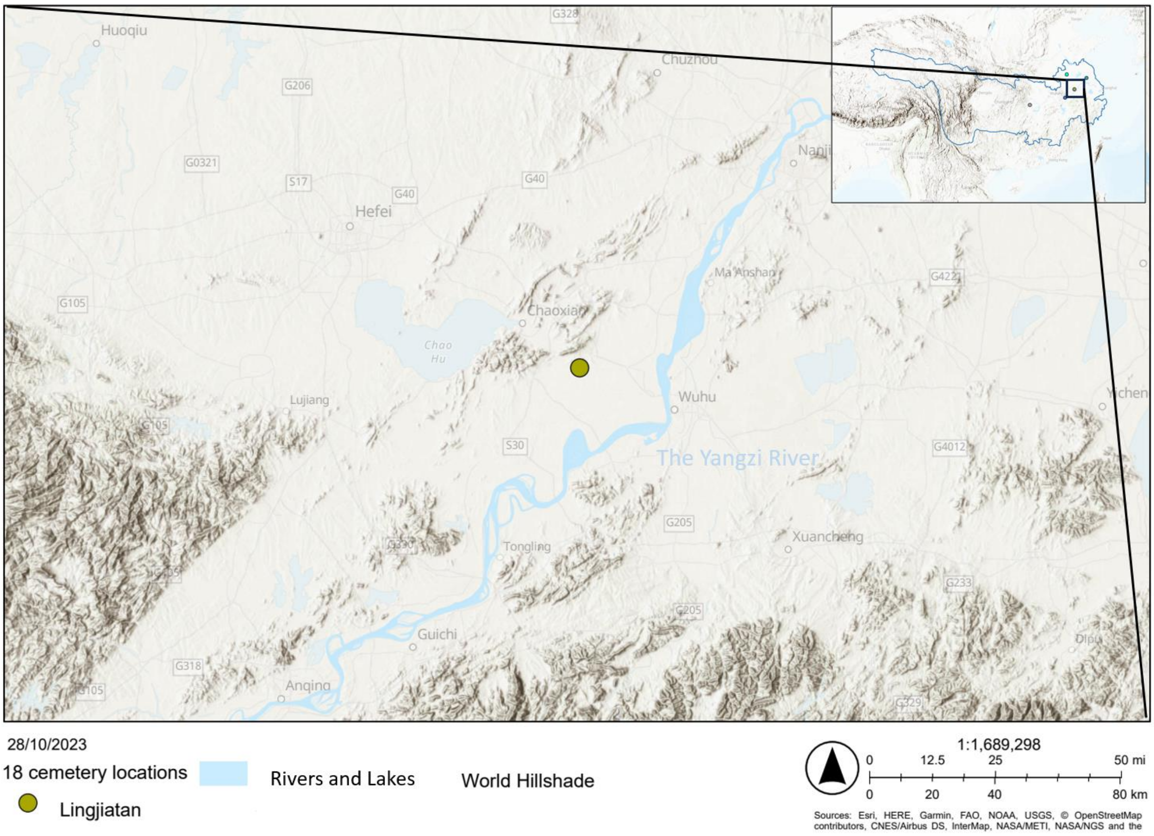


**Figure 4.59, the M94 burial owner’s face was covered by a bowl (LAT, 1999, p. image 6).**

### 4.3.3 Lingjiatan in Anhui

Lingjiatan is situated on the southern edge of a hill in Anhui Province, with Tu Mountain located 6.4 km (4 miles) to the northeast and Taihu Mountain to the north (map 4.20). The site's elevation decreases from 26 metres above sea level in its northern section to 6.7 metres at its southern extremity. Dating to 3600–3300 BC, it represents a late Neolithic settlement in the Yangzi River basin. Figure 4.60 illustrates the spatial organisation of the settlement and cemetery (APICRA and HCCRMO, 1999; APICRA, 2006; APICRA 2008). Recent excavations at Weigang (韦岗), Xiaotian (小田), Qiandun (钱墩) in the middle-upper Yuxi River valley have demonstrated that Lingjiatan functioned as a central hub within a regional network of smaller satellite sites (Liu and Wang, 2015; Shuo, Chen and Liu., 2015; Wang, 2018; Wang and Wu, 2021).




**Map 4.20, Lingjiatan.**

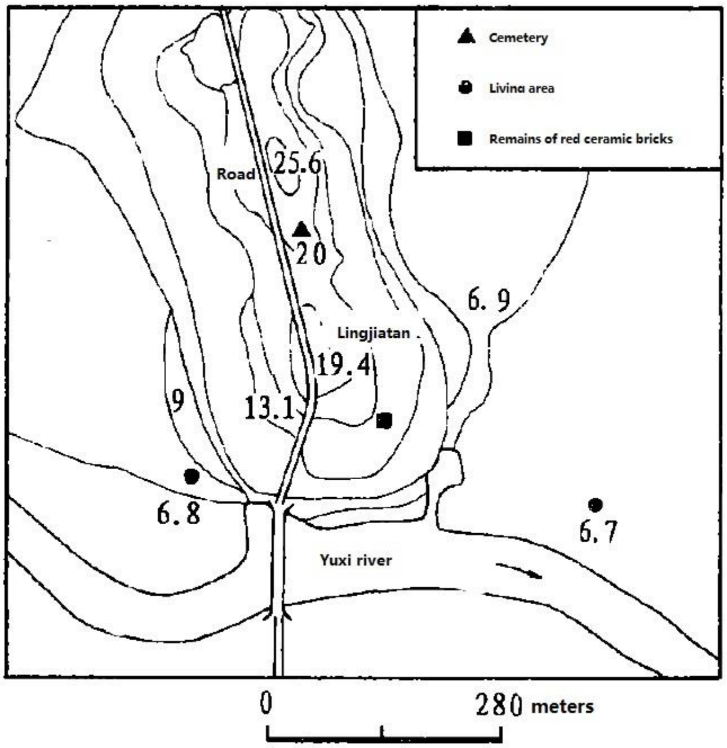



**Figure 4.60, partial layout of Lingjiatan in elevation map (APICRA and HCCRMO, 1999).**

Evidence of potential rice cultivation was identified in trenches near residential areas, suggesting proximity between agricultural fields and habitation zones. The Chao Lake basin economy during this period exhibited remarkable craft specialisation, facilitated by abundant ecological resources that supported both agricultural productivity and hunter-gatherer activities. This economic surplus enabled social stratification and the emergence of specialised handicraft industries distinct from subsistence activities (Xu, 2013) For detailed economic analyses, refer to Chapter 3's discussion of the Huai River Basin.

The site's ritual complex constitutes its most significant feature, bearing structural similarities to Liangzhu culture altars. Excavations revealed three sacrificial pits (J1–J3) and four stone oval formations (4-7) within the 0.12-hectare altar complex (figure 4.61). The top layer is formed by small stones and small pebbles, the central part of the altar is higher than the four corners. Geographically, the Taihu mountain is 5 miles north away from the altar, sunrise is in its southeast direction. A substantial deposit of red ceramic bricks from collapsed structures was identified between the altar and residential area, potentially representing temple or palatial remains. Yuxi River is in the south side of the living area. The vertical zonation of the site – altar (20 m ASL), brick deposit (13–15 m ASL), and residential area (6.7 m ASL) – creates a deliberate visual axis aligning Taihu Mountain with ritual and domestic spaces when viewed from the settlement.

Local accounts from 1987 describe a circular mound (several hundred $m^2$) at the site's apex containing Lingjiatan-period strata. Reports indicate the original presence of megalithic stones (7–8 m length × 1 m width) encircling the mound, though subsequent destruction for construction materials has obscured their original configuration.

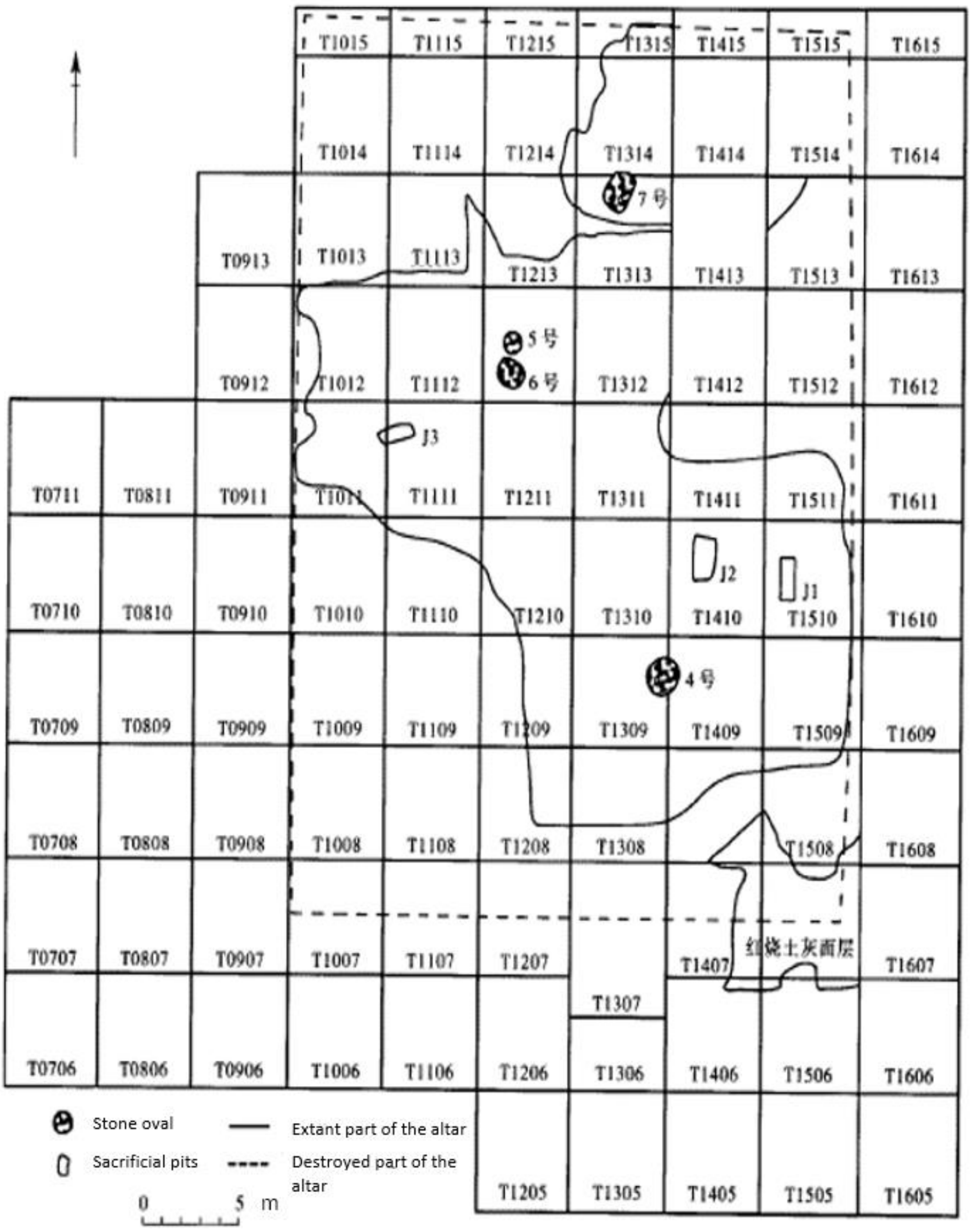



**Figure 4.61, the plan of altars (APICRA, 2006, p. 32).**

The cemetery (1.4 ha) is located on a platform north of the settlement. The northern section of the cemetery reaches an elevation of 26 meters above sea level, while the southern part slopes down to 20 meters above sea level. Therefore, the northern area represents the highest point of the hill. From the highest observation point at 26 meters, Taihu Mountain is directly to the north, while the cemetery, altars, living area, and Yuxi River align in a straight line to the south. The cemetery is divided into southern and northern sections by a ditch. Large burials are arranged in a west-east alignment, primarily distributed along the southern edge of the cemetery and extending into the southeast corner of the altar, near its summit. Unfortunately, due to the acidic soil, human bones have not been preserved. The predominant orientation of the 48 graves is south-north, and based on the positioning of grave goods, it is inferred that the heads of the deceased likely faced south. Additionally, four graves are oriented east-west.

The grave goods underscore the site's significance, with notable disparities in the quantity and quality of items across burials. Higher-status graves contain a greater proportion of jade artifacts, accounting for up to 60–70% of the grave goods, followed by stone artifacts and then ceramic wares, as exemplified by burial 87M4 (figure 4.62). The grave goods include a diverse array of objects, such as axes, *yue* (ceremonial axes), spoons, tiger-head *huang* pendants, *huang* ornaments, rings, bracelets, *bi* discs, square-shaped *bi*, pipes, shovels, *jue* ornaments, bird head-shaped ornaments, pendants, animal figurines, human heads, and anthropomorphic figurines. Some ritual artifacts were perforated, and cinnabar was applied to the second step within the graves. Additionally, octagonal star-like patterns were engraved on several jade artifacts, as well as on ceramics and stone tools.

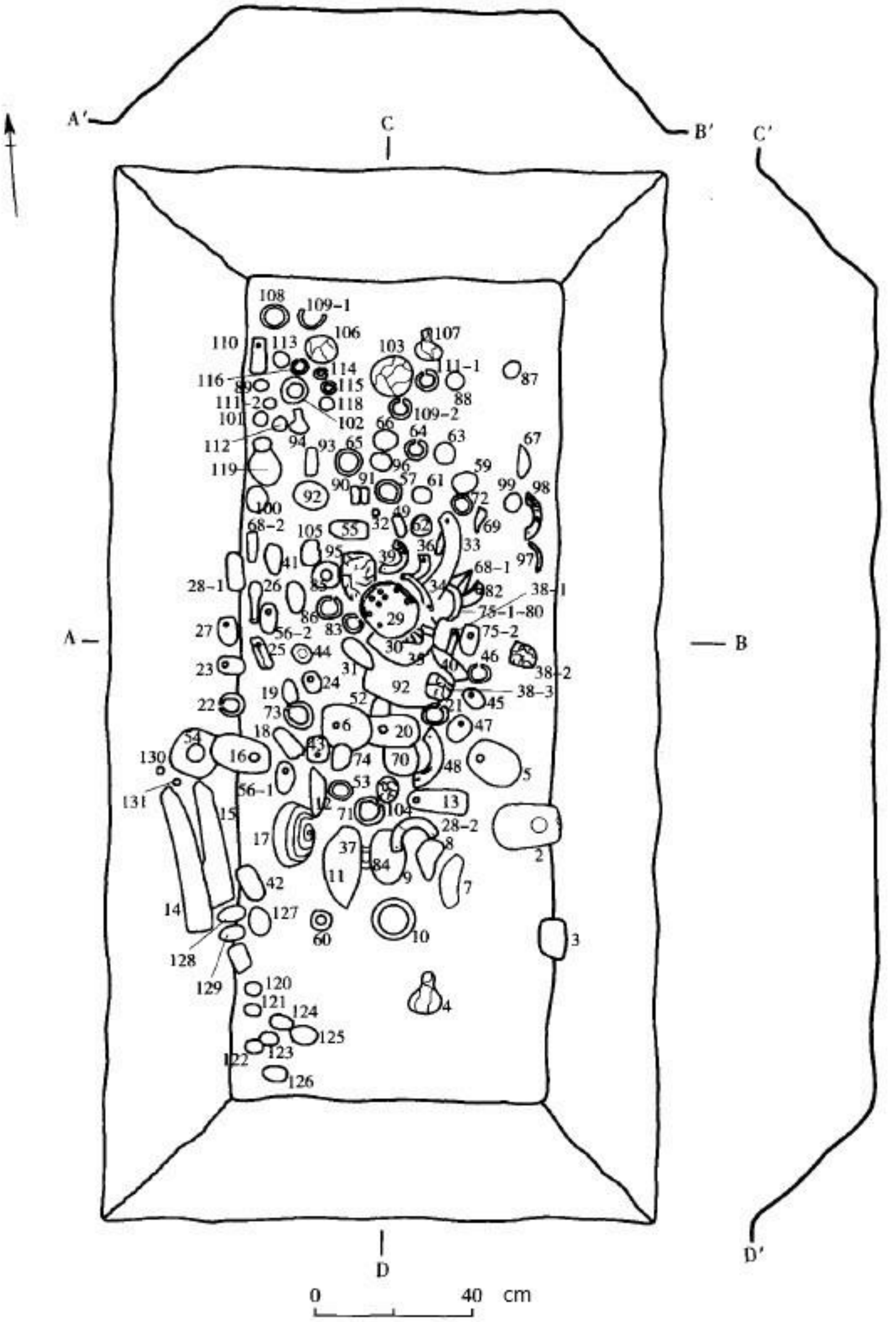



**Figure 4.62, burial 87M4, 1 stone Yue appears above the burial, 2,5,6,20,23,24,27,43,45,47,54,56-1,56-2,70, 75-2,100,119 stone Yue, 3,7-9,11,12,19,50-1,74**

**jade stones, 4,104,107 ceramic kettles, 10,53,65,72 jade bracelets, 13,49,50-2,51,69,91 stone adzes, 14,15,52,90,93 stone chisels, 16,25,110 jade Yue, 17,38-2,38-3,92,103,105,106 ceramic fragments, 18,31,41,42,55 stone axes, 21,22,46,64,71,73,83,86,109-2,111-1,112,114,115,116 jade Jue, 26 jade spoon, 28-1 jade axe, 28-2,33,34,37,38-1,39,48,67,75-1-82,84,97,98 jade Huang, 29,35 jade tortoises, 30 jade plate, 32-1,59,87-3,101,117 button-shaped jade ornaments, 32-2,32-3,32-4,89,113,120,126,128,129,130,131 circular-shaped jade ornaments, 36 jade hairpin, 40 crown-shaped jade ornament, 44,60,85 jade Bi, 57,108,109-1 jade rings, 58,127 mushroom-shaped jade ornaments, 61,62,66,121,122,123-1,124,125 plain circular-shaped jade ornaments, 63 jade ornament with handle, 68-1 triangular shaped jade ornament, 68-2,87-1,87-2,88,99,102,111-2,118,123-2 jade pipes, 94 ceramic lid, 95 ceramic pot, 96 jade ornament (APICRA, 2006, p. 48)**

Burial 87M4 contains a remarkable jade artifact: a tortoise with a jade tablet carefully placed between its dorsal and ventral shells (figure 4.63). The discovery of this tablet highlights the increasing social stratification during the Late Neolithic period and reflects the advanced development of the culture. The intricate patterns on the tablet have been interpreted as representations of *Hetu* (河图) and *Luoshu* (洛书) (Chen and Zhang, 1989). As illustrated in Figure 4.64, *Hetu* and *Luoshu* are believed to have been systems used by Neolithic communities to determine time, direction, and seasons based on astrological arrangements (for further details, see Chapter 6). Nevertheless, the origins of *Hetu* and *Luoshu* remain an ancient mystery in Chinese civilization, and it is challenging to pinpoint their exact geographical or cultural origins.

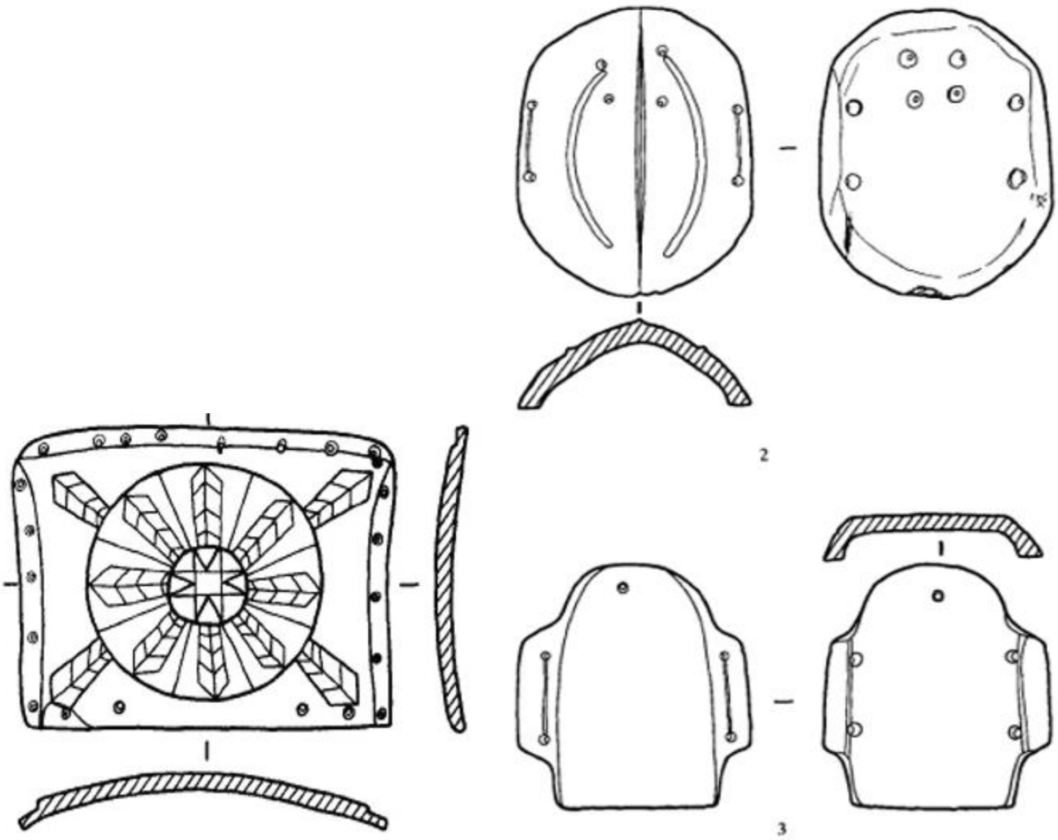



**Figure 4.63, Jade tablet and tortoise from 87M4 (APICRA, 2006, p. 49).**

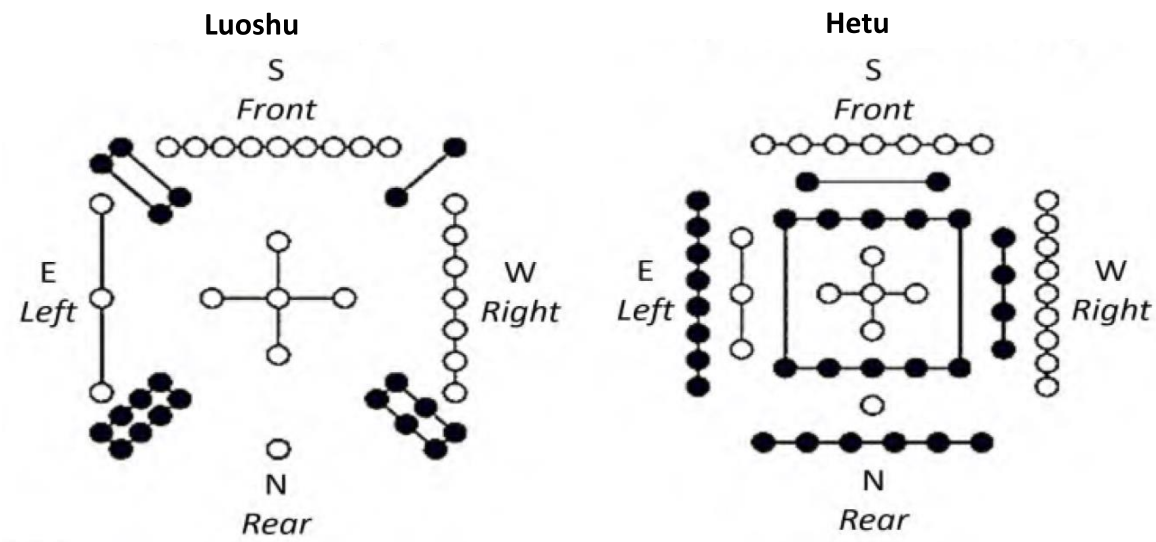


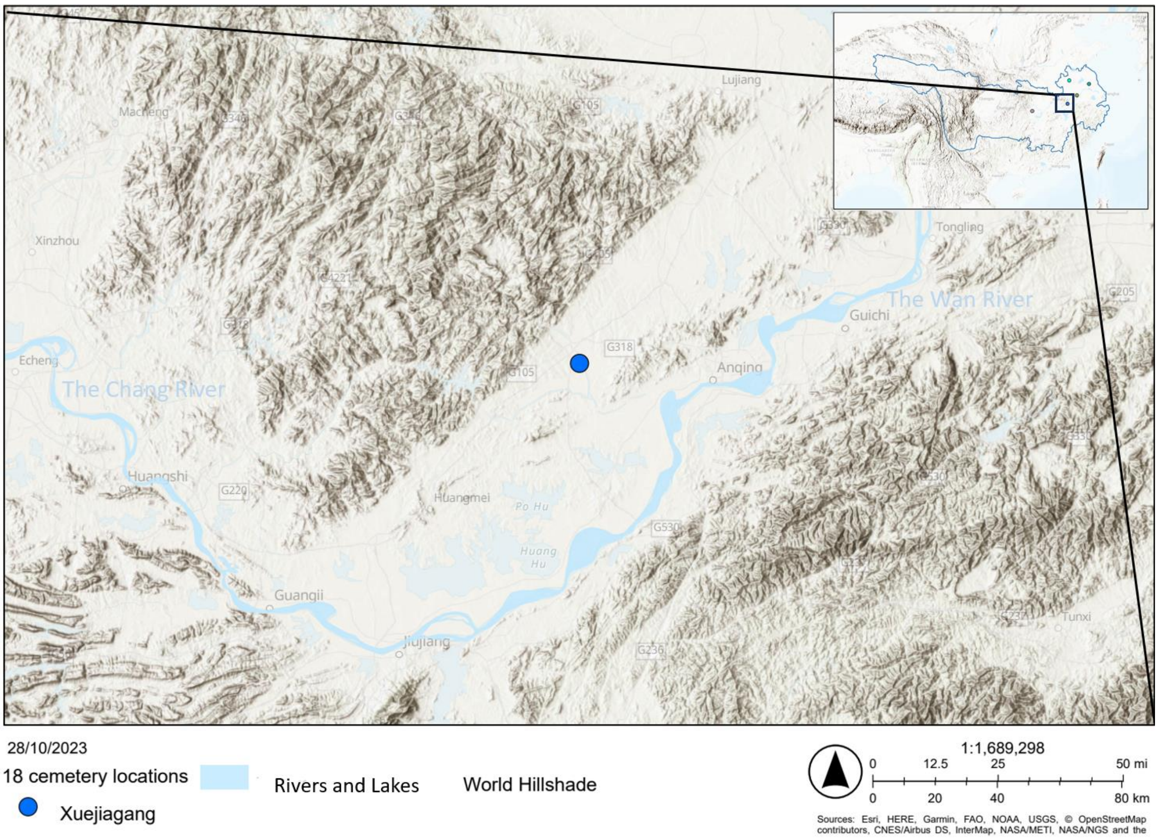

**Figure 4.64, Hetu and Luoshu (Shi, 2024).**

The construction of the entire site, particularly the altar and the arrangement of large stones on the round mound, required significant manpower, substantial material resources, and a highly organized system for coordinating labor. The technical sophistication evident in the site's layout and construction demonstrates that the people of Lingjiatan had already mastered fundamental principles of mathematics, spatial planning, and engineering. The production of intricate grave goods further attests to their advanced craftsmanship. Additionally, the altar and grave goods signify the growing importance of divine authority and the centralization of religious power. If the deliberate alignment of the site's functional areas with Taihu Mountain and the trajectories of sunrise and sunset was intentional, it suggests that the inhabitants possessed a deep understanding of geospatial and cosmological concepts.

Lingjiatan occupies a strategic position at the intersection of the lower reaches of the Yellow River, the middle and lower reaches of the Yangzi River, and the southern regions. Chao Lake serves as a vital link, connecting the Yangzi River, Huai River, and Yellow River, thereby facilitating smooth cultural exchange. This geographical advantage allowed Lingjiatan to function as a "transit point" for cultural transmission. The site absorbed and integrated cultural influences from various regions, enriching its own cultural vitality and diversity. Through these exchanges, Lingjiatan not only contributed to but also benefited from the broader cultural dynamics of the region.

### 4.3.4 Xuejiagang in Anhui

Xuejiagang, dated between 3500 and 2600 BC, represents the Xuejiagang variant, a local cultural development shaped by the significant influences of the Dawenkou culture from the north and the Liangzhu culture from the south. However, Neolithic deposits at the site are relatively sparse. According to excavation reports, the site is located on a hill named Xuejiagang on the southeastern side of the Dabie Mountains, with a small hummock situated to the west (map 4.21).




**Map 4.21, Xuejiagang.**

The Neolithic inhabitants of Xuejiagang relied on a mixed economy of subsistence, handicraft production, and trade (APICRA, 2004, p. 418). Evidence of rice husks in pottery sherds indicates that rice farming was practiced, though few agricultural tools have been discovered. Notably, stone knives, axes, and adzes, which are presumed to have been used for farming, show minimal signs of wear, and some even feature painted surfaces, suggesting they may have had ceremonial or symbolic functions rather than practical use. While soil conditions have limited the preservation of bones and plant remains, making it difficult to assess fishing, hunting, and gathering activities in detail, the presence of mussel fragments in pottery sherds suggests that these practices were part of the subsistence economy. Additionally, pig husbandry played a significant and stable role in the subsistence system over an extended period (APICRA , 2004, p. 419).

Jade and stone manufacturing emerged as dominant artisanal activities, particularly during the middle and late periods. The excavators propose that these industries may have been linked to long-distance trade, supported by the origins of raw materials and the distribution of finished products (APICRA, 2004, p. 420). The development of this technological industry, likely benefiting from cultural exchanges and the site's strategic geographic location, parallels patterns observed at the Lingjiatan site.

The living area was distinct from the cemetery from the early period onward. Early burials were concentrated in the southern part of the cemetery, while later burials were found in the western and northern sections. Traces of burned soil, discovered both outside the cemetery's edge and in its central area, date to later periods than the early burials. Although the cause of these burned soil deposits remains unclear, ritual activities are a plausible explanation.

The cemetery contains a total of 150 graves, though the acidic soil has severely degraded human remains, making it impossible to determine burial positions, gender, or age. The indistinct edges of many grave pits also obscure the orientation of most burials. Among the 22 graves where orientation could be identified, the majority are aligned northeast-southwest, with a few oriented north-south.

Ceramics dominate the grave goods (63.6%), followed by stone tools (19%), jade artifacts (17.1%), and bone tools (0.3%). While some graves contain no grave goods, 107 graves hold 1–5 items, and two graves contain more than 20 items, with the maximum number reaching 45. During the middle and late periods, jade and stone artifacts accounted for one-third of grave goods, reflecting their rapid development. Stone objects primarily include knives, adzes, and *yue* (ceremonial axes), while jade objects consist of pipes, ornaments, *huang* pendants, rings, and *yue*. Notably, perforated knives and stone adzes were placed in a northeast-southwest alignment, with the cutting edges of jade and stone *yue* or axes oriented northwest or southeast. Some axes and *yue* were found standing upright in the soil (figure 4.65). The handles of *dou* vessels generally align with the orientation of stone knives, and some ceramic basins or bowls were placed upside down. Additionally, spindle whorls were often found standing vertically rather than lying flat.

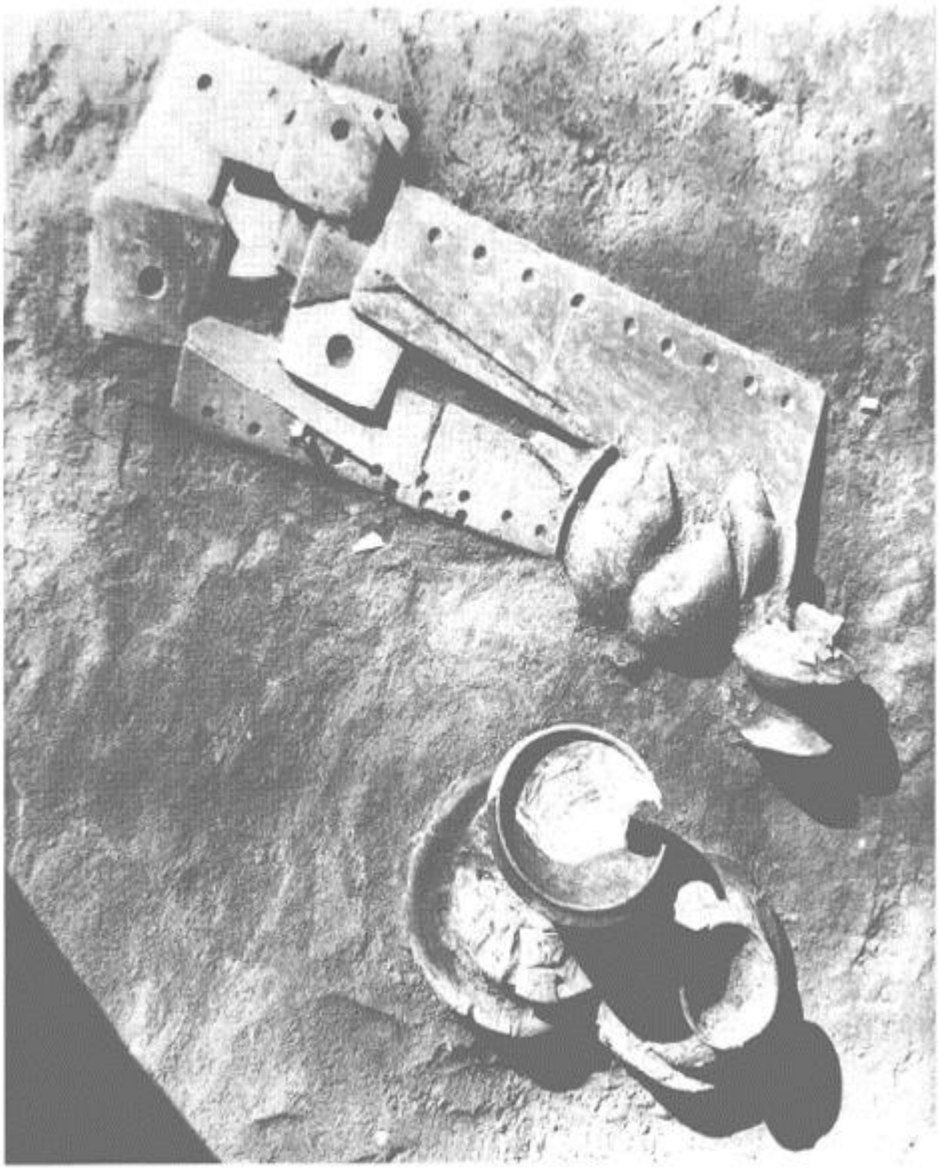
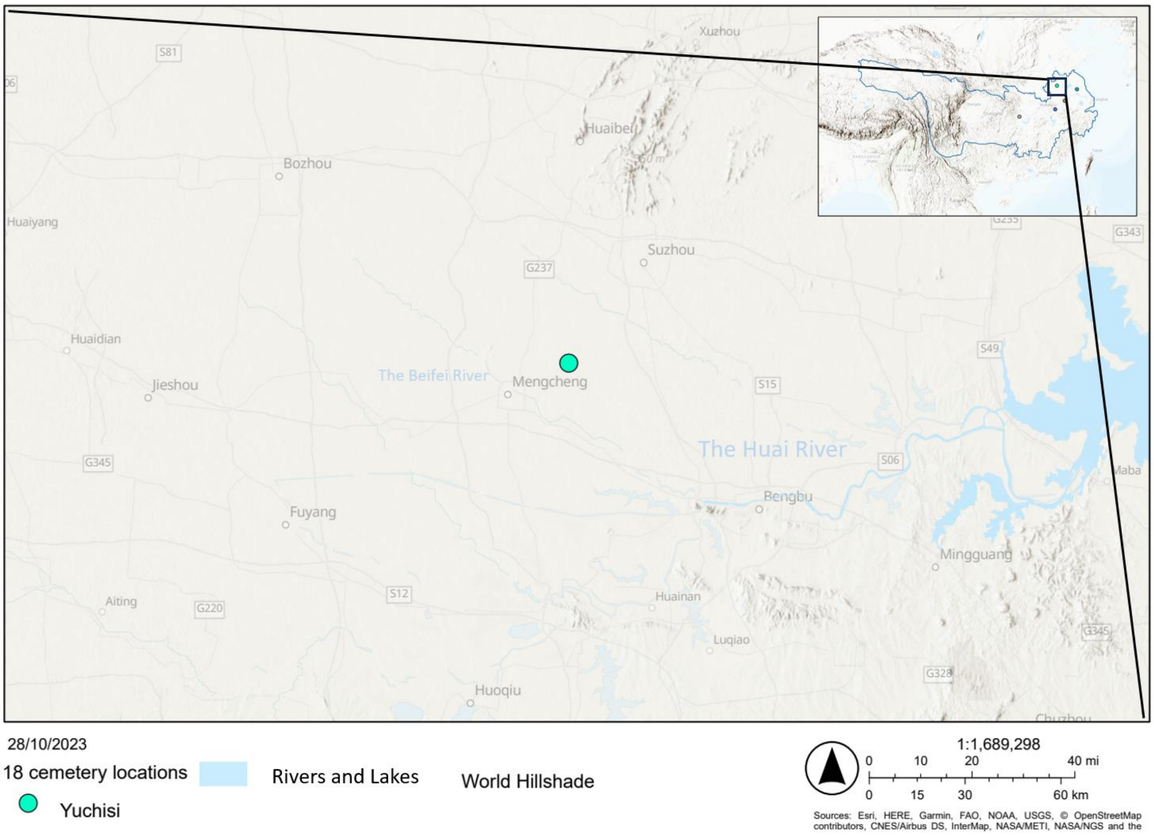


**Figure 4.65, grave goods of burial M40 in Xuejiagang cemetery, including ceramic wares and perforated knives, *yue* and adzes (APICRA, 2004, p. image 39).**

### 4.3.5 Yuchisi in Anhui

Yuchisi was established during the late Dawenkou period and the Longshan period (2800–2600 BC), though further chronological subdivisions have not been detailed. The site is situated on a relatively flat plain, approximately 2 miles north of the Beifei River (Map 4.22). As depicted in Figure 4.66, the site was encircled by a large ditch, which likely served dual purposes: as a defensive structure and as a facility for drainage or water storage.




**Map 4.22, Yuchisi.**

**Figure 4.66, reconstruction plan of Yuchisi (IACASS and CBMCAP, 2007, p. coloured image 4).**

Among the pits excavated, 10 stand out due to their contents, which include ceramics, animal bones, a few human bones, and tortoise shells. Pit JS10 is particularly notable, containing 12 ceramic vessels, two of which feature engraved patterns (figure 4.67, left and right). The arrangement of these artifacts resembles practices observed in the Shijiahe culture. The animal pits, primarily containing pig remains, are distributed in an arc to the north, northeast, east, and southeast of the site. The sole exception is pit S1, which contained a dog and dates to the 4th phase, while the others belong to the 6th phase. These pits are located near residential structures.

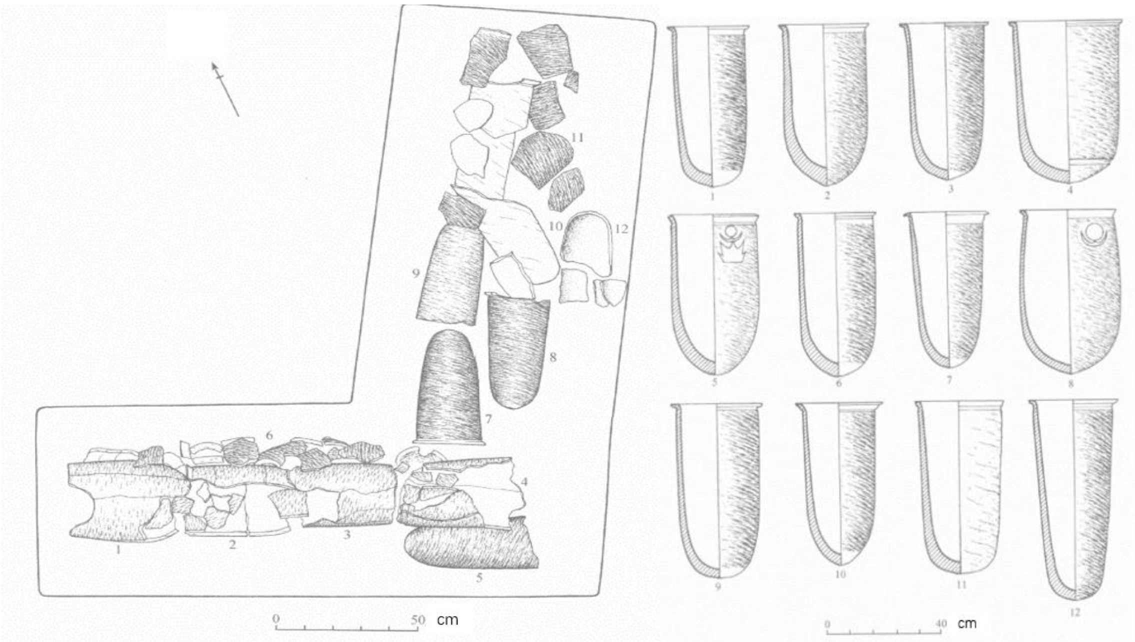



**Figure 4.67, pit JS10, containing 12 ceramic wares (left) (IACASS and CBMCAP, 2007: 101); the 12 ceramic wares from pit JS10 (right) (IACASS and CBMCAP, 2007, p. 102).**

Excavations at Yuchisi revealed concentrated piles of millet carbon remains from the late Dawenkou period, with grain sizes comparable to modern millet. Additionally, millet and rice remains were found in building materials. The Huai River, marking the boundary between northern and southern China, experienced a tropical to subtropical climate with an average annual temperature 2°C higher than today (IACASS and CBMCAP, 2007, p. 314). The inhabitants adapted to this transitional climate, developing a stable agricultural economy that incorporated characteristics of both northern and southern practices (IACASS and CBMCAP, 2007, pp. 192–193, 314–315). Hunting and gathering remained significant, as evidenced by the discovery of animal bones from species such as snails, mussels, fish, soft-shelled turtles, birds, chickens, rabbits, dogs, badgers, tigers, pigs, deer, elk, roe deer, and buffaloes in pits and house foundations (IACASS and CBMCAP, 2007, p. 192, 315). Domesticated pigs and dogs accounted for 56% of the animal remains, indicating a reliance on animal husbandry alongside fishing and hunting (IACASS and CBMCAP, 2007, p. 316). This diversified economic base supported societal development.

During the Longshan period, rice cultivation surpassed millet in importance, though millet remained a staple crop (IACASS and CBMCAP, 2007, pp. 311, 315). The types of animal bones were similar to those from the Dawenkou period, with domestic pigs comprising 49% of the remains (IACASS and CBMCAP, 2007, pp. 311–312).

In the late Dawenkou period, 192 graves and 170 urn burials were distributed around residential structures. All graves contained single interments, with head orientations matching the direction of house doors—a rare feature in prehistoric China and distinct from other Dawenkou sites. Most houses were aligned northwest-southeast, with doors facing southwest, and grave occupants were typically oriented southeast, facing southwest. The majority of burials were in an extended position, with some flexed or extended to one side. Longshan period graves (23 in total) followed similar patterns but were oriented between 105–135°.

Grave goods from the late Dawenkou period were typically placed near the head or feet, with manufacturing tools positioned beside the body or near the shoulders. In stepped graves, goods were sometimes placed on the second tier. Four cases of tooth extraction were recorded, and some graves contained pig tusks, tortoise shells, pig mandibles, antlers, deer bones, and fish bones. Cinnabar was applied to skeletons and grave goods in two burials, and a few pottery vessels were perforated. The proportion of graves containing manufacturing tools decreased from 64.3% to 33.3% from early to late Dawenkou phases, while other goods, such as animal bones and jade artifacts, increased (Ma, 2005). This shift suggests a concentration of wealth among a small elite group.

Comparisons between early female and male graves reveal disparities in grave goods. Early female graves often contained numerous items, while contemporary male graves (e.g., M141, 138, 24, and 25) were largely devoid of goods. This may reflect familial seniority or personal prestige, though the exact reasons remain unclear. However, social inequalities between genders were evident from the outset (Lin, 2016). Ma (2005) notes a transition in social power, with male graves in later phases containing significantly more grave goods than female graves, indicating a shift in societal dominance from females to males.

The number of Dawenkou urn burials nearly matched that of adult graves. Three urns bore engraved symbols such as "日，月，山" (sun, moon, mountain) or "日，月，叉" (sun, moon, fork). No urn burials or grave goods were found in the Longshan period.

## 4.4 The south region

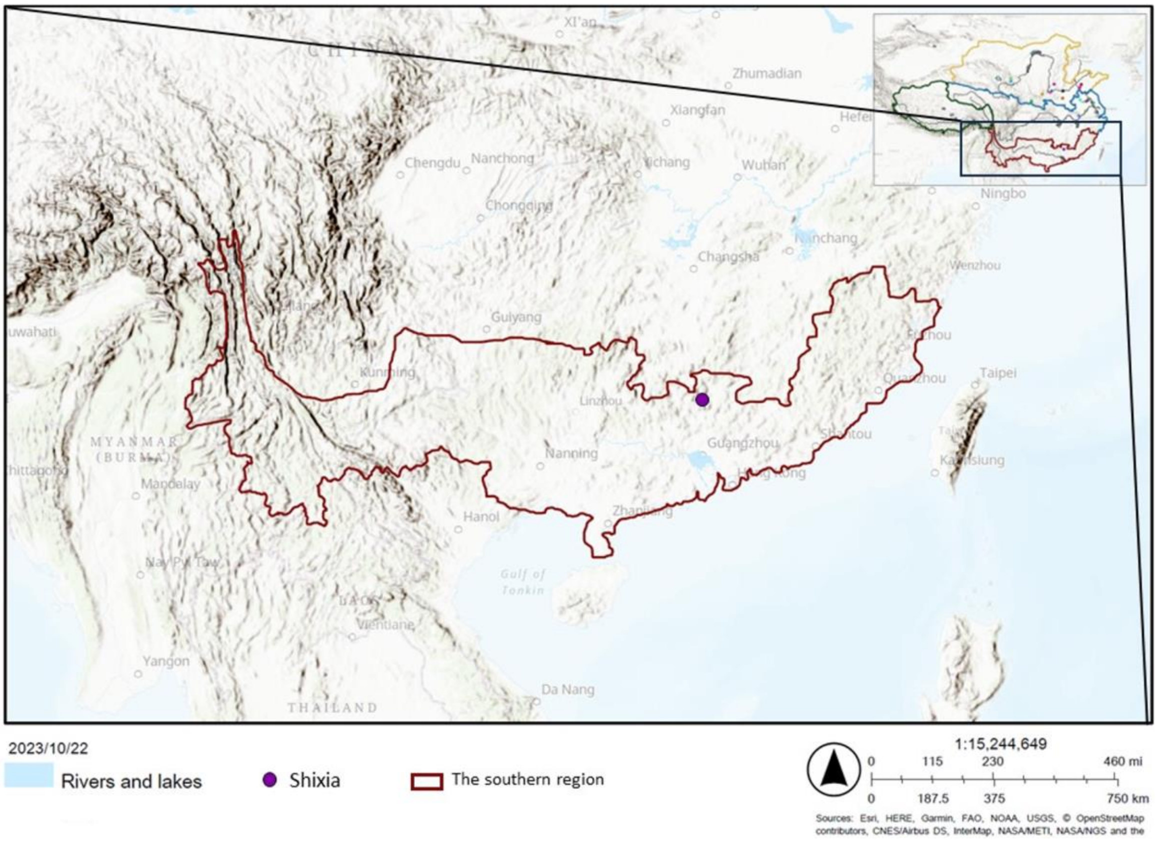
The southern region is characterized by mountainous and hilly terrain, with elevations decreasing from north to south. Mountains exceeding 500 meters in height cover about one-third of the area, predominantly trending northeast-southwest, such as the Nanling Mountains in northern Guangdong. The Nanling range serves as the watershed between the Yangzi River system and southern water systems. For example, the Dayuling range divides the Panyang Lake and Pearl River systems. The region's complex topography, shaped by numerous mountain ranges and water systems, is less distinct compared to other areas.

This study defines the southern region as encompassing Yunnan, Guangxi, Guangdong, Fujian, and parts of Guizhou. The Zhu River basin, spanning Yunnan, Guangxi, Guizhou, Guangdong, Hunan, and Jiangxi, is the primary hydrological feature. Guangxi, located on the southeastern edge of the Yunnan-Guizhou Plateau, lies at a higher elevation than the coastal provinces of Guangdong and Fujian, which feature low mountains and level terrain near sea level. The region experiences a tropical and subtropical monsoon climate, with higher average temperatures, long, humid summers, and warm winters interrupted by cold waves. Monsoons and tropical cyclones bring abundant rainfall and frequent flooding.

Neolithic cultures in the southern region developed more slowly than those in the Yangzi and Yellow River regions. The transition from gathering and fishing to agriculture occurred late, influenced by Yangzi River cultures, as evidenced by millet and rice remains at sites such as Shixia, Gantuoyan (感驮岩) and Jiuwuhou (旧屋后) (Zhang Wenxu, *et al.*, 2006; Zhang Wenxu, *et al.,* 2008; Zhang Chi and Hong Xiaochun, 2009; Xiang, Zhang and Wei, 2018). Gathering, fishing, and hunting remained predominant, with aquatic resources playing a significant role in the diet

(Zhang and Hong, 2008; Chen, 2020). etween approximately 5000 and 1500 BC, the coastline receded north of Guangzhou, limiting wetlands and hindering rice agriculture. Despite the introduction of rice cultivation, marine resources remained crucial (Xiang, 2005; Yang, *et al.*, 2018). By around 500 BC, the coastline had retreated to the Panyu area, and the expansion of the Pearl River Delta wetlands facilitated rice farming (Zong, et al., 2013). However, this shift was localized; for example, rice farming became dominant in the Foshan area of Guangdong only during the Jin dynasty (Guo, 2020).

Neolithic burials in Guangdong include 111 graves at Wusaoling, oriented at 44–70° and situated on a ridge over 200 meters above sea level (ICRAG, 1991). Artifacts resemble those from the third phase of the Shixia culture (Li, 2011). Surrounding sites with burials, such as Jidingzuishan, Luoweiyong, Luoshagangshan, were also located on hilltops or ridges, though most cemeteries are poorly preserved, complicating their cultural attribution. In 2019, 17 Shixia-period burials were excavated at Matouzhuang, primarily along the northern hilltop. Four published burials were secondary interments with irregular orientations (65°, 278°, 294°, 168°) (GICRA, 2022). The map 4.23 presents the selected Neolithic site Shixia in the southern region.

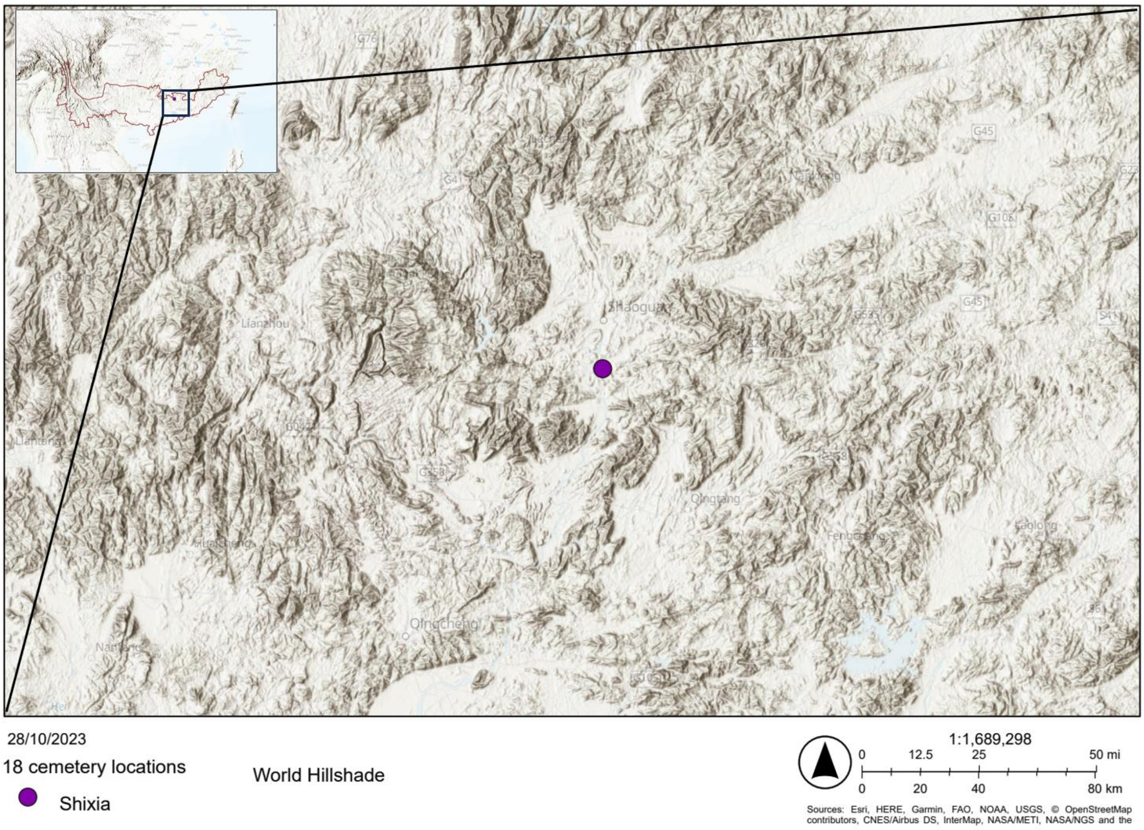



**Map 4.23, the selected Neolithic sites in the southern region.**

### 4.4.1 Shixia in Guangdong

Shixia, dating from 4000 to 1200 BC, is divided into two phases, with the first phase (4000–2000 BC) belonging to the Shixia Neolithic period. This section focuses on the Neolithic remains. The site is situated between the western foothills of Shitou Mountain and Shiwei Mountain (map 4.24 and figure 4.68). Evidence from surrounding areas indicates that Shixia served as a large central settlement during this period (ICRAG et al., 2014, p. 398).

Analysis of remains from 16 Shixia graves reveals that rice cultivation was practiced, though agricultural techniques remained primitive. The abundance of excavated arrows suggests that hunting was still a significant subsistence activity. However, the site stands out for its advanced tool-making and processing skills, surpassing nearby sites in the variety and craftsmanship of stone and jade tools. The selection of materials, cutting, drilling, and polishing techniques indicate a high level of specialization, possibly leading to the emergence of a skilled artisan class (ICRAG et al., 2014, p. 397).




**Map 4.24, Shixia.**

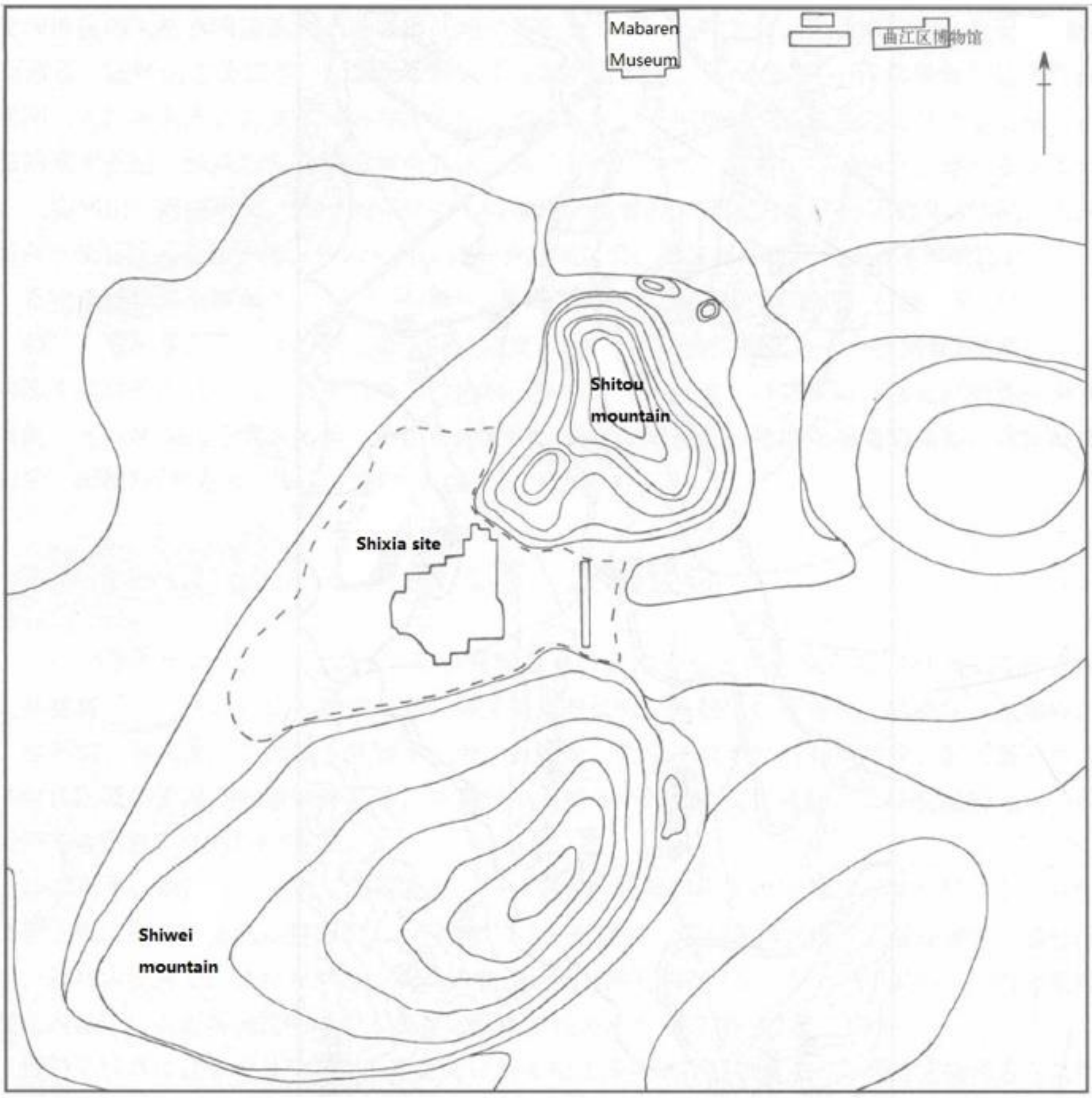



**Figure 4.68, Shixia site (ICRAG *et al*., 2014, p. 4).**

The cemetery layout is illustrated in Figure 4.69. It includes 30 primary burials, 56 secondary burials, and 16 *Qianchuzang* (where most of the primary burial has been removed). Skeletal preservation is poor. Graves are predominantly oriented eastward, with extended positions being the most common in primary burials. Burial M70 (Figure 4.70) exemplifies this, featuring a single extended individual surrounded by 33 stones and 98 stones piled above the fill. These stones were transported from Shitou Mountain and Shiwei Mountain. Stone placements are rare at Shixia and typically appear random.

1. Of the 132 graves, 109 contain grave goods. Primary burials typically hold 1–13 items, while secondary burials average 8 items per 100 graves. Grave goods are positioned in four ways: Mixed with grave backfill
2. Placed in the west, southwest, or northeast corners
3. Piled beneath bones or secondary grave goods (common in primary burials)
4. Separated from bones by a layer of backfill soil in the third layer of graves

This arrangement suggests that secondary burials may have involved two sets of grave goods: one buried during the initial interment and another added when remains were relocated. Cinnabar was applied to piled bones, the east or northeast sides of bones, or the surfaces of grave goods placed over bones.

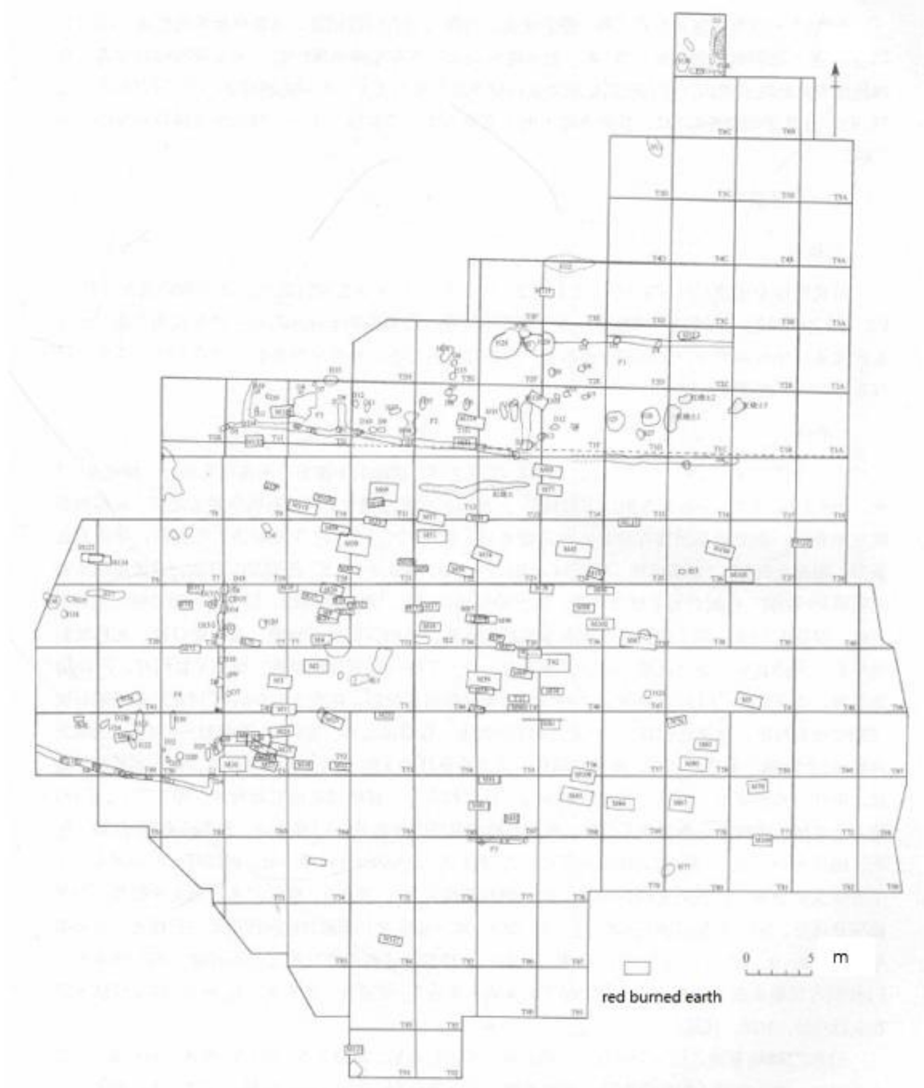



**Figure 4.69, plan of remains in the Shixia period (ICRAG *et al.*, 2014, p. 31).**

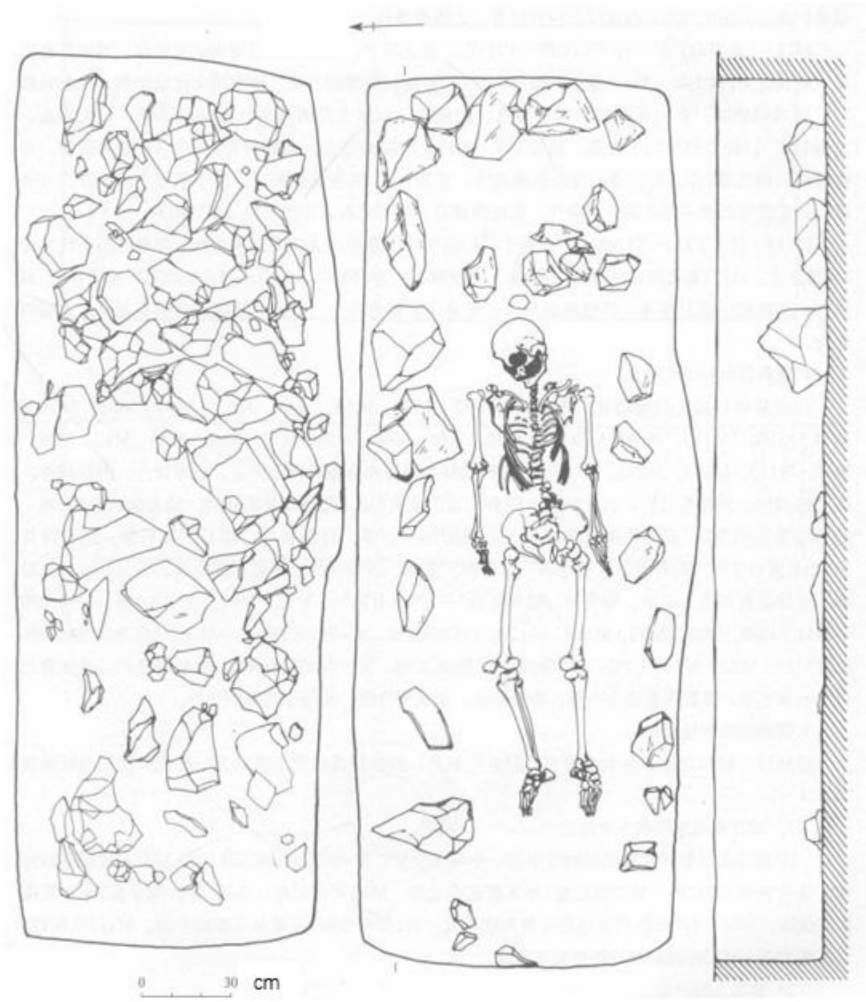


**Figure 4.70, burial M70, (ICRAG *et al.*, 2014, p. 537).**

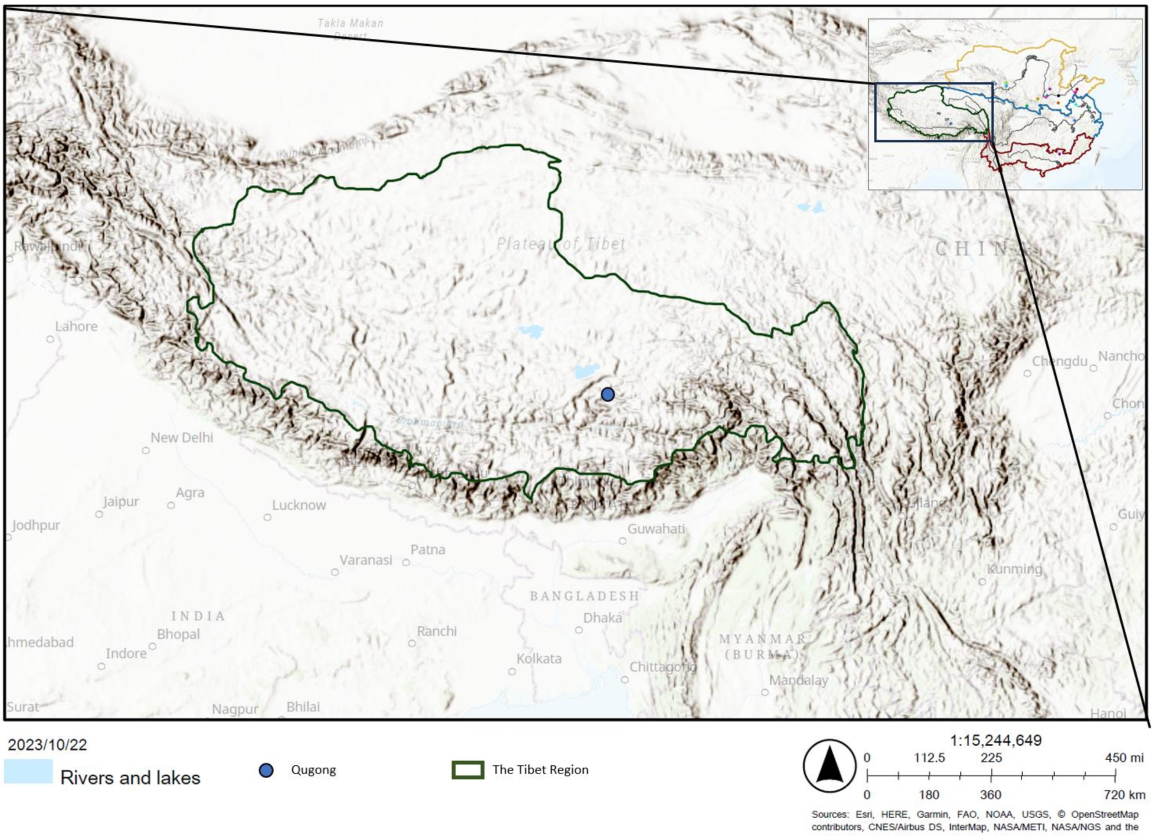
Ceramics and stoneware from Shixia show clear influences from contemporaneous cultures in the Pearl River Delta and coastal regions, despite differing geographic environments. Connections to the Liangzhu culture and northern mountain cultures are also evident in ceramic and jade types (ICRAG *et al*., 2014, p. 604).

## 4.5 Tibet

The Tibet Autonomous Region (TAR), located in western China, borders Sichuan, Xinjiang, Qinghai, and Yunnan provinces, as well as Burma, India, Nepal, Bhutan, and Kashmir. The Qinghai-Tibet Plateau dominates the region, featuring gorges, glaciers, parts of the Gobi Desert, and the Himalayas. Tibet also boasts China's highest concentration of lakes, including Yangzhuoyong, Mapangyong, Bangong, Basongcuo, and Senglicuo.

Prehistoric developments in Tibet occurred later than in central China. According to Wei (2013), the latest Neolithic period dates to around 1000 BC. The transition from the Neolithic is ambiguous, as stone tools continued to be used alongside bronze and iron without any one material dominating. Thus, Wei (2013) categorizes the period before and including this era as "prehistory" in Tibet.

Due to limited research, evidence of prehistoric Tibet is sparse. Two cultures, the Karuo (3500–2000 BC) and Qugong (2000–1000 BC), are better documented (Lv, 2014). Notably, the Karuo culture lacks evidence of sacrifice or burial, while the Qugong culture is characterized by such practices. The map 4.25 presents the selected Neolithic site Qugong in the Tibet region.



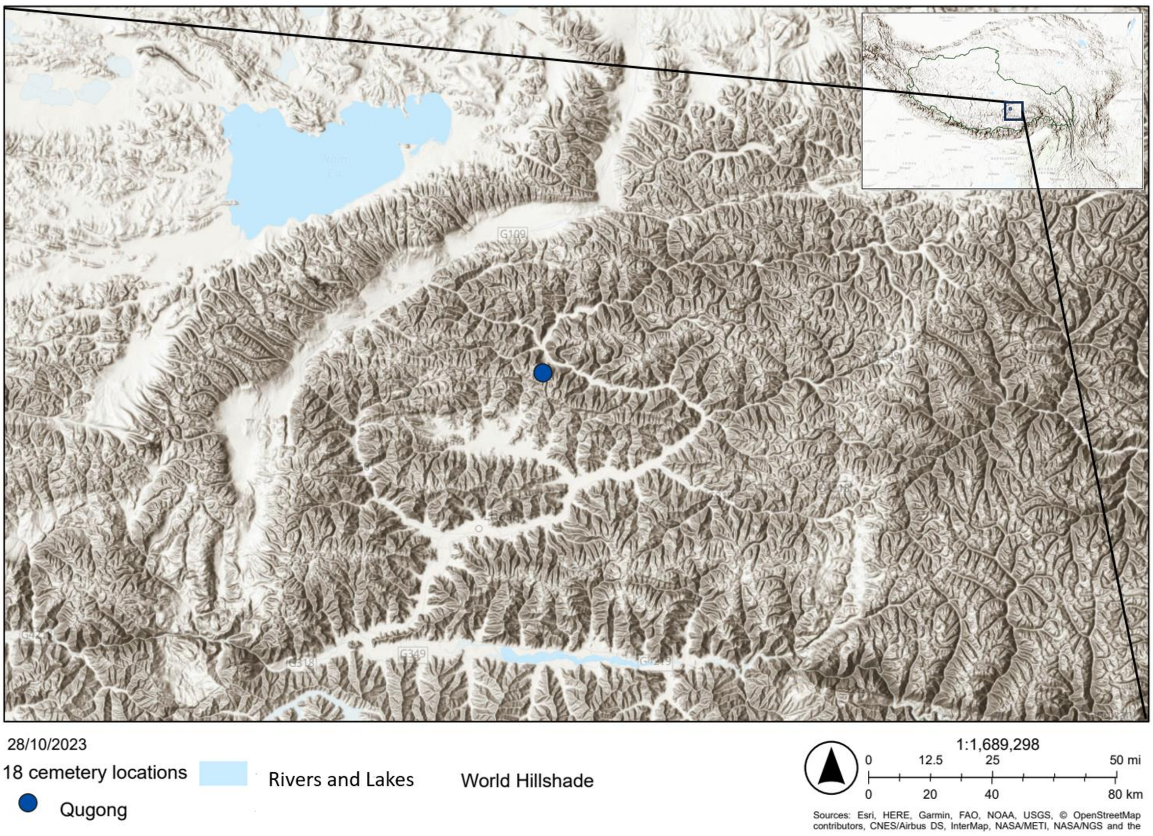

**Map 4.25, the selected Neolithic site in the Tibet region.**

## 4.5.1 Qugong in Tibet

Qugong, the only Neolithic site selected in Tibet, dates to 1750–1500 BC, significantly later than sites in other regions. Located on the northern edge of the Lhasa Valley at an elevation of 3,675–3,685 meters (map 4.26), the site is divided into early (1750–1700 BC) and late (1700–1500 BC) phases  (IACASS and BCRTAR, 1999: 216-220).

The early phase yielded 22 pits and 3 graves, with over 10,000 artifacts, including stone tools, ceramic vessels, bone tools, and a few bronze items. The late phase, though yielding fewer artifacts, included 29 burials, 6 altars, and 2 sacrificial remains.

The early phase reflects a highland agrarian tribal culture, with livestock as a supplementary subsistence strategy (IACASS and BCRTAR, 1999, p. 217). Highland barley was likely the staple food, while yaks and sheep were the primary domesticated animals. Stone tools dominated production, with bone tools such as needles, arrows, knives, hairpins, and augers also in use.




**Map 4.26, Qugong.**

Graves at Qugong were constructed with stones, primarily rectangular in shape. Secondary burials were the most common. Figure 4.71 shows the three early-phase graves: burial M111 is a collective burial with one 3-4 years old child, one 30-35 years old adult and one 13-15 years old girl; burial M112 is a secondary burial with one 45 years old male; burial M109 is a primary burial of a 25 years old flexed female. All graves are oriented southwest (230–266°). Grave goods are scarce, with only M111 containing 4 ceramic vessels and 2 stone tools.

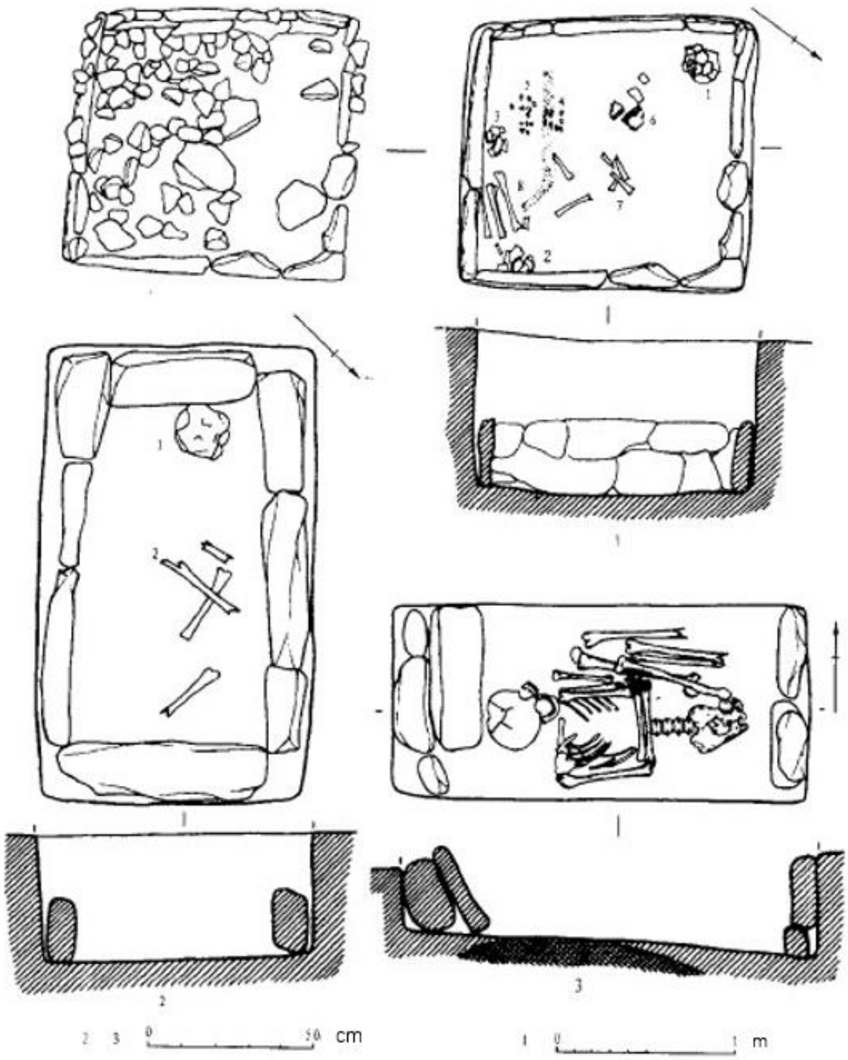



**Figure 4.71, burials of the early phase at Qugong, 1. M111, 2. M112, 3. M109 (IACASS and BCRTAR, 1999, p. 20).**

The late phase includes two cemeteries, though many burials remain unexcavated due to their location beneath a permanent national survey mark. Graves were constructed by piling stones in pre-excavated pits, with some featuring stones piled above the fill. The ratio of male to female burials is nearly equal, and children were also interred in the cemetery.

Cemetery I contains 12 burials (Figure 4.72), mostly secondary or lacking human remains. Orientations range from 36–50°, with exceptions at 80° (M106, M115) and 157° (M113). Only 5 burials contain ceramic vessels. Cemetery II, located on a slope south of the main cemetery, includes 17 graves, 6 stone altars, and 2 sacrificial remains. Most burials are secondary, though M204 and M207 are primary flexed burials (Figure 4.73), and M102, M202, M208, and M219 are collective burials (Figure 4.74). Orientations align with Cemetery I, with most facing northeast (10–35°), though some deviate (–7°, 48°, 87°). Five burials contain 7 ceramic vessels and 1 bronze mirror. Cinnabar was applied to some grave goods, particularly stone tools. Of the 37 identified skeletons, preservation is poor, with 14 males, 12 females, and 11 individuals of unknown sex.

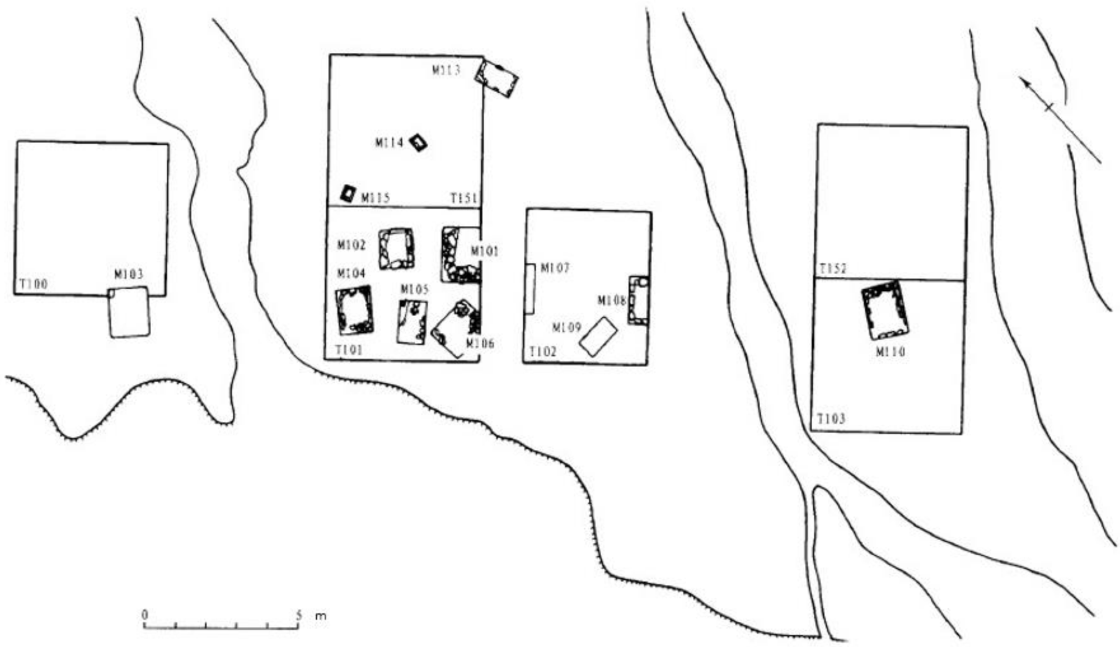



**Figure 4.72, plan of the I cemetery (IACASS and BCRTAR, 1999, p. 186).**

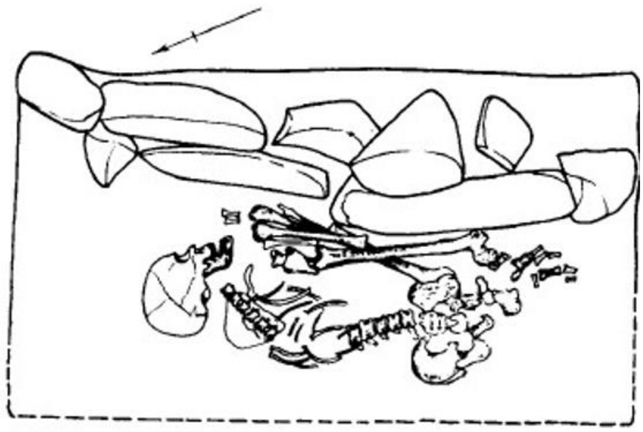


**Figure 4.73, burial M207 at the II cemetery of Qugong (IACASS and BCRTAR, 1999, p. 194).**

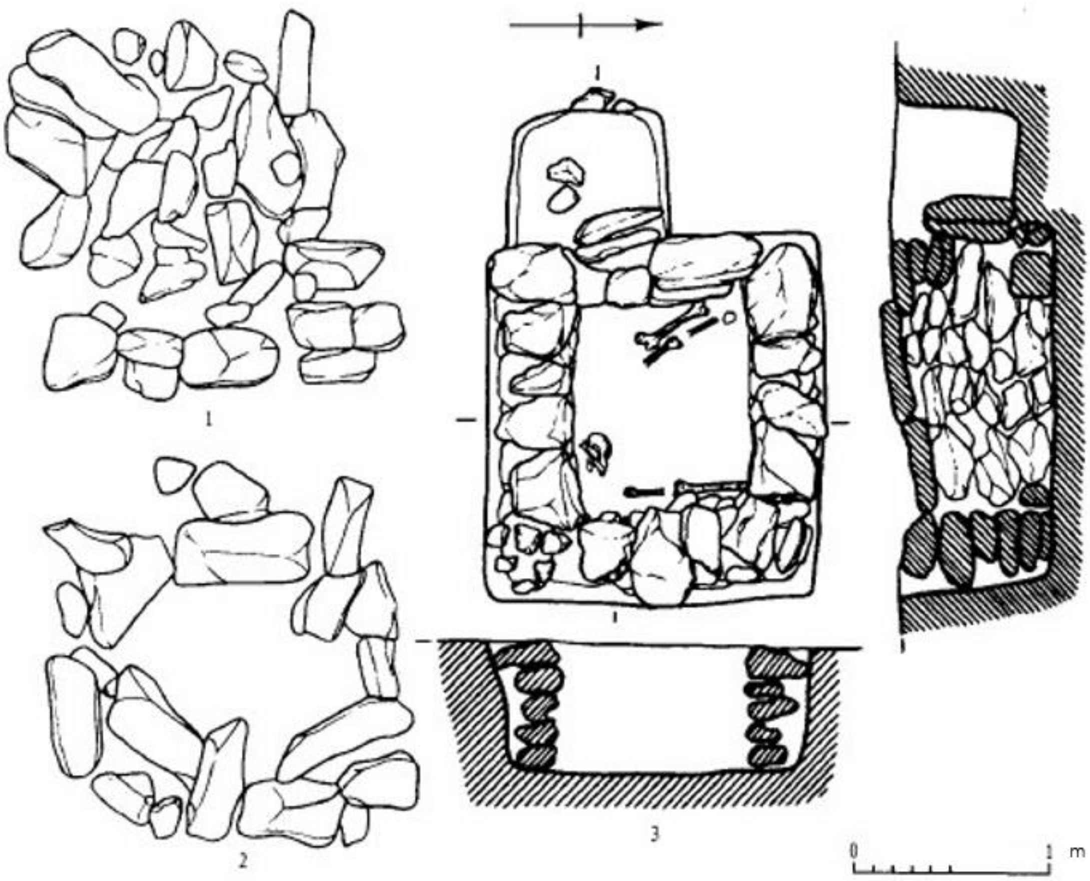



**Figure 4.74, burials M219 in the II cemetery of Qugong (IACASS and BCRTAR, 1999, p. 203).**

Excavators identified two altars and sacrificial remains in Cemetery II (Figure 4.75). The altars, oval-shaped and constructed from dozens of stones, show no signs of artificial polishing.

However, the stones in S1 were selected for their consistent color and texture. Altar J1 features a stone wall segment with 7 ceramic vessels placed to the east. Only the northern part of Altar J2 remains, also consisting of a stone wall segment, a ceramic cup, and the remains of an extended horse.

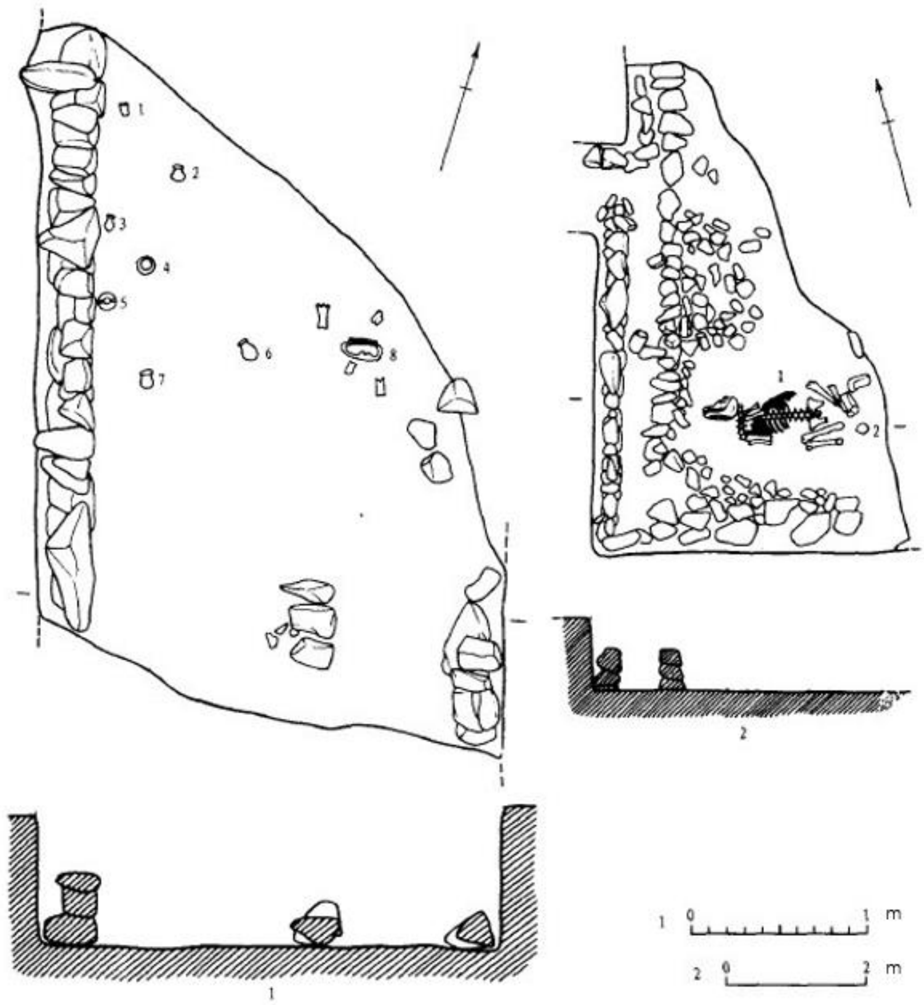


**Figure 4.75, 2 sacrificial remains, 1. J1 (1. Ceramic cup, 2-7. Circular based pots, 8. Animal tooth), 2. J2 (1. Horse bones, 2. Ceramic fragments) (IACASS and BCRTAR, 1999, p. 191).**

## 4.6 Summary

Eighteen sites for study, with the following dates and location: the early Neolithic (7000-5000 BC) Jiahu site in the MYellow River; Middle Neolithic (5000-3500 BC) Jiangzhai and Longgangsi in the

MYellow River, Dawenkou, and Wangyin in the lower reaches, Chengtoushan in the MYangzi River, and Longqiuzhuang in the LYangzi River; Late Neolithic (3500 to 1500 BC) Liuwan and Yangshan in the UYellow River, Dahecun, Xipo, Taosi, and Qingliangsi in the MYellow River. Chengtoushan in the MYangzi River also continued in to this period, then, Lingjiatan, Xuejiagang, and Yuchisi in the LYangzi River, Shixia in the southern region, and Qugong in Tibet.

The geography around the sites varies by region. The sites on the upper Yellow River and in Tibet are surrounded by high mountain ranges and relatively poorly supplied with water. The sites on the MYellow River and MYangzi River are surrounded by mountain ranges, as well as basins and plains, which make for more complex terrain and a richer water supply. The lower reaches of the Yellow and Yangzi Rivers and the southern regions are mostly dominated by plains, hills and relatively low mountain ranges, granting gentle terrain and rich water resources. Overall, the prehistoric inhabitants of the lower reaches were much less obstructed in their physical view of the world than those of the middle and upper reaches, with the sky and earth visible far into the distance.

Differences in climatic conditions and geomorphological features also led to differences in lifestyle among the inhabitants of the different regions. Agriculture appeared earlier in the Yangzi River basin than in the Yellow River basin but developed more slowly. Although there are traces of primitive farming on the upper Yellow River and in the highlands of Tibet, animal husbandry still accounted for a substantial proportion of the archaeological record. Drought-resistant agriculture was the mainstay of cultivation in this region. The inhabitants of the middle Yellow River developed millet farming at an early stage. In the Middle Neolithic period, domesticated millet replaced the hunting-gathering economy on the Yellow River, whereas excavated remains from the Yangzi River basin show that rice was still only semi-domesticated. The inhabitants along the LYellow River developed both dry-farming and rice-farming economies, and fishing, hunting and gathering activities continued until the Late Neolithic. The inhabitants of the middle and lower reaches of the Yangzi River developed a mainly rice-based economy, but only later than in the Yellow River basin did this reach a position where it could compete with the economy of fishing, hunting and gathering. By the Late Neolithic, agriculture on the LYangzi

River was moving towards a high level of sophistication, ahead of that along the middle reaches. In addition, the basic pattern of millet farming in the north and rice farming in the south was further developed to the extent that millet and rice were cultivated in some suitable areas. The agricultural system in the Central Plains was strengthened and diversified during the transition from the Neolithic to the Bronze Age. Livestock rearing, especially of pigs, also developed steadily, with pig mandibles or skulls often buried in tombs in some areas. Most areas relied primarily on domesticated animals for meat resources, with hunting taking a secondary role. Nevertheless, hunting, gathering and fishing still played a relatively important role in subsistence activities around the middle and lower reaches of the Yangzi River. Although there is evidence of primitive agriculture in the south, the economy was still dominated by fishing, hunting and gathering during this period. Tibet also entered a pattern of primary farming and secondary animal husbandry in the Late Neolithic.

Independent cemeteries were formed at all sites except for Yuchisi. The burials are mostly primary with a single inhumation, the burial style is extended and the orientation of burials in each cemetery area is relatively consistent or follows a discernible pattern. Burials at the sites on the upper Yellow River are mainly orientated in the four cardinal directions or mainly orientated to the north. Those on the MYellow River are predominantly west-facing. Those on the lower reaches are predominantly east-facing. In Tibet, burials predominantly face north or towards the mountains. Burial orientations on the MYangzi River are very scattered, a characteristic inherited by all the cultures that followed it in the Neolithic period. Burials on the LYangzi River are orientated in different directions; those in Yuchisi are orientated with reference to houses. Burials in the south are predominantly orientated towards the east.

It can be concluded that while the orientation of burials varies between regions, there appears to be a relatively clear general orientation within individual cultures. For example, in the Majiayao culture of the UYellow River, the predominant orientation is north-facing, but some burials face southeast or east. Burials of the Qijia culture are predominantly orientated towards the west or northwest. There are, however, cases where burial orientation changed during the evolution of the culture. The Yangshao culture of the MYellow River, for instance, presents mainly west-facing burials in the early period, with a few facing eastward in the middle period, but in the late period, the orientation of most burials changed, though the orientation within individual cemeteries remained relatively consistent. In the Dawenkou culture, the most common orientation is east, but some point to the northwest or in other directions. In the Longshan culture that followed, although most burials were orientated to the southeast or east, and a few to the northwest, the uniformity was much weaker because most burials were mixed with living areas, and the situation was not quite the same from site to site. In the Yangzi River basin, burials of the Tangjiagang culture along the middle reaches of the river are mostly aligned in a southeasterly direction; burials of the Daxi culture are mostly orientated towards the west, but some face the east and south; the different cemeteries of the Qujialing culture have their own uniform orientations; and the situation of the Shijiahe culture is similar to that of the Qujialing. In the Jianghuai area on the LYangzi River, due to the intricate distribution of its culture, burial orientations are more complex, but burials within specific cemeteries are still orientated in the same direction. In the south, there are so few data on Neolithic burials that it is currently difficult to recognise a pattern from the perspective of culture. In Tibet, orientation is also difficult to recognise because of the complexity of the burials, and the meaning(s) behind burial orientation may not be of as much concern as the burial position.

Special burial customs that appear in some burials in the Yellow River basin include cutting bones, placing water deer tusks in the deceased’s hand, extracting incisors before burial, artificially deforming the occipital bone, placing a small ball in the deceased’s mouth, smearing vermilion sand on the burial goods, deliberately breaking pottery pieces and placing a *bo* (bowl), sometimes with a small hole punched in the bottom, on a certain part of the body. Among the burial practices specific to the Yangzi River Valley is the placement of pottery and artefacts in a certain direction. In the south, there are burials in which vermilion sand is smeared on the surface of human bones or burial objects and stones are intentionally placed in the grave. The same phenomenon is found in burials in Tibet. Specific grave goods found in the Yellow River basin include fork-shaped objects; bone flutes and tortoiseshells containing small stones or burnt or perforated tortoiseshells; jawbones or skulls of animals, mainly pigs; and drums containing crocodile bones. Among the more unusual burial objects unearthed in the Yangzi River basin are knives and battleaxes with holes in them and tortoiseshells made of jade, an important material in burials on the LYangzi River, in particular. In addition, pits for animal or artefact sacrifice and altars have been excavated from sites in the Yellow and Yangzi River basins and Tibet.

The burials reveal a change in emphasis in the means of subsistence at some sites, as well as a shift in the division of labour between the sexes. A change is apparent from multiple burials of people of the same sex to mixed-sex multiple burials, with the gradual emergence also attested of multiple burials of men and children. Grave goods in male burials became progressively more numerous and elaborate than those of female burials, while the size of burials followed the same trend, and female burials were gradually replaced by male burials at the centre of cemeteries (Cao, 2007). Comparison of the size of burials and richness of burial goods from the Early to Late Neolithic illustrates a shift from relative equality to the heavy concentration of power and wealth in a certain group, influenced by a variety of demographic, climatic, social, political and religious factors. Some scholars have suggested a shift from matrilineal to patrilineal societies (Lin, 1984; Wang, 1990; Zhang and Zhu, 1994a; 1994b; Cao, 2007; Liu and Xiong, 2018), though others dissent (Wang, 1987).

The burial objects placed in special directions and positions, their exquisite decorations, special burial practices and the pits or building foundations defined as ritualistic all reflect the fact that these cultures had already developed primitive religions and that these occupied an important position and function in the organisation of their societies. Beliefs in gods and religion continued to drive social progress, widening gaps in status and supporting hierarchical order. At the same time, they trained and regulated people's aesthetics, ethics and social order.

# Chapter 5 Results

## 5.1 Introduction

In line with the section 3.4 of Methodology chapter, this chapter lists potential Neolithic celestial events, such as the movements of the Sun, Moon, stars and Milky Way that could have been identified by prehistoric skywatchers. This allows us to reconstruct objective astronomical facts that could be observed by day and night skywatching, particularly celestial trajectories related to the orientation of graves. Another key object of analysis is the surroundings of the sites, particularly in the directions indicated by burial orientations, which should allow us to conclude whether there are any similarities between different cultures or regions. Table 5.1 below gives the region, period and number of graves for each site.

Grave orientations may indicate points of particular significance in the surrounding landscape, such as the route to a settlement through surrounding mountains. Three broad possible functions exist for landscape features in this context: as a compass point, for example, a tree that forms, with the burial, a line indicating a particular celestial target; as a point of significance in its own right, such as a sacred mountain in Tibet; and as a feature to be combined with the skyscape, reflecting a complete whole of beliefs, such as mountains as mirror reflections of the sky. Important features could be summits, feet or gorges of mountains, branches of rivers, lakes or other special geographical settings. Among these natural landscapes, it is important to note that rivers and lakes are changeable compared to mountains and that rivers change their courses not only naturally but also in response to the needs of human social development. The rivers and lakes we see now, therefore, may not be as they were in the Neolithic; ancient river paths are particularly hard to trace.

The chapter will, therefore, evaluate the landscape features and potential celestial targets that appear in the orientation range of burials at each site and consider whether interaction is likely. The celestial alignment and trajectory of those potential celestial targets are also significant elements. The most significant alignments of the Sun, for instance, include the spring and autumn equinoxes and summer and winter solstices. The Moon is the most complex target in the sky, as explained in chapter 2. The most popular lunar phenomena for study include lunar standstills, crossovers of the Sun and equinoctial moons (Silva, 2012). Although they were not recorded in ancient literature (or have not yet been decoded by archaeologists), the lunar standstill and crossovers will be noted here. A further, unique celestial target that we should not ignore is the Milky Way. Its trajectory will be considered when it falls within the orientation range of graves at a site, as will the stars that appear within that range and are observable with the naked eye.

Each region may have seen its cultures develop in a different direction and to a different degree. The concept of the Big Dipper or the North Star may not be identified or associated with any given understanding in the imagination of some cultures. Before this issue is explored, however, the data from each site will be analysed and investigated through significance testing using skyscapeR, presented in this chapter. The significant declination range produced will list the possible astronomical alignments and targets, especially noting the brightest stars (appendix 6). Stellarium will then be used to display the positioning of these potential targets in a particular period. The skyscapes above the eastern and western horizons will each be recorded at two specific times: the eastern horizon one and a half hours before sunrise and half an hour before sunrise; and the western horizon half an hour after sunset and one and a half hours after sunset. An explanation of the years used to calculate celestial activity can be found in the chapter 3. If a cemetery is divided into early and late phases, each phase will be described individually. More detail is given in appendix 7. The purpose of this chapter is to identify the orientation of burials and the points of interest that appear on land and in the sky within the space indicated by that orientation.

| Regions | Sites | Period and Culture | Number of graves |
|---|---|---|---|
| The Yellow River-the middle reaches | Jiahu | The early Jiahu phase (7000-6600 BC) | 57 |
| | | The middle to late Jiahu phase (6600-5800 BC) | 389 |
| | Jiangzhai | The Banpo phase of the Yangshao period (5000-4300 BC) | 174 |
| | | The Shijia phase of the Yangshao period (4300-4000 BC) | 191 |
| | Longgangsi | The Banpo phase of the Yangshao period (4500-4000 BC) | 411 |
| | Dahecun | The last phase of the Yangshao period (2700-2400 BC) | 124 |
| | | The Longshan period (2400-2100 BC) | 60 |
| | Xipo | The Miaodigou phase of the Yangshao period (3300-2900 BC) | 34 |
| | Taosi | The early Taosi phase of the Longshan period (2300-1900 BC) (including 33 graves from previous phase) | 1412 |
| | Qingliangsi | The 1st phase, the Zaoshi phase (4050-3770 BC) | 17 |
| | | The 2nd phase, the Miaodigou phase of the Yangshao period (2280-1780 BC) | 189 |
| | | The 3rd phase, the Longshan period (2430-1700 BC) | 105 |
| | | The 4th phase, the Longshan period (2040-1700 BC) | 44 |
| The Yellow River-the lower reaches | Dawenkou | The Dawenkou period (4150-3700 BC) | 180 |
| | Wangyin | The Dawenkou period (4300-3500 BC) | 899 |
| The Yellow River-the upper reaches | Liuwan | The Banshan phase of the Majiayao period (2655-2270 BC) | 257 |
| | | The Machang phase of the Majiayao period (2270-1885 BC) | 872 |
| | | The Qijia period (1885-1500 BC) | 366 |
| | Yangshan | The Banshan phase of the Majiayao period (2655-2330 BC) | 218 |
| The Yangzi River-the middle reaches | Chengtoushan | The Daxi period (4200-3200 BC) | 214 |
| | | The Qujialing period (3200-2500 BC) | 183 |
| | | The Shijiahe period (2500-2300 BC) | 5 |
| The Yangzi River-the lower reaches | Longqiuzhuang | The Longqiuzhuang phase (5000-3500 BC) | 402 |
| | Lingjiatan | The Lingjiatan phase (3600-3300 BC) | 44 |
| | Xuejiagang | The Xuejiagang phase (3500-2600 BC) | 151 |
| | Yuchisi | The late Dawenkou period (2800-2700 BC) | 284 |

| | | | |
|---|---|---|---|
| | | The Longshan period (2700-2600 BC) | 24 |
| The Southern region | Shixia | The Shixia period (3500-2000 BC) | 102 |
| Tibet | Qugong | The late phase of the Qugong period (1700B-1500 BC) | 29 |
| Total | | | 7437 |

**Table 5.1, Basic information of each site (regions, names, periods and grave number).**

## 5.2 Regional studies of Chinese sites

### 5.2.1 The Yellow River

#### 5.2.1.1 The middle reaches

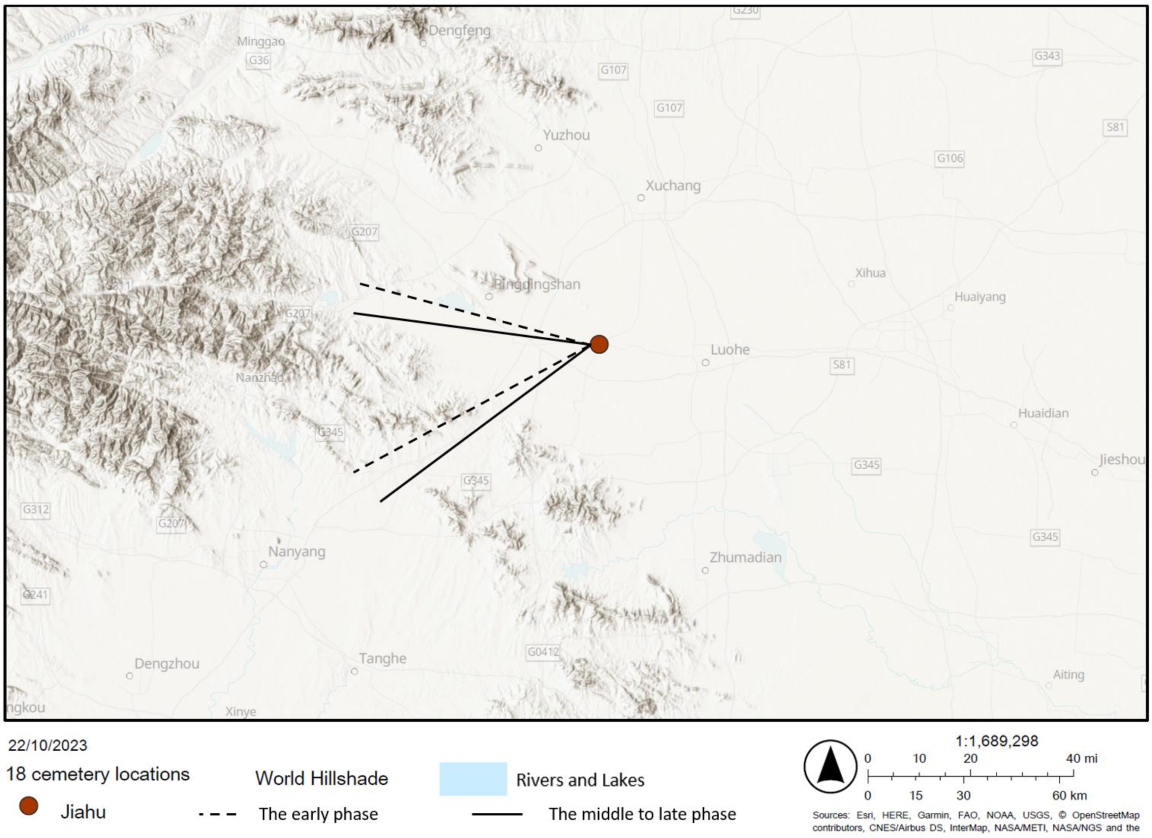
Although the MYellow River region spans politically from Hekou Town in Inner Mongolia to Taohuayu in Henan Province, the selected archaeological sites are primarily concentrated near the borders of Shaanxi, Henan, and Shanxi Provinces, where the Loess Plateau meets the North China Plain of the LYellow River. Jiahu and Dahecun are located at the transition zone to the North China Plain, situated at relatively low altitudes, with continuous mountain ranges extending to the west and north of these sites. Other sites, such as Jiangzhai, Xipo, Qingliangsi, and Taosi, are positioned sequentially along the crescent-shaped Jin-Shaan Basin, nestled within the surrounding mountain ranges. Longgangsi, the final site, lies in a basin bordered by the Qinling Mountains to the south and another mountain range to the north. The Yellow River, the region's most significant waterway, flows southward through this crescent-shaped basin from Inner Mongolia before turning eastward as it passes the Zhongtiao Mountains.

**Jiahu**

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Early Jiahu phase (7000-6500 BC) | 57 | 233.5-278.4 | -27.13°-3.5° |

| | | | |
|---|---|---|---|
| The Middle to Late Jiahu phase (6500-5500 BC) | 389 | 241.3°-284° | -18.06°-8.28° |

**Table 5.2, summary of grave orientation and Jiahu site information.**




**Map 5.1, the overall view grave orientaion at Jiahu.**

Jiahu is situated on a plain, and as illustrated in the panoramic landscape view (map 5.1), there are few geographical features that would have obstructed celestial observations during that period. The two brown lines in Figure 5.1 indicate the significant true azimuth range of 233.5° to 278.4° for the 57 early Jiahu phase graves (figure 5.1, left and middle). These orientations point toward the Qinling Mountains, specifically the middle section of the continuous mountain range visible to the naked eye, rather than the slightly higher peaks to the sides. However, these mountains are not prominent enough to serve as unique celestial markers. In the middle to late Jiahu period, the grave orientations shift slightly westward, with a significant true azimuth range of 241.3° to 284° (figure 5.2, left and middle).

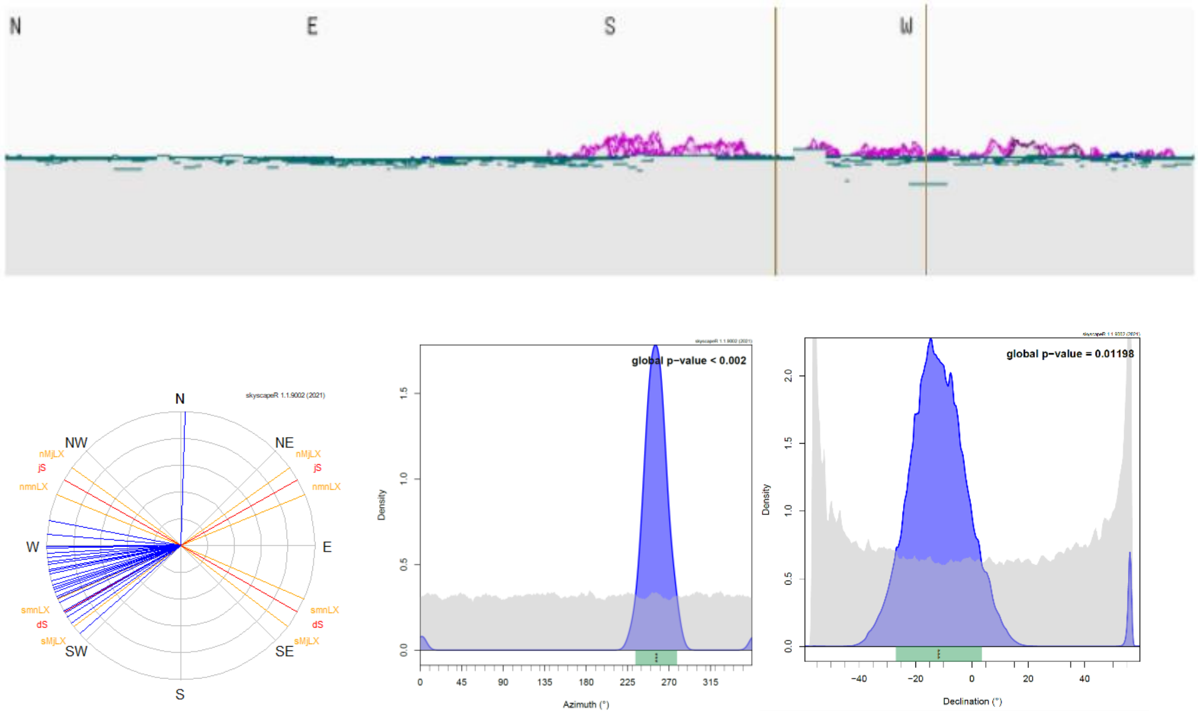



**Figure 5.1, depicts the panoramic view around the Jiahu site and the grave orientations of the early Jiahu phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiahu grave orientations in the early period (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

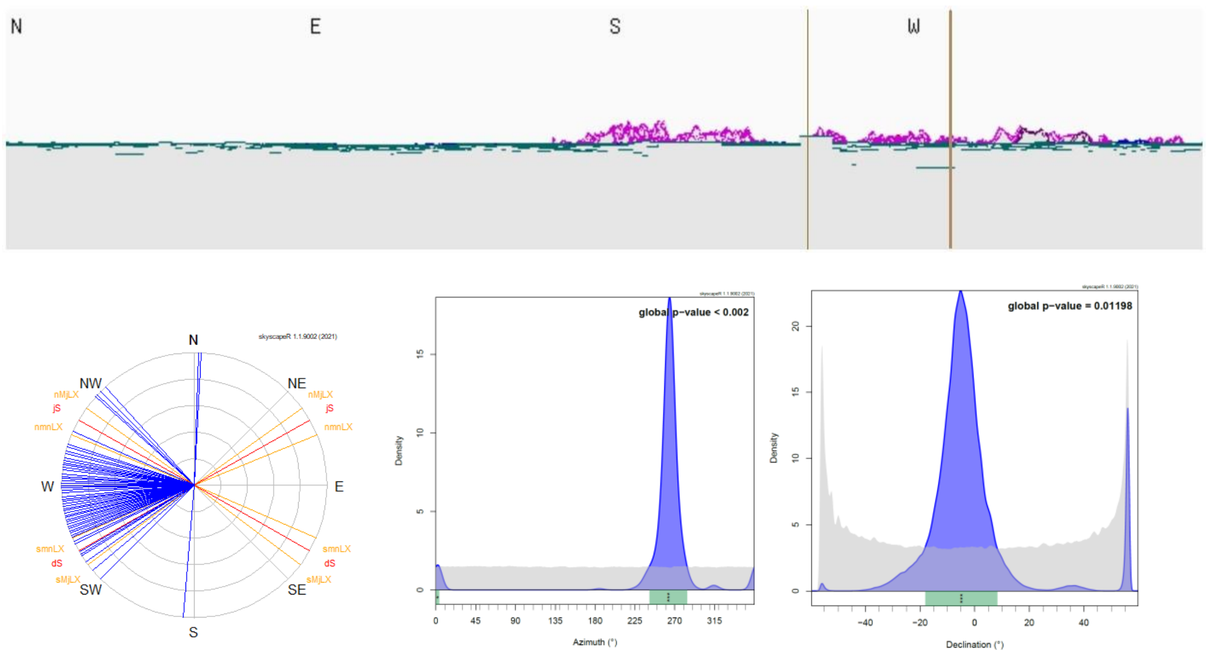


**Figure 5.2, shows the panoramic view around the Jiahu site and the grave orientations of the middle to late Jiahu phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiahu grave orientations in the middle to late period (left), a histogram of true azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

The significant declination range for the 57 early Jiahu phase burials is -27.13° to 3.5° (figure 5.1 right), suggesting possible celestial targets between 7000 and 6600 BC. These include the winter solstice and vernal and autumnal equinoxes (figure 5.3); sunset between 8th September and 31st March; Southern minor lunar extreme (SMinLE); Rigil Kentaurus, Procyon, Hadar and other stars, as well as Alphard appeared on the west horizon at nightfall of SE.

In the middle to late Jiahu phase, the significant declination range shifts slightly northward to -18.06° to 8.28° (figure 5.2, right), though this change would have been imperceptible to the naked eye. This range corresponds to celestial targets between 6500 and 5500 BC, including spring and autumn equinoxes, date ranges of sunset are 29th January to 12th April and 28th August to 6th November, and particular bright stars including Capella, Procyon, Pollux and others. Additionally, Alphard raised up from eastern horizon at dawn on SS.

Notably, at Jiahu, 149 of the 446 graves (exactly one-third) face a true azimuth of 264.84° or a magnetic azimuth of 270°. Additionally, 194 graves (43.5% of the total) are oriented within the true azimuth range of 260.84° to 269.84°. This clustering is more pronounced in the late period than in the early period. While a 5°–6° deviation is visually negligible, potential measurement and compass reading errors cannot be entirely ruled out. The skyscape in this direction aligns with the sunset during the vernal and autumnal equinoxes. When set to 264.84° in Stellarium, the Milky Way aligns almost vertically with this angle exactly one hour after sunset on the summer solstice, creating a breathtaking visual spectacle as it stretches across the sky like a luminous path of billions of stars.

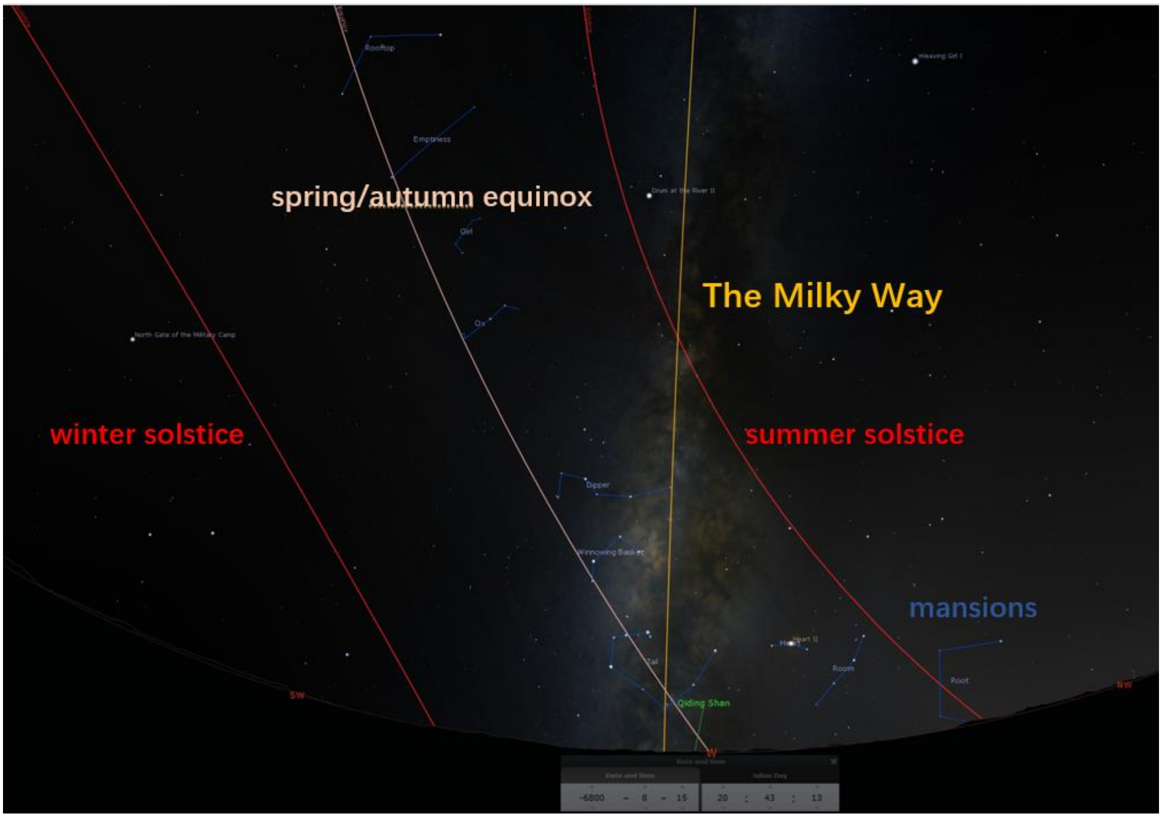
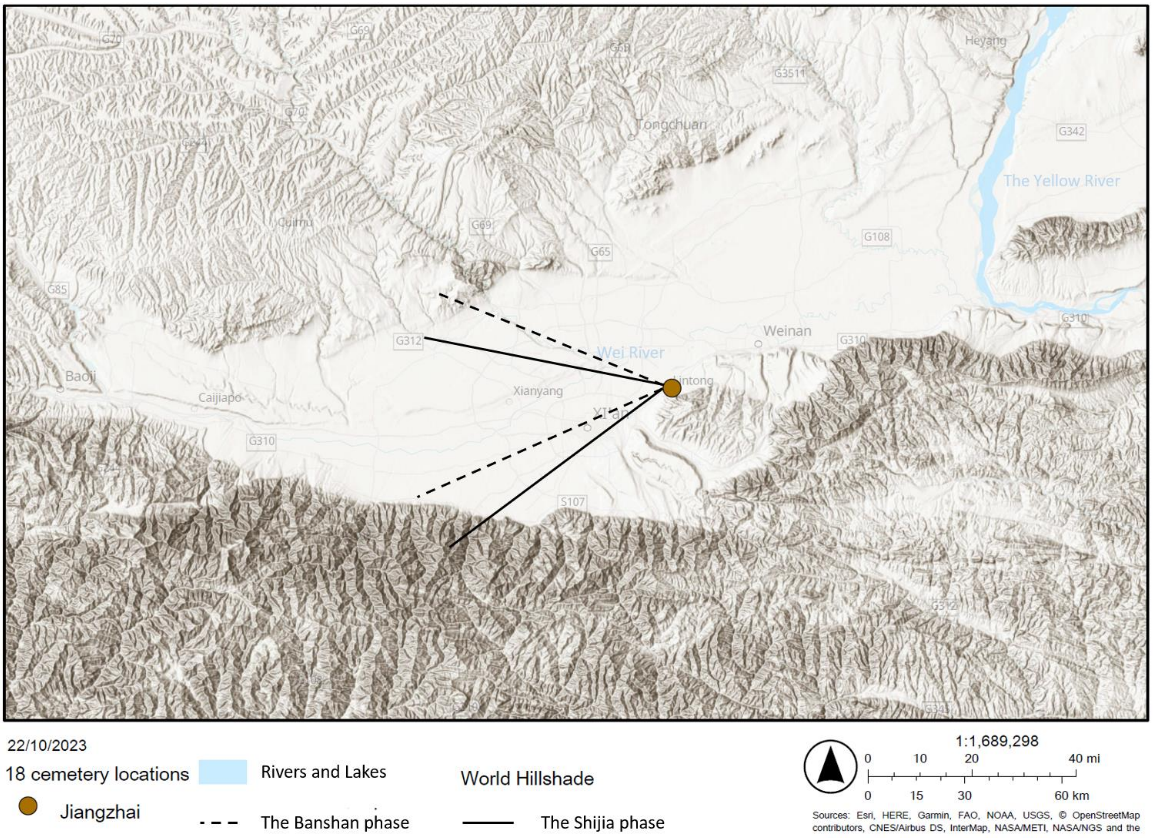



**Figure 5.3, the Milky way presents one hour after sunset on summer solstice at Jiahu, without Atmospheric effects.**

## Jiangzhai

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Banpo phase (5000-4300 BC) | 174 | 232.8°-292° | -25.97°-13.44° |
| The Shijia phase (4300-4000 BC) | 191 | 245.9°-280.5° | -15.86°-6.82° |

**Table 5.3, summary of grave orientation and Jiangzhai site information.**




**Map 5.2, the overall view grave orientaion at Jiangzhai.**

The Jiangzhai site is located in the Wei Plain within the crescent-shaped Jin-Shaan Basin. The surrounding landscape is dominated by the Qinling Mountains to the east and south, extending from the Jiahu region (map 5.2). The Wei River flows from west to east along the northern edge of the site. As shown in the panoramic image, the orientation range of the graves subtly avoids the mountain ranges to the north and south, instead aligning with the Wei River plain between them (figure 5.4, above). This direction not only marks the extension of the mountains but also the origin of the river.

During the Banpo phase at Jiangzhai, 174 graves were excavated and documented. The significant true azimuth range for these graves is between 232.8° and 292° (figure 5.4, left and middle). In the subsequent Shijia phase, the number of burials increased, but the significant true azimuth range narrowed to 245.8° to 280.3° (figure 5.5, left and middle).

The significant declination range for the Banpo phase graves is -25.97° to 13.44° (figure 5.4, right), indicating possible celestial targets such as the winter solstice and spring/autumn equinoxes, sunset during 17th August to 17th December and 20th December to 27th April, SMinLE and bright stars, such as Rigil Kentaurus, Procyon, Betelgeuse, Hadar, Aldebaran, Antares and others. Additionally, Antares raised from eastern horizon and Rigel reached western horizon at dawn on AE.

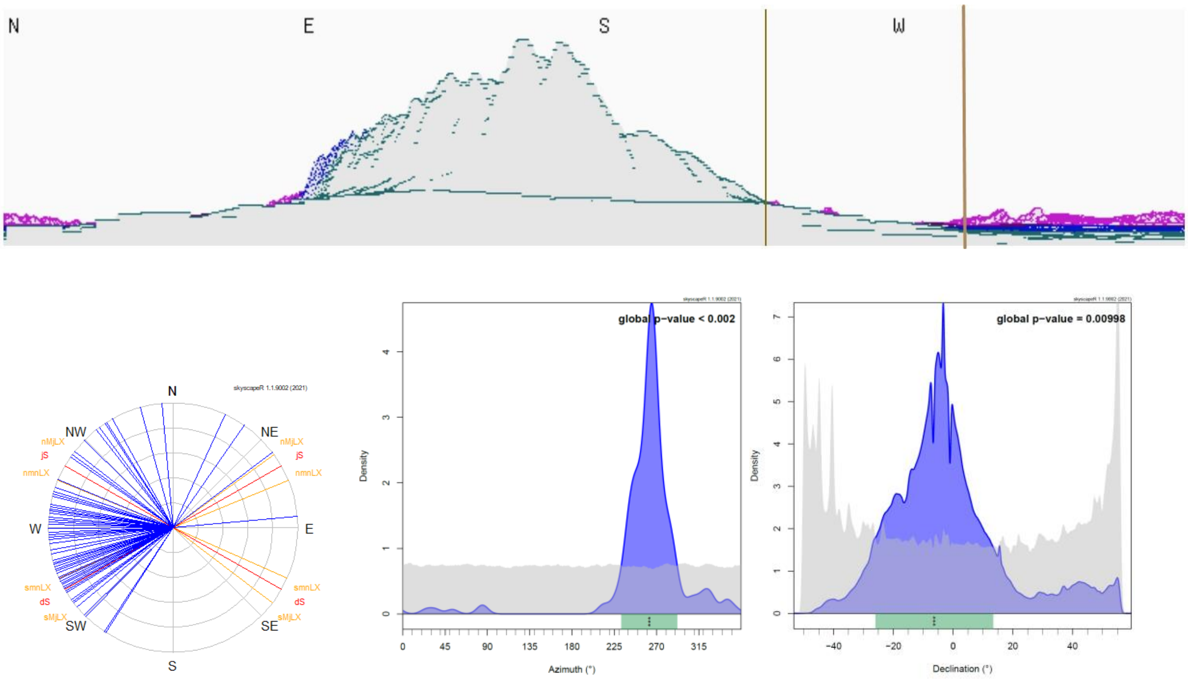



**Figure 5.4, illustrates the panoramic view around the Jiangzhai site and the grave orientation range of the Banpo phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiangzhai grave orientations in the Banpo phase (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

In the Shijia phase, 191 graves were recorded, with 10 lacking detailed documentation. The significant declination range for this phase is -15.86° to 6.82° (figure 5.5, right). During the period from 4300 to 4000 BC, notable celestial phenomena included the two astronomical equinoxes and sunset during 5th February and 9th April, 3rd September and 1st November; the bright stars include Procyon, Betelgeuse, Aldebaran, Antares and others. Although the range of true azimuth is narrower than for the Banpo graves, the movement of stellar objects changed very little. Then, Antares rose up on from eastern horizon at dawn on AE, meanwhile, while Rigel set on the opposite horizon, mirroring the conditions observed in the Banpo phase.

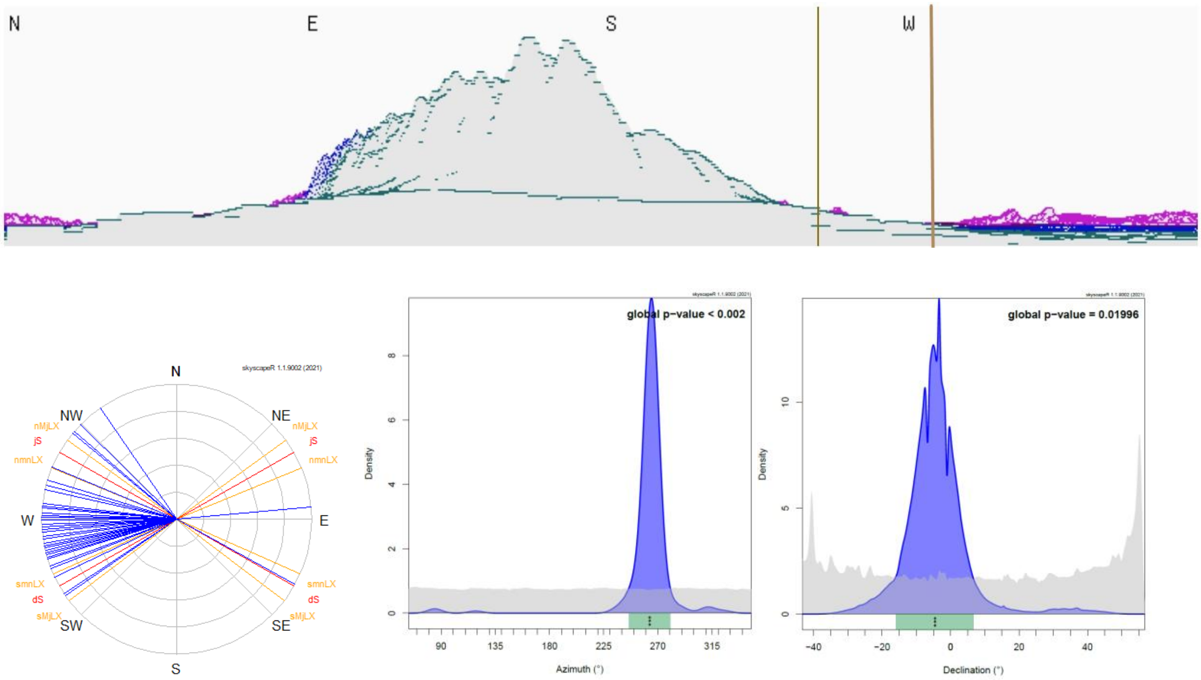



**Figure 5.5, depicts the panoramic view around the Jiangzhai site and the grave orientation range of the Shijia phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Jiangzhai grave orientations in the Shijia phase (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

Similar to Jiahu, the graves at Jiangzhai exhibit a pronounced concentration around a true azimuth of 264.68° or a magnetic azimuth of 270°. A total of 178 graves (48.8%) from both the Banpo and Shijia phases are aligned in this direction. This orientation corresponds to the sunset during the spring and autumn equinoxes. However, unlike Jiahu, the Milky Way's alignment after the summer solstice sunset does not appear to have been a primary target for the burial orientations, as it diverges significantly during the other three seasons (Figure 5.6). Furthermore, the orientation range and panoramic landscape at Jiangzhai closely resemble those at the Xipo site, which will be discussed in detail later.

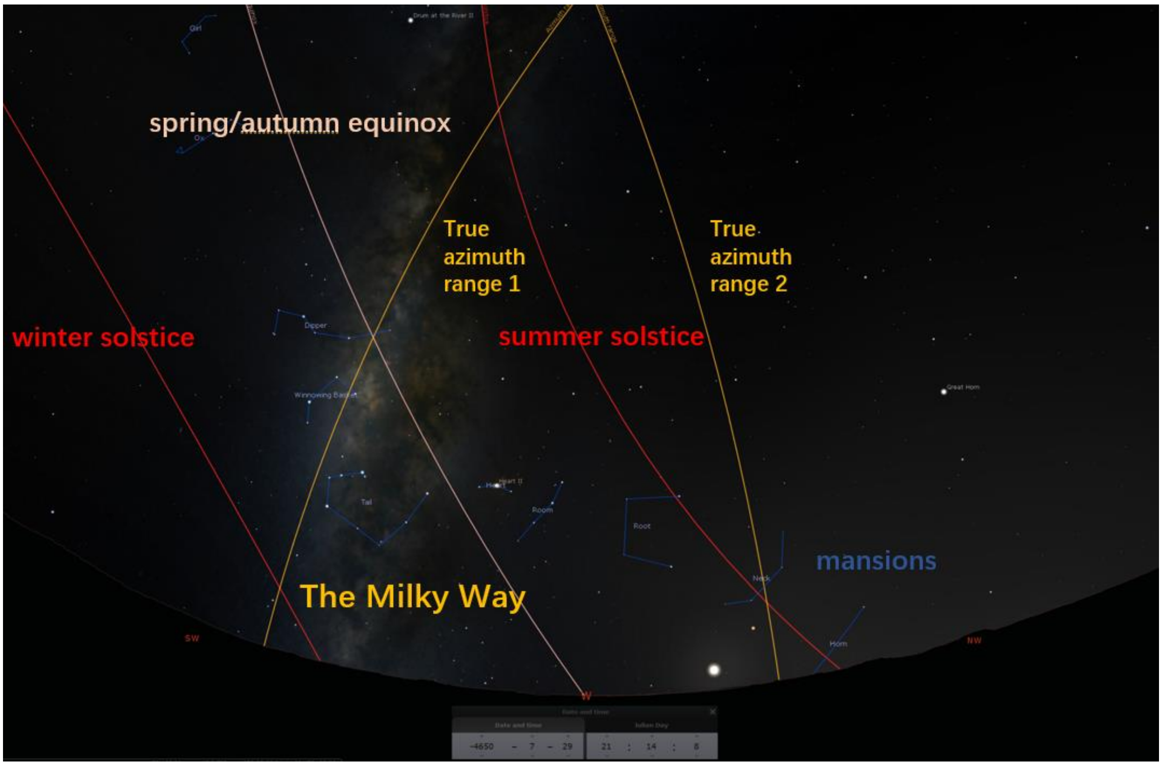
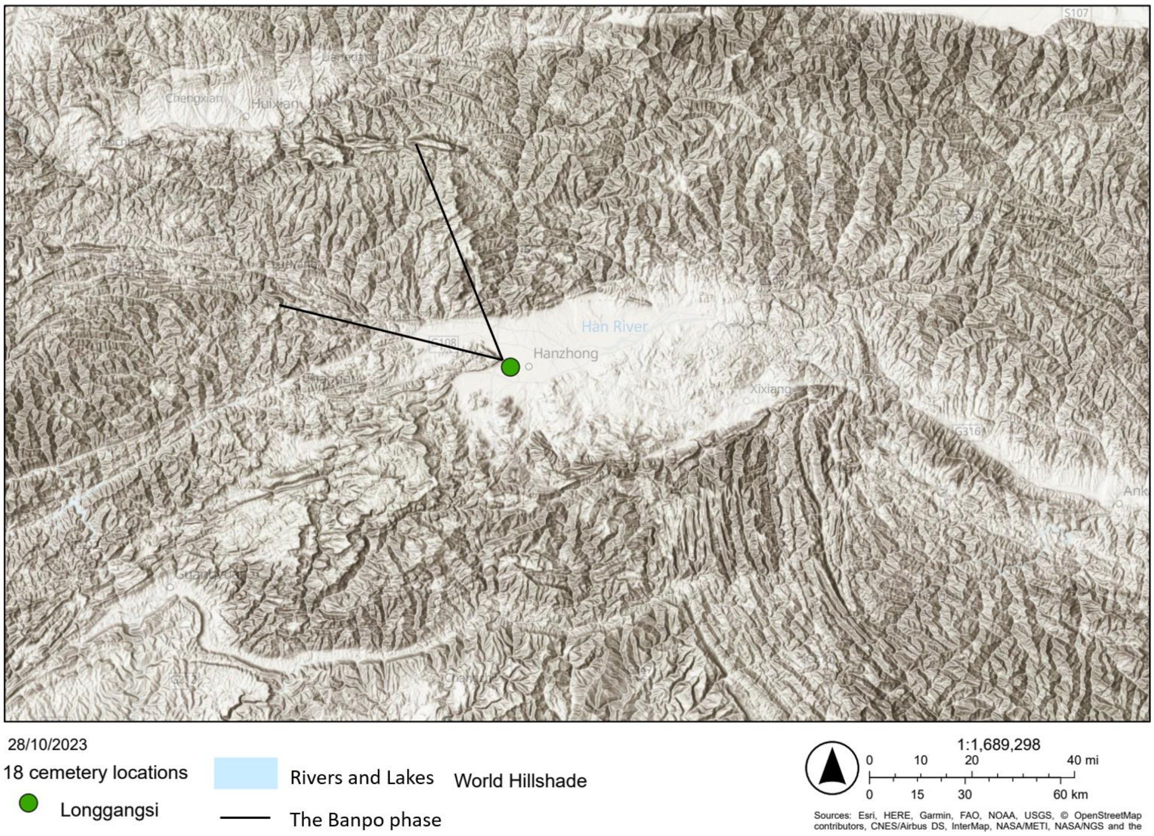



**Figure 5.6, the Milky Way appeared after sunset on SS at Jiangzhai, without atmospheric effect.**

## Longgangsi

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Banpo phase (4500-4000 BC) | 411 | 287.4°- 338.2° | 19.8°-51.8° |

**Table 5.4, summary of grave orientation and Longgangsi site information.**




**Map 5.3, the overall view grave orientaion at Longgangsi.**

The graves at Longgangsi all date to the Banpo phase, a key period of the Yangshao culture in the Central Plains. The site is nestled between two significant mountain ranges, which run parallel to each other and converge in the west, effectively enclosing the site in the middle. As depicted in the panoramic image (figure 5.7, above), the site is surrounded by mountains on all sides except the east, where the terrain flattens, providing a natural entrance and exit for trade and interaction with neighbouring tribes. This geographically fortified setting likely offered strong defensive advantages, protecting the inhabitants from external threats. The site itself is situated on a prominent hill overlooking a river that borders the hill. Despite this strategic location, none of the 411 burials (including 61 graves with uncertain orientations) face the settlement’s entrance, the opposite direction, or the river’s origin.

The significant true azimuth range for the Banpo phase graves is 287.2° to 338.1°, with a declination range of 19.8° to 51.8° (figure 5.7, left, middle, and right). When projected into a sky simulator, these ranges align with potential celestial phenomena, including the summer solstice alignment and sunset between 19th May and 21st June, 25th June and 27th July, as well as Northern Major Lunar Extreme (NMajLE). At night, observable stars within this range include Vega, Capella, Spica, Deneb and others. Notably, the azimuth range of the graves is significantly further north than the movement of the four animal constellations in Stellarium but too far south to align with the Pole Star or Ursa Minor. A striking discovery is Arcturus, which is also known as Great Horn (大角星) in Chinese, maintained in the true azimuth range for a long time, instead of the declination range. The vmag of Arcturus is -0.04, which is not as visible as Rigil Kentaurus, but is the second brightest compared to the stars in the stellar list. Furthermore, the appearance of four special stars in the sky of Longgnagsi is intriguing. As a result, Alphard arose on the eastern horizon at dawn on SS, accompanied with particularly intense sunlight; Antares and Rigel appeared on the eastern and western horizon at dawn on AE respectively. However, these stars fall outside the significant true azimuth and declination ranges.

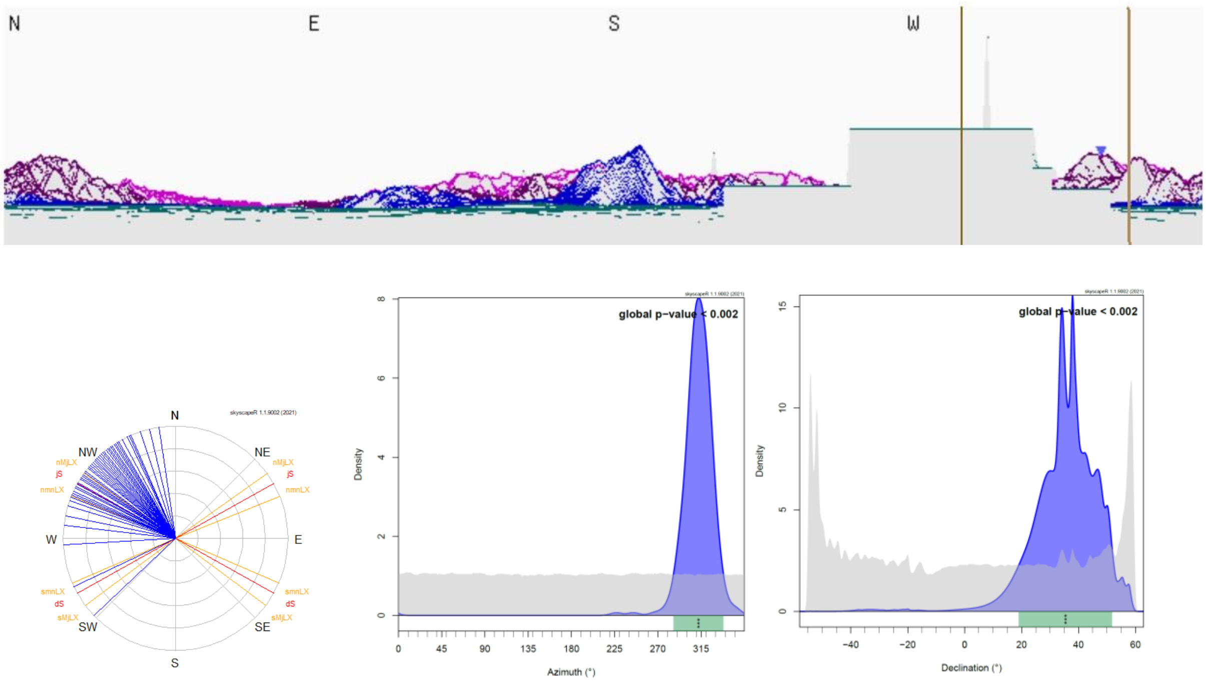
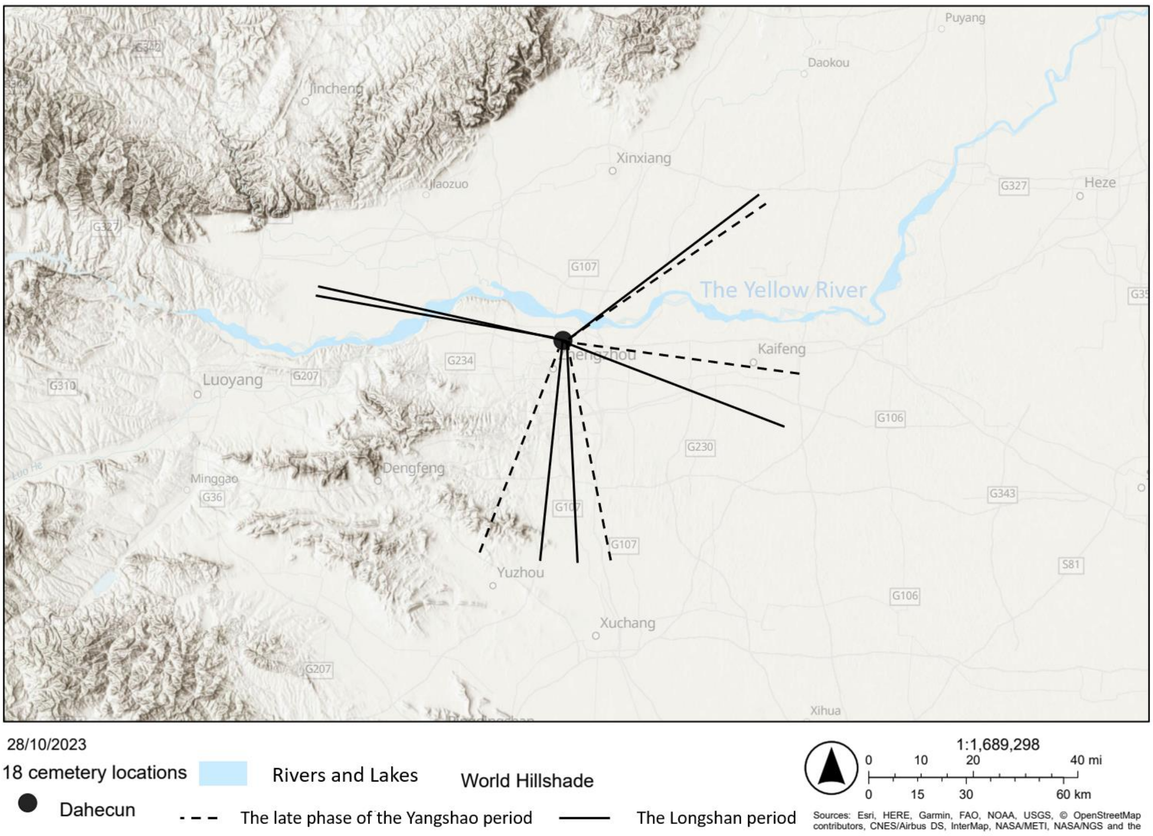



**Figure 5.7, shows the panoramic view around the Longgangsi site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Longgangsi grave orientations in the Yangshao period (left), a histogram of azimuth distribution in the significance test of the Banpo phase (middle), and a histogram of declination distribution in the significance test of the Banpo phase (right).**

## Dahecun

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The last phase of the Yangshao period (2700-2400 BC) | 118 | Range1: 55.7°-97.4° | Range1: -61.9°--51.12° |
| | | Range2: 170°-201.2° | Range2: 2.39°-24.11° |
| The Longshan period (2400-2100 BC) | 60 | Range1: 52.9°-113.3° | Range1: -62.52°--55.22° |
| | | Range2: 178°-186.1° | Range2: -17.51°-21.65° |
| | | Range3: 279.4°-282.1° | |

**Table 5.5, summary of grave orientation and Dahecun site information.**




**Map 5.4, the overall view grave orientaion at Dahecun.**

Dahecun is located on the North China Plain, with remnants of the Qinling Mountains visible to the southwest and northwest, at least 40 miles away. These remnants lie further south than those near Jiahu (map 5.4). The geography around Dahecun is highly similar to that of Jiahu, with mountain altitudes below 1°, making it an ideal location for sky observation. To the northwest, several major tributaries of the Yellow River converge, creating a fast and voluminous flow to the north of the site. Interestingly, graves from the Yangshao period are primarily oriented east and south, while those from the Longshan period are more evenly distributed across all four cardinal directions.

During the Yangshao period, 118 of 124 graves at Dahecun are unevenly distributed across four directions, with the remaining graves lacking clear orientation data. The majority face east, followed by south, west, and finally north (figure 5.8, above, left, and middle). Two main orientation ranges were identified through significance tests: 55.7° to 97.4° and 170° to 201.2°. The corresponding declination ranges are -61.9° to -51.12° and 2.39° to 24.11° (figure 5.8, right). The first range aligns with prominent stars in the northern sky, particularly Canopus. The second range corresponds to the summer solstice alignment and sunrises between 27th May and 21st June, 25th June and 16th September, as well as Northern Minor Lunar Extreme (NMinLE). Notable stars are Capella, Procyon, Altair, Antares, Spica, Pollux and others.

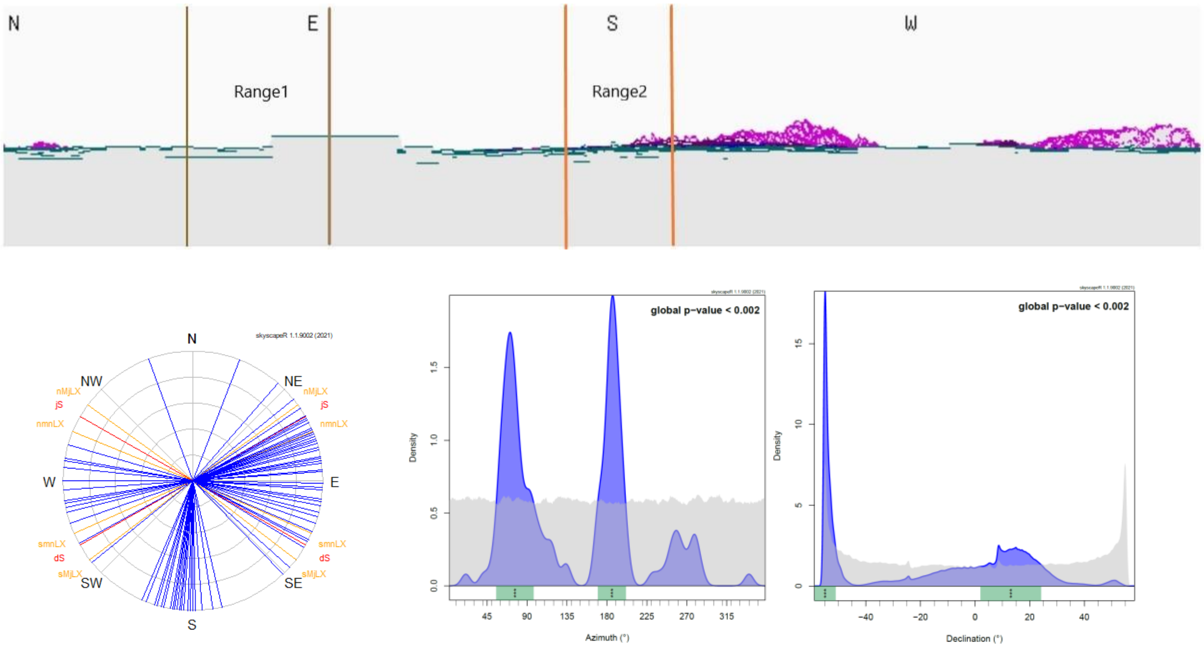


**Figure 5.8, illustrates the panoramic view around the Dahecun site and the grave orientation range of the late Yangshao period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dahecun grave orientations in the Yangshao period (left), a histogram of azimuth distribution in the significance test of the Yangshao period (middle), and a histogram of declination distribution in the significance test of the Yangshao period (right).**

In the Longshan period, the earlier tradition of grave orientation distribution was maintained. Sixty graves are relatively evenly oriented across the four cardinal directions (figure 5.9, above, left, and middle), with one grave lacking orientation data. The significant azimuth ranges are 52.9° to 113.3°, 178° to 186.1°, and 279.4° to 282.1°. The declination ranges of significance are -62.52° to -55.22° and -17.51° to 21.65° (figure 5.9, right). The first declination range includes stars such as Canopus, Alnair, Tiaki and Ankaa, while the second one contains equinox alignment and sunrise between 31st January and 29th May, 18th July and 8th November and NMinLE. Notable stars are Procyon, Betelgeuse, Altair, Aldebaran, Antares, Spica and others.

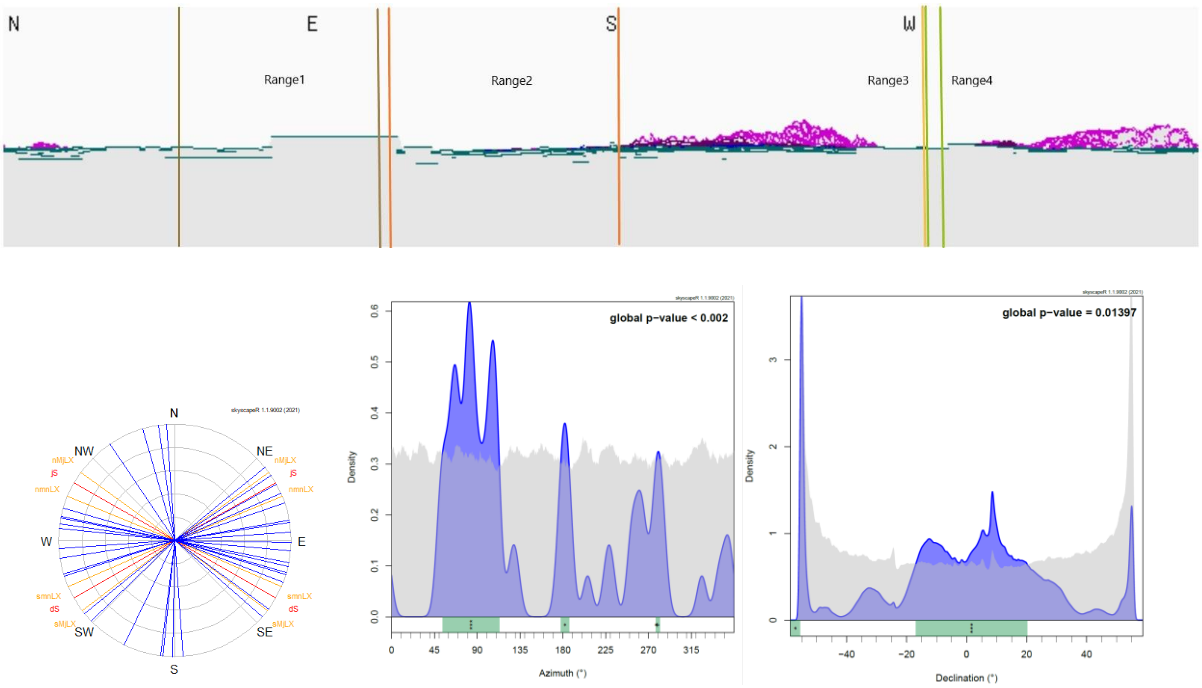


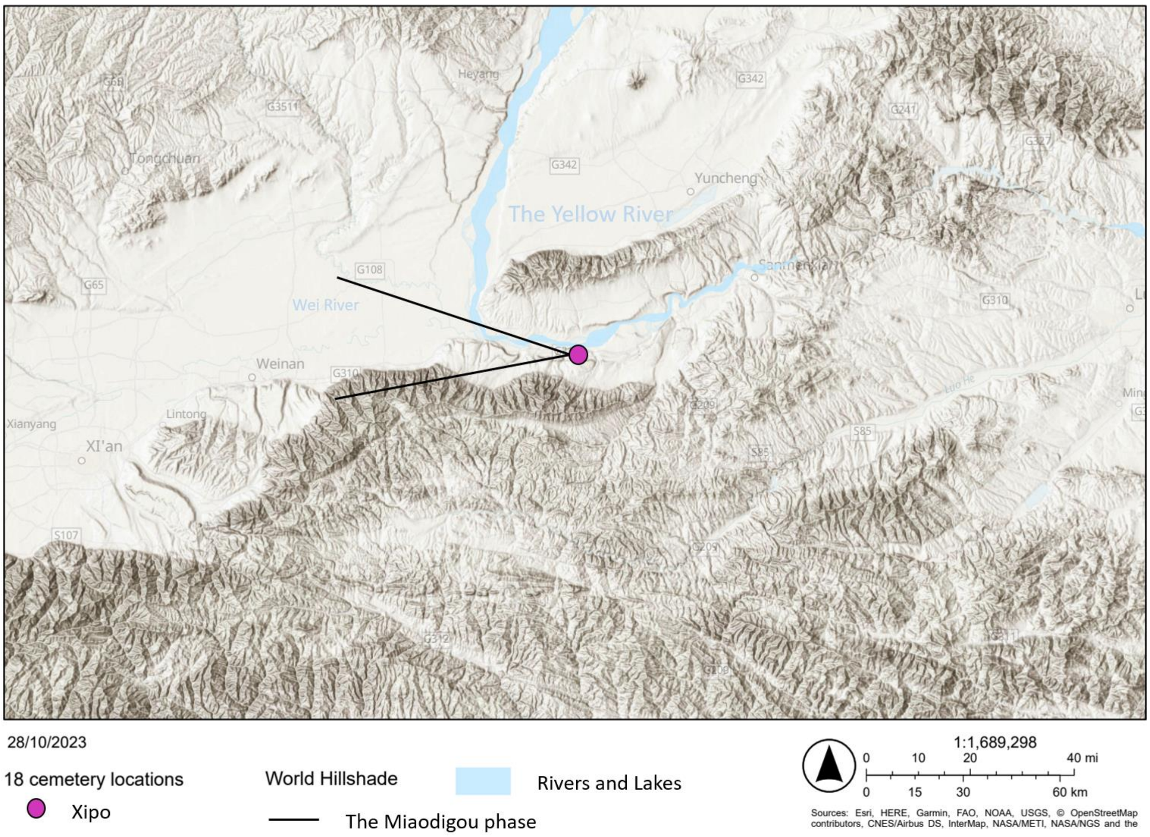

**Figure 5.9, depicts the panoramic view around the Dahecun site and the grave orientation range of the Longshan period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dahecun grave orientations in the Longshan period (left), a histogram of azimuth distribution**

**in the significance test of the Longshan period (middle), and a histogram of declination distribution in the significance test of the Longshan period (right).**

## Xipo

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Miaodigou phase of the Yangshao period (3300-2900BC) | 34 | 259.91°-298.02° | -4.43°-22.73° |

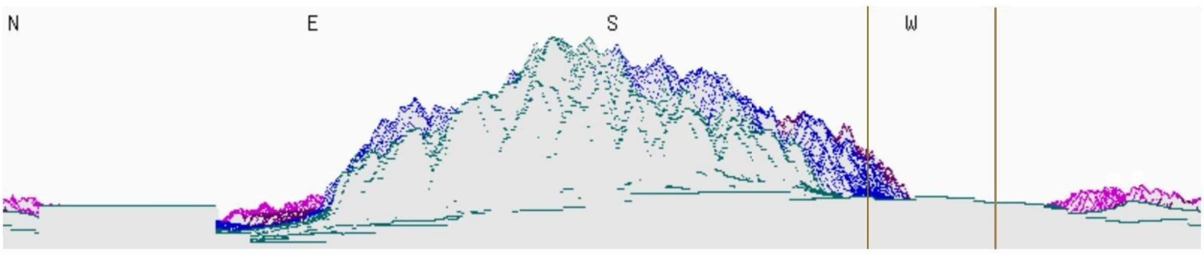
**Table 5.6, summary of grave orientation and Xipo site information.**




**Map 5.5, the overall view grave orientaion at Xipo.**

From the satellite map, the Xipo site is situated between the Yellow River and the Xiao Mountains, with the Zhongtiao Mountain range located on the opposite side of the Yellow River. These mountain ranges stretch north and south, running parallel to the Yellow River (map 5.5). To the west lies the Wei River Plain, where the Wei River meets the Yellow River at its bend. The panoramic view of Xipo reveals that the Xiao Mountains dominate the east, south, and west directions, lying close to the site and occupying nearly the entire field of view. The highest peak, at an altitude of 8.97°, is located 5 miles away in the 160° direction. However, the landscape within the burial orientation range differs somewhat from that of Jiangzhai. It does not align with the Wei River Basin or the mountains directly but instead includes the foothills to the west and a significant portion of the Wei River Basin (figure 5.10, above).

The prehistoric inhabitants of Xipo could observe sunrises and sunsets between the two sides of the mountains. Of the 34 graves, 32 are oriented between 265° and 295°, with one at 184° and another of unknown orientation. The true azimuth range of these orientations is 261.47° to 291.47° (figure 5.10, left and middle). Statistical significance tests indicate a significant azimuth range of 259.91° to 298.02°, with a corresponding declination range of -5.09° to 22.7° (figure 5.10, right). This declination range suggests possible celestial targets between 3300 and 2900 BC, including the solar equinoxes; sunset between 10$^{th}$ March and 4$^{th}$ June, 13$^{th}$July and 2$^{nd}$ `October; NMinLE; the notable stars Procyon, Altair, Aldebaran and Antares, etc. Finally, the Milky Way moved to the mountain foot at the one and half an hour before sunrise on SS (figure 5.11).



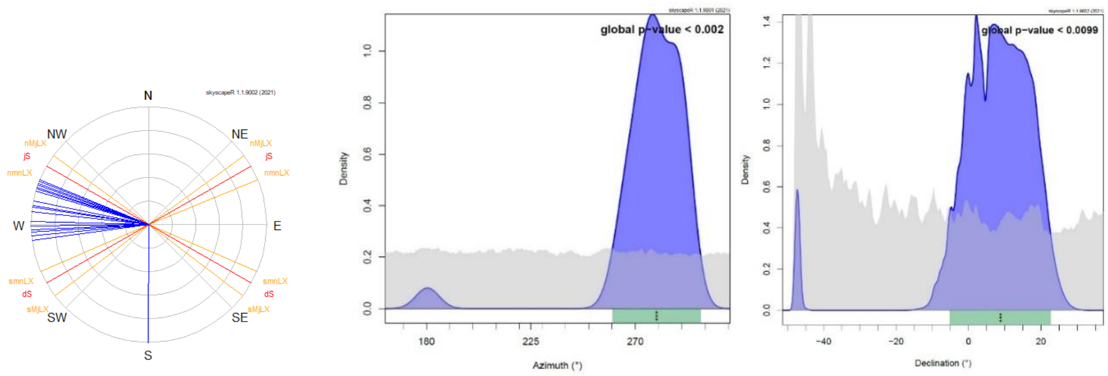



**Figure 5.10, shows the panoramic view around the Xipo site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar chart of grave orientations at Xipo (left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

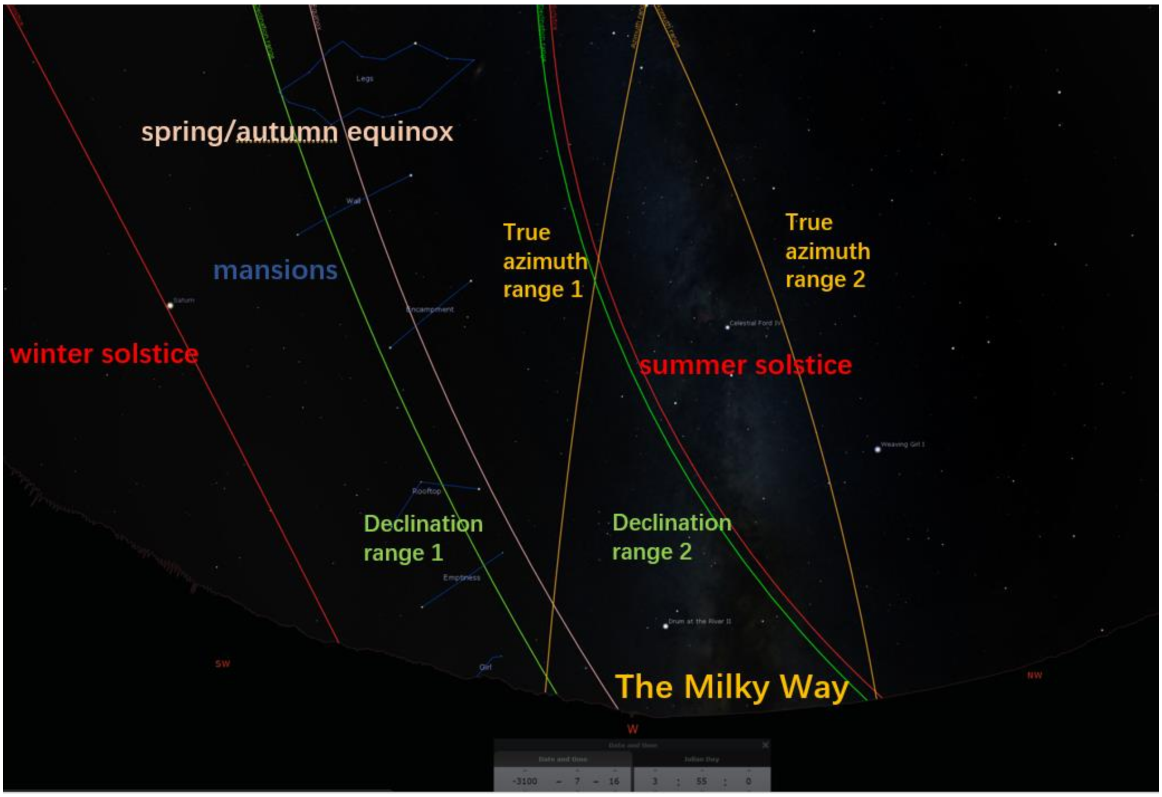


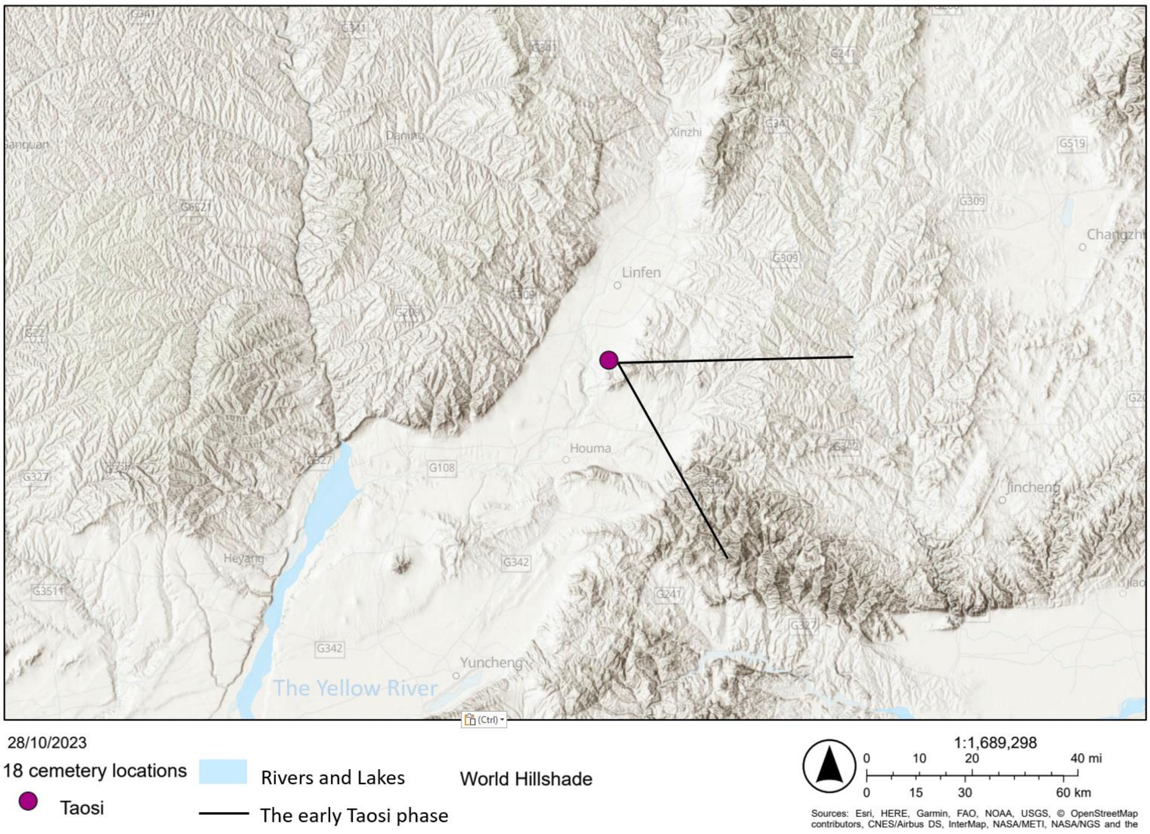

**Figure 5.11, the Milky Way appeared before dawn on SS at Xipo, without atmospheric effect.**

The movements of the four brightest stars associated with animal signs are particularly noteworthy. Alphard rose up from eastern horizon at nightfall on WS, while Enif appeared on the eastern horizon at dawn on the same day. On the day of SE, Antares rose up from the eastern horizon at nightfall, and set on the western horizon at dawn. This means the movement of Antares is always in the position unaffected by the sunlight, allowing it to be observed clearly all the time. On the day of SS, Enif lowered down to the western horizon at dawn. Finally, Rigel sank to the western horizon at dawn of AE, but this one is not included in the grave orientation range. A significant observation is that stars rising and setting on both the eastern and western horizons aligned with the mountain foothills, suggesting a possible symbolic connection between celestial movements and the surrounding landscape.

## Taosi

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The early Taosi phase of the Longshan period (2300-1900BC) | 1412 | 88.8°-154.6° | -45.29°--7.11° |

**Table 5.7, summary of grave orientation and Taosi site information.**




**Map 5.6, the overall view grave orientaion at Taosi.**

The landscape around the Taosi site is more complex than those of the previously discussed sites. The massive Taer Mountain lies to the east, extending both north and south (map 5.6). To the west is the smaller Gushe Mountain. These two parallel mountain ranges are separated by the Fen River, which flows through the basin formed between them. The site itself is located within this basin, nestled between the river and Taer Mountain. The highest point of Taer Mountain, at an altitude of 6.07°, is located 5 miles away in the 118° direction, falling within the grave orientation range. The entire range of grave orientations faces directly opposite Taer Mountain (figure 5.12, above).

The early Taosi burials exhibit a consistent southeast orientation, with a true azimuth range of 66.37° to 164.37° (figure 5.12, left). This dataset includes 33 graves from the living area of the Miaodigou phase and 1,379 graves from the cemetery of the early Taosi phase of the Longshan period (2300–1900 BC), with 83 graves lacking orientation data. While the Miaodigou phase graves are scattered throughout the living area and poorly preserved, the Longshan period graves are densely packed in a cemetery, showing a highly concentrated orientation pattern. Over 400 years, graves were repeatedly overlapped, often breaking into one another. The significant true azimuth range for the Longshan period is 88.8° to 154.6° (figure 5.12, middle), with a declination range of -45.29° to -7.11° (figure 5.12, right).

This declination range corresponds to notable celestial phenomena, including the winter solstice alignment and sunrises between 9th October and 18th December, 21st December and 3rd March; SMajLE and SMinLE. Marked stars are Sirius, Rigil Kentaurus, Rigel, Hadar, Acrux, Anatares, Mimosa and others. Alphard rising up on the eastern horizon at nightfall on WS. On the same day, Enif appeared on the eastern horizon at dawn, but the sunlight diminished the visibility of the star. At nightfall on SE, Antares touched the eastern horizon. Finally, the Milky Way moved vertically to the central of the true azimuth orientation range after one and half an hour after sunset on WS (figure 5.13).

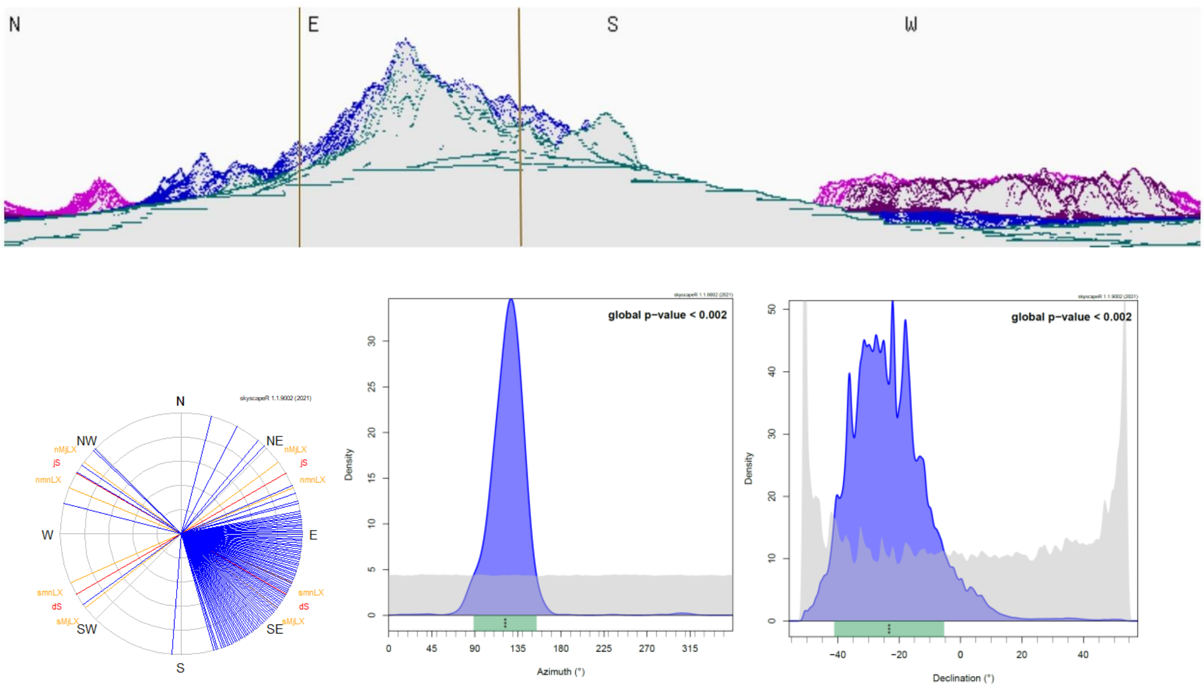



**Figure 5.12, illustrates the panoramic view around the Taosi site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Taosi grave orientations**

**(left), a histogram of azimuth distribution in the significance test (middle), and a histogram of declination distribution in the significance test (right).**

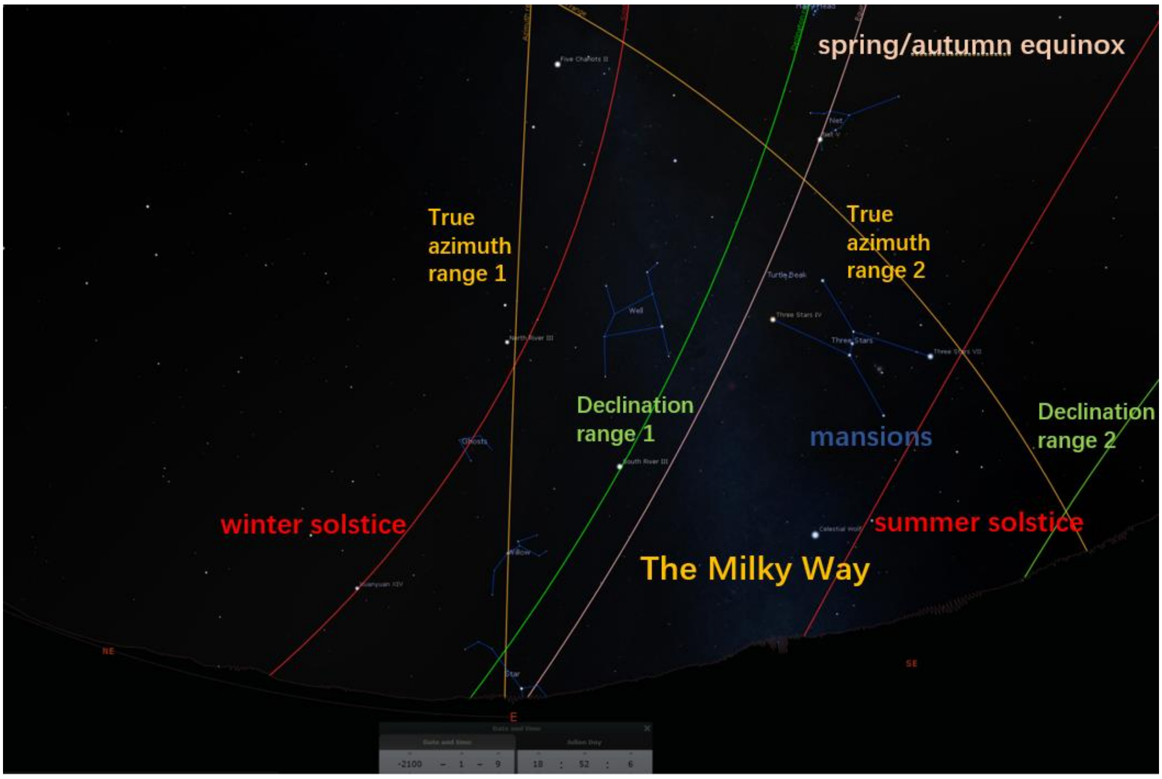


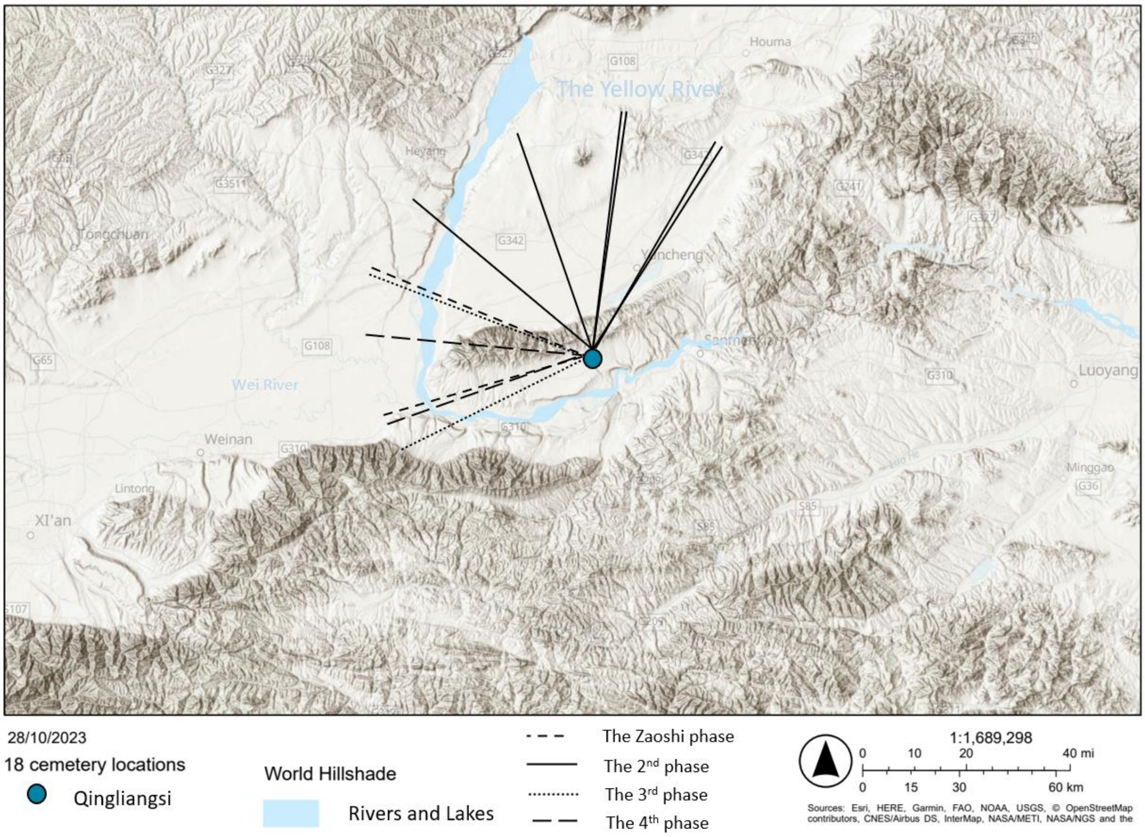

**Figure 5.13, the Milky Way moved to the central of the orientation range at nightfall on WS at Taosi, without atmospheric effect.**

## Qingliangsi

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The 1st phase, the Zaoshi phase (4050-3770BC) | 17 | Range1: 5.3°- 5.7° | |
| | | Range2: 30.1°-30.6° | |
| | | Range3: 309.3°-340.9° | 32.03°-39.65°<br>41.41°-49.18° |

| | | | |
|---|---|---|---|
| The 2nd phase, the Miaodigou phase of the Yangshao period (2280-1780 BC) | 189 | 252.6°-292.4° | -13.16°- 13.83° |
| The 3rd phase, the Longshan period (2430-1700 BC) | 105 | 248.8°- 289.8° | -13.2°- 14.4° |
| The 4th phase, the Longshan period (2040-1700 BC) | 44 | 251.4°- 274.1° | -11.65°- 5.99° |
| The 2nd - 4th phase (2280-1700 BC) | 355 | 250.5°- 291.8° | -14.04°-14.26° |

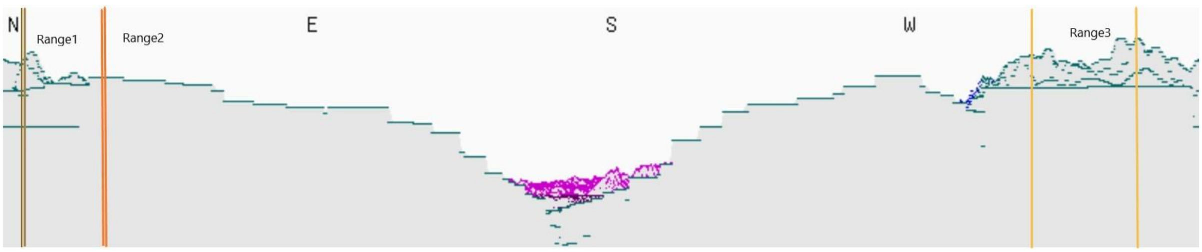
**Table 5.8, summary of grave orientation and Qingliangsi site information.**




**Map 5.7, the overall view grave orientaion at Qingliangsi.**

Qingliangsi is situated between the same mountain ranges as Xipo, with the Yellow River flowing between them. Xipo lies to the south, while Qingliangsi is located to the north, near the foot of Zhongtiao Mountain (map 5.7). The panoramic view (figure 5.14, above) reveals a notable basin to the south of the site, as Qingliangsi is positioned at a higher altitude, overlooking the Xiao Mountains on the opposite side of the river. However, the burials from the 1st phase are oriented in the opposite direction, facing the Zhongtiao Mountains to the northeast and northwest. The highest peak in this view, at an altitude of 7.18°, is located 3 miles away in the 335° direction and falls within the burial orientation range of the 1st phase. In contrast, graves from later phases are uniformly oriented to the west (figure 5.14, above and left). The landscape within the orientation ranges of the 2nd to 4th phases includes the plains to the west, near the foothills of Zhongtiao Mountain, though the mountain itself is not directly within the range (figure 5.15). This pattern is reminiscent of the orientations observed at Jiangzhai and Xipo. Thus, the burial orientations in the 1st phase may have been influenced by the mountains, while those in the 2nd to 4th phases appear to align with the western direction itself or similar factors observed at Jiangzhai and Xipo.

In the 1st phase, 17 graves were recorded. The significance test identifies three azimuth ranges, with the third range (309.3°–340.9°) being the most notable (figure 5.14, middle). This range is unusually far north, not aligning with typical sunrise/sunset or moonrise/moonset positions. It corresponds to two declination ranges (figure 5.14, right), which include stars such as Deneb in the first range and Arcturus and Vega in the second range. Additionally, all stars revolving around Polaris pass through this range, suggesting a possible connection to circumpolar stars.



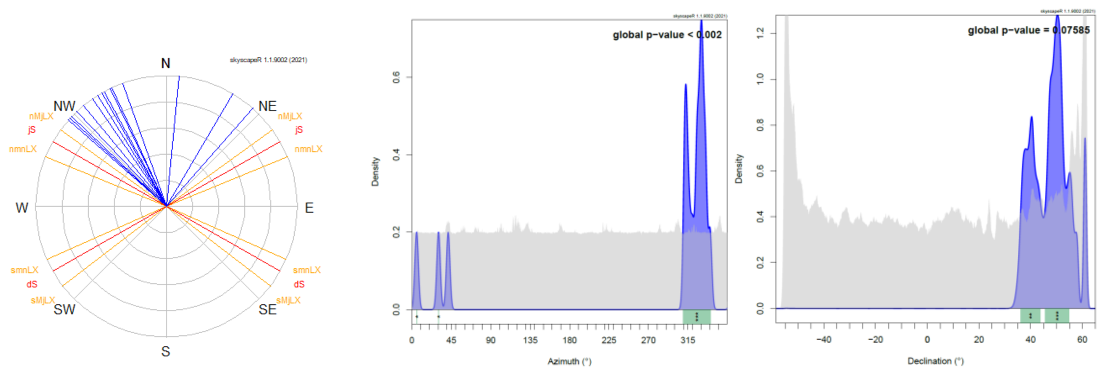



**Figure 5.14, shows the panoramic view around the Qingliangsi site and the grave orientation range of the 1st phase (HeyWhatsThat, 2022). It includes a polar diagram of grave orientations in the 1st phase (left), a histogram of the 1st phase azimuth distribution in the significance test (middle), and a histogram of the 1st phase declination distribution in the significance test (right).**

The 2nd to 4th phases of Qingliangsi represent a continuous period and are analyzed together. In the 2nd phase, associated with the Miaodigou variant, 189 graves (excluding one with an unknown orientation) are oriented further west, with a significant azimuth range of 252.6° to 292.4° and a declination range of -13.16° to 13.83° (figure 5.16, above row). Possible celestial targets include the spring and autumn equinoxes, sunsets between February 14 and April 28, and August 17 to October 26, as well as stars such as Procyon, Betelgeuse, Altair, Aldebaran, Antares, and Spica. The 3rd phase, identified as the Longshan period, shows a slightly more southerly azimuth range of 248.8° to 289.8° and a declination range of -13.2° to 14.4° (figure 5.16, middle row), with similar celestial targets. This pattern continues into the 4th phase, where the azimuth range narrows to 251.4°–274.1° and the declination range to -11.6°–5.99° (figure 5.16, below row). At dawn on SE, Antares sets on the western horizon. At nightfall on SS, Enif appeared above on the eastern horizon. Finally, the Milky Way aligned with the mountain foot an hour and half before sunrise on SS, which is similar to the pattern be observed at Xipo (figure 5.17).

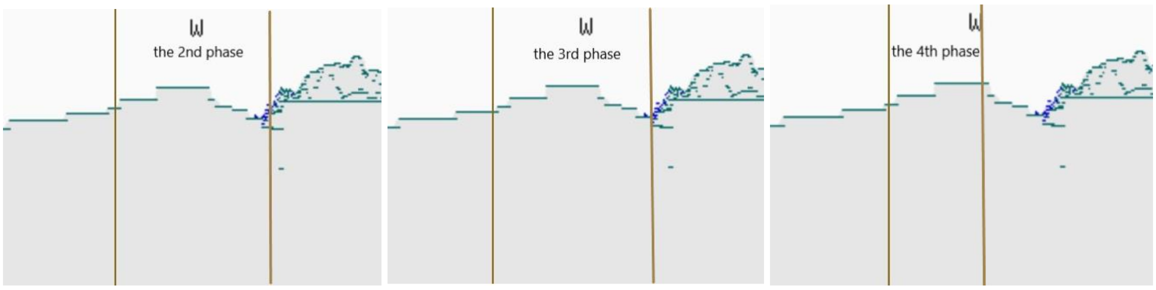



**Figure 5.15, illustrates the panoramic view around the Qingliangsi site and the grave orientation range of the 2nd to 4th phases (from left to right) (HeyWhatsThat, 2022).**

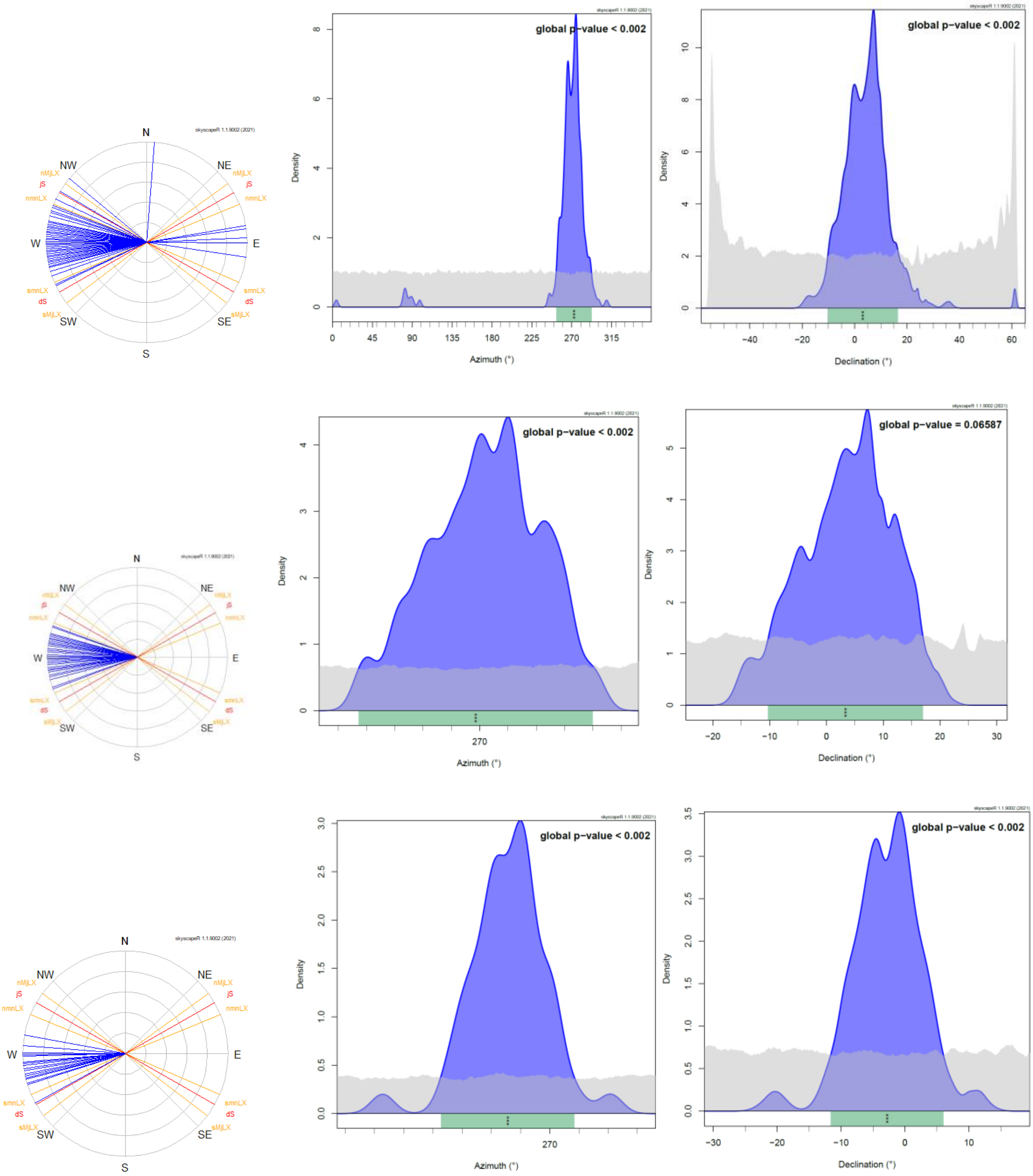


**Figure 5.16, includes polar diagrams and histograms of the true azimuth and declination distributions in the significance tests for the 2nd phase (above row), 3rd phase (middle row), and 4th phase (below row).**

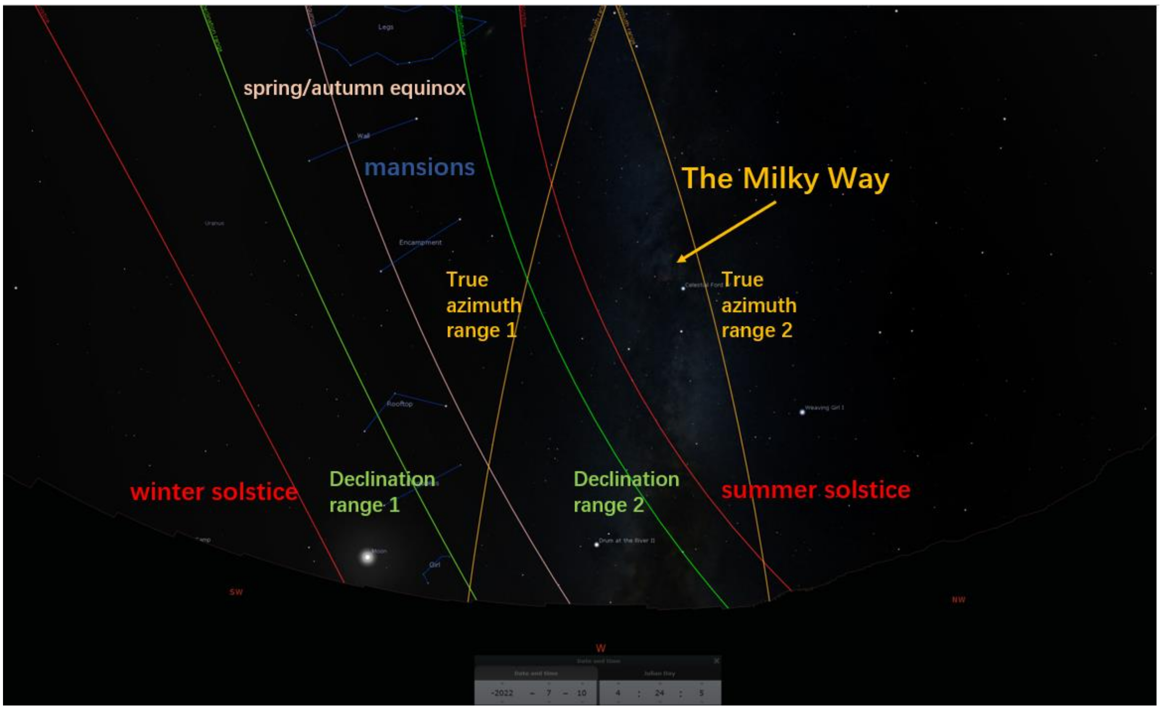



**Figure 5.17, the Milky Way appeared before dawn on SS at Qingliangsi cemetery, without atmospheric effect.**

## A comparison of all ranges

After a comprehensive analysis of the surrounding landscapes and skyscapes at each site, it becomes evident that there are overlaps in the azimuth and declination ranges among some sites, with several celestial events occurring within these overlapping ranges. While analyzing individual sites provides insights into the possible cosmological significance of specific celestial events, this approach is limited and prone to coincidental interpretations. A more definitive understanding can be achieved by comparing the orientations across different variants, cultures, and all selected sites in the middle reaches of the Yellow River. This comparison reveals a shared orientation pattern, pointing to celestial phenomena that should not be overlooked.

**Significant true azimuth ranges**

When all selected sites are considered, a clear preference for westward orientations emerges. The greatest overlap occurs between 259.91° and 278.4°, encompassing the early and middle to late phases of Jiahu, the Banpo and Shijia phases of Jiangzhai, Xipo, and the 2nd to 3rd phases of Qingliangsi (figure 5.18). Among these sites, Jiangzhai, Xipo, and Qingliangsi in the middle and late Neolithic periods share a similar pattern of burials oriented along the foothills of mountains toward the plains between two mountain ranges. The exception is Jiahu in the early Neolithic period, which is surrounded by plains, with mountains visible in the distance to the west. Notably, not all sites exhibit a predominant westward orientation. In the middle Neolithic period, Longgangsi and the 1st phase of Qingliangsi are oriented northwest, toward higher mountains. In the late Neolithic period, Dahecun's burials are dispersed across four directions, though the significant test reveals a primary eastward orientation. Unlike Taosi, where burials are highly concentrated toward Taer Mountain, Dahecun's surrounding landscape is predominantly flat, with distant mountains to the north and south. This suggests that the orientation choices at these sites were influenced by different factors than those at sites with westward-facing burials.

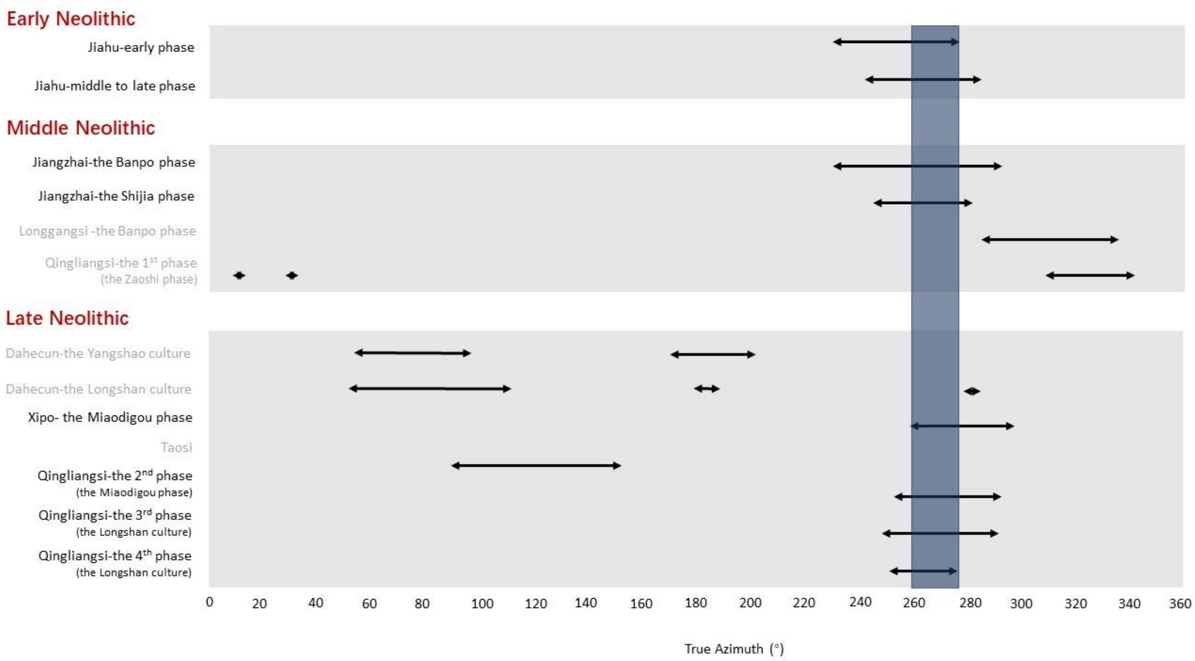



**Figure 5.18, overlaps of significant true azimuth ranges between all sites from the middle reaches of the Yellow River.**

**Significant declination ranges of sites with west-facing burials**

Since the purposes may be different between these sites, they need to be analysed separately before deciphering the celestial images revealed by the overlapping orientation range. This range, between -4.43° and 3.5°, narrows the possible celestial targets to sunsets between 9th March to 30th March and 8th September to 3rd October (including SE and AE days), as well as Milky Way on SS (figure 5.19). Stars within this range (Table 5.9) not only associated with the 12 signs of zodiac in western sky culture, but also construct different mansions of four animal signs in Chinese sky culture. Prominent stars such as Antares (associated with the dragon) and Alphard (associated with the phoenix) stand out, along with Betelgeuse, Aldebaran, and Alhena. However, this was probably not the targets to the Neolithic people from sites with west-facing burials, but an observation experience attached to it by later generations. Or perhaps the Neolithic people did notice some of the stars, but did not define them carefully, but rather later generations gave the concept of animal signs. Therefore, further analysis is demanded in the next chapter. Furthermore, it is important to note that although this table 5.9 includes all possible stars in the overlapping range, there are few stars that do not actually appear on all of these sites. For example, Antares do not appear on either the early or the middle to late phase of Jiahu. This may be because the calculating of stars in this overlapping range is based on the entire Neolithic period, which spans 6000 years, whereas Jiahu was dated to the early Neolithic period.

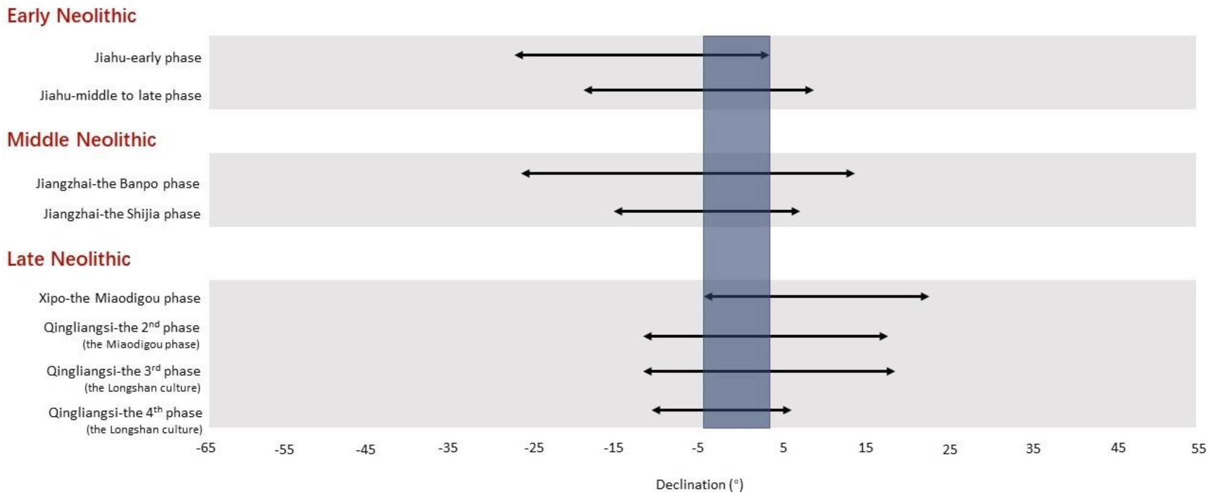



**Figure 5.19, overlaps of significant declination ranges of sites with west-facing burials from the middle reaches of the Yellow River.**

| Stellar | name | identifier | magV | min.dec | max.dec |
|---|---|---|---|---|---|
| 1 | **Procyon** | alfCMi | 0.37 | -18.5364843 | 6.8463458 |
| 2 | Betelgeuse | alfOri | 0.42 | -32.1712557 | -0.5396965 |
| 3 | Aldebaran | alfTau | 0.86 | -26.7992561 | 3.1407798 |
| 4 | **Antares** | alfSco | 0.91 | -12.2390031 | 17.5372911 |
| 5 | Pollux | betGem | 1.14 | -1.0086491 | 27.8486062 |
| 6 | Castor | alfGem | 1.58 | 0.5645532 | 30.4978086 |
| 7 | Shaula | lamSco | 1.62 | -26.2471972 | 5.1112742 |
| 8 | Bellatori | gamOri | 1.64 | -35.3343557 | -3.6865400 |
| 9 | **Elnath** | betTau | 1.65 | -13.2261501 | 17.8701798 |
| 10 | Sargas | tetSco | 1.85 | -32.0665369 | -0.8445968 |
| 11 | Kaus Australis | epsSgr | 1.85 | -27.0772649 | 4.7748322 |
| 12 | N/A | alfGemA | 1.9 | 0.5900445 | 30.5057117 |
| 13 | **Alhena** | gamGem | 1.92 | -19.6835623 | 11.3143163 |
| 14 | **Alphard** | alfHya | 1.97 | -14.5533544 | 1.1881297 |
| 15 | Hamal | alfAri | 2.01 | -14.1694795 | 4.6867601 |
| 16 | Menkent | tetCen | 2.05 | -16.9602761 | 4.4409101 |
| 17 | **Mirach** | betAnd | 2.05 | 1.8589552 | 16.6636421 |
| 18 | **Alpheratz** | alfAnd | 2.06 | 1.9105632 | 11.1803865 |

| | | | | | |
|---|---|---|---|---|---|
| 19 | Nunki | sigSgr | 2.067 | -21.9074884 | 9.2585081 |
| 20 | Almach | gam01And | 2.1 | 3.2294026 | 23.4046709 |
| 21 | Algol | betPer | 2.12 | -1.7302403 | 23.2053382 |
| 22 | Larawag | epsSco | 2.29 | -20.9118066 | 9.7983427 |
| 23 | N/A | etaCen | 2.31 | -23.6075278 | -0.8305664 |
| 24 | Dschubba | delSco | 2.32 | -7.0622083 | 21.3656733 |
| 25 | N/A | kapSco | 2.386 | -28.6421898 | 2.8024474 |
| 26 | Enif | epsPeg | 2.39 | -1.5281862 | 12.5500658 |
| 27 | Sabik | etaOph | 2.42 | -4.4021541 | 26.7806573 |
| 28 | N/A | etaOph A | 2.463 | -4.3200510 | 27.0179210 |
| 29 | Markab | alfPeg | 2.48 | -4.3684187 | 2.8063506 |
| 30 | Acrab | betSco | 2.5 | -4.5789245 | 24.1339636 |

**Table 5.9, stars appeared in the overlapped declination range by sites with west-facing burials in the middle reaches of the Yellow River.**

### Other orientation choice

Sites with northwest-facing graves, such as Longgangsi and the 1st phase of Qingliangsi, exhibit overlapping declination ranges of 32.03° to 39.65° and 41.41° to 51.8° (figure 5.20). These ranges include circumpolar stars such as Arcturus, Vega, and Deneb (table 5.10), which are visible year-round and move minimally, making them useful for navigation and timekeeping. The Big Dipper, whose stem aligns with this range, may have played a significant role in the lives of these communities, aiding in the precise determination of direction, time, and season. as mentioned in Chapter 2.


**Figure 5.20, overlaps of declination ranges of sites with northwest-facing burials from the middle reaches of the Yellow River.**

| Stellar | name | identifier | magV | min.dec | max.dec |
|---|---|---|---|---|---|
| 1 | Arcturus | alfBoo | -0.05 | 51.26479 | 57.74177 |
| 2 | Vega | alfLyr | 0.03 | 45.63844 | 51.29616 |
| 3 | Deneb | alfCyg | 1.25 | 36.43781 | 38.22093 |
| 4 | Rasalhague | alfOph | 2.07 | 30.87891 | 39.25414 |
| 5 | Denebola | betLeo | 2.13 | 35.83519 | 36.63575 |
| 6 | Sadr | gamCyg | 2.23 | 34.50407 | 37.34823 |
| 7 | Caph | betCas | 2.27 | 29.65839 | 33.39390 |
| 8 | N/A | gamCas | 2.39 | 27.92705 | 32.81392 |
| 9 | Alderamin | alfCep | 2.46 | 45.04369 | 46.36208 |

**Table 5.10, stars appeared in the overlapped declination range by sites with northwest-facing burials in the middle reaches of the Yellow River.**

Finally, the east-facing burials at Dahecun and Taosi in the late Neolithic period are not directly comparable due to their differing landscapes and orientation patterns. At Taosi, the Taer Mountain played a central role in the lives of its inhabitants, with the observatory and burials consistently oriented toward it. In contrast, Dahecun's burials are dispersed across a flat plain, suggesting different underlying beliefs and practices.

**Assumptions**

While comparing overlapping azimuth and declination ranges provides new insights into burial orientation determinants, this approach has limitations. If burial orientations follow a Gaussian distribution, the overlapping range (marked in blue in Figure 5.18) may fall within the marginal ranges of most sites, rather than their central orientations. For example, the most concentrated orientations at the early phase of Jiahu and Xipo do not align with this overlap. This raises questions about whether the stars observed in these excluded directions were unique to specific sites or shared across regions. Unlike European megalithic tombs, which often have precise alignments through doors or windows, e.g. Hoskin, 2001 (Silva, 2020: 67-71). Neolithic cemeteries in China are open and contain multiple burials, making it difficult to determine whether individual or collective choices influenced orientation. Given the large number of graves at some sites, this study focuses on the cemetery as a whole rather than individual burials. Similarly, while celestial objects within the overlapping range are significant, those observed in the central declination ranges of individual sites also warrant further analysis.

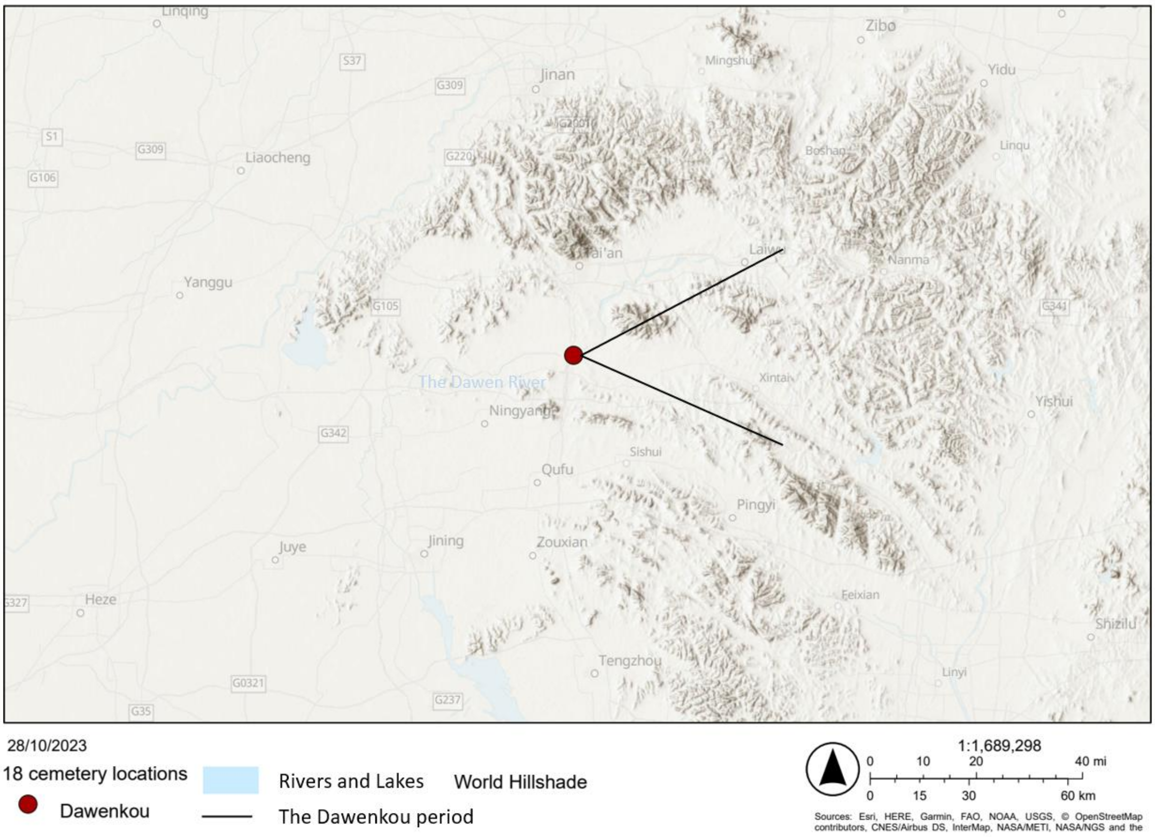
#### 5.2.1.2 the lower reaches

The two selected sites in the LYellow River are Dawenkou and Wangyin, both located in Shandong Province within the North China Plain. This region, formed by centuries of alluvial deposits from the lower reaches of the Yellow River, is characterized by a vast, gently sloping plain, mostly less than 100 meters above sea level.

### Dawenkou

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Dawenkou period (4150BC.-3700BC) | 180 | 63°- 113.8° | -14.2°- 19.56° |

**Table 5.11, summary of grave orientation and Dawenkou site information.**




**Map 5.8, the overall view grave orientation at Dawenkou.**

The Dawen River splits into northern and southern branches after flowing south of the Dawenkou site from west to east (map 5.8). The most prominent mountain in the vicinity is Culai Mountain, part of the Tai Mountain range, located 13 miles to the east at an azimuth of 62° and with a peak altitude of 2.29°. The burials at Dawenkou are primarily oriented eastward, with orientations radiating to the southeast and northeast, placing the eastern half of Culai Mountain almost entirely within the burial orientation range (figure 5.21, above and left). Other mountains, lower in elevation or farther away, are scattered to the south and north of the site. Notably, Tai Mountain, a historically significant landmark, lies to the north. It remains unclear why the inhabitants of Dawenkou chose to orient their graves toward Culai Mountain rather than Tai Mountain, suggesting that the eastern direction itself may have held greater significance than the specific mountain.

A total of 180 graves were excavated at Dawenkou, with one grave lacking precise orientation data. The significant true azimuth range is 63° to 113.8°, and the corresponding declination range is -14.2° to 19.56° (Figure 5.21, middle and right). Within the timeframe of 4150–3700 BC, possible celestial targets include the spring and autumn equinoxes, sunrises between 11th February and 29th May, 28th July and 27th October, as well as NMinLE. Then, Capella, Procyon, Betelgeuse, Altair, Aldebaran, Antares, Spica, Pollux and other less bright stars accompany at night with inhabitants at Dawenkou. Antares appeared at dawn on SE, Alphard and Enif appeared on eastern and western horizon at dawn on SS respectively, then, Antares and Rigel appeared on the eastern and western horizon at dawn on AE. Sunrise on spring equinox day is exactly locate on the east foot of Culai mountain, whilst, the summer solstice is at the peak of the mountain. This alignment may be coincidental, as the winter solstice sunrise does not correspond to any notable geographic feature. The situation of the Milky Way at Dawenkou is similar to Longqiuzhuang, but it was invisible on WS (figure 5.22).

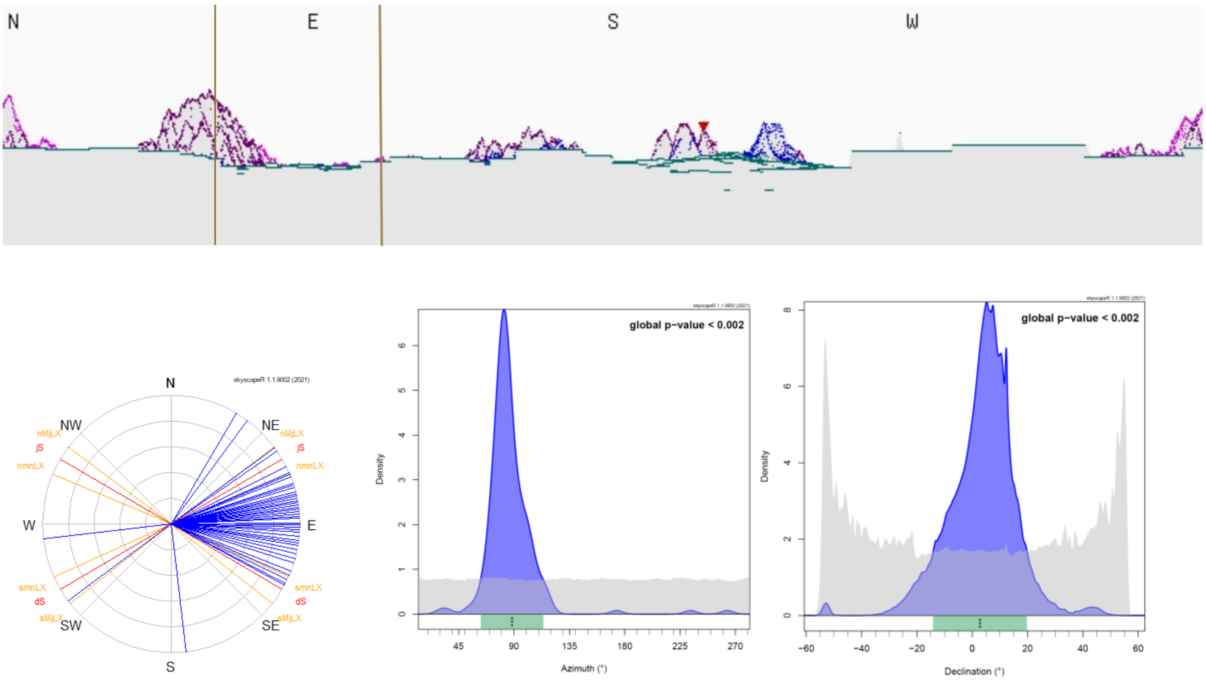



**Figure 5.21, shows the panoramic view around the Dawenkou site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Dawenkou grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

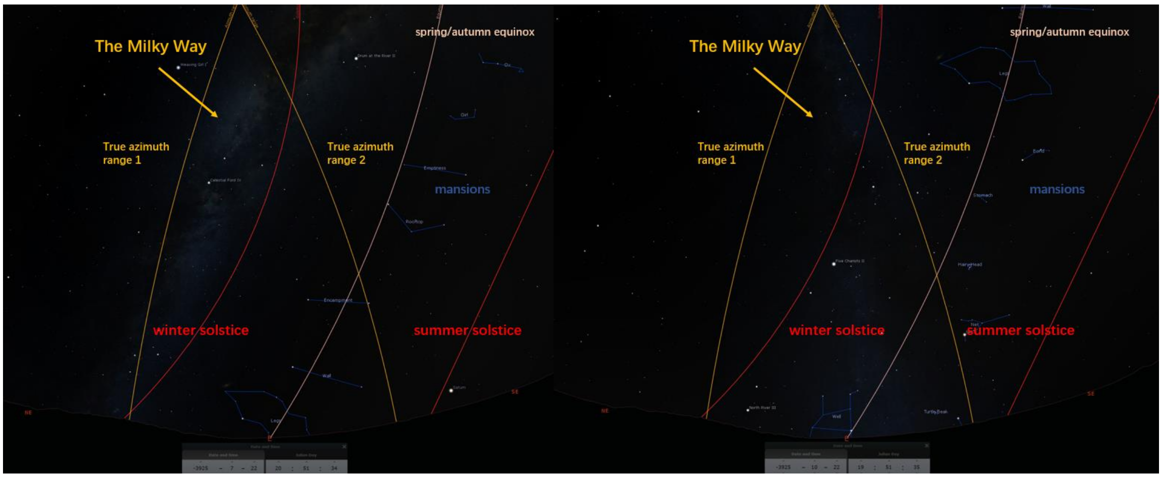
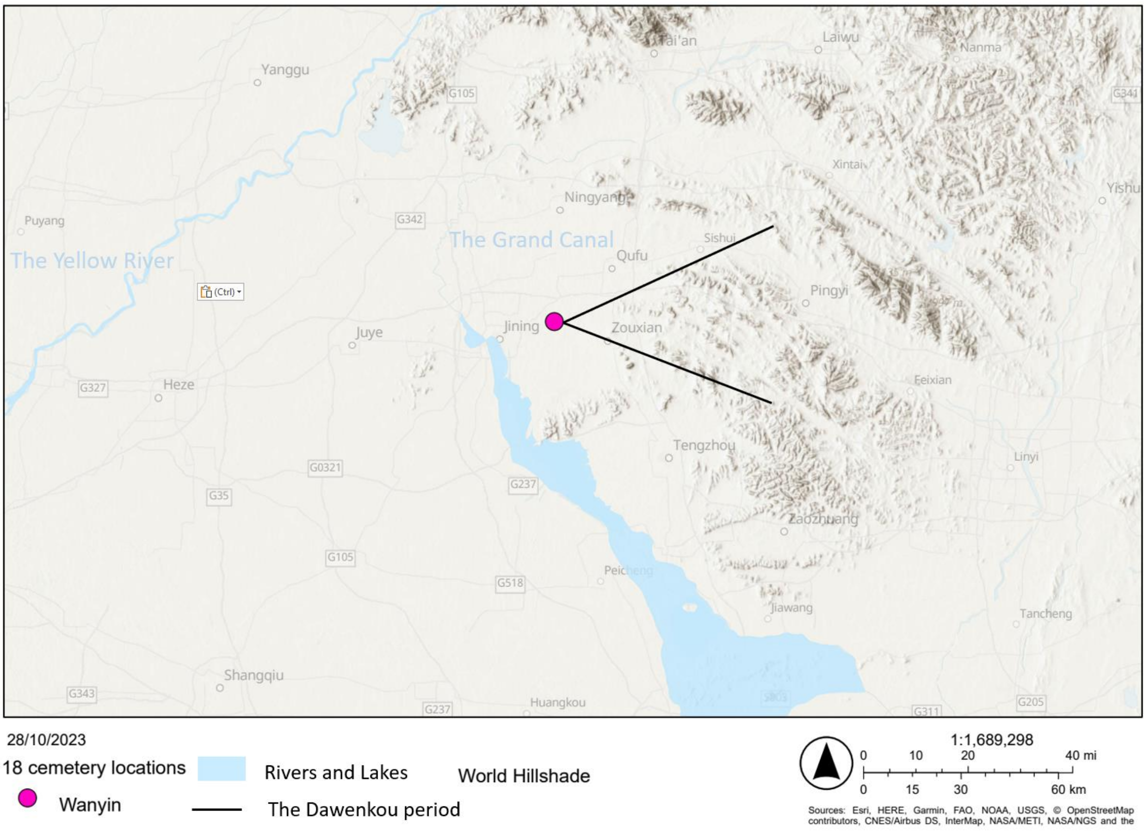



**Figure 5.22, the Milky Way after nightfall on SS (left); the Milky Way after nightfall on AE (right).**

## Wangyin

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Dawenkou period (4300BC.-3500BC.) | 899 | 66.2°-110.6° | -13.91°-16.84° |

**Table 5.12, summary of grave orientation and Wangyin site information.**




**Map 5.9, the overall view grave orientation at Wangyin.**

Wangyin is also situated on a plain, with a few mountains visible to the east, south, and north (map 5.9). The Si River flows from north to south to the east of the site. The highest peak observable from Wangyin is located 13 miles to the east at an azimuth of 61°, with an altitude of 2.17°. However, this mountain falls outside the burial orientation range (figure 5.23, above). Like Dawenkou, most graves at Wangyin are oriented eastward (figure 5.23, left), with a flat but slightly undulating horizon within this range. Wangyin is approximately 70 miles northeast of Dawenkou, and Tai Mountain, though farther north, is also visible from Wangyin.

The true azimuth range for Wangyin graves is concentrated between 65.38° and 120.38° (figure 5.23, middle). The excavators divided the Dawenkou period at Wangyin into three layers (early, middle, and late), and the grave orientations were analyzed accordingly (figure 5.24, left, middle, and right). Over 800 years, the orientations remained remarkably consistent, particularly in the early layer. A few burials in the middle layer face southwest or northwest, while a small number in the late layer face west or south. Both Dawenkou and Wangyin show a strong preference for an orientation of 83°. The significant true azimuth range for all Wangyin graves is 66.2° to 110.6°, with a declination range of -13.91° to 16.84° (figure 5.23, right).

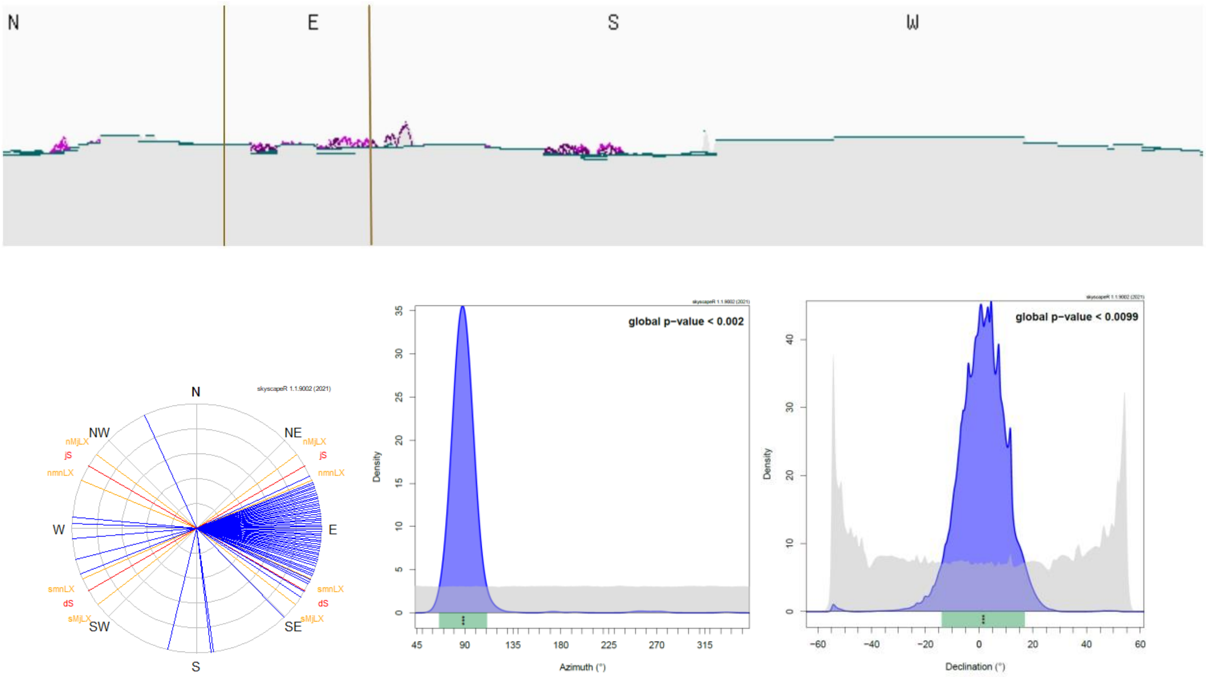



**Figure 5.23, llustrates the panoramic view around the Wangyin site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of all Wangyin grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

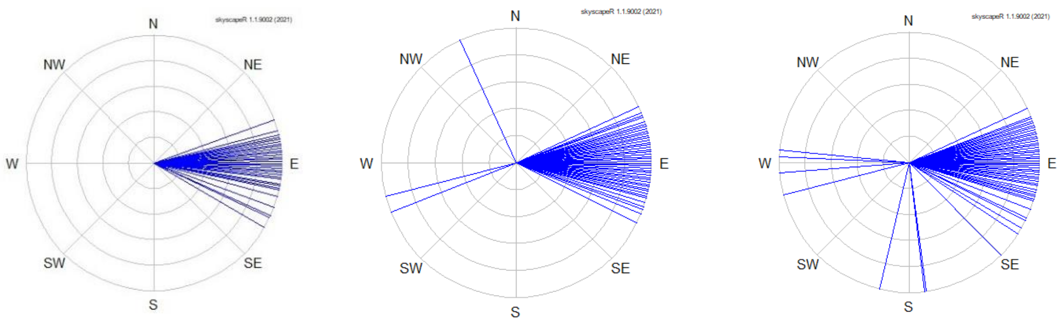



**Figure 5.24, presents polar diagrams of the early (left), middle (middle), and late (right) Wangyin grave orientations.**

Geographically, Wangyin is close to Dawenkou, and their skyscapes in Stellarium are highly similar. Possible celestial targets between 4300 and 3500 BC include sunrises from 12th February to 9th May, and from 7th August to 26th October. The astronomical spring and autumn equinoxes are also included in this declination range. The principal stars appearing in within this portion of the night sky are Procyon, Betelgeuse, Altair, Aldebaran, Pollux and others. Antares fell into western horizon at dawn on SE. Antares also rose up from eastern horizon at dawn on AE, whiles, Rigel dropped into the other side of horizon. The positions of the Milky Way that present in this range is also similar to Dawenkou. As shown in figure 5.25 left and right, the Milky Way appeared straightly on the horizon at dawn on SE, then, laid down at nightfall on the same day. It also moved into the range vertically at nightfall on SS and AE.

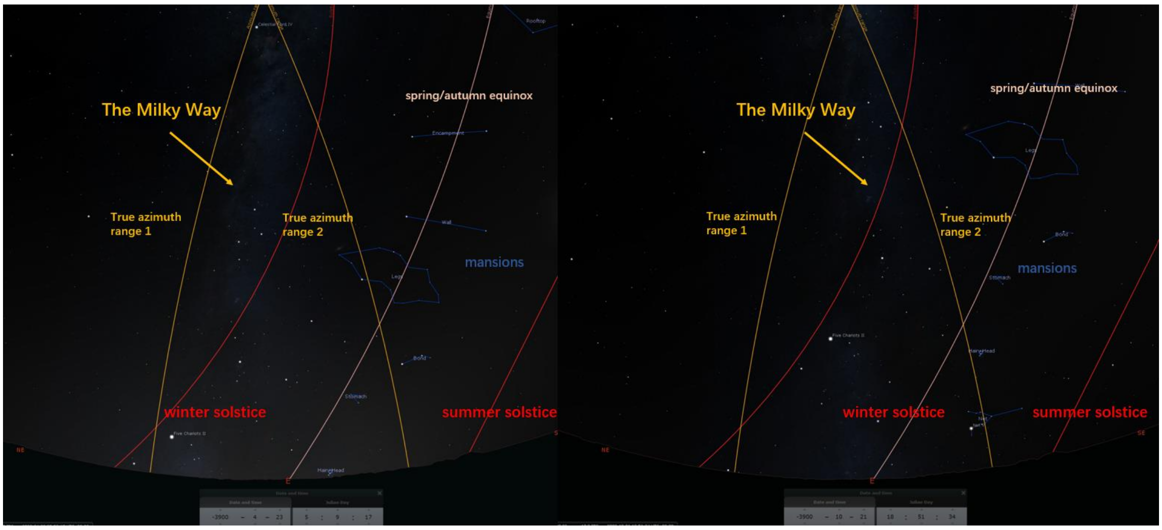



**Figure 5.25, the Milky Way at dawn on SE (left), at nightfall on AE (right).**

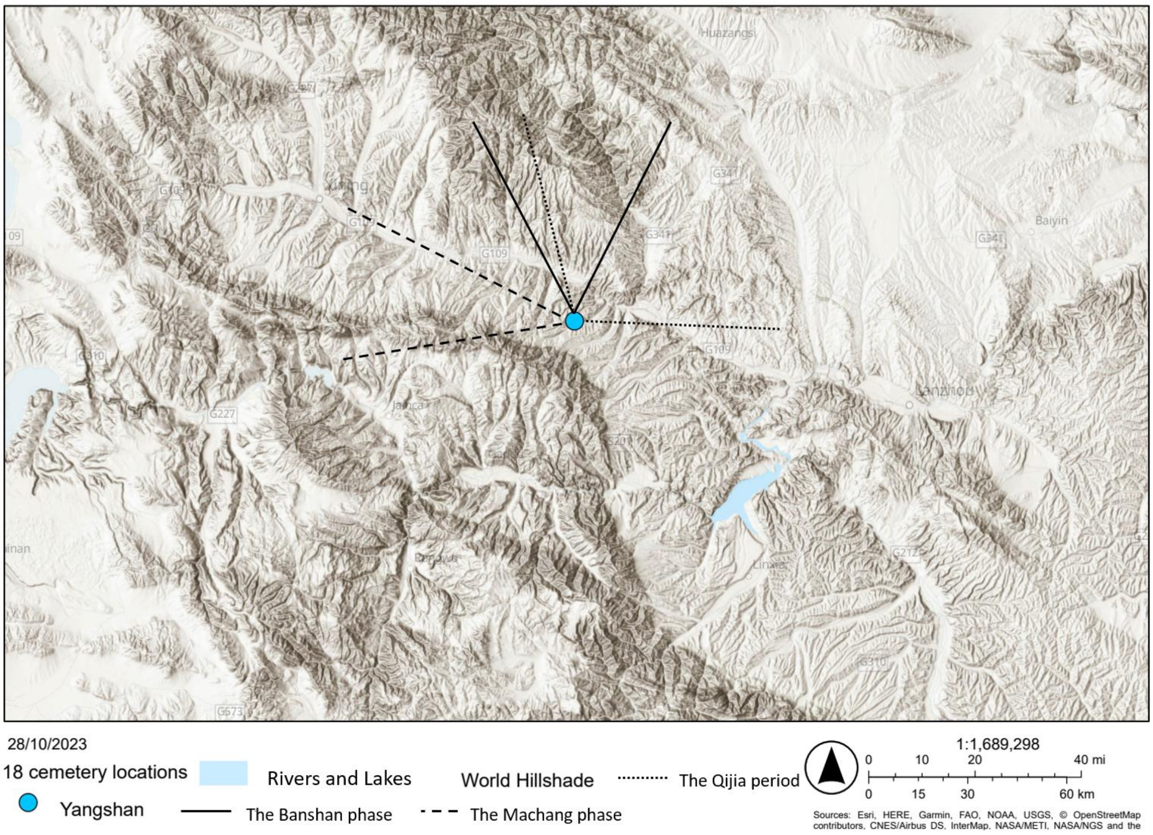
### 5.2.1.3 the upper reaches

The geography of Qinghai Province is more complex than that of the Loess Plateau or the North China Plain, characterized by intertwined mountain ranges and an average altitude of no less than 3,000 meters. The Liuwan and Yangshan sites are located relatively close to each other, situated between mountains near the border of Qinghai and Gansu Provinces, east of Qinghai Lake. Geographically, these sites lie on the transitional edge between the Qinghai-Tibet Plateau and the Loess Plateau, with the Qilian Mountains to the north. The region experiences a continental plateau climate, marked by long hours of sunshine, significant daily temperature fluctuations, low rainfall, and rivers constrained by the surrounding mountain ranges.

## Liuwan

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Banshan phase of the Majiayao period (2655-2270 BC) | 257 | 332.9°-26.4° | 47.43°- 90° |
| The Machang phase of the Majiayao period (2270-1885 BC) | 872 | 261.9°- 294.2° | -5.39°- 19.31° |
| The Qijia period (1885-1500 BC) | 366 | 345°- 91.4° | 4.6°-90° |

**Table 5.13, summary of grave orientation and Liuwan site information.**




**Map 5.10, the overall view grave orientation at Liuwan.**

The Liuwan cemetery is situated on the high slopes of a mountain (map 5.10). When facing south, southeast, or southwest, the site overlooks a valley, while the north and east directions face mountain peaks. Currently, there is no visible water flow in the vicinity. The site was occupied during three distinct periods, though the exact time range for each period remains unspecified by excavators. For ease of calculation, these periods are evenly divided, as shown in the accompanying table.

During the Banshan phase, 257 graves were excavated, with a significant true azimuth range of 332.9° to 26.4°, spanning northwest to northeast (figure 5.26, above, left, and middle). The corresponding declination range is 47.43° to 90° (figure 5.26, right). This declination range does not include any solar alignments or sunrise/sunset positions. However, it encompasses stars with visual magnitudes (vmag) between 1.77 and 2.46, visible to the naked eye but requiring some effort to distinguish. Notably, this range includes Polaris, Ursa Minor, and Ursa Major.

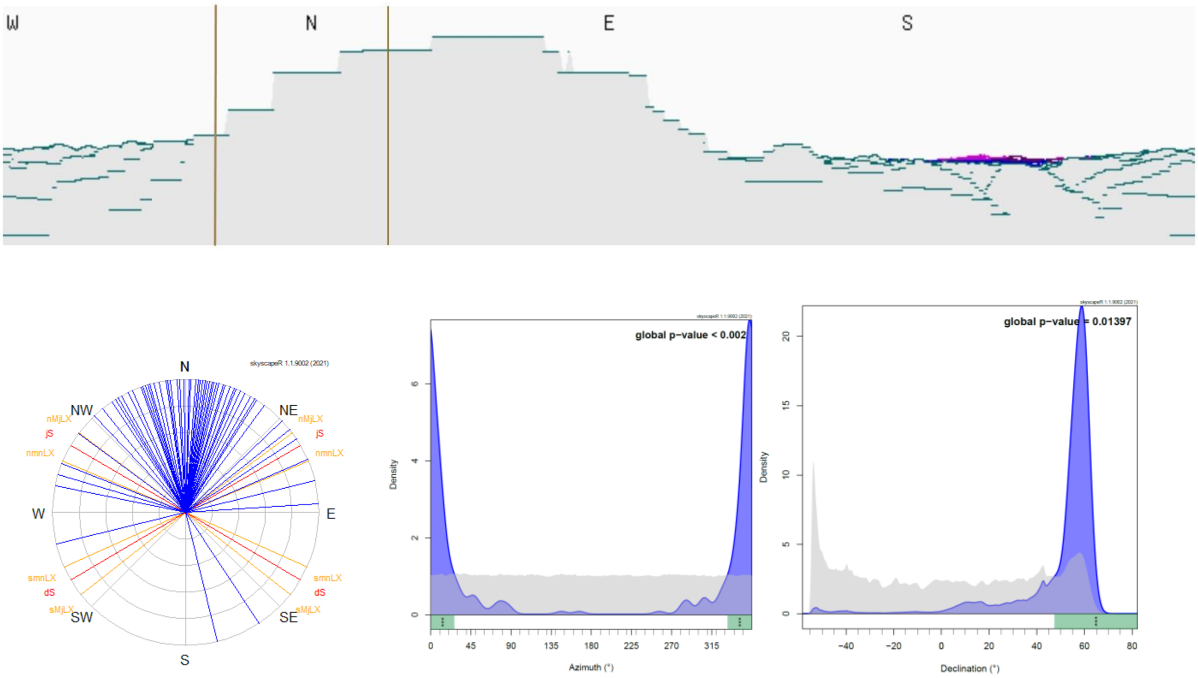
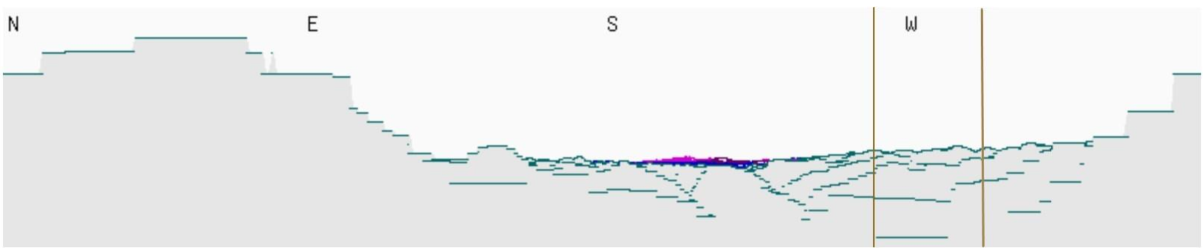



**Figure 5.26, shows the panoramic view around the Liuwan site and the grave orientation range of the Banshan phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Banshan phase (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

In the Machang phase, 872 graves were identified, including 18 with unknown orientations. The orientations are distributed across all directions but are slightly more concentrated toward the north (Figure 5.27, above, and left). The significant true azimuth range is 261.9° to 294.2°, with a declination range of -5.39° to 19.31° (figure 5.27, middle, and right). This range includes stars similar to those in the Banshan phase, with the addition of Kochab. The Milky Way aligns with the significant true azimuth range at dawn on SS.



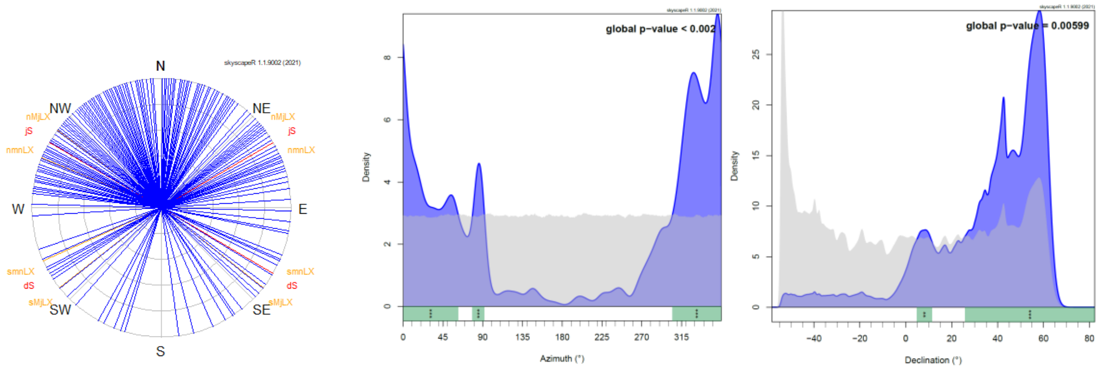
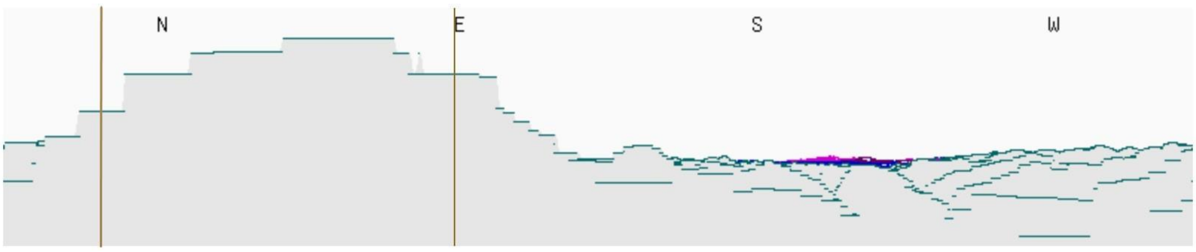



**Figure 5.27, illustrates the panoramic view around the Liuwan site and the grave orientation range of the Machang phase (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Machang phase (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

During the Qijia period, 366 graves were excavated, with three lacking orientation data. The orientations are less concentrated than in the Machang phase (figure 5.28, above, and left). The significant true azimuth range is 345° to 91.4°, with a declination range of 4.6° to 90° (figure 5.28, middle, and right). This range includes a broader array of celestial phenomena, such as the summer solstice alignment, sunrises between 2nd April and 22th June, 25th June and 11th September; northern lunar minor and major extremes. Extremes. Prominent stars within this range include Arcturus, Vega, Capella, Procyon, Altair and Spica.



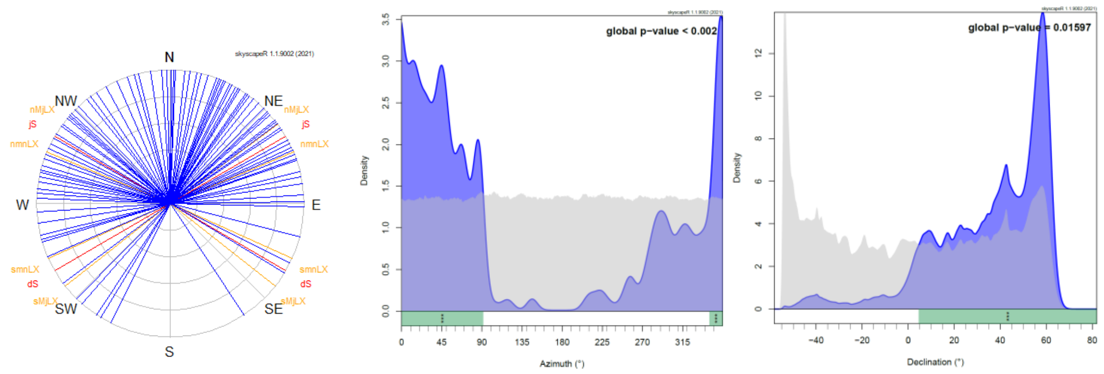


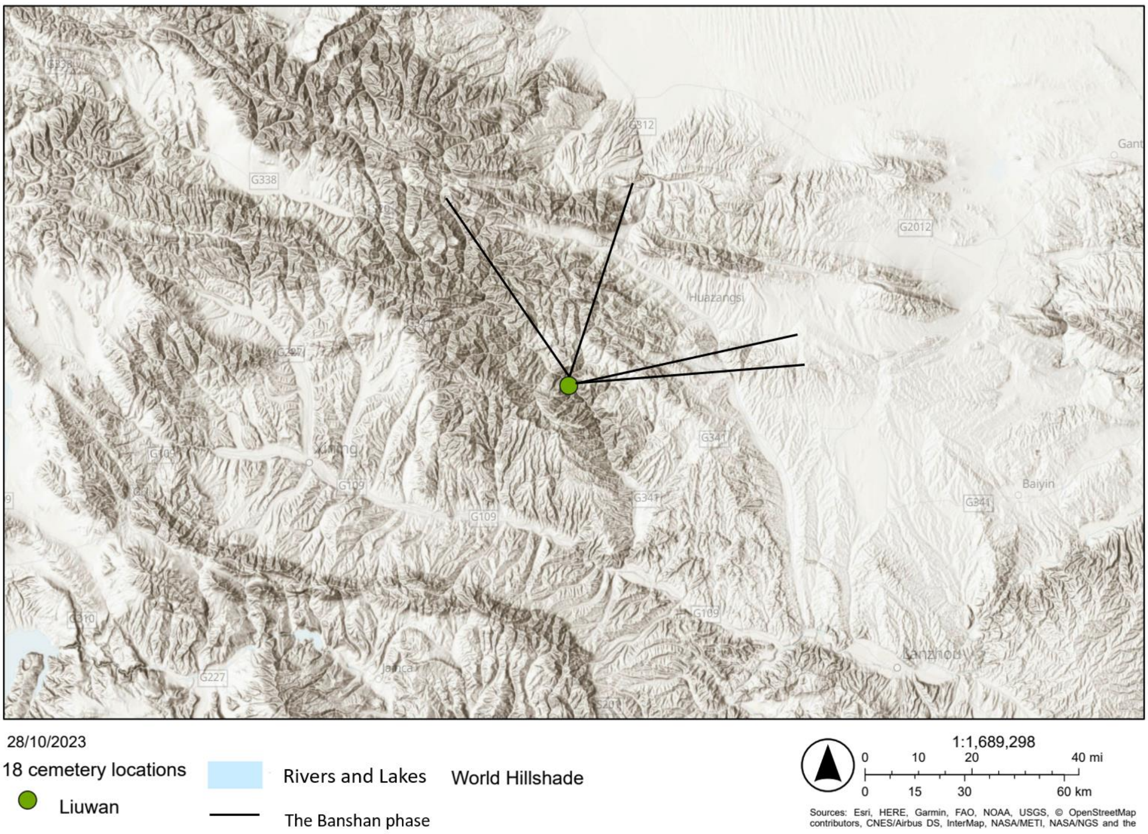

**Figure 5.28, depicts the panoramic view around the Liuwan site and the grave orientation range of the Qijia period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Liuwan grave orientations in the Qijia period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

In summary, the burial orientations at Liuwan are predominantly northern, especially during the Banshan phase. The Machang phase saw a proliferation of burials and a more dispersed orientation pattern, with northwest and northeast directions becoming equally prominent. The Qijia period continued this tradition, with the mountain on which the site is located playing a significant role in shaping the orientation choices.

## Yangshan

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Banshan phase of the Majiayao period (2655-2330 BC) | 218 | Range1: 326.8°- 17.4° | 57.2°- 90° |
| | | Range2: 78.2°- 86.4° | |

**Table 5.14, summary of grave orientation and Yangshan site information.**




**Map 5.11, the overall view grave orientation at Yangshan.**

The Yangshan cemetery is nestled in a ravine, with a village to the south (map 5.11). Although geographically close to Liuwan, Yangshan exhibits a different pattern in grave orientation distribution, more closely resembling the Dahecun site in the middle reaches of the Yellow River. However, the orientations at Yangshan are more evenly distributed across all four cardinal directions (figure 5.29, above, and left).

In the Banshan phase at Yangshan, 218 graves are oriented in four directions, with the north being the most common and the south the least. One grave lacks orientation data. The significance test reveals two true azimuth ranges: 326.8° to 17.4° and 78.2° to 86.4° (figure 5.29, middle). The corresponding declination range is 57.2° to 90° (figure 5.29, right), similar to that of the Banshan phase at Liuwan but lacking stars such as Alphecca, Izar, and Alderamin.

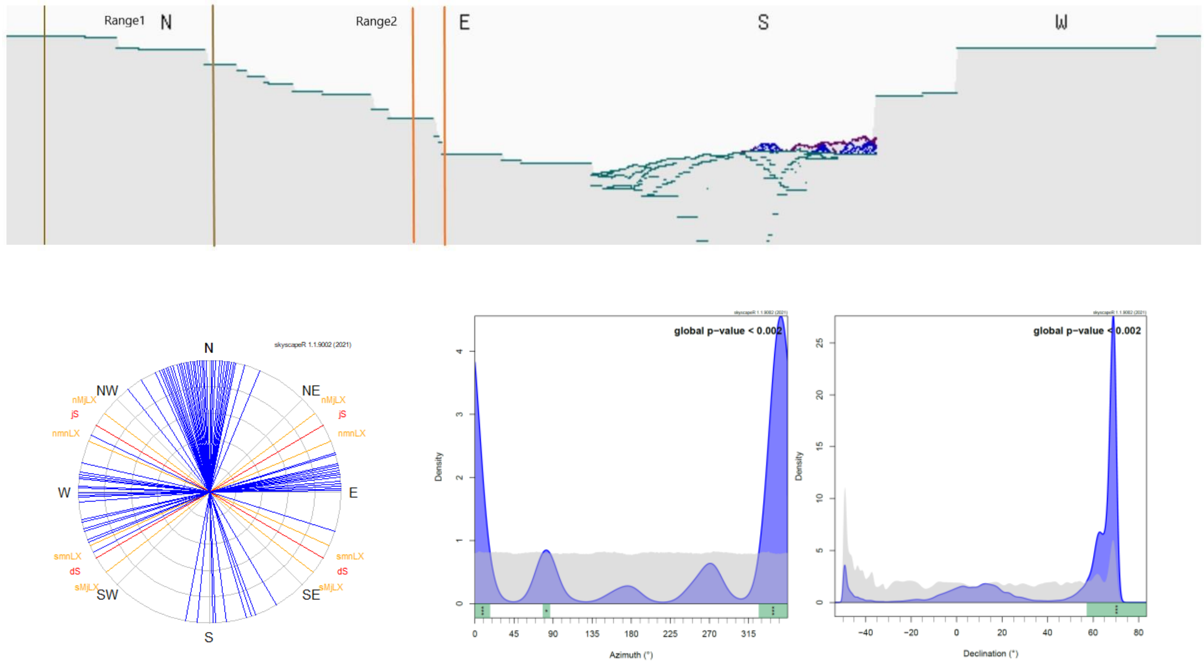



**Figure 5.29, shows the panoramic view around the Yangshan site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yangshan grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

## 5.2.2 The Yangzi River

### 5.2.2.1 the middle reaches

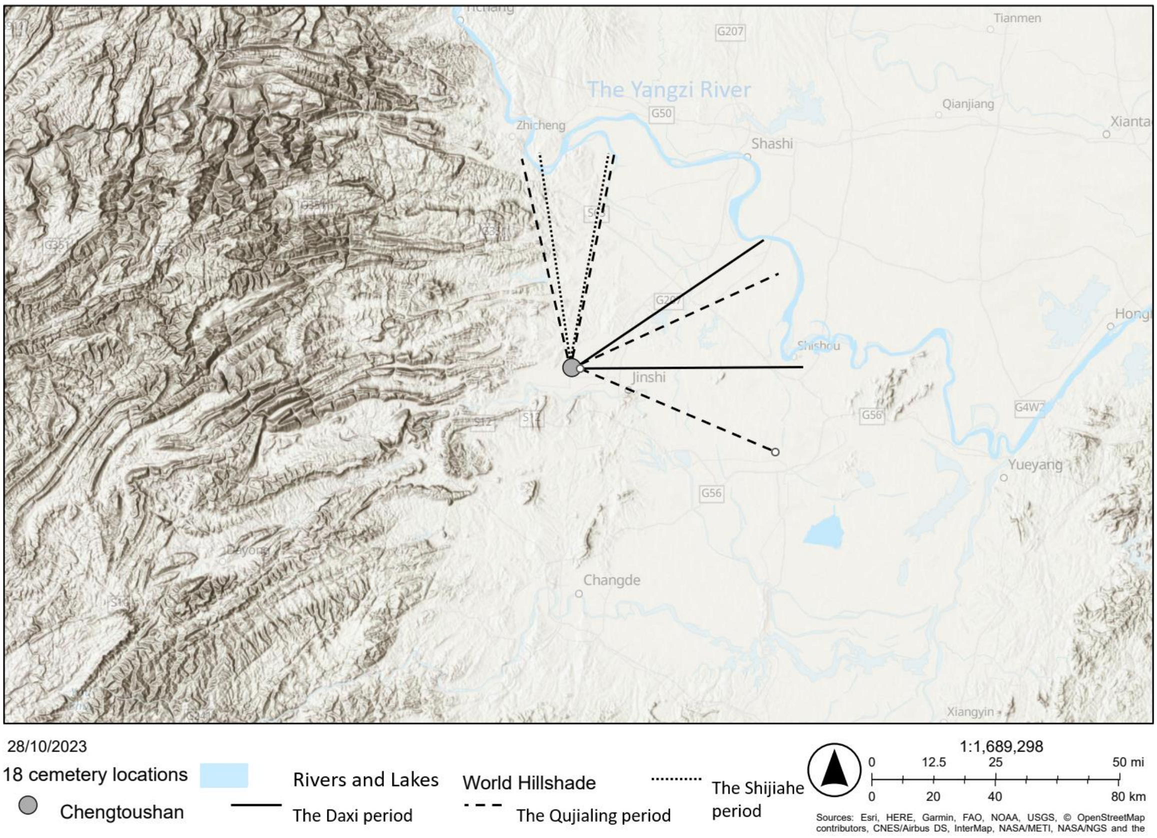
As there is only one site, which is Chengtoushan in the MYangzi River region, so the geographic description and map is shown in below section directly.

## Chengtoushan

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Daxi period | 214 | 57.2°- 90° | -20.58°- 18.11° |

| | | | |
|---|---|---|---|
| (4200-3200 BC) | | | |
| The Qujialing period (3200-2500 BC) | 183 | Range1: 346.4°- 11.8° | Range1: 57.61°- 66.93° |
| | | Range2: 67°- 113.3° | Range2: -16.3°- 18.05° |
| The Shijiahe period (2500-2300 BC) | 5 | 351.3°- 10.6° | 58.12°- 66.92° |

**Table 5.15, summary of grave orientation and Chengtoushan site information.**




**Map 5.12, the overall view grave orientation at Chengtoushan.**

The site Chengtoushan is situated within the Wuling Mountain range, the area is characterized by low to medium mountainous terrain, with modest peaks surrounding the site on all sides except the east (map 5.12). The Li River flows from west to east to the south of the site. The region experiences a humid subtropical monsoon climate, with ample precipitation and moderate temperatures. The burial orientations at Chengtoushan are highly scattered, resembling the pattern observed at Liuwan in the upper Yellow River region, with no single dominant directional focus.

During the Daxi period, 214 graves (including 7 with unknown orientations) exhibit a wide distribution of orientations, with the fewest graves pointing south (figure 5.30, above, and left). The significant true azimuth range is 57.2° to 90°, with a declination range of -20.58° to 18.11° (figure 5.30, middle, and right). This range corresponds to potential astronomical events such as the spring and autumn equinoxes, sunrises between 19th January and 13th May, 3rd August and 18th November. The lunar target that also appears in the significant range is SMinLE. Prominent stars within this range include Procyon, Betelgeuse, Altair, Aldebaran, Antares, and Spica. The Milky Way appears in the significant true azimuth range at dawn on SE, with one end connecting to the ground.

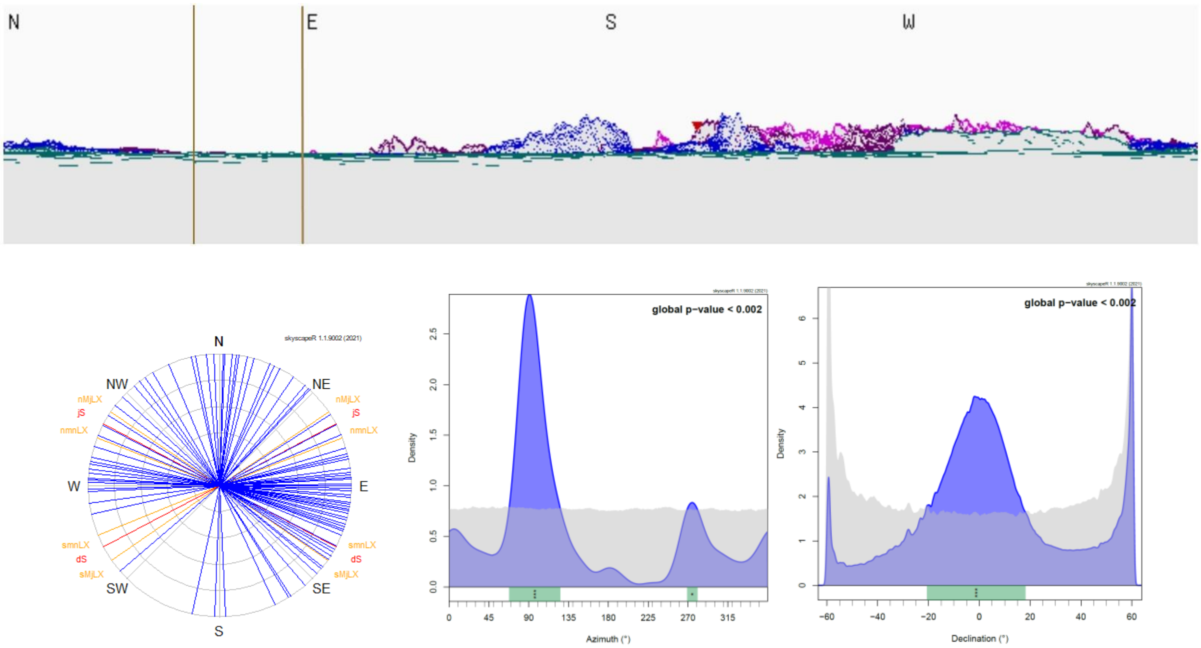



**Figure 5.30, shows the panoramic view around the Chengtoushan site and the grave orientation range of the Daxi period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Daxi period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

In the Qujialing period, 183 graves (1 with unknown orientation) show a continuation of the Daxi period's burial orientation customs. The significant true azimuth ranges are 346.4° to 11.8° and 67° to 113.3° (figure 5.31, above, left, and middle), with declination ranges of 57.61° to 66.93° and -16.3° to 18.05° (figure 5.31, right). The first range includes stars such as Polaris, Eltanin, and Merak, while the second range encompasses the spring and autumn equinoxes, sunrises between 4th February and 12th May, 3rd August and 4th November, obvious stars are Procyon, Betelgeuse, Altair, Aldebaran, Antares and Spica, etc. Similar condition of the Milky Way also occurred in this period, but it was at nightfall on AE.

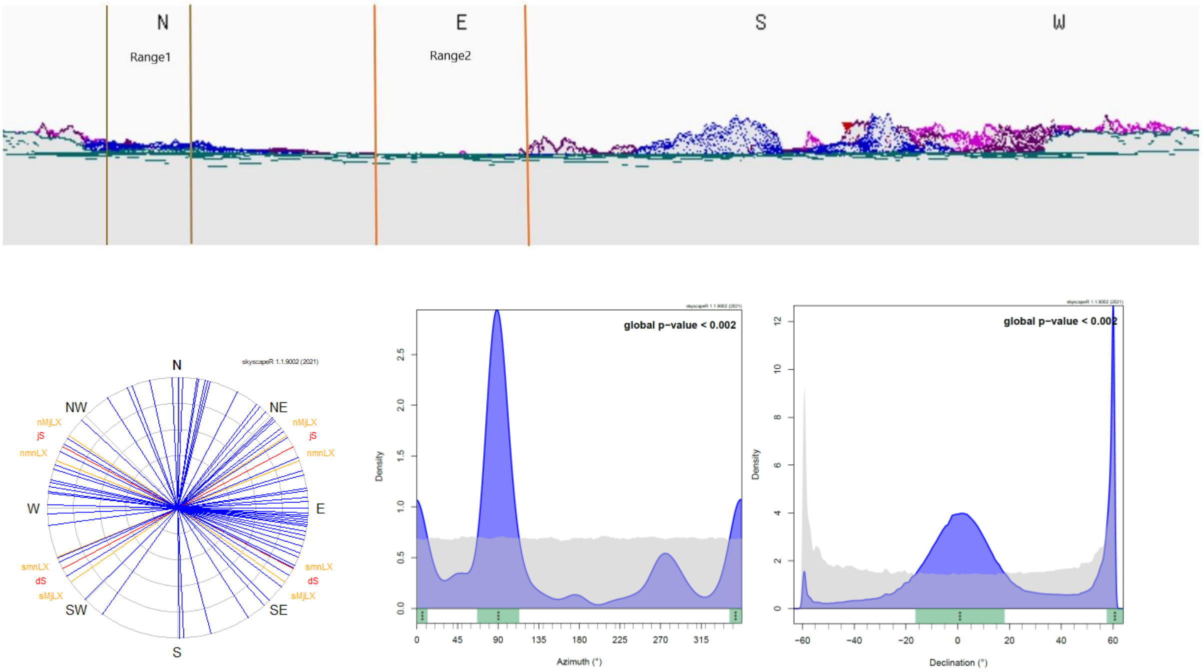



**Figure 5.31, illustrates the panoramic view around the Chengtoushan site and the grave orientation range of the Qujialing period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Qujialing period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

The Shijiahe period includes only five graves, making it difficult to determine whether their orientations reflect a continuation of earlier traditions or random factors. The significant true azimuth range is 351.3° to 10.6° (figure 5.32, above, left, and middle), with a declination range of

58.12° to 66.92° (figure 5.32, right). This range includes potential astronomical targets such as the spring and autumn equinoxes, sunrises between 19th January and 13th May, 3rd August and 18th November, southern minor lunar extreme and stars like Procyon, Betelgeuse, Altair, Aldebaran, Antares and Spica.

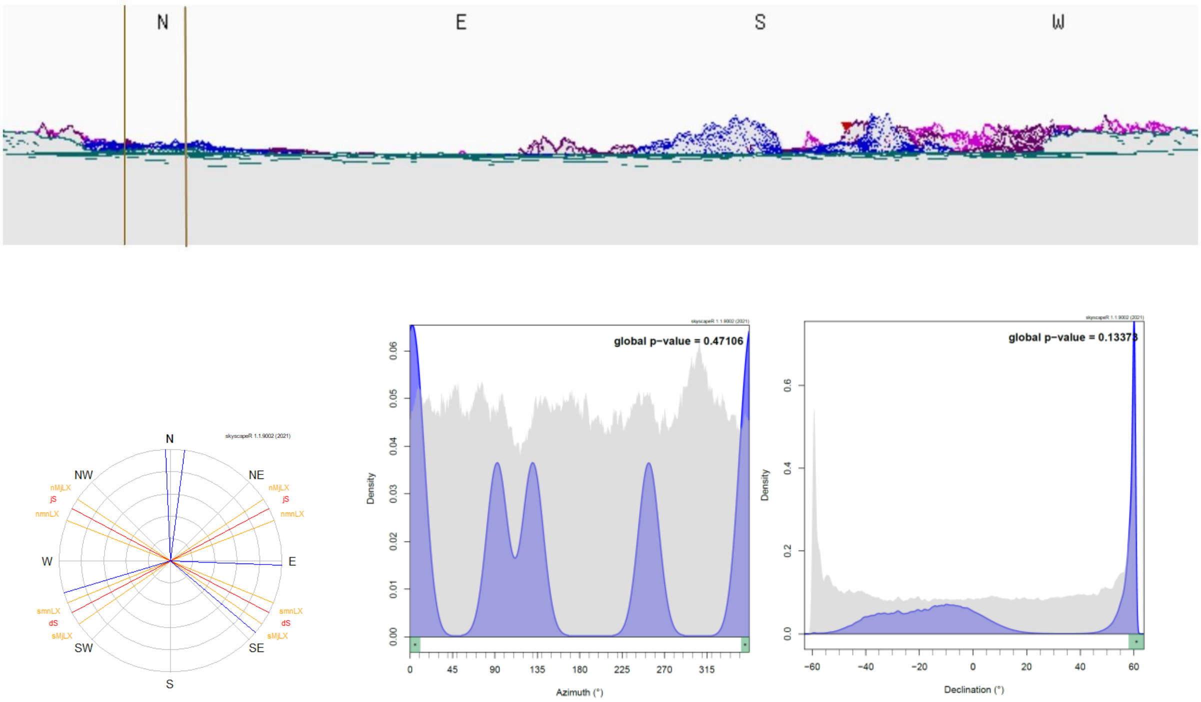



**Figure 5.32, depicts the panoramic view around the Chengtoushan site and the grave orientation range of the Shijiahe period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Chengtoushan grave orientations in the Shijiahe period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

In summary, the burial orientations at Chengtoushan across the three periods reflect a continuation of traditions similar to those at Liuwan. Although the orientations appear scattered, the histograms reveal a preference for east, west, and north directions, akin to patterns observed at Dahecun and Yangshan.

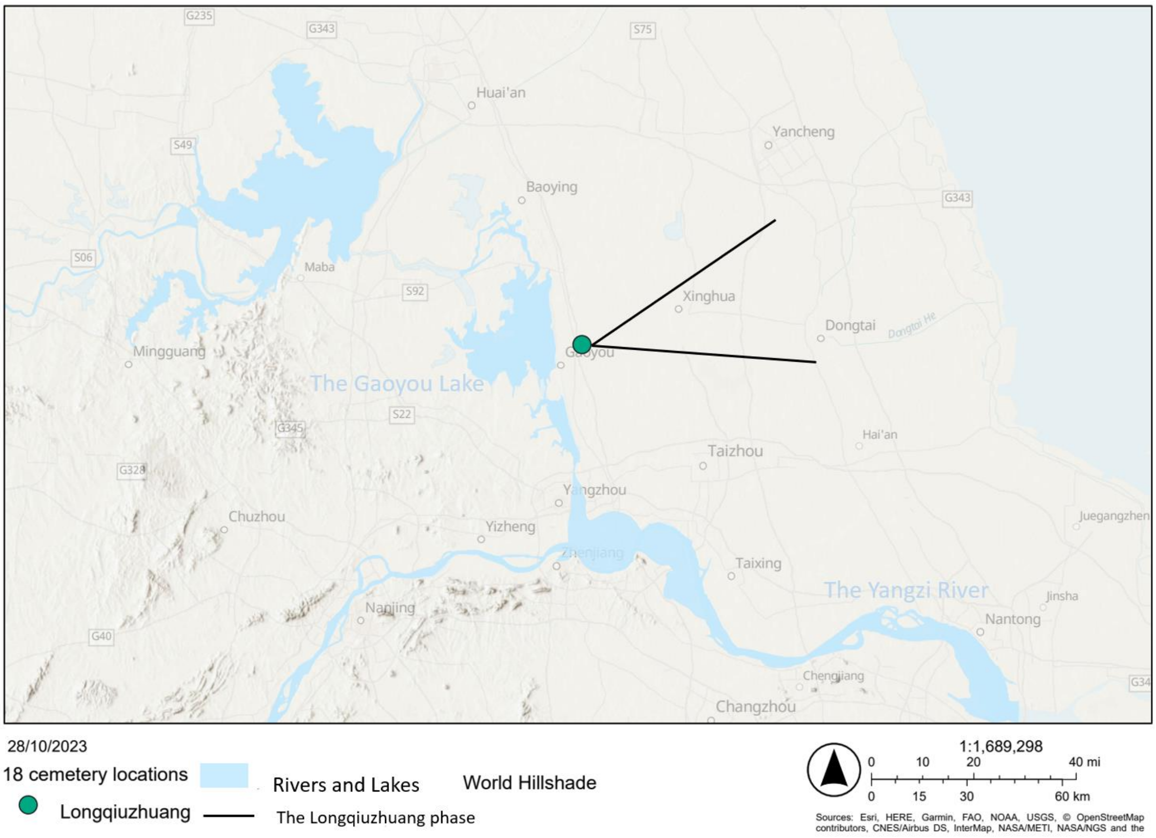
### 5.2.2.2. The lower reaches

The LYangzi River are predominantly flat, with plains and hills interspersed with some mountainous areas (Map 5.15). This region serves as a transitional zone between the warm temperate semi-humid monsoon climate of the north and the humid subtropical monsoon climate of the south, characterized by seasonal variations in precipitation. Four sites—Longqiuzhuang, Lingjiatan, Xuejiagang, and Yuchisi—are located in Jiangsu and Anhui Provinces. Longqiuzhuang lies further south of Wangyin, at the junction of the North China Plain and the Yangzi Plain, within the eastern Huai River Basin. Lingjiatan and Xuejiagang are situated on the northern bank of the Yangzi River, while Yuchisi is further north, closer to the LYellow River region.

## Longqiuzhuang

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Longqiuzhuang phase<br>(5000-3500 BC) | 402 | 55.2°- 94.2° | -1.7°- 26.21° |

**Table 5.16, summary of grave orientation and Longqiuzhuang site information.**




**Map 5.13 the overall view grave orientation at Longqiuzhuang**

Longqiuzhuang is located 5 miles east of Gaoyou Lake (map 5.13). The surrounding elevation is under 10 meters, with no significant hills or mountains, making it difficult to identify a distinct landscape feature as an orientation target (figure 5.33, above).

A total of 402 graves were analyzed, with orientations predominantly between northeast and east (figure 5.33, left). The significant true azimuth range is 55.2° to 94.2°, with a declination range of -1.7° to 26.21° (figure 5.33, middle, and right). Possible astronomical phenomena include the summer solstice, spring and autumn equinoxes, sunrises between 17$^{th}$ March and 21$^{st}$ June, 24$^{th}$ June and 22$^{th}$ September; and NMinLE. Stars including Capella, Procyon, Altair, Antares, Spica and others. The significant stars that appeared above the horizon were Alphard at dawn on SS and Antares at dawn on AE. In addition, the Milky Way emerged at the orientation range before sunrise on WS. It moved from east to the south sky after sunset on SE, later the tail stayed in the range before sunrise (figure 5.34 left). Finally, the Milky Way maintained vertically on the eastern horizon after sunset on SS (figure 5.34 right).

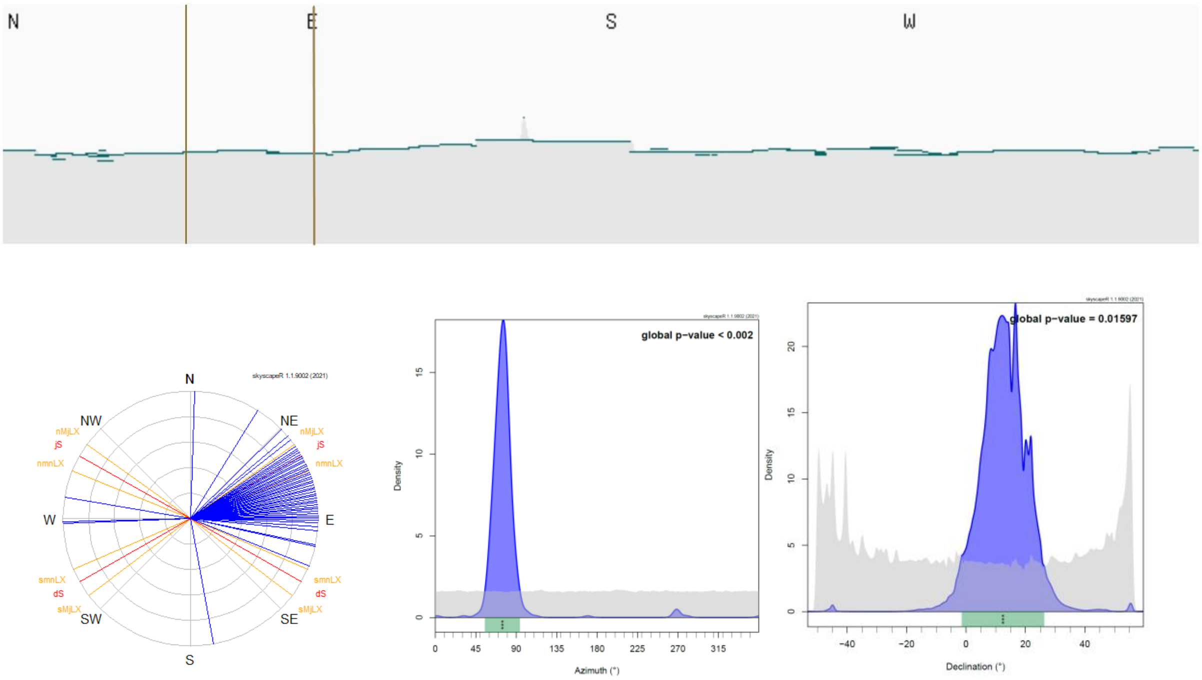



**Figure 5.33, shows the panoramic view around the Longqiuzhuang site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Longqiuzhuang grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

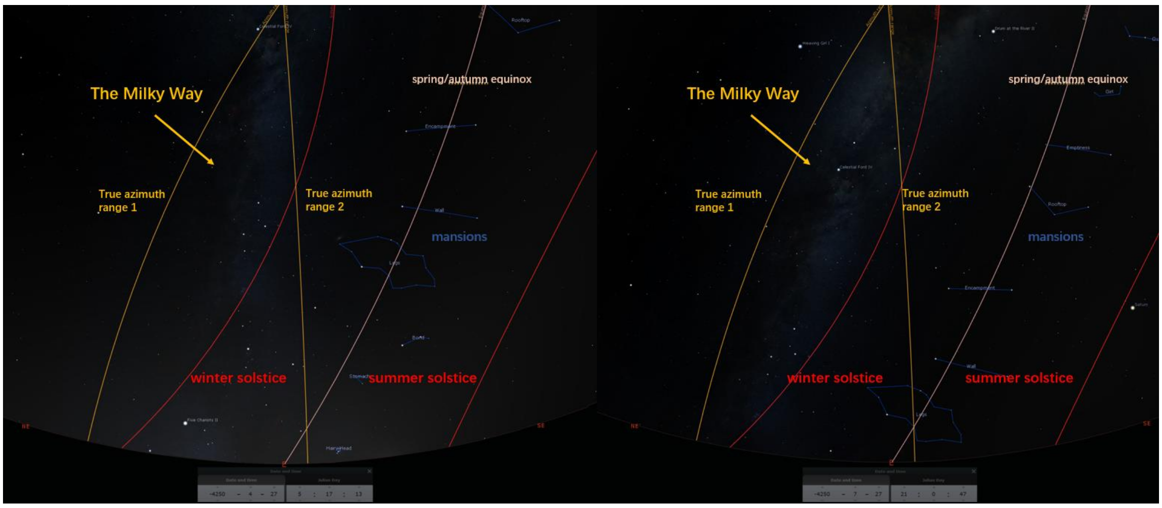
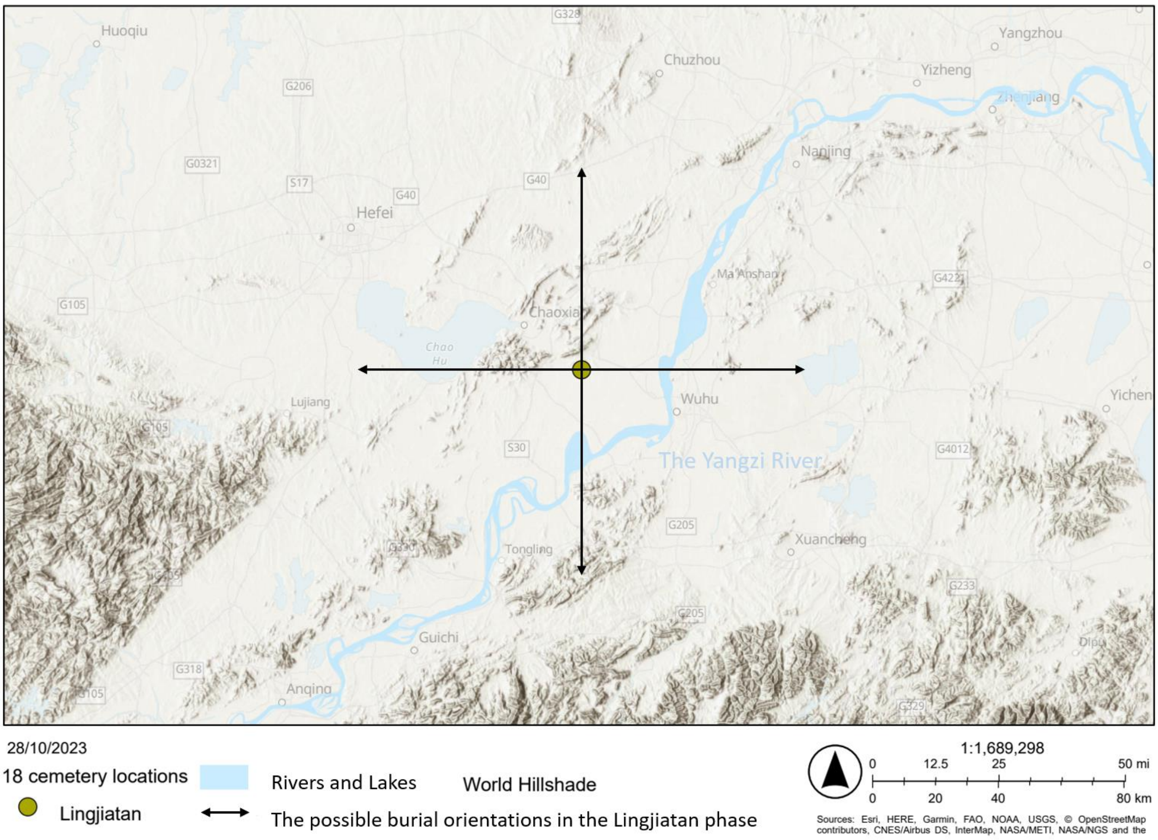



**Figure 5.34, the Milky Way before sunrise on SE (left); the Milky Way after sunset on SS (right).**

## Lingjiatan

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Lingjiatan phase (3600-3300 BC) | 44 | S-N (37), W-E (4) | N/A |

**Table 5.17, summary of grave orientation and Lingjiatan site information.**




**Map 5.14, the overall view grave orientation at Lingjiatan.**

Lingjiatan is located on a Buddha-shaped hill, with the Taihu Mountains to the west and north (map 5.14 and figure 5.35). The highest peak, at an altitude of 3.46°, is 4 miles away in the 334° direction. Chao Lake lies to the northwest, and the Yangzi River flows southwest to north to the south of the hill. Unfortunately, only 37 graves have a rough north-south orientation, 4 graves are oriented west-east, and the rest lack orientation data, making significance tests and celestial target analysis impossible.

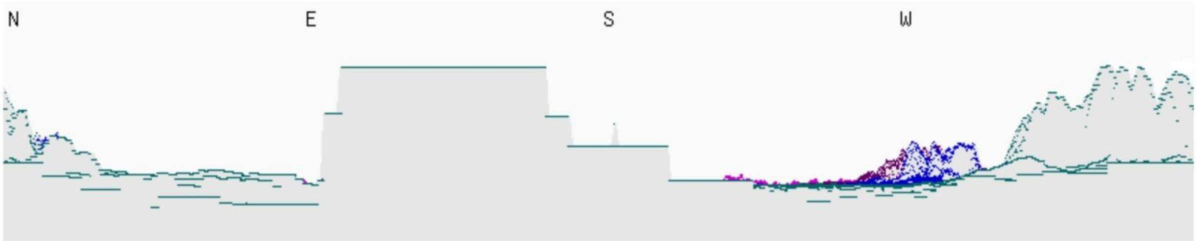
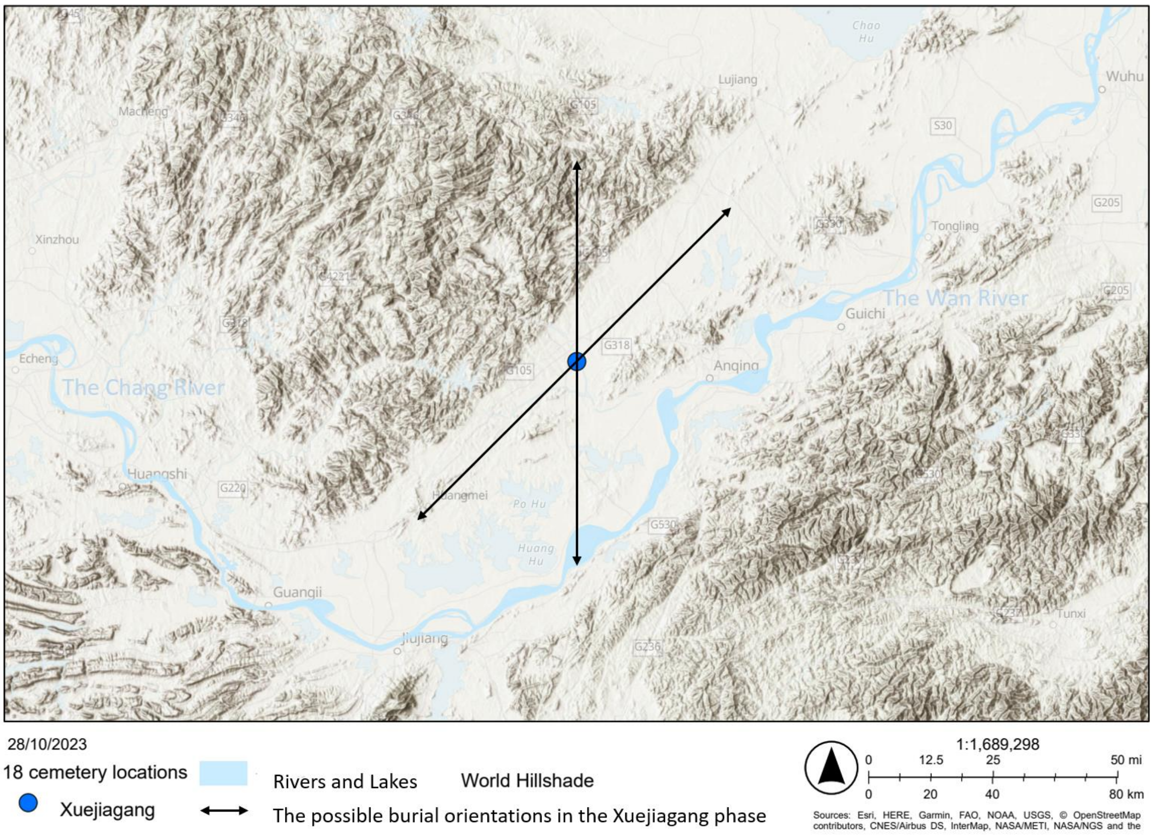



**Figure 5.35, illustrates the panoramic view around the Lingjiatan site (HeyWhatsThat, 2022).**

## Xuejiagang

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Xuejiagang phase (3500-2600 BC) | 151 | NE-SW (43), N-S (6), | N/A |

**Table 5.18, summary of grave orientation and Xuejiagang site information.**




**Map 5.15 the overall view grave orientation at Xuejiagang.**

Xuejiagang is surrounded by the Dabie Mountains to the west and north, with the highest peak 15 miles away in the 326° direction and an altitude of 3.08°. The Qian River flows north to south to the east of the site, converging with the Wan River to the northeast (map 5.15 and figure 5.36). Despite the mountainous surroundings, the graves are oriented toward the north and east, where the terrain is flatter. Of the 151 graves excavated, 24 have precise orientation data, 49 have ambiguous orientations, and the rest are unknown (figure 5.37).

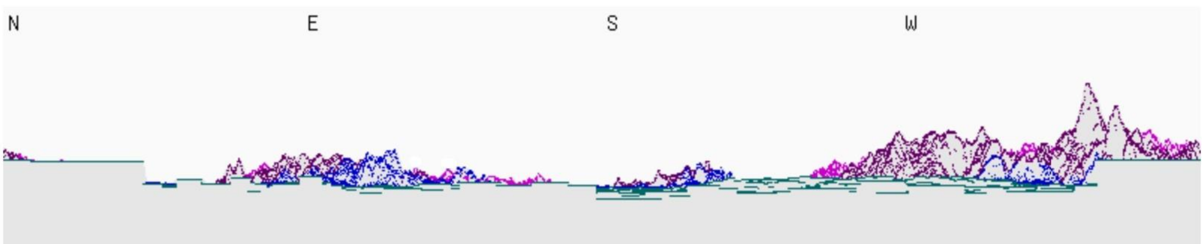



**Figure 5.36, shows the panoramic view around the Xuejiagang site (HeyWhatsThat, 2022).**

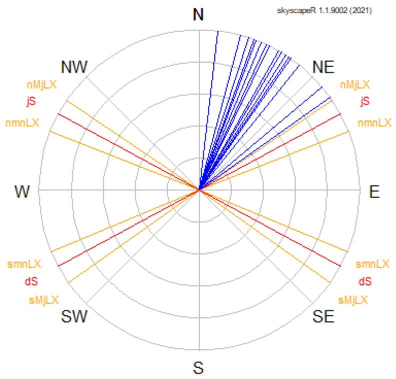
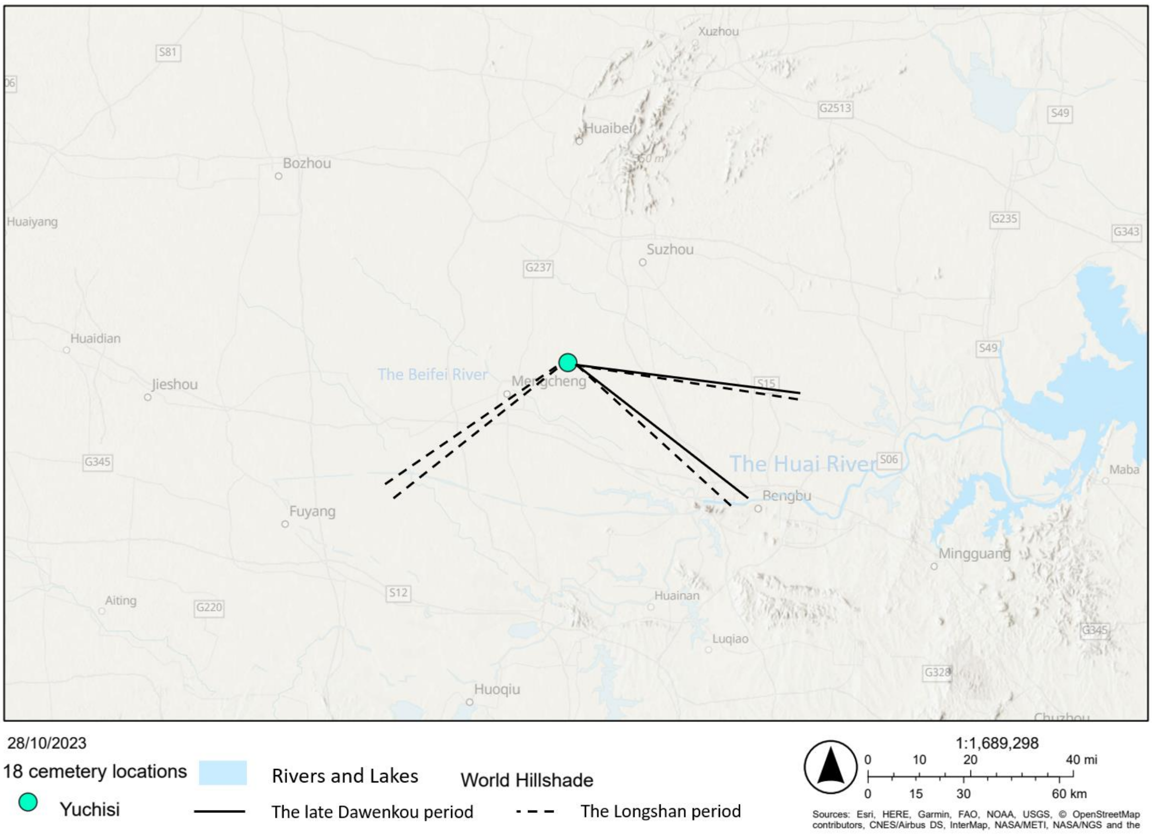



**Figure 5.37, presents a polar diagram of partial Xuejiagang grave orientations.**

## Yuchisi

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The late Dawenkou period (2800-2700 BC) | 284 | 97.6°- 142.5° | -39.63°- 10.14° |
| The Longshan period (2700-2600 BC) | 24 | Range1: 98.7°- 138.2° | -38.86°- -10.81° |
| | | Range2: 212.1°- 215.1° | |

**Table 5.19, summary of grave orientation and Yuchisi site information.**




**Map 5.16 the overall view grave orientation at Yuchisi.**

Yuchisi is situated on a flat plain with no significant hills, rivers, or lakes nearby (map 5.16 and figure 5.38, above). The elevation to the east and south is approximately 0.14°. During the late Dawenkou period, 284 graves (9 with unknown orientations) were identified, most oriented east and southeast (figure 5.38, left). The significant true azimuth range is 97.6° to 142.5°, with a declination range of -39.63° to 10.14° (figure 5.38, middle, and right). This range includes potential celestial targets such as the winter solstice, sunrises between 16th October and 17th December, 20th December and 23rd February, southern minor and major lunar extreme and stellar, such as Sirius, Rigil Kentaurus, Rigel, Hadar, Acrux and Mimosa, etc. The Milky Way, though visible, does not align with the declination range during specific observation times.

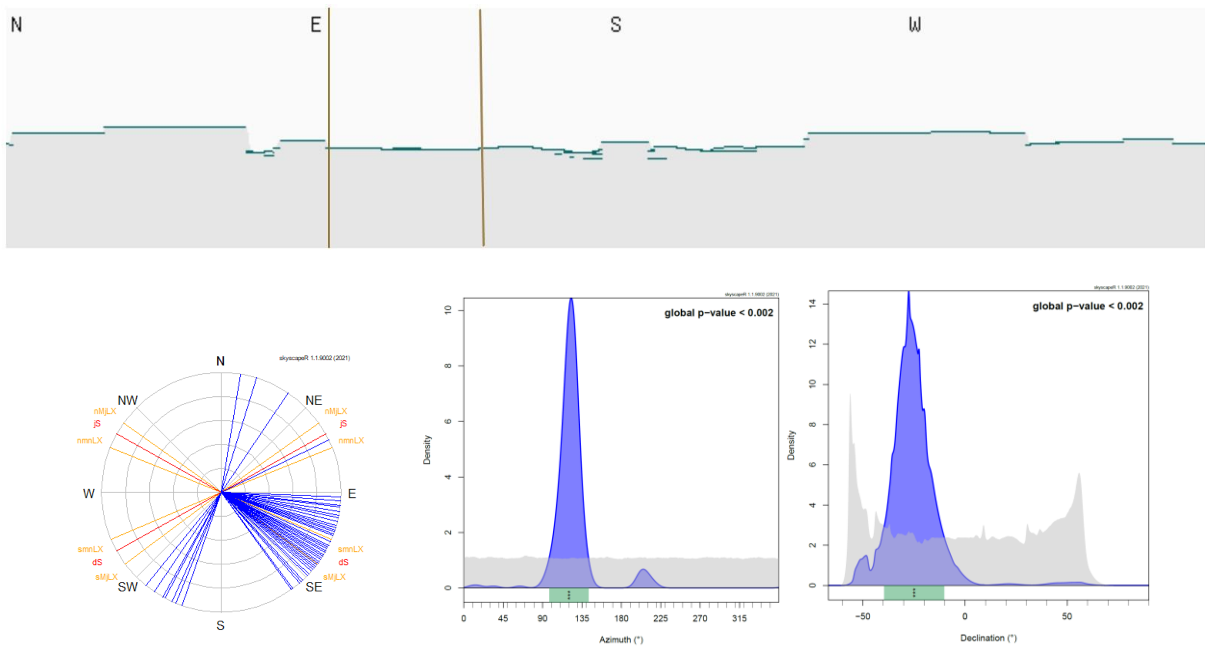
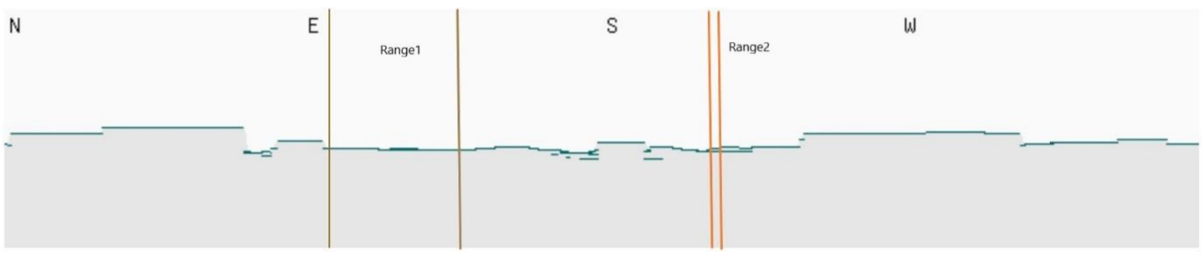



**Figure 5.38, depicts the panoramic view around the Yuchisi site and the grave orientation range of the late Dawenkou period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yuchisi grave orientations in the late Dawenkou period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

In the Longshan period, 24 graves were identified, continuing the eastward orientation tradition (figure 5.39, above, and left). The significant true azimuth ranges are 98.7° to 138.2° and 212.1° to 215.1°, with a declination range of -38.86° to -10.81° (figure 5.39, middle, and right). The celestial targets are similar to those in the late Dawenkou period, with a slightly reduced sunrise date range (18th October to 17th December, 21st December to 20th February). The Milky Way's position remains consistent with the earlier period.



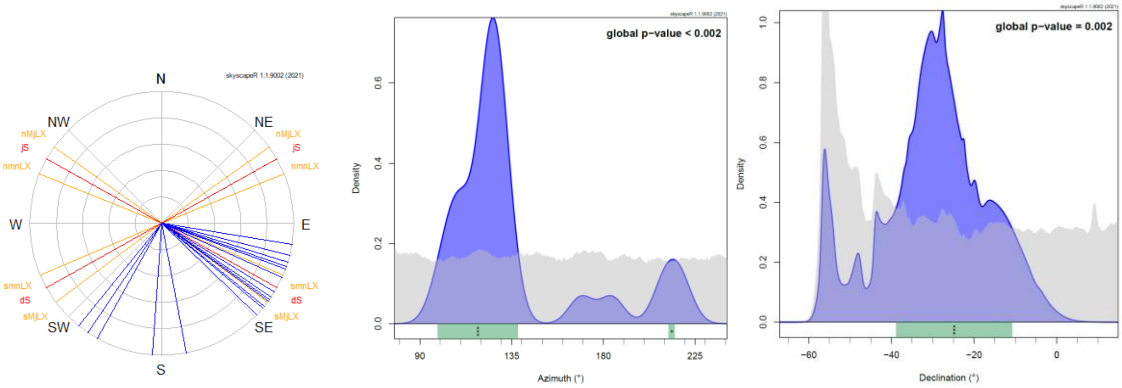


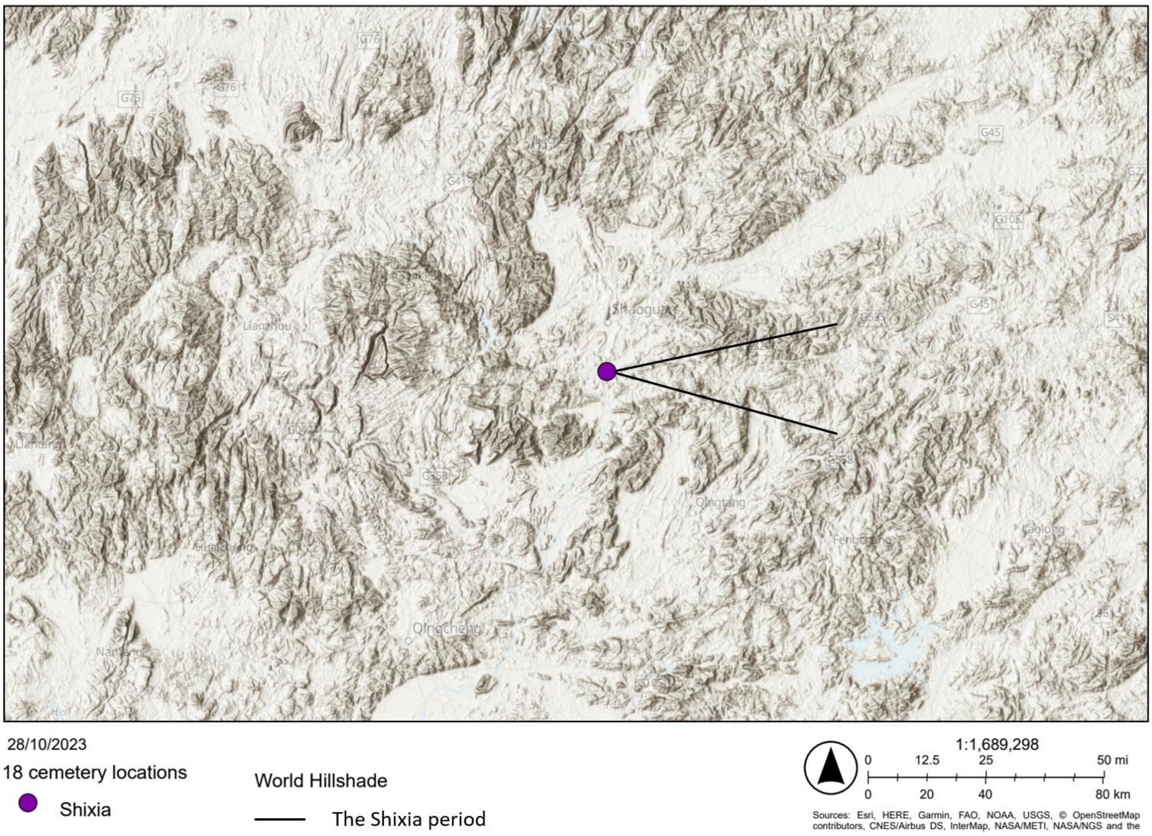

**Figure 5.39, illustrates the panoramic view around the Yuchisi site and the grave orientation range of the Longshan period (above) (HeyWhatsThat, 2022). It includes a polar diagram of Yuchisi grave orientations in the Longshan period (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

### 5.2.3 The Southern region

## Shixia

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The Shixia period (3500-2000 BC) | 102 | 78.7°- 105° | -10.14°- 11.79° |

**Table 5.20, summary of grave orientation and Shixia site information.**

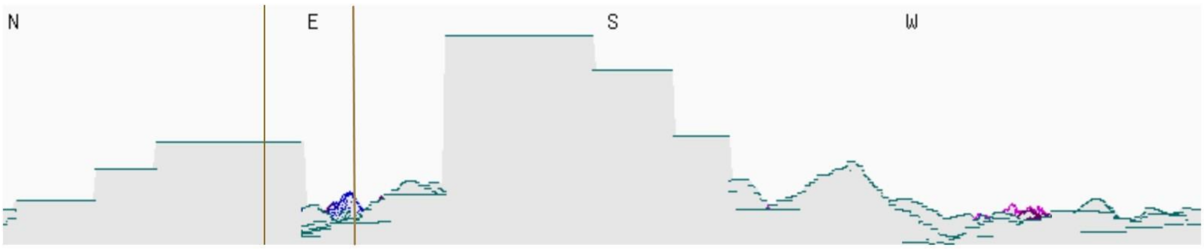



**Map 5.17, the overall view grave orientation at Shixia.**

The Shixia site is not situated directly between Shitou Mountain and Shiwei Mountain but rather in the foothills between these two peaks (map 5.17). As shown in the panoramic image (figure 5.40, above), the eastern view from the site offers a clear view of the sky through the gap between the mountains. Located in a humid subtropical monsoon climate zone, the region experiences higher average temperatures and more abundant rainfall compared to the previously discussed areas. The mountains not only provide shade and lower temperatures but also mitigate the effects of the damp season, similar to the modern climate of Guangzhou. For instance, they block southerly winds from the Pacific during spring, reducing humidity and protecting organic materials such as clothing, leather, and woodwork. A long strip of lake lies to the west of the site, though it is uncertain whether this feature existed contemporaneously with the site.

In southern China, the orientation of houses and burials is closely tied to temperature, humidity, and monsoon patterns (Zhao et al., 2021). Since the region lies south of the Tropic of Cancer, it experiences direct sunlight twice a year. North-facing houses receive morning and afternoon sunlight in summer but remain shaded in winter, while south-facing houses receive no direct sunlight due to the sun's high angle. West-facing houses are exposed to intense afternoon and evening sunlight year-round, making them uncomfortably hot in summer. East-facing houses, however, receive sunlight at a comfortable temperature in both winter and summer. From March to April, warm, humid air from the South China Sea meets cold air from the north, creating a phenomenon known as the "Return to the South Days," characterized by high humidity, light rain, and fog. South-facing houses are more prone to dampness and mold, while north-facing ones remain drier. From a ventilation perspective, southeast and southwest-facing houses are more suitable for habitation. Therefore, settlements opening to the southeast and sheltered by mountains to the northwest, or surrounded by mountains on three sides, are ideal for this unique climate. However, the geography of the Shixia site is the opposite, with mountains to the east.

The orientation of 101 graves at Shixia aligns with the gap between the mountains, though one grave lacks orientation data (figure 5.40, left). The significant true azimuth range is 78.7° to 105°, with a declination range of -10.14° to 11.79° (figure 5.40, middle, and right). This range corresponds to potential celestial targets such as the spring and autumn equinoxes, sunrises between 23rd February and 22nd April, 22nd August and 17th October, as well as prominent stars like Procyon, Betelgeuse, Altair, Aldebaran, Antares and Spica. he Milky Way is visible year-round in this direction, both after sunset and before sunrise, though it does not clearly align with the grave orientation range during the equinoxes or solstices.



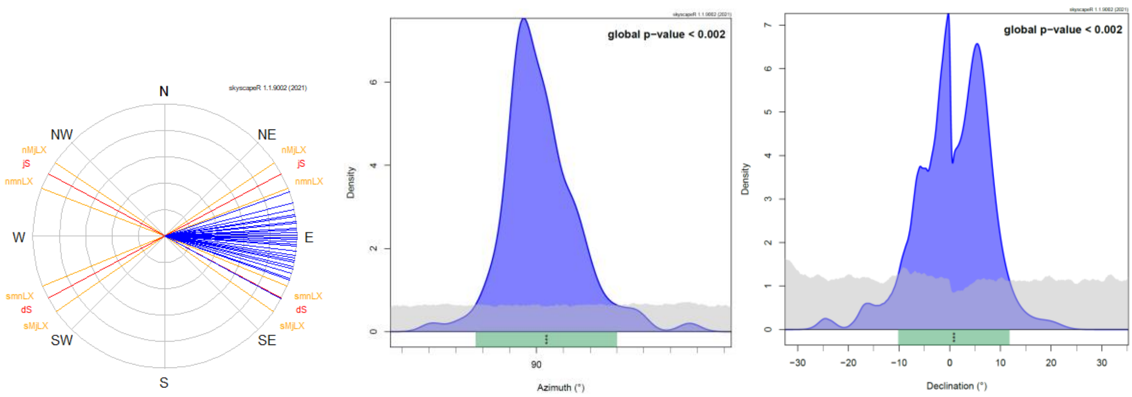


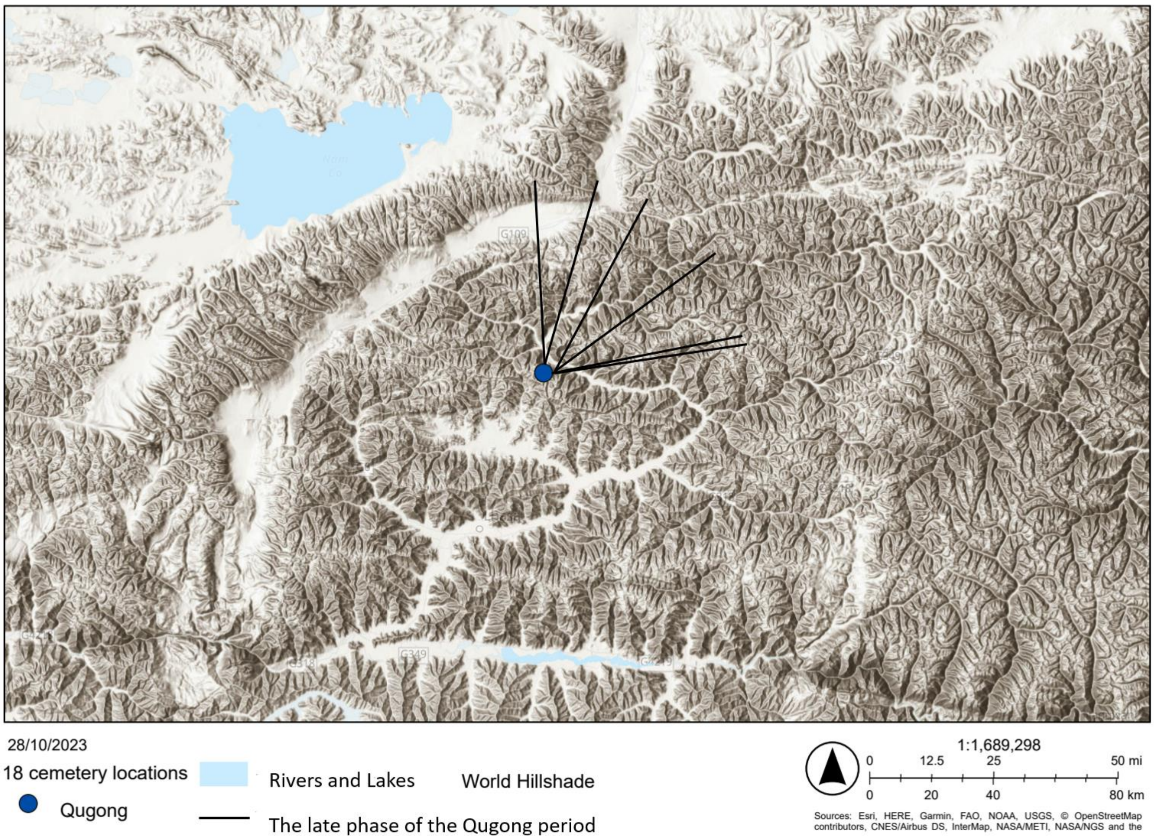

**Figure 5.40, shows the panoramic view around the Shixia site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Shixia grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

### 5.2.4 Tibet

## Qugong

| Period | Number of graves | Range of significant true azimuth | Range of significant declination |
|---|---|---|---|
| The late phase of the Qugong period (1700-1500 BC) | 29 | Range1: 358.3°-16.9° | 69.65°- 90° |
| | | Range2: 28.9°-51.6° | 36.48°- 50.22° |
| | | Range3: 78.7°-82.2° | |

**Table 5.21, summary of grave orientation and Qugong site information.**




**Map 5.18, the overall view grave orientation at Qugong.**

Qugong, located on the Qinghai-Tibet Plateau, has the highest elevation among the studied sites (map 5.18). The site lies on the lower slope north of present-day Qugong Village, with exposed cliffs above and the Lhasa River valley below, creating a relatively gentle terrain. Due to urban expansion, the original Lhasa valley has largely disappeared, making it difficult to trace the river that once existed. During the Neolithic period (which developed later here than in the Yellow and Yangzi River basins), the site may have been situated near a river in the valley, though water scarcity was likely an issue. The region experiences a temperate semi-arid monsoon climate, with intense sunlight and limited rainfall due to downdrafts from the northern Himalayas.

Of the 27 graves analyzed (excluding 2 with unknown orientations), the significant true azimuth ranges are 358.3° to 16.9°, 28.9° to 51.6°, and 78.7° to 82.2° (figure 5.41, above, left, and middle). However, these orientations are not ideal for stargazing, as the hillside obstructs the view. The declination ranges are 69.65° to 90° and 36.48° to 50.22° (figure 5.41, right), which do not include solar movements or particularly prominent stars, except for Arcturus and Vega.

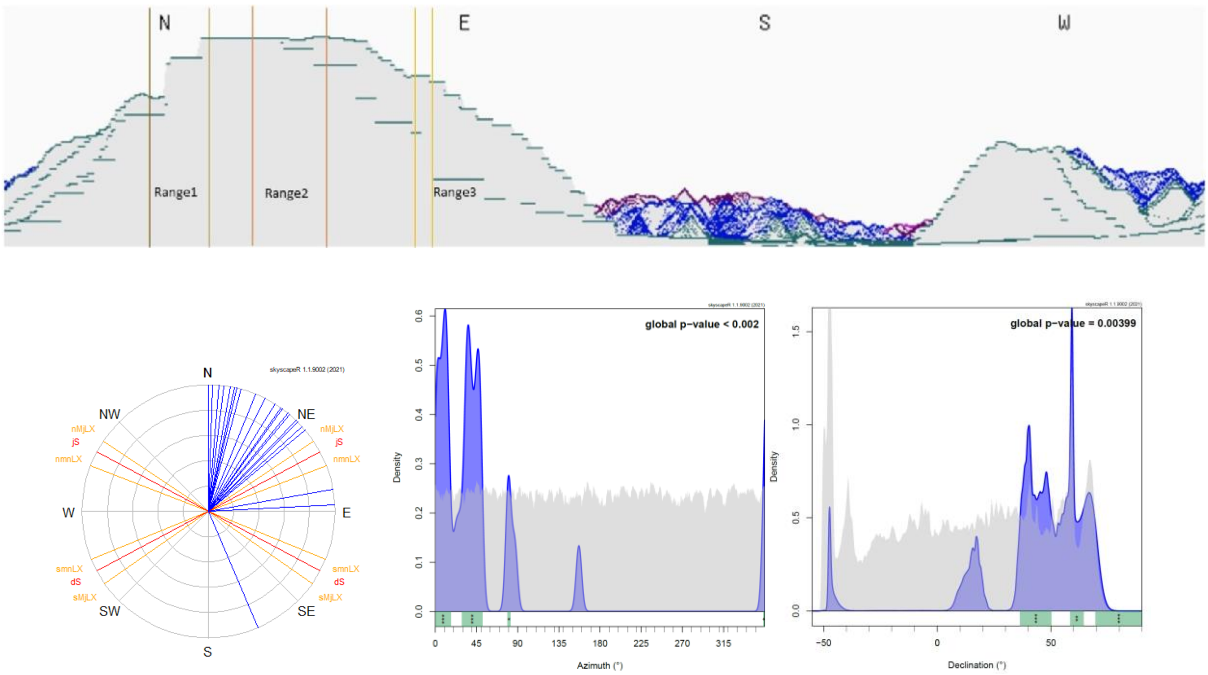



**Figure 5.41, illustrates the panoramic view around the Qugong site and the grave orientation range (above) (HeyWhatsThat, 2022). It includes a polar diagram of Qugong grave orientations (left), a histogram of the azimuth range in the significance test (middle), and a histogram of the declination range in the significance test (right).**

## 5.3 Summary

**The issue of orientation**: By listing the distribution of burial orientation at the 18 sites, these sites can be placed into five main categories. First, the sites with burials facing west (including southwest and northwest) are Jiahu, Jiangzhai, Longgangsi, Xipo and Qingliangsi. Second, the sites with burials facing east (including southeast and northeast) are Taosi, Dawenkou, Wangyin, Longqiuzhuang, Xuejiagang, Yuchisi, Shixia and Qugong. Third, only one site presents burials orientated north–south, which is Lingjiatan. Fourth, burials follow divergent orientations at Liuwan and Chengtoushan. Fifth, two sites present burials facing in all four directions, which are Yangshan and Dahecun. It can be deduced that facing west and facing east are the two mainstream burial orientation choices.

The fourth and fifth categories follow their own patterns. The majority of burials at Liuwan face a directional range that includes west, north and east. The burials at Chengtoushan, although seemingly chaotic, include a large proportion that face the four cardinal directions, perhaps constituting a combination of two types. The burials at Dahecun and Yangshan have a clear classification of burial orientation into the four cardinal directions. What enabled them to locate the four directions accurately? What was the basis for selecting a given direction as the orientation of a burial?

**The issue of regionality**: From a regional perspective, the Yangshao culture on the middle Yellow River is dominated by west-facing burials, while the Dawenkou culture on the lower Yellow River has primarily east-facing burials. The burials of the Longshan culture, which was active in both areas, are based on the orientations of previous cultures at each site. Burials on the lower Yangzi River appear to be mostly east- and northeast-facing, but each site belongs to a different cultural variant, meaning that further analysis is needed to identify the factors involved. The other three regions (the upper Yellow River, Tibet and the south) provide only one or two sites each, so perhaps further analysis of other sites within the respective cultures will reveal the true determinants of their burial orientations. It seems that some regions have their own preferences, but in reality, the choices made still depend on associations within the culture in which each region is located, associations that were perhaps bred over the course of people's lives according to the unique local climate and topography.

**The issue of chronology**: From a macroscopic point of view, that is, considering the three main phases of the Neolithic, the early period is dominated by a westward orientation. The middle period is split roughly equally between sites with west-facing and east-facing burials, with divergent orientation types emerging in this phase. The Late Neolithic period is the most complex, with nearly half of the sites dominated by burials facing east, southeast and northeast, one-third dominated by burials facing west and two sites dominated by the four cardinal orientations, in addition to divergent orientations. In summary, this shows a picture of an increasing diversity of choices. Even within a single culture, there are also exceptions, such as at Dahecun. At a microscopic level, even though burials at individual sites are classified into different phases, their orientation was inherited, and the choice of burial orientation rarely changes depending on the period.

**Landscape analysis:** From the DEM maps, we can see that all sites were built beside branches of rivers or lakes, except for those in high-altitude areas, where water is scarce because of low precipitation and abundant sunshine. However, it is difficult to analyse the influence of the direction of water flow on burial orientation choices. As mentioned in 5.1 above, rivers that existed during the Neolithic period are difficult to trace, and most present rivers have been modified over the millennia due to urban construction and development.

If the sites with divergent and cardinal-direction orientations are excluded, the remaining 14 can be classified into three types of landscape: direct mountain view, no mountain view and intermediate. The first type includes Longgangsi, Taosi and Qugong, sites very close to mountains, whose burials point directly to those mountains. The second type includes Longqiuzhuang, Wangyin, Xuejiagang and Yuchisi, whose grave orientation ranges cover mainly level landscapes, with any mountains far away. The third type includes Jiahu, Jiangzhai, Xipo, Qingliangsi, Dawenkou, Lingjiatan and Shixia, whose burials are orientated towards a space, gap or plain between mountains, all very close to the site in question.

**Regional analysis**: Sites on the upper Yellow River and in Tibet are mountain-view landscapes, as described immediately above, while those on the middle Yellow River and middle Yangzi River and in the south are dominated by the mountain-view and non-mountain-view types and those on the lower Yellow River and lower Yangzi River are dominated by the intermediate type.

Regional analysis provides a more macroscopic view than landscape analysis. It is important to consider not only the topography at different altitudes but also the different celestial events observable at various latitudes and longitudes: for example, when the Milky Way appears in an upright position on the horizon from the Yellow River basin, a different picture is visible from the Yangzi River basin. Climate also affects observational habits; we might consider, for example, the summer monsoon in the south. Differences in what is seen and how observations are conducted can lead to widely divergent perceptions and thus to a variety of cosmological views. Details of the regional analysis will be elaborated in chapter 6.

**Skyscape analysis:** Of the celestial events encompassed in the orientation ranges of graves at the various sites, the frequently included in the orientation ranges are sunrise and sunset, moonrise and moonset, and the movement of the the Milky Way and some particularly conspicuous stars. Ranges covering sunset are represented at Jiahu, Jiangzhai, Longgangsi, Xipo and Qingliangsi. Ranges covering sunrise are represented at Dahecun, Taosi, Longqiuzhuang, Dawenkou, Wangyin, Liuwan (in the Qijia period), Chengtoushan, Yuchisi and Shixia: this is almost twice the number of sites whose ranges cover sunset. The Milky Way appears within the burial orientation ranges at dawn and nightfall, in an upright position and connected at one end to the horizon, at Jiahu, Jiangzhai, Xipo, Taosi, Qingliangsi, Longqiuzhuang, Dawenkou and Wangyin, all of which lie along the middle and lower reaches of the Yellow River. Finally, some stars occur with very high frequency within the orientation ranges. These mostly consist of the 28 mansions recorded in ancient texts. This may, however, be a coincidence, as while facing west or east, one will see the 28 mansions moving around the ecliptic.

The most important stars in Chinese history, as explained in chapter 2, are those of the 28 mansions (divided among the four animal signs of the Dragon, Phoenix, Tiger and Tortoise) and the Big Dipper, as well as the pole star. As also mentioned in chapter 2, however, it is difficult to assess when the concepts of these mansions or the four animal signs were first formed, with opinions including by the middle of the Warring States period (Qian, 1983, p. 348) or by the Han dynasty (Needham, 1959, p. 248). Nonetheless, regardless of whether Neolithic observers connected the stars in this way, these same stars were observable and behaved in the way described, making them what Iwaniszewski (2015b, pp.317–318) called ‘astronomical facts’. As such, and merely to explore whether they may have been significant already in the Neolithic, these stars will be mentioned here (see appendix 7 for more details of the appearance of these stars within the burial orientation range at each site).

A similar situation holds for the four stars mentioned in the *Canon of Yao*. As mentioned in chapter 2, it is uncertain whether Neolithic people had recognised these, and there is still no fully unanimous conclusion as to which stars they are. The stars Alphard (α Hya) and Antares (α Sco) appear in the burial orientation ranges of Dawenkou, Wangyin, Longqiuzhuang, Shixia, Jiahu, Xipo, Jiangzhai, Taosi and Qingliangsi, whereas (β Aqr) and (7 Tau) do not feature. Naturally, other hypotheses are not ruled out, but this thesis is not concerned with the identification of these stars.

Additionally, the results of these data raise some questions about combining landscape and celestial phenomena. These include whether the choice of a burial orientation range facing the space between two mountains and specific foothills at Jiangzhai, Xipo, Qingliangsi (in its second and third stages), Dawenkou and Shixia was intended to point to a particular celestial target; a combination of celestial phenomena of special significance, such as sunrise/sunset, a subset of the 28 mansions or the Milky Way; or nothing in particular. This specific phenomenon may be because the cultures to which these sites belong reflect relatively strong consistency in orientation. It is possible that the burials were simply orientated towards the west: the sunset and the appearance of the stars and the Milky Way after sunset might have been considered a guide or secondary targets; mountains may have served as an indicator of direction; or people may not actually have been aware of this coincidence but orientated burials towards this cardinal point for other reasons, such as an original home or the source of a river. In addition, the data from Tibet suggest that celestial or cardinal orientation did not have the same significance there but that burial orientation was instead associated with mountains. The various factors that influenced orientation decisions require further exploration, which they will receive in the next chapter.

# Chapter 6 Discussion

## 6.1 Introduction

In chapter 4, 18 sites from 7 regions are described in terms of chronology, site distribution, lifestyle and burial customs to understand their economic patterns and social structure. In chapter 5, the landscapes around the sites are detailed through DEM maps and panorama images; a list produced using skyscapeR then enumerates the celestial phenomena that occurred within the burial orientation ranges of these sites, and simulations made using Stellarium are presented.

The results of chapter 5 indicate three key points: first, the orientation of burials, whether they are classified regionally or chronologically, was influenced by the culture to which they belonged. Second, the observation of celestial phenomena in different regions was influenced by altitude, latitude, longitude and climate, meaning that the different astronomical observation habits and common celestial phenomena visible in each region may have influenced the formation of different groups' cosmology. Third, some celestial phenomena may have been intentionally incorporated within the burial orientation ranges and may have interacted with particular landscape features in the surroundings of a small number of sites. However, whether the celestial objects highlighted by conspicuous landscape features were the main targets, and whether particular celestial objects indeed appeared in close relation to characteristic landscapes at specific positions, such as sunrise/sunset at the Taosi observatory, both need to be further explored in this chapter.

Other cultures exist that show their unique cosmology through burial orientation, such as the megalithic cultures of Neolithic Europe, the temples of Malta, the Mayan altars and the elite tombs of ancient Egypt. Even in the pre-modern Ainu period, hunter-gatherers in Hokkaido, Japan, arranged their burials towards the east, apparently based on river direction (towards a sacred mountain in the east), land slop and other factors. These groups' folklore records, however, that if the deceased, who were buried with their heads to the east, should wake up, they would find themselves facing west, where the dead were supposed to go after dying, and thus would never get lost on their journey. West, therefore, is actually more important to the dead (Akira, 2018). The aims stated in chapter 1 must be reiterated here: this research seeks to cautiously and multifacetedly explore patterns in the orientation of graves from different cultural contexts and subsistence regimes to understand whether the inhabitants of Neolithic China used this orientation to express their cosmology. An attempt is also made to explore the broader context of Neolithic Chinese cosmology by considering not only astronomical phenomena but also the relationship between the natural environment, subsistence and the orientation of burials.

Iwaniszewski (2015b, p. 319) states, regarding the application of cognitive archaeology in the field of archaeoastronomy, that archaeoastronomers may infer from the study of the material record human cognitive abilities related to perceiving the sky, as well as the patterns of interpretation of celestial phenomena by people living in the past. For example, astronomical patterns displayed on stone tablets may represent different categories of celestial objects, reflecting ancient classificatory systems, while crescent shapes may indicate how people perceived changes in the moon (Iwaniszewski, 2015b, p. 319). Therefore, in addition to the study of burial orientation in relation to the surrounding natural environment and subsistence activity, it is necessary to propose possible interpretations of the relevant material record, such as the shape of artefacts and their surface patterns. This can offer a multidimensional perspective from which to explore the Neolithic perception of cosmology. As understood by Malafouris (2013, p.78) in his research approach to cognitive archaeology, thought emerges from the contextualised interplay between "brain, body, and things." The primary role of early mark-making and subsequent imagery is to provide a scaffolding mechanism that gradually enables human perception to become aware of itself (Malafouris, 2013, p.239). Therefore, in the process of attempting to explore the cosmological cognition of Neolithic people through the field of archaeoastronomy, it is also necessary to include the interpretation of artefacts and the pictorial symbols inscribed upon them.

This chapter is divided into five sections. The first section is this introduction. The second section presents the cultural, chronological and regional patterns behind the distribution of burial orientations and demonstrates the influence of gender, age and social status. The third section discusses the sites' surroundings, including such aspects as rivers, mountains, plains and altitude, and the relationship between this and the orientation range of the burials. The fourth section discusses the influence of celestial phenomena on the orientation range of the burials and considers whether different subsistence regimes affect this. To examine the specific determinants of orientation, the position and decoration of burial objects will be included in the fifth section.

## 6.2 the cultural, chronological and regional patterns behind burial orientation

Why did Neolithic people concentrate burial orientations within the scope of specific astronomical phenomena? In hunter-gatherer societies, individuals were not only adept at hunting and intimately familiar with the terrain, but they also possessed a deep understanding of climatic patterns, seasonal shifts, and celestial movements that guided direction and time. This knowledge was crucial for navigating dense forests without losing their way. As societies transitioned to agriculture, the reliance on hunting and gathering diminished, yet farmers became even more attuned to seasonal changes. They meticulously observed the positions of celestial bodies that signaled these changes, as such knowledge was vital for successful crop cultivation, which was essential for their survival. Both subsistence strategies—hunting-gathering and farming—likely fostered celestial beliefs and associated ritual practices.

However, other factors could also have influenced burial orientations. These include societal shifts from matrilineal to patrilineal structures, the challenges of surviving in harsh environments, or other naturalistic beliefs centered around mountains, rivers, winds, and deserts. Therefore, before concluding that celestial phenomena were the primary influence on grave orientations, it is essential to rule out these other potential factors. That said, it is possible that multiple influences coexisted. For instance, a grave might align with a specific celestial range or astronomical event, yet this alignment could coincidentally also point toward the ancestral homeland. Thus, while celestial phenomena may have played a significant role, they likely interacted with other cultural and environmental factors in shaping Neolithic burial practices.

### 6.2.1. Was there a shared pattern of the burial orientation?

The results presented in Chapter 5 reveal that the burial orientations across 18 sites initially appear random, with graves facing various directions. However, when these orientations are categorized according to the four cardinal directions, a distinct pattern emerges: the majority of burials are oriented either toward the west (including northwest and southwest) or the east (including northeast and southeast). Specifically, sites such as Jiahu, Jiangzhai, Longgangsi, Xipo, and Qingliangsi exhibit a predominant western orientation, while Taosi, Dawenkou, Wangyin, Longqiuzhuang, Xuejiagang, Yuchisi, Shixia, and Qugong are primarily oriented toward the east.

The remaining sites display more varied patterns: Liuwan and Chengtoushan demonstrate divergent orientation trends, Yangshan and Dahecun exhibit a four-directional orientation pattern, and Lingjiatan stands out with a distinct north-south burial orientation. These distributions are not arbitrary but instead reflect underlying organizational principles. Furthermore, the prevalence of westward and eastward orientations as dominant choices is unlikely to be coincidental, suggesting intentional cultural or symbolic significance behind these directional preferences.

### 6.2.2. What are the regional patterns? And culture relations? Do they stay the same through time?

Could these systematic burial orientation patterns be linked to the geographical regions, cultural affiliations, or chronological contexts of the cemeteries? By examining the regularities in relation to these factors—region, culture, and chronology—we may uncover whether the motivations behind burial orientations were consistent or varied across different contexts. What similarities or differences can be identified?

**Regional pattern**

The analysis of seven regions (Table 6.1) reveals distinct trends in burial orientations. In the Middle Yellow River region, a consistent westward orientation predominates, as seen in sites such as Jiahu, Jiangzhai, Longgangsi, Xipo, and Qingliangsi. However, exceptions exist, such as Taosi, which primarily faces east, and Dahecun, which exhibits a four-directional orientation pattern. In contrast, the Lower Yellow River region shows a clear preference for eastward orientations, exemplified by Dawenkou and Wangyin. The Upper Yellow River region presents the most complex pattern, with Liuwan displaying a divergent orientation and Yangshan adopting a four-directional orientation.

In the Yangzi River Basin, the middle reaches exhibit a divergent orientation pattern, while the lower reaches predominantly face east, as seen in Longqiuzhuang, Xuejiagang, and Yuchisi. Lingjiatan, however, stands out with a north-south orientation. In the southern region, the single site of Shixia also aligns eastward. Similarly, in Tibet, the Qugong site follows an eastward orientation.

| | East | West | Divergent | Four directions | North-South |
|---|---|---|---|---|---|
| UYellow | | | Liuwan | Yangshan | |
| MYellow | Taosi | Jiahu, Jiangzhai, Longgangsi, Xipo, Qingliangsi | | Dahecun | |
| LYellow | Dawenkou, Wangyin, | | | | |
| MYangzi | | | Chengtoushan | | |
| LYangzi | Longqiuzhuang Xuejiagang, Yuchisi | | | | Lingjiatan |

| | | | | | |
|---|---|---|---|---|---|
| South | Shixia | | | | |
| Tibet | Qugong | | | | |

**Table 6.1, the distribution of burial orientations at 18 sites in 7 regions.**

Geographically, the LYellow River, LYangzi River, southern region, and Tibet all share a preference for eastward orientations. The MYellow River is unique in its westward orientation, while the UYellow River and MYangzi River exhibit more varied and seemingly random patterns. Although some regions are geographically proximate, their burial orientation patterns differ significantly. For instance, Tibet's high mountainous terrain likely limited cultural exchange, yet its eastward orientation aligns with distant regions like the LYangzi River. Why, then, does Tibet share this preference despite its isolation? Similarly, why do the MYellow River sites of Taosi and Dahecun deviate from the regional norm? Furthermore, what connections, if any, exist between Dawenkou in the MYellow River, Chengtoushan in the MYangzi River, and Yangshan in the UYellow River?

**Cultural correlation**

Burial orientations can also be analysed through a cultural lens, as outlined in Table 5.1 (Chapter 5). The 18 sites are associated with various cultures, including the Yangshao culture (with variants such as Banpo, Shijia, and Miaodigou), the Longshan culture, the Dawenkou culture, the Majiayao period (including Banshan and Machang variants), the Qijia culture, the Daxi culture, the Qujialing culture, the Shijiahe culture, the Longqiuzhuang culture, the Shixia culture, and the Qugong culture. Additionally, some sites are linked to cultural variants, such as the Jiahu, Taosi, Zaoshi, Lingjiatan, and Xuejiagang variants.

As shown in Table 6.2, the Yangshao culture predominantly exhibits a westward orientation, with sites like Jiangzhai, Longgangsi, Xipo, and Qingliangsi adhering to this pattern. However, Dahecun remains an exception. In contrast, the Dawenkou culture consistently aligns burials eastward, as seen in Dawenkou, Wangyin, and Yuchisi. The Majiayao culture displays the most variability, with Liuwan and Yangshan—both containing the Banshan phase—showing divergent and four-directional orientations, respectively, suggesting that cultural affiliation may not have dictated orientation choices in this case. The Qijia culture appears to inherit its orientation preferences from the Majiayao culture, as evidenced by the continuity at Liuwan. Similarly, the Longshan culture maintains orientation patterns from earlier cultures at Dahecun, Qingliangsi, and Yuchisi, indicating that burial orientations in this culture may have been influenced by regional precedents rather than a unified cultural directive.

While the Daxi, Qujialing, and Shijiahe cultures exhibit divergent orientation patterns, the limited evidence from Chengtoushan makes it difficult to draw definitive conclusions. The Shixia, Qugong, Jiahu variant, Taosi variant, Longqiuzhuang culture, and Xuejiagang variant all display eastward orientations, though each is represented by only a single site. Finally, the Zaoshi and Lingjiatan variants show northwest and north-south orientations, respectively.

| | East | West | Divergent | Four directions | North-South |
|---|---|---|---|---|---|
| The Jiahu variant | | Jiahu | | | |
| The Yangshao culture | | Jiangzhai, Longgangsi, Xipo, Qingliangsi | | Dahecun | |
| The Daxi culture | | | Chengtoushan | | |
| The Longqiuzhuang variant | Longqiuzhuang | | | | |
| The Dawenkou culture | Dawenkou, Wangyin, Yuchisi | | | | |
| The Qujialing culture | | | Chengtoushan | | |
| The Longshan culture | Yuchisi | Qingliangsi | | Dahecun | |

| | | | | | |
|---|---|---|---|---|---|
| The Shixia culture | Shixia | | | | |
| The Lingjiatan variant | | | | | Lingjiatan |
| The Xuejiagang variant | Xuejiagang | | | | |
| The Majiayao culture | | | Liuwan | Yangshan | |
| The Taosi variant | Taosi | | | | |
| The Zaoshi variant | | Qingliangsi | | | |
| The Qijia culture | | | Liuwan | | |
| The Shijiahe culture | | | Chengtoushan | | |
| The Qugong culture | Qugong | | | | |

**Table 6.2, The distribution of burial orientations at 18 sites in different cultures and variants.**

Culturally, the Dawenkou, Shixia, Qugong, Jiahu variant, Taosi variant, Longqiuzhuang culture, and Xuejiagang variant share a clear preference for eastward orientations, particularly the Dawenkou culture. The Yangshao culture also demonstrates a concentrated westward orientation, with the exception of Dahecun. The Daxi, Qujialing, and Shijiahe cultures exhibit patterns similar to the Majiayao culture, though these similarities may stem from different underlying reasons rather than shared cultural influences.

**Chronological relations**

Finally, the distribution of burial orientations may also be linked to chronological developments. For instance, certain periods exhibit more consistent orientation patterns. As outlined in previous chapters, the Neolithic period in China has been divided into three phases for this study:

early, middle, and late. As shown in Table 6.3, Jiahu is the only site dated to the early Neolithic period, and it displays a westward burial orientation. During the middle Neolithic period, sites such as Jiangzhai and Longgangsi continue the westward orientation, while Dawenkou, Wangyin, and Longqiuzhuang adopt an eastward orientation. However, Chengtoushan introduces a divergent orientation pattern during this period.

By the late Neolithic period, the situation becomes more complex, with a variety of orientation patterns emerging. The eastward orientation remains dominant, as seen at Taosi, Xuejiagang, Yuchisi, Shixia, and Qugong. Meanwhile, Xipo and Qingliangsi maintain the westward orientation. Sites like Liuwan and Chengtoushan exhibit divergent patterns, while Dahecun and Yangshan show four-directional orientations. Additionally, Lingjiatan stands out with a distinct north-south orientation.

A clear trend emerges from this data: westward orientations were predominant in the early Neolithic period. By the middle period, eastward orientations became more common, though other patterns began to appear. In the late period, while eastward orientations remained dominant, the diversity of burial orientations increased significantly. Notably, although westward orientations declined in prevalence, they never disappeared entirely, persisting from the early to the late Neolithic period.

| | East | West | Divergent | Four directions | North-South |
|---|---|---|---|---|---|
| Early Neolithic | | Jiahu | | | |
| Middle Neolithic | Longqiuzhuang, Dawenkou, Wangyin | Jiangzhai, Longgangsi | Chengtoushan | | |
| Late Neolithic | Taosi, Xuejiagang, Yuchisi, Shixia, Qugong | Xipo, Qingliangsi | Chengtoushan, Liuwan | Dahecun, Yangshan | Lingjiatan |

**Table 6.3, The distribution of burial orientations at 18 sites in different periods.**

**Summary of the shared patterns and differences in regions, cultures and chronology**

The regional, cultural, and chronological analyses reveal distinct orientation preferences and trends, indicating that none of these factors can be entirely dismissed. When considered together, several patterns emerge. The Yangshao culture in the Middle Yellow River region demonstrates a strong and consistent preference for westward burial orientations, a tradition that persisted from the middle to the late Neolithic period, possibly influenced by the earlier Jiahu variant in the same region. However, this tradition does not appear to have significantly influenced neighboring regions. For example, the Dawenkou culture in the LYellow River exhibits a more uniform eastward orientation, while the Daxi culture in the MYangzi River displays a divergent orientation pattern that persisted into the late Neolithic period.

Other regions also show increasing diversity in burial orientations during the late Neolithic. The Longshan culture, spanning the Middle and Lower Yellow River as well as the Lower Yangzi River, inherited orientation patterns from preceding cultures at each site. The Majiayao culture in the UYellow River exhibits orientation patterns similar to those in the MYangzi River, though the Yangshan site introduces a four-directional orientation, suggesting that some sites made independent choices rather than adhering to regional or cultural norms. The relationship between these sites, such as whether the four-directional patterns at Dahecun, Yangshan, and Chengtoushan are connected, warrants further exploration.

From the south to the east of China, the Shixia culture, Xuejiagang variant, Longqiuzhuang culture, and Dawenkou variant consistently exhibit eastward orientations. This raises questions about potential cultural exchanges and influences between these groups. For instance, why do the Taosi variant in the MYellow River, the Shixia culture in the south, and the Qugong culture in Tibet share similar eastward orientations despite their geographical distance? Conversely, why does the Lingjiatan variant, located in the same region and chronological range as the Xuejiagang and Longqiuzhuang cultures, adopt a north-south orientation? Could this reflect social factors such as gender, age, or social status? Or might it be tied to the local landscape or beliefs stemming from specific celestial events?

### 6.2.3. Is social identity involved in grave orientation? (gender, age, social status)

Mortuary practices exhibit a highly varied and complex structure. It is possible that different cultures—and even cultural variants—underwent shifts in burial orientation and the factors influencing them due to variations in subsistence practices, gender roles, age distinctions, and social hierarchies. These elements may have contributed to differences in funerary orientations and their underlying determinants. As Binford (1971) cautioned, it is inherently biased to propose hypotheses or interpretations of such data without thorough analysis. Therefore, after examining burial orientation distributions from regional, cultural, and chronological perspectives, it is essential to explore the social dimensions that may have influenced these practices. Since humans are inherently social beings, burial orientations may have been shaped by common social factors such as gender, age, and social status.

The excavation reports from the 18 sites under study provide preliminary data on the sex and approximate age of the human skeletons. However, these data are rarely refined or systematically classified, and even fewer analyses integrate gender, age, occupation, and social status. This lack of detailed analysis makes it challenging to identify patterns or preferences in burial orientations across sites based on gender, age groups, or social status. For this study, we will rely on the descriptions of gender and age groups provided in Chapter 4 for each site.

In the MYellow River region, preliminary studies have identified the sex and approximate age of human skeletons at all sites, offering totals for different age groups and sexes. Graves at Jiahu, Xipo, and Taosi have been classified by social status based on grave size and burial goods. However, there is no detailed analysis of the sex and age of individuals within different social classes. Among these sites, Xipo and Qingliangsi provide clearer data on age, sex, and social status classifications, offering some insights into the relationship between gender, age, social status, and burial orientation.

At the Xipo cemetery, males outnumber females by more than twofold. Statistical analysis of true azimuth and declination reveals that male burials are concentrated between 260.2° and

298.3°, while female burials are more concentrated between 262.1° and 293.7°. The orientation ranges for both sexes are nearly identical to the overall range observed at the Xipo cemetery, indicating no particular directional preference based on gender. Similarly, at Qingliangsi (Phase 2), the SPD (Statistical Probability Distribution) results show a pattern akin to Xipo. Individuals aged 40 to 49 dominate the burial population, with no individuals in the 20 to 29 age group. The true azimuth results are categorized into four age groups: 270.9°–290.6° for the 10–19 age group; 260.2°–273.8° and 285.3°–297.6° for the 30–39 age group; 260.8°–297.1° for the 40–49 age group; and 271.4°–290.7° for the unknown age group. Notably, the distribution of orientations is relatively even across age groups, with no significant concentration in any particular direction. At Qingliangsi, the SPD results again mirror the pattern observed at Xipo.

At Xipo, the excavators classified burials into four levels based on grave size as the primary indicator of social status, supplemented by the quantity and type of burial goods. The SPD of true azimuth for the highest-status burials ranges from 281.4° to 298.7°, while levels 2 and 3 range from 267.8° to 295.9° and 264.3° to 295.5°, respectively. This suggests that higher-status burials may trend slightly more northwest, though this could also reflect the smaller sample size of high-status graves compared to the larger number of lower-status burials, which exhibit a wider orientation range. Unfortunately, the Qingliangsi excavation report lacks detailed social status data, making direct comparisons with Xipo difficult.

Overall, neither gender, age, nor social status appears to have significantly influenced burial orientation decisions at these sites, at least within the context of the Yangshao culture in the MYellow River region. However, this conclusion is based on limited data, and future studies may yield more refined insights if burial information from additional sites is systematically classified by age and social status. Such analyses could help clarify whether these factors played a more nuanced role in determining burial orientations.

## 6.3 Landscape

People achieves harmony with nature and  cultivate a sense of reverence through the process of adaptation, interaction and creation of the earth's landscape. This enduring sense of awe and worship lies at the heart of the religious impulse (Salisbury, 2015, p. 20). Prehistoric inhabitants sought to bridge the two realms they inhabited—the earthly and the spiritual. It was this profound yearning that led them to turn their attention to mountains, caves, rocks, water, trees, and other natural elements in their quest for divinity (Salisbury, 2015, p. 30). Over time, they began to erect standing stones and construct henges, transitioning from the veneration of timeless natural formations to the worship of human-made landscapes (Bradley, 2000). Across the globe, local prehistoric communities embedded their ideals and beliefs into the landscape, constructing their own cosmologies. For example, Mount Olympus was revered as the dwelling place of the Greek gods, while Mount Everest was regarded as the center of the world and the abode of one of the five sister goddesses worshipped by the Sherpa people.

The landscape profoundly shaped the consciousness of prehistoric peoples. However, it is important to recognize that while different communities may have shared similar beliefs about certain landscape features, their interpretations of these beliefs were not necessarily identical. These subtle differences in perception may have been reflected in their daily practices and activities, such as burial customs, artifact production, and artistic expression. In this section, we will explore whether specific types of landscapes, as defined by the orientation ranges of burials, played a role in the spiritual world of Neolithic inhabitants. Drawing on archaeological evidence and local ethnographic studies (Section 6.5), we will investigate whether these landscapes were deliberately chosen as focal points for burial orientations. This analysis will shed light on the extent to which the natural and constructed environment influenced the spiritual and ritual practices of Neolithic communities.

### 6.3.1 Whether the grave orientation relate to the surrounding rivers or mountains, plains?

Based on the results in Chapter 5, the types of landscapes toward which the burials are directed are categorized in Table 6.4 as the most significant mountain, areas between mountains, plains, and the most significant river. It is worth noting that changes to river courses since the Neolithic period can no longer be precisely reconstructed. The final category includes sites whose burial orientations cannot be clearly linked to specific landscapes, such as Yangshan, Liuwan, Dahecun, and Chengtoushan. At these sites, burials are either oriented in the four cardinal directions or are so dispersed that their relationship to the surrounding landscape is difficult to determine.

| | the most significant river | the most significant mountain | Between mountains | plain | N/A |
|---|---|---|---|---|---|
| Lower Yellow River | | | Dawenkou | Wangyin | |
| Lower Yangzi River | | | | Longqiuzhuang, Xuejiagang, Yuchisi, Lingjiatan | |
| South | | | Shixia | | |
| Middle Yangzi River | | | | | Chengtoushan |
| Middle Yellow River | Jiangzhai, Xipo, Qingliangsi | Longgangsi, Taosi | Jiahu, Jiangzhai, Xipo, Qingliangsi | | Dahecun |
| Upper Yellow River | | | | | Yangshan, Liuwan |
| Tibet | | Qugong | | | |

**Table 6.4, the relationship between different type of landscape and sites in seven regions.**

After excluding the four sites that cannot be classified as facing specific landscapes, the remaining fourteen sites reveal distinct patterns. In the LYellow River and LYangzi River regions, graves predominantly face plains, with the exception of Dawenkou, where burials are associated with the foot of a mountain, and Lingjiatan, where the exact orientation of the graves is ambiguous. If the burials at Lingjiatan primarily face north, they would align with the most significant mountain; if they face south, they would align with the plain. However, based on the excavators' analysis of artifact placement within the graves, it is more likely that they were oriented to the south. A closer examination of the panoramic views in Chapter 5 reveals that the landscapes around these sites are dominated by extensive plains. This suggests that if the plains were a determining factor in burial orientation, there would have been no necessity to specifically choose a southern orientation. Therefore, while the plains may have played a role, their influence was likely coincidental, and other factors may have been at play.

Sites such as Dawenkou, Shixia, Jiahu, Jiangzhai, Xipo, and Qingliangsi are oriented toward areas between or near the foot of mountains. Specifically, with the exception of Jiahu, these sites in the Middle Yellow River region are situated in the Jin-Shaan Basin and are closely associated with the Wei River, which flows from west to east and falls within their burial orientation ranges. However, the Dawen River diverges in multiple directions at Dawenkou, and no significant rivers are present near Shixia. Although the burials at Dawenkou point toward the highest and most prominent mountain, other mountains are also present in the vicinity. Similarly, at Shixia, the burials not only face east but also offer views of nearby and distant mountains to the southwest. This suggests that mountains were not the sole factor influencing burial orientation. The direction itself may have held significance, or the alignment with mountains may have been coincidental. Beyond geomorphological factors, other reasons may have influenced the choice of orientation, leading to east-facing burials at Shixia and Dawenkou and west-facing burials at Jiahu, Jiangzhai, Xipo, and Qingliangsi. These choices may have varied depending on geographical and cultural contexts.

Finally, the Qugong site in Tibet, like Longgangsi and Taosi in the Middle Yellow River region, is clearly oriented toward nearby mountains, with no significant rivers passing through or near these sites. While burials in different regions may face similar types of landscapes, the motivations behind these orientations may differ. For example, Tibet is a plateau region entirely surrounded by mountains, making it statistically more likely for burials to face mountainous landscapes. In such an environment, it is natural for inhabitants to develop a worldview centered on mountains. Historically, mountains like the Meili Snow Mountain (revered by Tibetans as the God of the Snowy Mountains), Mount Kailash (a sacred peak in Buddhism), and Benzai Mountain (a sacred site in Bon, the indigenous religion of Tibet) have held profound spiritual significance. In contrast, the choice of orientation at Taosi may have been more deliberate. The Middle Yellow River region features a more complex geography, offering a wider range of potential orientation targets. Although both Taosi and Qugong feature east-facing burials, the worldview of the Taosi people was likely more intricate than that of the Qugong people. This suggests that a more detailed, localized analysis is necessary to fully understand these patterns.

### 6.3.2 How do topographic features influence grave orientation at different elevations?

To delve deeply into the cosmologies of Neolithic peoples across different regions, this analysis explores the relationship between burial orientation preferences and the topographic features of each area. In China, the topography descends in a step-like manner from the west (e.g., the Tibetan Plateau) to the east (e.g., the North China Plain). This gradient is also reflected in the upper, middle, and lower reaches of the Yangzi and Yellow Rivers, which are divided into three elevation zones—high, middle, and low—as outlined in Chapter 3. However, precise elevation data for each site are unavailable, so they are classified broadly into these three categories.

| Altitude level | Site | chronology | Significant true azimuth range | Significant declination range |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| High altitude-Tibet | Qugong | 1700 -1500BC | 358.3°-16.9°<br>28.9°-51.6°<br>78.7°-82.2° | 69.65°- 90°<br>36.48°- 50.22° |
| High altitude-UYellow River | Liuwan | 2655-2270BC | 332.9°-26.4° | 47.43°- 90° |
| | | 2270-1885BC | 261.9°- 294.2° | -5.39°- 19.31° |
| | | 1885-1500BC | 345°- 91.4° | 4.6°-90° |
| | Yangshan | 2655-2330BC. | 326.8°- 17.4°<br>78.2°- 86.4° | 57.2°- 90° |
| | | | | |
| Middle altitude-MYellow River | Jiahu | 7000-6500BC | 233.5-278.4 | -27.13°-3.5° |
| | | 6500-5500BC | 241.3°-284° | -18.06°-8.28° |
| | Jiangzhai | 5000-4300BC | 232.8°-292° | -25.97°-13.44° |
| | | 4300 -4000BC | 245.9°-280.5° | -15.86°-6.82° |
| | Longgangsi | 4500-4000BC | 287.4°- 338.2° | 19.8°-51.8° |
| | Dahecun | 2700-2400BC | 55.7°-97.4°<br>170°-201.2° | -61.9°--51.12°<br>2.39°-24.11° |
| | | 2400-2100BC | 52.9°-113.3°<br>178°-186.1°<br>279.4°-282.1° | -62.52°--55.22°<br>-17.51°-21.65° |
| | Xipo | 3300-2900BC | 259.91°-298.02° | -4.43°-22.73° |
| | Taosi | 2300-1900BC | 88.8°-154.6° | -45.29°--7.11° |
| | Qingliangsi | 4050-3770BC | 5.3°- 5.7°<br>30.1°-30.6°<br>309.3°-340.9° | 32.03°-39.65°<br>41.41°-49.18° |
| | | 2280-1780BC | 252.6°-292.4° | -13.16°- 13.83° |
| | | 2430-1700BC | 248.8°- 289.8° | -13.2°- 14.4° |
| | | 2040-1700BC | 251.4°- 274.1° | -11.65°- 5.99° |
| Middle altitude-MYangzi River | Chengtoushan | 4200-3200BC | 57.2°- 90° | -20.58°- 18.11° |
| | | 3200-2500BC | 346.4°- 11.8°<br>67°- 113.3° | 57.61°- 66.93°<br>-16.3°- 18.05° |
| | | 2500-2300BC | 351.3°- 10.6° | 58.12°- 66.92° |
| | | | | |
| Low altitude-LYellow River | Longqiuzhuang | 5000-3500BC | 55.2°- 94.2° | -1.7°- 26.21° |
| | Dawenkou | 4150-3700BC | 63°- 113.8° | -14.2°- 19.56° |
| | Wangyin | 4300-3500BC | 66.2°-110.6° | -13.91°-16.84° |
| Low altitude- | Lingjiatan | 3600-3300BC | S-N, W-E | N/A |

| | | | | |
|---|---|---|---|---|
| LYangzi River | | | | |
| | Xuejiagang | 3500-2600BC | NE-SW, N-S | N/A |
| | Yuchisi | 2800-2700BC | 97.6°- 142.5° | -39.63°- 10.14° |
| | | 2700-2600BC | 98.7°- 138.2°<br>212.1°- 215.1° | -38.86°- -10.81° |
| Low altitude-south region | Shixia | 3500-2000BC | 78.7°- 105° | -10.14°- 11.79° |

**Table 6.5, sites in different levels of altitude.**

Using the tables of significant true azimuth and declination for each site from Chapter 5, this analysis examines the patterns of burial orientation across different altitude zones. The UYellow River and Tibet, characterized by high latitudes and altitudes, are regions where life is dominated by layers of mountains that seem endless. The three sites in these regions—Qugong, Liuwan, and Yangshan—are situated at the foot or midway up mountains, offering views of distant peaks, nearby slopes, and the paths between them. At Qugong, burials are located on lower slopes and face toward the mountain summits. Liuwan exhibits a scattered orientation, though the nearest mountain range remains within the burial orientation range. Yangshan, however, presents a unique case, possibly influenced by conceptual directions rather than physical landscapes. Thus, within this high-altitude zone, burial orientations may not be tied to celestial events but rather to the significant mountains surrounding the sites, though this is not an absolute rule.

Highland barley cultivation emerged during the late Qugong period, while millet farming was a staple in the Majiayao period at Liuwan and Yangshan. However, the availability of pasture resources, determined by temperature, rainfall, and natural conditions, was likely more critical to their livelihoods than agricultural practices. Consequently, celestial phenomena may not have played a prominent role in the beliefs of high-altitude communities, overshadowed instead by the worship of sacred mountains. Ethnographic evidence supports this, as groups like the Tibetans and Naxi have long revered majestic mountains as sacred, viewing them as the centre of the universe, the axis dividing heaven and earth, a ladder to the heavens, and a portal to the afterlife (Bai, 1996; Yang Fuquan, 2005). Over time, anthropomorphic representations of mountain deities and related myths further enriched these cosmologies (Xie, 1988; Yang Fuquan, 2005; Li Yuqin, 2013). Even today, annual rituals honoring sacred mountains persist at regional, village, and individual levels, reinforcing communal beliefs and moral frameworks while strengthening social bonds (Li Yuqin, 2013; Nan, 2013; Wang Xiao, 2017). This suggests that in Tibet, mountain worship may have held greater significance than celestial observations. This is further supported by the eight burials at Qugong, which face northeast toward the Selawuqi Mountains, as noted in Chapter 4.

The MYellow River and MYangzi River regions, both mid-altitude zones, exhibit considerable topographic diversity due to their latitudes. In the Jin-Shaan Basin, similar landscapes may have influenced the burial orientations at Jiangzhai, Xipo, and Qingliangsi, resulting in comparable orientation ranges. However, other sites, such as Longgangsi and Dahecun, present different patterns. Dahecun, in particular, is surrounded primarily by plains rather than prominent landscapes, suggesting that its burial orientations may reflect conceptual rather than visual influences. In the MYangzi River, the Chengtoushan site lies amidst plains and mountains, with the Li River and Wuling Mountains serving as potential visual focal points. Yet, only a few burials align with these features, and some exhibit orientations similar to those at Dahecun and Yangshan, indicating that landscape may not have been a decisive factor in burial orientation decisions.

In the LYellow River region, the topography lacks the continuous mountain ranges found further upstream, making it visually challenging to identify a focal point on the undulating plains. Nevertheless, small, isolated mountain ranges and less concentrated river systems are present. Despite this, burials in this region display a remarkable uniformity in eastward orientation, suggesting that factors other than topography—such as cultural or celestial influences—may have been primary drivers, with topography playing a secondary role.

In the LYangzi River basin, the Dabie Mountains near Xuejiagang and the Taihu Mountains north of Lingjiatan (as mentioned in Chapter 5) introduce a more diverse landscape. However, burial orientations at these sites appear to disregard these prominent features, whether mountains or rivers. Similarly, Yuchisi and Longqiuzhuang, located closer to the North China Plain, do not exhibit consistent orientations. In short, while sites in the Yangzi River basin display distinct burial orientation preferences, landscape features do not seem to have been a decisive factor.

In Guangdong Province, the Shixia site lies at the foot of mountains to the northwest of Shitou and Shiwei, offering a somewhat restricted view. Burials here are oriented partly toward the foot of a smaller mountain and partly toward a distant mountain range. Whether the focus was on the nearer mountain, the distant range, or a conceptual eastward direction remains unclear and warrants further analysis, though information on Shixia culture burials is currently limited.

Overall, topography appears to be a subtle yet influential factor. In the Middle Yellow River, the uniformity of burial orientations among some Yangshao sites suggests a shared focus on a single target, possibly influenced by the region's prominent landscapes. In the Lower Yellow River, where mountains and rivers are less visually dominant, celestial phenomena or cultural traditions may have provided a unifying focus for burial orientations, as seen in the Dawenkou culture. In the Middle and Lower Yangzi River regions, despite the presence of notable landscapes, burial orientations often ignore these features, reflecting a lack of cultural uniformity compared to the Yellow River basin. Instead, each site exhibits its own distinctive orientation patterns, indicating diverse underlying factors.

In the Upper Yellow River, Tibet, and the southern regions, mountain ranges appear to be potential focal points for burial orientations, though other possibilities cannot be ruled out, necessitating further investigation. While topography may not have directly dictated burial orientations, it likely played an irreplaceable role in shaping local ideologies and cosmologies, indirectly influencing these practices. For instance, in the Upper Yellow River, mountains dominate daily life and spiritual beliefs, whereas in the lower reaches, water may hold greater significance. These differing environmental focuses could lead to distinct decision-making processes and cultural practices (Bai and Zhang, 2001). In other words, the natural environment shapes economic lifestyles, and varying conditions give rise to diverse cultural traditions and practices. Finally, it is essential to consider the skyscape alongside terrestrial landscapes, as celestial phenomena may have held equal or greater importance in shaping Neolithic cosmologies.

## 6.4 Skyscape

### 6.4.1 Most important celestial phenomena by region and site

As in the discussion of landscape in relation to the orientation of burials, the specific orientation types of Chengtoushan, Yangshan and Liuwan will be treated separately. The rest 15 sites are listed on the basis of table 6.4, based on the results in chapter 5 and the appendix 6 and 7, most possible celestial targets of each site will be listed as well. These targets are sunrise and sunset, the most notable star representing each of the four animal signs, and the Milky Way when perpendicular to the horizon.

Although calculations in skyscapeR yielded a list of potential targets that appear in the significant declination range at each site, actual observation may present a slightly different situation, as the list refers only to the declination and not to the possible choice of observation times in the Neolithic. For this reason, stars that appear on the horizon within the significant true azimuth ranges within the hour and a half before sunrise or after sunset, as simulated by Stellarium in chapter 5, are also noted in the table. In chapter 5, the days assumed to be exceptional are the equinoxes and solstices. Therefore, if, for example, Alphard can be observed on the eastern horizon before sunrise on SS within the burial orientation range, Antares appears before sunrise on AE, and both stars are listed as potential celestial targets, these are within the remit of this study. Conversely, if Enif is listed as a potential astronomical target, but does not appear within the relevant window on a specific o'clock and day, as above, it will not be discussed.

| | Landscape | | | | Celestial targets | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Regions** | the most significant river | the most significant mountain | Between mountains | plain | Sunset (includes equinoxes) | Sunrise (includes equinoxes) | Antares | Enif | Rigel | Alphard | The Milky Way (vertically) |
| **LYellow River** | | | Dawenkou | Wangyin | | Dawenkou<br>Wangyin | Dawenkou<br>(AE dawn)<br>Wangyin<br>(AE dawn) | Dawenkou<br>Longqiuzhuang<br>Wangyin | | Dawenkou<br>(SS dawn)<br>Wangyin | Dawenkou (SS nightfall, AE nightfall)<br>Wangyin (SE dawn, AE nightfall) |
| **LYangzi River** | | | | Longqiuhuang<br>Xuejiagang<br>Yuchisi<br>Lingjiatan(?) | | Longqiuzhuang | Longqiuzhuang<br>(AE dawn) | | Yuchisi | Longqiuzhuang<br>(SS dawn) | Longqiuzhuang (SE dawn, SS nightfall) |
| **South** | | | Shixia | | | Shixia | Shixia | Shixia | | Shixia | |
| **MYangzi River** | | | | | | | | | | | |
| **MYellow River** | Jiangzhai<br>Xipo<br>Qingliangsi(?) | Longgangsi<br>Taosi | Jiahu<br>Jiangzhai<br>Xipo<br>Qingliangsi | | Jiahu<br>Jiangzhai<br>Xipo<br>Qingliangsi | Taosi | Jiangzhai<br>Xipo<br>(SE dawn)<br>Taosi<br>(SE nightfall)<br>Qingliangsi<br>(SE dawn) | Jiahu<br>Jiangzhai<br>Xipo<br>(SS dawn)<br>Qingliangsi | Taosi | Jiahu<br>(SE nightfall)<br>Jiangzhai<br>Xipo<br>Qingliangsi | Jiahu (SS nightfall)<br>Jiangzhai (SS nightfall)<br>Xipo (SS dawn)<br>Taosi (WS nightfall)<br>Qingliangsi (SS dawn) |
| **UYellow River** | | | | | | | | | | | |
| **Tibet** | | Qugong | | | | | | | | | |

**Table 6.6, the landscape and possible celestial events that can be seen in the range of burial orientation each site.**

Based to Table 6.6, this can be summarised as follows: the burials in the Yangzi River basin do not point to a particular celestial event, within sunset, sunrise, the four stars representing the animal signs and even the Milky Way failing to appear in the burial orientation ranges at an appropriate observing time, except in the case of Longqiuzhuang. This does not mean, however, that the Neolithic people of the LYangzi River ignored or drew nothing from the sky, because the landscape along the LYangzi River is mostly plains, which are well suited to observing varied celestial phenomena at night without any visual obstructions. The cultures of the Yangzi River basin may have taken such phenomena into account in their cosmology, but reflected them in other context, such as burial objects. The choice of celestial phenomena reflected may also have been different, resulting in a different form of manifestation than that seen in the Yellow River basin. Alternatively, the people of the Yangzi River basin may have considered astronomical phenomena more important to the earthly life of the living than the people of the Yellow River basin. The situation may also be related to the different subsistence activities and even the different climates of the Yangzi and Yellow River basins.

The burial orientation ranges on the LYellow River encompass one or more astronomical phenomena, notably including the sunrise, Antares at AE dawn, Alphard at SS dawn and the Milky Way at SE dawn, SS nightfall and AE nightfall. Enif, as it is situated near the ecliptic and celestial equator, like Antares and Alphard, may be included in the two burial orientation ranges, but it does not lie centrally within these ranges, making the Milky Way a less likely target than the others. In seasonal order, sunrise on the equinox and the Milky Way's appearabce after sunset would occur first, then Alphard before sunrise on SS and the Milky Way after sunset, and finally Antares before sunrise on AE. It is difficult to surmise purely from the number of occurrences of each celestial event what was likely the most important target for the Neolithic people when burying their dead. It could have been a single one, such as the sunrise, Antares or the Milky Way, or it could have been all of the celestial events occurring in this direction that were observed and remembered by the inhabitants.

The celestial targets pointed to by the burials at Jiahu, Jiangzhai, Xipo and Qingliangsi on the MYellow River are very similar to those on the LYellow River, but with slightly different timings, including sunset on the equinoxes, Antares on SE and the Milky Way on SS. Enif and Alphard are also included within the burial orientation range, but they only appear in suitable viewing positions at Xipo and Jiahu respectively, and so are relatively unlikely to have been noticed. By season, the first to appear would be Antares and sunset on SE, then the Milky Way on SS, and finally sunset on AE. Although the Taosi graves follow the opposite orientation, the celestial events to which they point are almost identical, with the opposite timing. This suggests that sunrise, sunset, Antares and the Milky Way were all focuses of attention in the Yellow River region. That focus, however, was mediated through different orientations at different points in time, so the focus in terms of belief may also have been different.

The orientation of burials in the south is also likely to have been specific to astronomical phenomena. Sunrise, Antares, Enif and Alphard all occur in the declination range but did not move above the horizon within the timeframe mentioned earlier, possibly because of a difference in how they are observed. The targets to which burials in the south point may be coincidentally similar to those in the MYellow River basin, but interpreted differently.

Sunrise, sunset and the Milky Way are the astronomical phenomena that appear most frequently on the middle and lower Yellow River. They are more striking presences and occupy more of the burial orientation range in terms of volume than a single star. Of the individual stars, Antares receives the most attention, followed by Alphard, then Enif and, to a lesser extent, Rigel.

The concentration of burials orientated to the west or east can be interpreted in two ways. One is that they were intended to direct the attention of the living to the celestial phenomena that appear in this direction; the other is that the local inhabitants wished to go in this direction after death because the celestial phenomena had given them indications by which to live. Why are the seasons important? Is this related to the inhabitants' means of survival and the farming economy? Understanding the way of life of the Dawenkou and Longshan cultures may allow us to decipher whether the target of their beliefs was a single or multiple celestial sign(s), the direction itself or a fused concept, with multiple celestial signs appearing in this direction.

### 6.4.2 The effect of topography and climate on observation habits and subsistence activity

At different longitudes and latitudes, one observes celestial events differently. On a given day, people at Dawenkou would see Antares fall below the western horizon slightly later than people at Shixia. The further north we go, the more the celestial equator we see tilts to the south. People at Xuejiagang would see the Sun rise an hour and a half before people at Qugong. The climate is also subject to various changes influenced by areas' unique topography, which gives rise not only to the development of different ways of life, such as farming or nomadism, but also to different habits of sky observation. Even if people live under the same sky, the differences in what they see and think will naturally lead to different views of the universe.

The 'subsistence' section of table 6.7 lists the main forms of subsistence at each site: at Jiahu, for instance, the inhabitants cultivated primitive rice. Farming yields, however, were small, and communities relied mainly on fishing and gathering. In addition, livestock rearing took place from the Early Neolithic period, but it was insufficient to serve as a major source of subsistence, and domesticated livestock were fed on the by-products of millet or rice cultivation and household scraps (Zhao and Pan, 2016). This by-product itself has little to do with climate, seasons and celestial phenomena and is therefore not noted in the list.

| | **Celestial targets** | | | | | | | Subsistence | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Regions** | Sunset (includes equinoxes) | Sunrise (includes equinoxes) | Antares of the Dragon | Enif of the Tortoise | Rigel of the Tiger | Alphard of the Phoenix | The Milky Way (vertically) | Nomadism | Agriculture (Millet as the main) | Agriculture (Rice as the main) | Fishing-hunting-gathering |
| **LYellow River** | | Dawenkou<br>Wangyin | **Dawenkou**<br>(AE dawn)<br>**Wangyin**<br>(AE dawn) | Dawenkou<br>Wangyin | | **Dawenkou**<br>(SS dawn) | Dawenkou(SS nightfall, AE nightfall) | | Dawenkou | Wangyin | Wangyin<br>Dawenkou |
| **LYangzi River** | | Longqiuzhuang | **Longqiuzhuang**<br>(AE dawn) | Longqiuzhuang | Yuchisi | **Longqiuzhuang**<br>(SS dawn)<br>Wangyin | Longqiuzhuang(SE dawn, SS nightfall)<br>Wangyin(SE dawn, AE nightfall) | | Yuchisi | Longqiuzhuang<br>Yuchisi<br>Lingjiatan<br>Xuejiagang | Longqiuzhuang<br>Yuchisi<br>Lingjiatan<br>Xuejiagang |
| **South** | | Shixia | Shixia | Shixia | | Shixia | | | | | Shixia |
| **MYangzi River** | | | | | | | | | | Chengtoushan | Chengtoushan |
| **MYellow River** | Jiahu<br>Jiangzhai<br>Xipo<br>Qingliangsi | Taosi | Jiangzhai<br>**Xipo**<br>(SE dawn)<br>**Taosi**<br>(SE nightfall)<br>**Qingliangsi**<br>(SE dawn) | Jiahu<br>Jiangzhai<br>**Xipo**<br>(SS dawn)<br>Qingliangsi | Taosi | **Jiahu**<br>(SE nightfall)<br>Jiangzhai<br>Xipo<br>Qingliangsi | Jiahu(SS nightfall)<br>Jiangzhai(SS nightfall)<br>Xipo(SS dawn)<br>Taosi(WS nightfall)<br>Qingliangsi(SS dawn) | | Jiangzhai<br>Longgangsi<br>Xipo<br>Qingliangsi<br>Taosi<br>Dahecun | Dahecun(? | Jiahu |
| **UYellow River** | | | | | | | | Liuwan-Qijia period | Liuwan<br>Yangshao | | |
| **Tibet** | | | | | | | | Qugong | | | |

**Table 6.7, the possible celestial events that can be seen in the range of burial orientation and ways of subsistence of each site.**

### 6.4.2.1 Nomadism

According to recent records of highland barley sowing, the choice of the date of sowing is the most important in the process and is validated using several methods, one of which is measuring the angle between the Sun's rays and the earth's equatorial plane. The timing of the harvest was left to nature to decide (Chen, 2012). For Tibetans, therefore, who still rely on nomadic herding as their main source of income, it is perhaps more necessary to have high mountains with suitable pastures for grazing, as some mountains take two or three years to recover their resources. During this period of recovery, people would draw a line to close the mountain to villagers. This also serves as a dividing line between humans and the mountain gods to ensure that humanity and nature can live in peace for a long time (Yang Fuquan, 2005).

Differences exist in the relative perceived intensity of local climate change among farmers and herders at different altitudes. The perceived intensity of temperature change is higher among farmers and herders in high-altitude areas who are highly dependent on natural resources than among farmers on the lower reaches of the Yangzi and Yellow Rivers and tends to increase with altitude, while the perceived intensity of changes in rainfall and their impact on crops decreases with altitude, with people in lower-altitude areas such as the LYellow River, LYangzi River and south more sensitive to rainfall and likely to relate it to flooding (Li *et al*., 2014; Zhu *et al*., 2015; Mei *et al.*, 2019). Changes in temperature directly affect herders' arrangements and the development of livestock farming during the year. These herders' judgment of temperature changes is directly physical, and there is no mention of any celestial forecasts.

### 6.4.2.2 Millet-farming model

Yangshan and Liuwan belong to the Middle and Late Majiayao culture, where farming was expanded and the main crop grown was millet. Although not a complete replacement, this became an important means of supplementing diets in addition to the primitive hunting economy (dogs, pigs and sheep; Duan, 2012). While reminders of important dates for farming activities would have been more necessary for the Banshan- and Machang-phase inhabitants of these two sites, such aids to memory may not have been applicable for the Qijia-period inhabitants of Liuwan, who instead needed seasonal reminders appropriate for animal husbandry. The orientation of burials at both sites, however, is distinctive and does not point in any direction associated with the appearance of celestial targets in the corresponding season, nor towards a particular mountain range, as is the case with the Qugong culture. As analysed in the landscape section above, the burials at Liuwan mostly face north during the Banshan phase, but by the Machang phase and Qijia period, all directions appear to be subjects of focus, except the south. The precise orientation of the burials at Yangshan in each of the four cardinal directions suggests that the concept of the four directions was well established. It is thus possible to suggest that the beliefs behind the orientation of the burials had little to do with subsistence practices. Moreover, the Banshan-phase burials at various sites show completely different burial practices in terms of orientation. It is possible that from the beginning, beliefs within this culture were not entirely consistent.

In the Early Neolithic period, Jiahu remained dominated by fishing and gathering, while the primitive cultivation of rice crops began. In the Middle Neolithic period, the Yangshao culture, to which Jiangzhai and Longgangsi belong, was dominated by a millet-farming model, supplemented by livestock rearing. The main crops cultivated were foxtail millet and broomcorn millet. In the Late Neolithic period, although foxtail millet had replaced broomcorn millet as the mainstay, this model still had a place in the agricultural structure. Planting and livestock farming complemented one another as interdependent and closely linked activities (Zhao, 2018). Similar sites include Xipo, Qingliangsi and Taosi. Like Jiahu, Dahecun is located in the region of the Yellow and Huai Rivers, a zone where the rice and millet farming economies collided. Therefore, rice and millet cultivation have both been found there.

By the Middle Neolithic, Dawenkou's economy was based on millet farming. Rice resources, however, were influenced by the Longqiuzhuang culture and the Majiabang culture of the lower Yangzi River and were again introduced to Shandong as part of the agricultural economy of some late Dawenkou sites, such as Wangyin (Jin, 2001; Luan, 2005). Hunting, fishing and gathering were important supplementary activities during this period, although their share declined.

### 6.4.2.3 Rice-farming model

Of the four periods during which Chengtoushan was occupied, the rice economy developed vigorously from the Daxi period and intensified further during the Shijiahe period. Because of the abundance of wildlife, fishing, hunting and gathering always played an important part in the Neolithic inhabitants' livelihood patterns, although agriculture emerged earlier than on the Yellow River.

By the Middle Neolithic, artefacts from Longqiuzhuang suggest that the site's economic life was dominated by fishing, hunting and gathering, with rice farming as a supplement (Guo, 2000). Towards the end of the Late Neolithic, the former set of economic activities became supplementary to the latter (Guo, 2000). The large number of rice husks interspersed with red-burned clay from the ceramic sherds excavated at Xuejiagang and Lingjiatan suggests that at this time, rice cultivation was the main economic model. The relative proximity of Yuchisi to the lower Yellow River and the relative complexity of its plant remains suggest that broomcorn millet, foxtail millet and rice were all of importance in its agriculture (Cheng, 2020). In terms of production tools, sites such as Xuejiagang have not only produced a large number of turning tools, suggesting an expansion of crop cultivation and increased production (Lu and Zhou, 1992); ritualised stone knives and stone *yue* (axes) have also been excavated, emphasising the importance of agricultural tools, possibly in relation to the increasing proportion of the economy dominated by agriculture. Drinking vessels such as large jars and cups for storing food also appear, indicating that surplus crops were stored and used for brewing (Dai, 2008). The superior geography of the Jianghuai region also allowed for substantial gathering, fishing and hunting, which remained significant means of food supplementation during this period. Such means also included the domestication of livestock, mainly pigs, dogs, goats and cattle (Lu and Zhou, 1992).

As described in chapter 4, the more favourable natural conditions of the Yangzi River region became a constraint for the local population, hindering them from developing a purely productive economy (Zhao, 2018). This is relatively unlikely to have given rise to the obsession, as seen in the Yellow River basin, with the precise timing of farming according to the weather to ensure high yields. Because such natural conditions also gave rise to a high level of spiritual development, however, the inhabitants' understanding of the heavens may have been revealed in other ways.

#### 6.4.2.4 Fishing and gathering

The Neolithic culture of the south developed more slowly than that of the Yellow and Yangzi River regions; only in the Late Neolithic period did the agricultural model take root under the influence of the Yangzi River cultures. As a result, fishing and gathering economies were long dominant. For the inhabitants of Shixia, the supply of food for fishing and hunting would have been influenced by the tides and the monsoon, and it was perhaps most important for their survival to master the relationship between the patterns of these phenomena. Although monsoon and tidal conditions are variable and uncontrollable, the records of the Western Jin dynasty reveal that people could judge the actual conditions of the monsoon by summarising those of weather changes or natural phenomena, such as the migration of birds (Jiang, Zhao and Peng, 2017, pp. 34–35). In addition, experienced fishermen of today still judge high and low tides according to the lunar calendar, which corresponds to the position of the moon. It is not yet clear, however, whether the four animal signs and the monsoon were associated in the conception of people in the south. Overall, it is difficult to judge whether Neolithic burials in the south, especially in the late Neolithic period, were orientated as they were because of a particular physical or geographical circumstance, a phase of the Moon or the sunrise.

### 6.4.3 The relationship between climate, agricultural model, seasons and celestial observation

#### 6.4.3.1 Times of cultivation and harvest for dry and rice farming in the Yellow and Yangzi River regions

Based on Holocene palaeoclimate changes, Qin (2012) argues that in large-scale warming or cooling events, the change tends to be greater at higher latitudes than at lower latitudes. The mid-latitude temperate regions of the northern hemisphere are particularly sensitive to geographical variability, so the Yellow River basin is more affected by environmental change than the Yangzi River basin and the south. Around the middle and lower Yangzi River, vegetation types did not change as much if the climate became colder or drier. This explains the long-standing position of rice cultivation as a standby and supplement in early cultures of the region. The problem of flooding from the annual summer rains, meanwhile, may have weakened any intention to substantially exploit rice resources, thus slowing their domestication still further. In the Yellow River basin, on the other hand, because the collection of wild food resources was less stable than further south, people relied more heavily on deliberately cultivated food and were more eager to master the domestication of millet to ensure steady annual grain production. In this context, those Neolithic inhabitants who relied on an agricultural economy may have sought a more accurate natural calendar.

Agricultural production is highly seasonal, and harvests are directly influenced by seasonal changes. Weather-related festivals could be predicted by observing the weather and changes in climate and phenology, enabling people to prepare in advance to increase the probability of a good harvest for the year (Chen, 2020). Modern farming products have developed in a variety of ways across regions and ethnic groups, and while the timing of sowing and harvesting in the millet-farming and rice-farming models may appear to be similar to that of sowing in March and harvesting in October, there are many subtle differences in practice. Zhu (1964), for example, found that rice in the Yangzi River Valley was a summer crop, sown in April and harvested in August, with the growing season lasting only 150 days. The United States Department of Agriculture, however, notes the presence in China of both single-crop and double-crop approaches, as shown in figure 6.1, with sowing in early April (single) or mid-March and early July (double) and harvesting in mid-August (single) or late July and late October (double; USDA, 2023). There is no evidence at present to suggest that such an arrangement was in place during the Neolithic period, so both modes of sowing will be considered here. In contrast, the main crop in northern dry agriculture, millet, is sown in mid-April and harvested in mid-September (USDA, 2023). As the basic growth season and pattern of crops do not change substantially, these data can be used to infer at least the length of growing seasons.

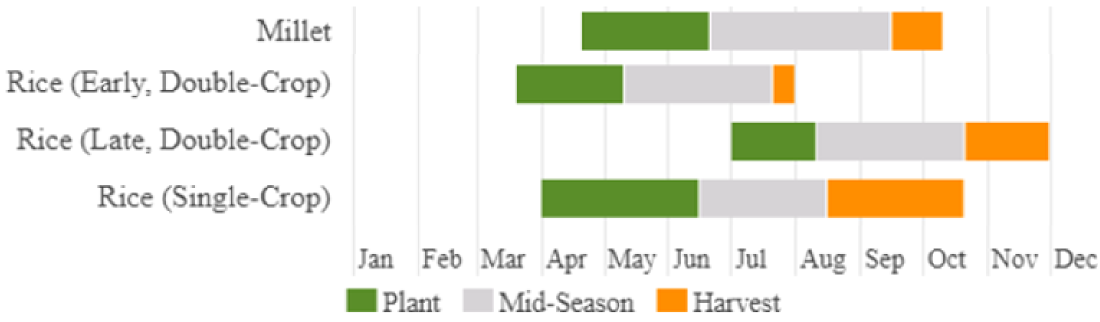



**Figure 6.1 , partial crop calendars for China (USDA, 2023).**

Some Chinese ethnic minorities still retain their ancient calendars. These calendars are closely related to farming activities and living customs and maintain these groups' unique view of the universe. Although it is difficult to judge whether this view matches that of their prehistoric ancestors, it is a useful perspective from which to explore some concepts.

The Zhuang people living on the MYangzi River and in the south call the Big Dipper the Hudou Star (戽斗星) or the Plough Head Star, both of which are farming tools. When the Plough Head Star points to the southeast at dusk, it is the spring ploughing season (Chen, 2013, pp. 112–113). Some of the stars of Scorpio near the Room mansion and some of the stars of Libra make up the constellation of the Old Man, which is considered by the Zhuang people. It appears in the southern sky at dusk when the new grains appear and summer farming begins. As the Old Man is a southern constellation, it cannot easily be seen in northern China, so it is seldom involved in northern folklore (Chen, 2013, p. 113).

The Shui people, who migrated from the LYangzi River to the MYangzi River and the south, have their own 28 mansions, nearly half of which are different from the traditional 28 mansions of the Han (Pan, 2001). The Shui calendar may have begun with the sighting of the Snake mansion in the southern sky at the time of the autumn equinox (Wang Lianhe, 1990). The Miao people (who live mainly in Guizhou, Hunan, Hubei, Sichuan, Yunnan, Guangxi and Hainan provinces) also have their own 28 mansions, but these are largely the same as those of the Shui, with both groups having named most of the mansions after animals (Pan, 2001). The popular calendar of the 28 mansions of the Yi people (who live mainly in Guizhou, Yunnan, Sichuan and Guangxi) begins with the Pleiades (Zhu and Chen, 1982; Li and Meng, 1983; Yang, 2024). The day when the Moon meets the star Copperhead is an auspicious day for sowing, and the day when the Moon meets the star Ludong (露冬) is an auspicious day for hunting (Li and Meng, 1983). Farming and hunting activities were interspersed throughout the year. In the area where the Yi people live, the population includes Naxi, Tibetans, Bai and Lisu people. Some of the names of the 28 mansions of the Naxi are related to animals, while others seem to reflect their shapes, such as the Hexangular star. The Naxi liken the stars in the sky to a human body, which circulates in a certain orbit (Chen, 2013, p. 446). It has also been argued, however, that the recorded hieroglyphs were so difficult to pin down even for the Dongba scribes that it is impossible to define the meanings of the names (Li, 2006)).

Apart from the calendar of the 28 mansions, other calendars are also popular among some ethnic minorities. The Yi's ten-month calendar sets the seasons according to the orientation of the Sun in the first half of the year. In the second half of the year, observations are made in the evening of the direction of the handle of the Big Dipper and changes in the position and direction of the Milky Way (Liu and Chen, 1981). The ten-month calendar is also used by the Bai, Lisu and Hani ethnic groups, with the Bai setting the first day of the year as the first day of spring, while the Yi set it as the winter and summer solstice days. Chen (2013, p. 407) suggests that this may be because the Yi set the first day of the year by the Sun's position, while the Bai set it by Antares and the handle of the Big Dipper.

Additionally, the Dragon Festival is not the only one in the south. The Zhuang people's February Little New Year Festival corresponds to the 'Dragon raising its head on the second of February' (二月二龙抬头), and the Maonan and Buyi peoples' Dragon Festival corresponds to the summer solstice when Antares appears in the southern centre of the sky. Both are related to the Dragon sign, but they fall in February and May, respectively (Chen, 2013, p. 116).

From the ancient documents it is possible to provide an early and common pattern of millet farming and rice cultivation. In the poem *诗经-豳风-七月* (Shi Jing - Bin Feng – July), it is mentioned that "四之日举趾", "十月获稻" and "十月纳禾稼", the translation being that April is a busy month for ploughing. October is the time of the grain harvest (Zhang, 2001; 2003). The full set of 24 solar terms was formed during the Warring States period, and these have been an important part of the traditional Chinese calendar ever since, corresponding to the productive rhythms of spring planting, summer hoeing, autumn harvesting and winter storage (Cui, 2009; Hu, Zhang and Yan, 2017). Since their inception, Chinese peoples used the cyclical pattern of the 24 solar terms to divide the farming cycle and arrange the temporal distribution of agricultural labour. The spring and autumn equinoxes and the winter and summer solstices are acknowledged among the solar terms as four of the important festivals.

Xu Shen's Han-dynasty *Shuowen* asserts that the dragon will ascend into the sky to send rain when the rice is sown in spring, and that it will only dive into the abyss to hibernate in autumn after the rice has been harvested (Huang, 2016). This may be an interpretation of the practice of sowing seeds after the rising of Antares at the spring equinox and harvesting before its setting at the autumn equinox. Antares was considered in early China to be a significant signal at least for the beginning of the farming season (Chen, 1980). Shaughnessy (1997) has presented corroborating evidence through the interpretation of the *qian* and *kun* trigrams, but with the slight difference that the Horn and Neck mansions of the Dragon sign appear on the horizon at twilight between the beginning of March and the end of April. From the end of April to the middle of May, the entire body of the Dragon, including Antares, the Heart mansion, appears on the horizon. The movement of the dragon across the sky, as recorded in the *qian* trigram, corresponds to the various stages of the growing season. Later, the *kun* trigram conceals the completion of the handover from Dragon to Tortoise below the horizon, marking the end of the agricultural year and the beginning of winter, October, the end of the growing season and the time of the harvest. Pankenier (2013, p. 54; 2016) offers a different interpretation of the *kun* trigram, that the 'dragon battling in the wild' represents not the Dragon and Tortoise but the Dragon alone, because it is divided into the Yang Dragon (spring and summer) and the Yin Dragon (autumn and winter). While the Yang Dragon sinks into the ground in the west on an evening in August, the Yin Dragon rises from the east at dawn a few weeks later and completely disappears into the western horizon by one sunrise the following February. Meanwhile, the horns of the Yang Dragon appear on the eastern horizon at dusk, so that the Dragon appears in different positions at dawn and dusk. This can be thought of as *yin* and *yang* battling one another on the dividing line between day and night. Nonetheless, the point that the *qian* and *kun* trigrams suggest people's farming activities for the year remains unchanged.

On the whole, it was a natural law that could not be disobeyed that sowing took place in spring and harvesting in autumn. The months and calendars mentioned in ancient documents may be misleading, for these elements were devised in the written period (after the Neolithic), after people had learned from life experiences and come to grasp the laws of nature, a basis for their calendrical thinking that included the act of farming. It can be concluded from both the interpretation of ancient documents and ethnographic evidence that for the inhabitants of the Yellow and Yangzi River basins, the timing of farming practices was judged on the basis of specific celestial events, in addition to climatic and phenological changes. People in different regions pay different attention to the sky depending on their farming needs. As stated by Harding *et al.* (2006), there is a close relationship between skyscapes and life cycles: people respond to the cyclical nature of the heavens and the seasons in the world around them, thus coming to understand the processes of creation and change and live in harmony with nature. It is, therefore, particularly crucial to this research to understand whether the subsistence farming practices of the Yellow and Yangzi River basins coincided with the specific celestial events included in their respective burial ranges.

#### 6.4.3.2 The relationship between farming-related celestial events and burial orientation

Celestial events were crucial to early farming peoples, but they were a concern of the living; we may ask, therefore, what relevance they had to the dead. As explained in chapter 1, modes of survival shaped lifestyles and ideas, and the view of death presented in the form of burials developed from the lifestyles and ideas of the living. It is possible that people not only glimpsed the reflection of natural laws in the celestial signs but also came to a deeper level of awareness. The Neolithic people of the Yellow River basin arranged their dead in a highly consistent orientation, perhaps for reasons derived from new meanings perceived in the agrarian significance of the celestial targets towards which these burials were aligned.

Based on the significant true azimuth ranges from all sites on the middle Yellow River in chapter 5, the burial orientations of these sites are plotted against their dominant subsistence models (figure 6.2). This suggests that subsistence models may not the main factor affecting the orientation of burials. The burial orientation at Jiahu, for example, where fishing and hunting were the main means of subsistence, overlaps considerably with sites where millet farming was the main mode of subsistence. The burial orientation of Dahecun, where both millet and rice farming took place, is completely different from that of burials at sites primarily reliant on millet farming. The burial orientation of Taosi, another millet-farming site, is the opposite of that seen at other millet-farming sites. The comparison must be further refined.

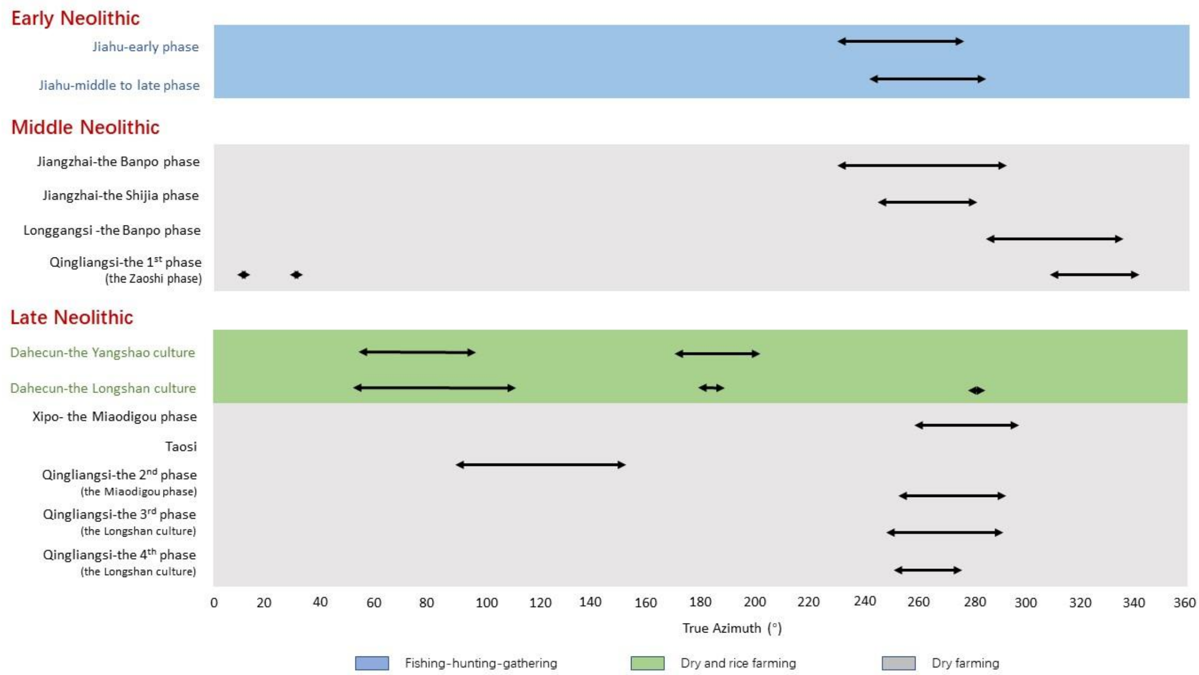



**Figure 6.2 , different subsistence of sites in the MYellow River, according to the significant true azimuth ranges.**

In table 6.8, the Milky Way, which appears perpendicular to the horizon at the summer and winter solstices, would not coincide with key farming activities, because neither sowing nor harvesting occurs at these times, so 'Millet farming – none' is shown. In contrast, sunrise and sunset at the spring equinox and the appearance of Antares before sunrise on the spring equinox fit perfectly with the sowing of millet at all sites in table 6.8, and sunrise and sunset on the autumn equinox fit perfectly with the harvesting of millet at all of these sites. According to Chen (in press), Antares was not the orientation target for the burials of the Yangshao culture, represented by Xipo and Qingliangsi. The burials show a Gaussian distribution over the range of orientations, so it is worth considering what the sunset represents at the peak of this distribution. The burials were not oriented towards the sunset on the day of burial. Most face towards a sunset orientation around the equinoxes. This is also the 'conceptual west' of the most common sunset of the year. The sunset may have been considered an essential part of a natural cycle that had no end, like sowing and harvesting or life and death. Thus, in the view of life and death of the people of the middle Yellow River, the setting sun was probably a beacon for the dead and a sign of hope that life would be reborn at sunrise. This idea will be discussed in the next section, where supporting evidence will be shown in the form of symbolic motifs on excavated artefacts.

The orientation of burials at Longgangsi and Dahecun, however, suggests that not all Yangshao sites followed this cosmology exactly or executed it rigorously in the orientation of burials. This does not mean that the cosmology suggested was completely absent from the lives of the inhabitants of these sites, as it is evidenced, for example, by the similar pot motifs (will be described in next section). Some unknown influence may have provoked a different choice.

Taosi burials face east, making the corresponding celestial events the sunrise on the equinoxes and Antares after sunset on the spring equinox. The choice of orientation can be analysed in relation to the surrounding landscape, as previously observed, since to the east, the Taer mountain is a natural celestial indicator. Both the observatory and the cemetery face towards it. The burials also show a Gaussian distribution in orientation. It is not clear, however, whether the Taosi burials point to the mountain, sunrise or Antares. It is possible that all three are the target, as they are in a very similar direction. The reason remains unclear. To assess whether there is a similar view of cosmology in play to that of the Yangshao culture would require interpretation of the excavated burial objects.

| Middle Yellow River | Spring | | | Summer | Autumn | | Winter |
|---|---|---|---|---|---|---|---|
| | Sunrise on SE | Sunset on SE | Antares on SE | The Milky Way on SS | Sunrise on AE | Sunset on AE | The Milky Way on WS |
| Jiangzhai | | Millet farming-Sow | | Millet farming-none | | Millet farming-Harvest | |
| Xipo | | Millet farming-Sow | Millet farming-Sow | Millet farming-none | | Millet farming-Harvest | |
| Qingliangsi | | Millet farming-Sow | Millet farming-Sow | Millet farming-none | | Millet farming-Harvest | |
| Taosi | Millet farming-Sow | | Millet farming-Sow | | Millet farming-Harvest | | Millet farming-none |

**Table 6.8 , the relationship between farming cycle and the celestial events that pointed by burials from the MYellow River.**

| Lower Yellow River | Spring | | Summer | Autumn | | |
|---|---|---|---|---|---|---|
| | Sunrise on SE | The Milky Way on SE | The Milky Way on SS | Sunrise on AE | Antares on AE | The Milky Way on AE |
| Dawenkou | Millet farming-Sow | | Millet farming-none | Millet farming-Harvest | Millet farming-Harvest | Millet farming-Harvest |
| Wangyin | Rice farming-Sow | Rice farming-Sow | | Rice farming-Harvest | Rice farming-Harvest | Rice farming-Harvest |

**Table 6.9, the relationship between farming cycle and the celestial events that pointed by burials from the LYellow River.**

In figure 6.3, the situation on the lower Yellow River is similar to that of the middle Yellow River. By the Middle Neolithic, Dawenkou had turned to millet farming, but the direction of burials there overlaps considerably with that of burials at the rice-farming site of Wangyin. The determinants behind burial orientation in the Dawenkou culture thus also seem to be unfettered by specific types of farming.

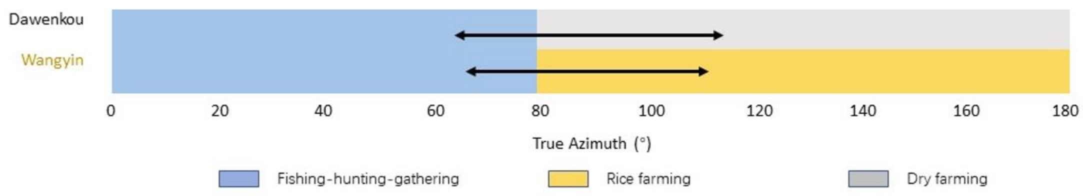



**Figure 6.3, different subsistence of sites in the LYellow River, according to the significant true azimuth ranges.**

As shown in table 6.9, sunrise at the spring and autumn equinoxes, and Antares before sunrise at the autumn equinox are appeared in the burial orientation ranges of Dawenkou and Wangyin, respectively. In other words, why do the graves along the MYellow River face west and those along the LYellow River face east? What determined or changed the burial orientations during the evolution of the culture? Were these groups, like those of the Yangshao culture, trying to express the cycle of life and death? Or did the Dawenkou culture simply respond to 'life'? Might the burials on the MYellow River represent a shift from death to life, while the burials on the lower Yellow River do the opposite? In addition, the Milky Way appears vertically at the summer solstice, but also at the autumn equinox at Dawenkou and Wangyin, and at the spring equinox at Wangyin. However, the Milky Way appears less clearly in the east than in the west, so it is relatively unlikely as a potential target.

Although the celestial signs were of equal interest to the rice farmers of the Yangzi River Valley, none were observed at relevant times, as they were in the Yellow River Valley. It is therefore difficult to determine whether the important celestial events that provided signals for farming, fishing, hunting and gathering activities for inhabitants of this region are consistent with those of the Yellow River basin. Perhaps belief in the relevant celestial events had not yet been applied to the awareness of life and death. It is possible that these celestial events did not acquire great importance because the fishing and gathering economic model remained relatively important until the late period, when it was completely replaced by farming. It was, however, precisely the abundance of wilderness resources that led to the Yangzi basin peoples' not having to bear the same pressures as the inhabitants of the Yellow River basin. The concentration of beliefs, therefore, as well as their unity, is less evident in the Yangzi River basin than along the middle reaches of the Yellow River, with beliefs associated with both hunting-gathering and farming existing. Such beliefs are, therefore, not reflected in the orientation of the graves, with the four sites on the lower Yangzi River showing different ranges of orientation. Further interpretation is needed based on the excavated burial objects.

In summary, the uniform orientation of the graves on the middle and lower Yellow River also suggests highly concentrated organisation and a high degree of cohesion. The celestial signs may, in this context, have been not only the reflection of natural laws but also the tools used by the higher levels of society to achieve such cohesion, potentially securing a monopoly on resources for the culture that followed. This could likewise be evidenced in the design of the Taosi observatory, where Pankenier (2013, p. 29) argues that the Taosi elite monopolised the sunrise observation rituals, no doubt for reasons of control and prestige. It is also possible that the monopolisation of astronomical knowledge at Stonehenge occurred at some point, and Darvill (2022) speculates that this may have been a form of social control by those high in the local hierarchy. This kind of cultural cohesion seems to have anticipated the rise of the Erlitou culture in the Yellow River Valley, as this state emerged at the end of the Longshan culture from the integration of other cultures in the Central Plains (Wang Lixing, 2006).

## 6.5 Supporting evidence from burial objects

In light of the descriptions of the burial objects from each site in chapter 4, these objects can provide another perspective on several questions in the previous section that require further exploration: 1) How do the motifs on Yangshao pottery express the culture's cosmology? 2) Do pottery patterns at Taosi express similar cosmology to that of the Yangshao culture? 3) How do pottery patterns in the Dawenkou culture express 'life' in a way that relates to sunrise? 4) What kind of celestial beliefs distinguish the Yangzi River region from the Yellow River region? 5) How do celestial beliefs in the LYangzi River basin relate to death?

### 6.5.1 How do the motifs on Yangshao pottery express the culture's cosmology?

Interpretations of motifs on Yangshao pottery are diverse, including fertility-, nature- and ancestor-worship, totems, clan symbols and conceptual themes (Peng, 1984; Wang, 1989b; Xu, 1989; He, 1992). Another possibility is that they represent the original form of the *taiji* diagram, as discussed by Feng (1994). After outlining the evolution of the painted motifs, Wang (1999) rejects the idea that water swirls were used to symbolise waves and instead proposes the hypothesis that they represent larger objects in motion, such as celestial bodies, including the earth itself. The Sun was particularly important in agrarian cultures: the swirling patterns may have represented the ecliptic or even particular celestial phenomena. For example, some of the painted pottery pieces are decorated with sunbird figures. The pots from Dahecun emblazoned with 12 suns (figures 6.4 and 6.5) have been interpreted as symbolising the 12 months of the year or as connected with astrological chronology, or at least as the result of long-term observation of the heavens or as records for the development of agriculture (Guo and Ren, 2014).

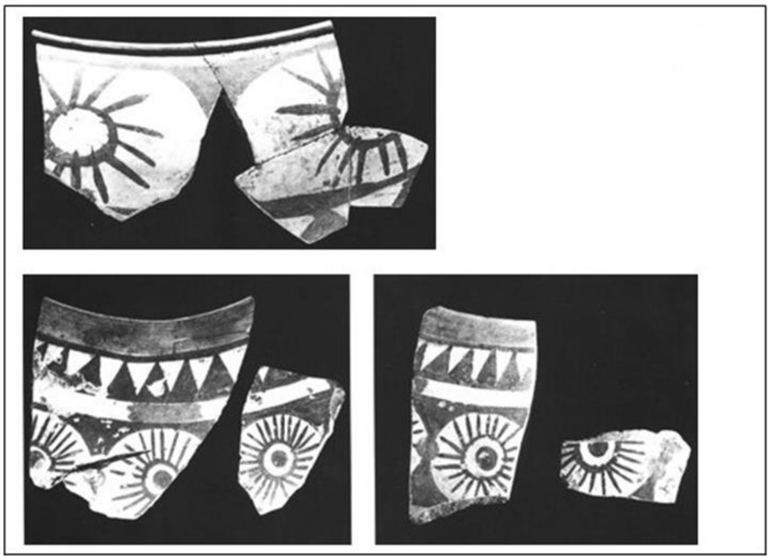


**Figure 6.4, ceramic fragments of two pots with different sunburst patterns from Dahecun (ZICRA, 2001, p. image form 30).**

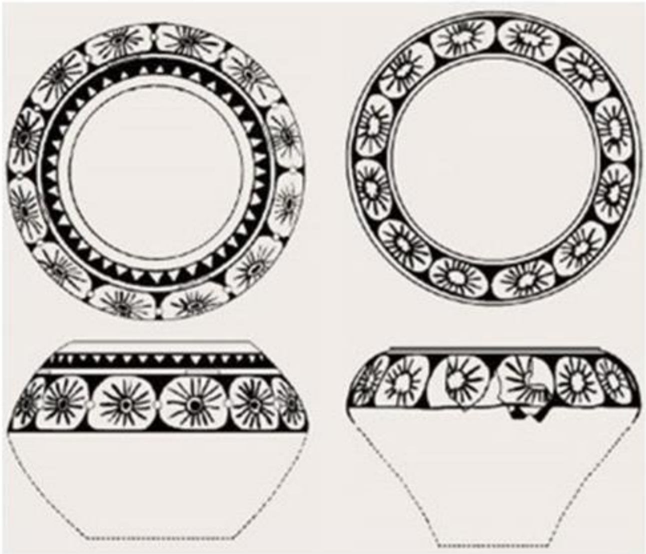


**Figure 6.5, reconstructed pots from Dahecun (Wu, 2020).**

Wu Jiabi (2020) offers a more detailed interpretation of the two pots, arguing that the painted portions indicate ‘heaven’ and that the maximum diameter of the bellies indicates the boundary of the sky. The Sun is travelling along the ecliptic, and the consistent height and size of the sun motifs indicate that it is tracing its path on the canopy of heaven and has not gone underground or into the water. These artefacts thus represent the basic idea of the Gaitian theory as held by the Yangshao people. Wu (2020) further deduces that this may be related to the ‘12 times’ of the ecliptic recorded in the *Han Book of Laws and Calendars* (汉书 律历志 *Han Shu Lv Li Zhi*), which provides the earliest example of the use of longitude to represent the position of the sun during the 24 solar terms. Because the 12 suns are at the same height and an equal distance from the centre of the pot, the latitudinal position of the Sun cannot be represented, and there are 12 nodes between the 12 suns, which are the starting points of the ‘12 times’ (Wu, 2020).

Neolithic peoples may not have had as sophisticated an understanding of the heavens as Wu Jiabi’s proposal suggests. There is, naturally, no denying its possibility. When we include the previously mentioned interpretation of ancient documents and ethnographic evidence, we can see that the need to observe and grasp celestial phenomena was based on the necessities of livelihood and that people’s concern for celestial objects concerned not only the path of the sun but also the presence of other objects in the sky. Importantly, Wu Jiabi’s proposal is based on interpreting the sun motifs on the two Dahecun pots mainly on the basis of ancient literature of the Han dynasty, without consideration of the characteristics of the many other motifs seen on Yangshao ceramics (e.g. figure 6.6) or evaluating the applicability of Han-dynasty literature to interpreting Neolithic symbolism. Two cosmological ideas may be represented in the basic features of Yangshao painted ceramics (Zhang, 2015). The first is the ‘circle of heaven and square of earth’ mentioned in the *Zhou Gnomon Arithmetic Classic*, with the ‘circle’ of the vessels represented by straight, continuous, symmetrical, circling, tight and sparse lines and the variations in these lines producing rhythms and echoes that correspond to emotions, but this may be overambitious. The process of infinite cycles is, however, suited to the second cosmological reading: the motifs are almost always linked at the beginning and end, and the cycle repeats itself as the sun rises and sets. This is also consistent with the understanding of the laws of natural cycles seen in section 6.4.3.1.

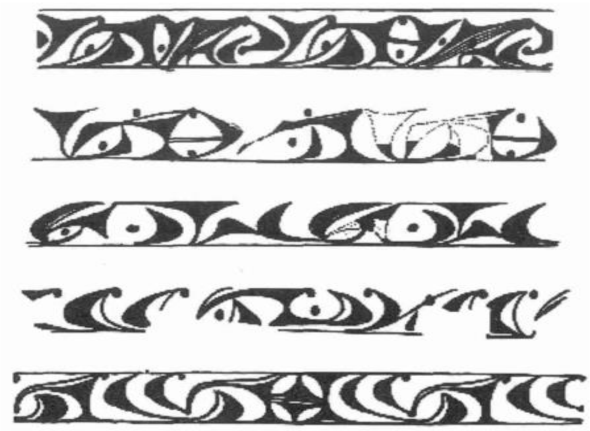


**Figure 6.6, patterns on painted ceramics of the Yangshao culture (Zhang, 2015)**

### 6.5.2 Do pottery patterns at Taosi express similar cosmology to that ofthe Yangshao culture?

Patterned pottery accounts for half of the total pottery found in burials. Motifs include dots, circles, stripes, s-shapes and other geometric motifs, as well as images of various animals. In terms of decoration, type and assemblage, the pottery remains suggest that the early Taosi culture contains many elements of the second phase of the Miaodigou variant but is neither a simple continuation of that variant nor an exact equivalent (IACASS and LCRBSP, 2015, p. 1092). Painted motifs and vessel types reflect the influence of the Dawenkou culture, as well as other regional influences such as the Qujialing, Daxi and Shijiahe cultures and even the Songze culture of the lower Yangzi River. Li Xinwei (2021) notes that Taosi lies within the core area of the Miaodigou variant, and even though the painted pottery culture in this area was somewhat disrupted during the second phase of Miaodigou, the style of the motifs may have benefited from exchange with the Banshan variant, which led to a revival and continuation of the bird motif (figure 6.7). The painted pottery was used exclusively in high-ranking burials and is thus highly indicative of rank (Wang, 2021).

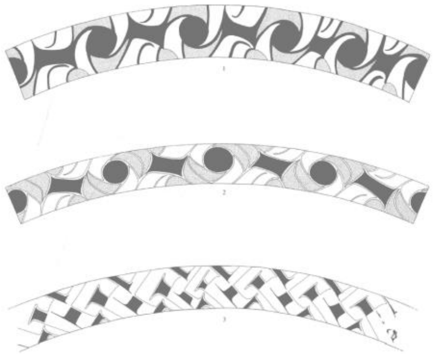


**Figure 6.7, expanded decoration from a folded-belly basin (IACASS and LCRBSP, 2015, p. 607)**

Four painted dragon plates have been excavated from Taosi, found only in the highest-ranking burials (figure 6.8). Various origins have been suggested for such painted dragons, including importation from the Liangzhu culture (Zhu, 1998) or the Hongshan culture (Su, 1999; Sun, 2001). The dendritic bifurcation of the dragon's mouth has been interpreted as a 'serpent's tassel'. Cui (2017), however, argues that the four dragons at Taosi are static and that their spitting snake tokens is, therefore, a misinterpretation. By comparing silkworm motifs excavated from other prehistoric sites with the features of silkworm-shaped artefacts, such as the segmented abdomen, and by considering the biological characteristics of the silkworm, such as its eating mulberry leaves and spitting out silk to weave cocoons, Cui (2017) suggests that the 'dragons' were eating leaves. As Chang Kwang-chih suggests, the ancient shamans used tools to communicate between heaven and earth. Because the silkworm transforms into a moth and ascends to heaven, this representation coincides with the ritual desire to achieve such communication. This is why the image of the silkworm was constantly ritualised and associated with hierarchy in the higher echelons of Taoist society. Based on Cui's interpretation, the owners of the dragon plates at Taosi may have believed that being buried after death was like a silkworm's envelopment in a cocoon to await transformation into a moths to achieve true access to the heavens, or rebirth. This may have constituted another reason for burying the dead with their heads facing east. The Taosi people may have believed that orientation towards the sunrise was linked to rebirth based on their understanding of the cyclical renewal of life that filled the world around them, allowing them to enter the cycle of life after death. Whether the dragon was a silkworm, however, and whether its mouth was a mulberry leaf, is not actually certain, and it is also possible that it was a figment of the Taosi imagination that borrowed the biological properties of the silkworm. Other explanations may well emerge in the future.

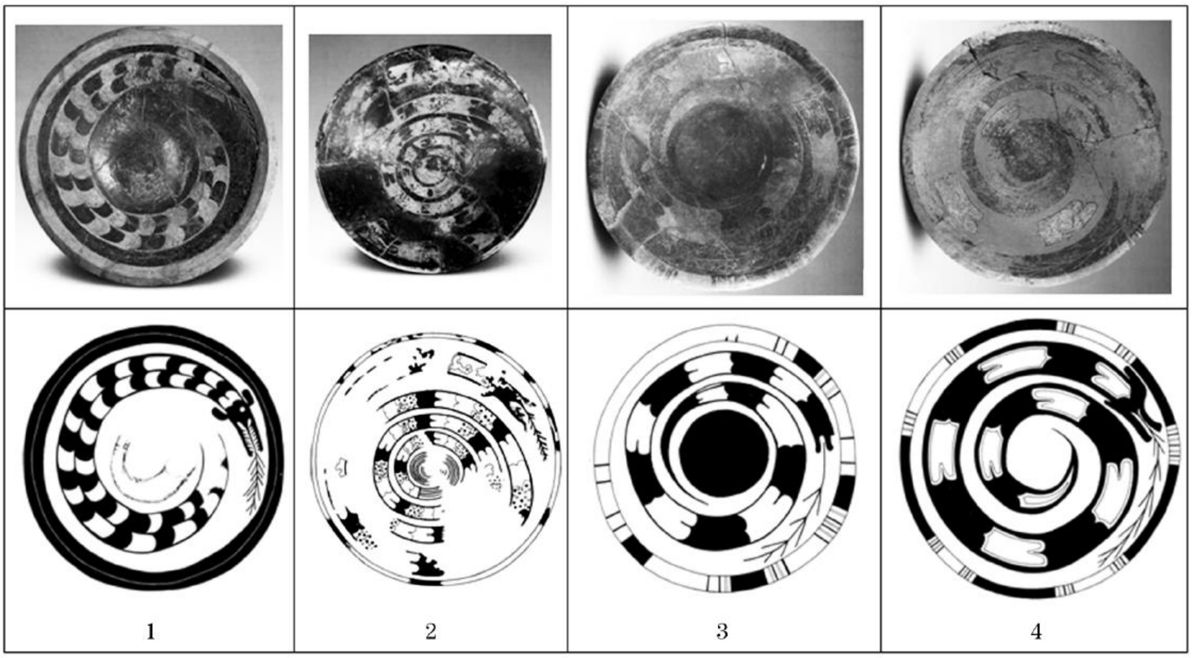



**Figure 6.8, the painted coiled dragon on four plates and basins (Cui, 2017).**

### 6.5.3 How do patterns in the Dawenkou culture express 'life' in a way that relates to sunrise?

As mentioned in the previous subsection, the painted elements of pottery at Taosi were influenced by the Dawenkou culture, and painted ware was a status symbol that lay solely in the hands of the elite, thus implying their unique view of the universe and life and death. The burials at Taosi, Dawenkou, Wangyin and Longqiuzhuang all face east. This may enable us to glimpse part of the Dawenkou cultural cosmology of the LYellow River.

Most of the painted pottery from the Dawenkou culture is found in burials. The eight-pointed star motifs on five items excavated from Dawenkou graves have been analysed by scholars many times. On one such item (figure 6.9), there are five white solar octagonal star shapes with unpainted central squares around the belly, with two white vertical lines painted between each of them. The vertical lines together represent the total number of months in the ten-month solar calendar. The combination of the five octagonal star motifs may suggest a connection between the five elements of nature, *yin* and *yang*, and the ten-month calendar (Wang, 2008). However, this is only conjecture, and there is no relevant archaeological or documentary evidence to support it

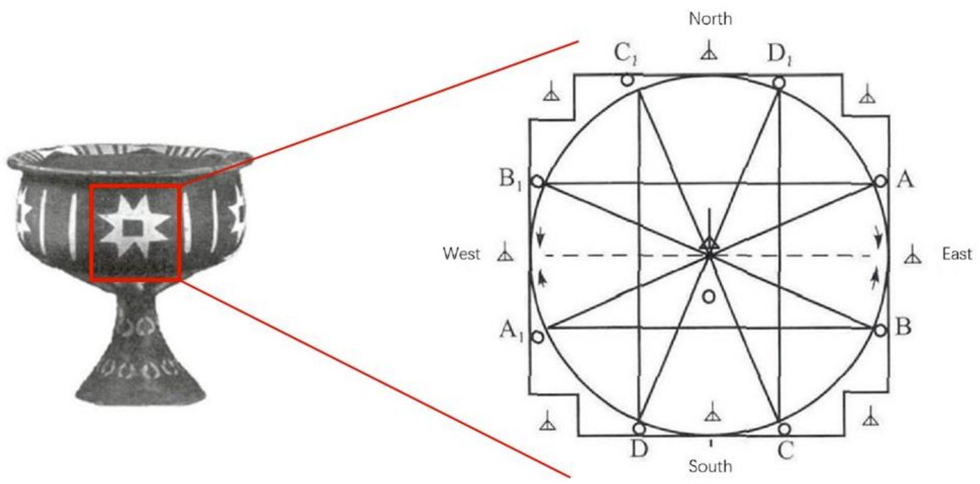



**Figure 6.9, painted pottery item with solar octagonal star pattern (left) and illustration of a solar octagonal star (Lv, 2015).**

Lv (2015) sees this octagonal star as a sign of the Dawenkou people's observing the Sun's movement and dividing the year into two seasons, spring and autumn. As shown in the schematic in figure 6.9, a pattern from the Songze culture is used as a model, with the centre of the octagonal star as the centre, O, and a wooden stake erected over it. A circle is drawn with the corners of the octagonal star lying on its circumference. The diameter of the circle can be used as the side length to construct a square representing the altar; however, there is no evidence for this altar in the Dawenkou culture of this period, so it will not be discussed. Points A and B in the east indicate the range of sunrise, with A being the far northeastern point, the summer solstice sunrise, and B being the far southeastern, the winter solstice sunrise. In the west, A1 and B1 mark the winter and summer solstice sunsets. BOB1 and AOA1 are lines indicating the division of the year into spring and autumn because spring stars at B and autumn stars at A for six months. COC1 and DOD1 are lines bisecting AOA1 and BOB1 respectively, indicating the equal division of day and night. Late Neolithic people were already well aware that the days when day and night were equal were those of the spring and autumn equinoxes. It is certain that both the Dawenkou people of the lower Yellow River and the Late Neolithic inhabitants of the Yangzi River Valley were at least sufficiently aware of the path of the sun to have derived a corresponding concept of time.

Aside from these painted pottery items, there are also several examples of a carved symbol on large-mouthed vats revealed in burials of the Dawenkou culture. This symbol, which first appeared approximately 5000 years ago, may be associated with landscape features and celestial events. This symbol takes two basic forms, as shown in figure 6.10. Early interpretations suggested that the upper circle was shaped to indicate the Sun, the central shape to indicate that of a cloud and the lower shape to indicate that of a mountain with five peaks. Thus, Yu (1973) understood it to be the clouds on a mountain holding the sun, the image of sunrise. It has also been assumed that the middle symbol represents fire, later evolving into the character 炅, meaning heat, and representing a semantic ideogram (Tang, 1979). Wang (1986) interpreted the symbol as a whole as a description of the local geography, with the Sun rising due east above the main peak at eight or nine o'clock in the morning in spring and autumn, making it a copy of a long-term observation of this scene. Although the motif has been interpreted as a sunrise, it could also represent a sunset, as the motif does not necessarily indicate an eastward direction but merely depicts a scene likely developed through frequent observations of the Sun.

As these two forms were present on pottery discovered at Lingyanghe, Du (1986) measured the peaks near the site and deduced that if the lunar cycle coincided with the equinoxes, which occurred approximately once every four or five years, then this fact, combined with the Xi Zhong recorded in the *Canon of Yao* (mentioned in chapter 2), proves that Lingyanghe was a prehistoric astronomical observatory where sunrise was observed to determine the equinox. Different tribes or ritual observation sites would then have used the different mountains around them to determine the equinox day. However, Tian (1982) and Rao (1996) argue that the complete mark is a tribal emblem of the Taihao (太皞) and Shaohao (少皞) representing the Sun, Moon and mountains, with a bright moon above the mountain and the Sun above the Moon. In addition to the Sun, Moon and clouds, Wang (1997) suggests that the central part of the symbol is fire, representing Antares, and that the whole figure expresses the observation of Antares, the ritual and the observing of the time. Combined with the fact that such symbols at Yuchisi are only found on the burial urns of infants and children, it is suggested that the position of skywatcher may have been hereditary (Wang, 2014). In addition, Pankenier (2013, p. 62) argues that alligators excavated from the Dawenkou culture and the Taosi site specifically demonstrate that the people of the time had complete knowledge of the sign of the Dragon, centred by Antares, as a correspondence can be found between the alligator's yearly activity pattern and the movement of the Dragon in the sky.

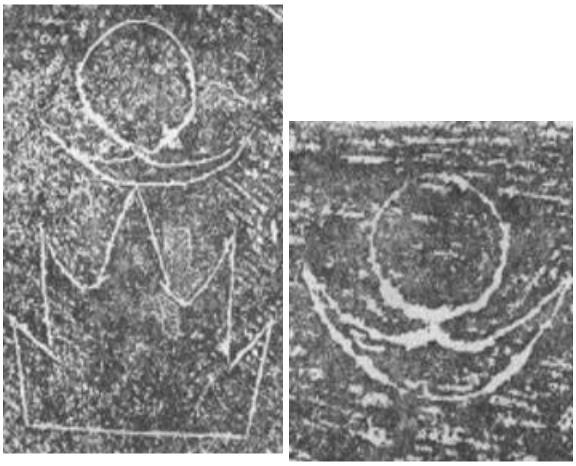


**Figure 6.10, two versions of a carved symbol found on Dawenkou ceramics.**

The earlier the period, the more intimately astronomy was integrated into all aspects of culture, as in the case of the Taosi observatory, not far from the North China Plain, which reminds us of how people in the Late Neolithic period used a series of pillar slits to observe the direction of sunrise to determine the seasons, rather than relying solely on the Taer mountain, making it clear that people had long since moved from an early, tentative stage to one of skilled use (Xu, 2010). The carved symbols at Dawenkou therefore not only represent tribal emblems but must also have been associated with astronomical observation. The Dawenkou people were also skilful at synthesising the local landscape, as well as the phenological features, and made long-term observations of not only the ecliptic but also the movement of stars, including Antares and other stars that make up the sign of the Dragon. The directions in which these celestial phenomena rose and set each day, east and west, could thus not have been ignored. This also represents a preliminary stage in the development of spiritual culture in the Middle to Late Neolithic period around the North China Plain.

### 6.5.4 What kinds of celestial beliefs distinguish in the MYangzi River region from the Yellow River region?

The earliest white pottery has been found in the lower layers of the Zaoshi culture (approximately 7500 BC) and the lower layers of the Gaomiao culture (7800–7400 BC) and was prevalent in the Gaomiao and Tangjiagang cultures (figure 6.11). White pottery has largely been excavated from high-ranking burials and, similar to painted pottery, used motifs to express the will of the people, representing a powerful culture; all had a strong capacity for dissemination. White pottery was a high-class object that circulated among the upper classes. The main motifs found on ritual white pottery excavated from high-class graves are the Sun, the octagonal star and the fang and bird motifs. These can be classified into two main themes: astronomical and animal. They condense the essence of the hunting and gathering life and the beliefs that arose from this system. Guo and Guo (2014c), however, argue that the octagonal star motif is a product of the exchange and fusion of technologies, ideas and images between farming and hunting communities.

The octagonal star motifs excavated are consistent with those of the Dawenkou period, but here they are not only much earlier but also more elaborately drawn. It is thought that the explored supernovae of Vela or the Cygnus Loop may have led to the copying and recording of the shape of this celestial event over time (Zhao, *et al.*, 2013). The octagonal star of the MYangzi River appeared around 3000 to 4000 years earlier than that of the LYellow and LYangzi Rivers, so it is difficult to argue that the associated cultures had the same interpretation and use of this motif, especially when they also relied on different means of survival. The interpretation of the octagonal star of the Dawenkou is based, therefore, on that of the Songze culture, which is similar in time and geographical location.

In addition to reflecting the temporal pattern of the Sun's movement around a pole, the octagonal star motif found on the MYangzi River also indicates how to identify directions using the Sun, the earliest manifestation of astronomical knowledge (Li, 1991; Feng, 2010). Behind the mutual exchange and integration of farming and hunting-gathering concepts and images is a change in the observation of the sky. It is not that astronomical phenomena were no longer observed but rather that the emphasis changed in the face of different needs. Hunter-gatherers in mountainous areas had a convoluted sense of space and needed to rely on an accessible network of calibrated reference points to choose their paths, while farmers on the plains occupied a wide, open space and did not need to move frequently. Such people regularised the natural space of the plains and drew the laws of time from the directions of sunrise and sunset on the solstices and equinoxes. The need for direction and movement declined, and mastery of the rice cultivation schedule increased. Moreover, only farmers would naturally find a centre in the concepts of eight or four directions and identify their settlements as that centre, while people living in mountainous areas would not have done so (Guo and Guo, 2014c). Therefore, octagonal stars on white pottery were particularly common in the Tangjiagang period.

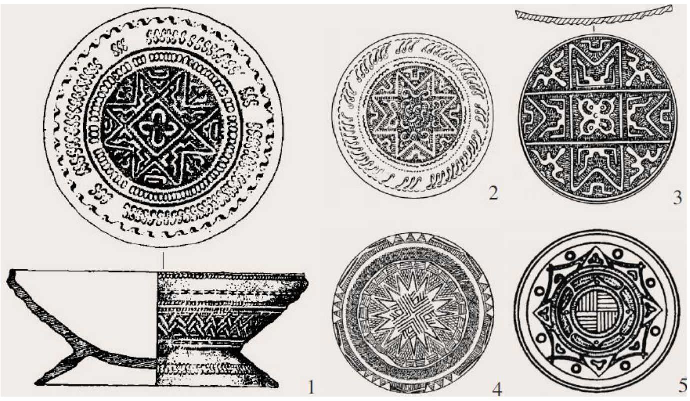


**Figure 6.11, octagonal stars on pottery from the Tangjiagang culture (Li, 2004).**

Feng (2010) offers a different interpretation in terms of ancient documents about directions. This involves the basic ‘four directions’ (south, east, north and west) and ‘five positions’ (south, east, north, west and centre; figure 6.12-1), with the latter being a planar concept based on the former. The ‘eight directions’ (figure 6.12-2) and the ‘nine squares’ (figure 6.12-3) are extensions of the five positions. The eight directions are the endpoints of a set of straight lines called the ‘two ropes’, which intersect to form the four directions of east, south, west and north, and the ‘four dimensions’, which intersect to form the four directions of northeast, northwest, southeast and southwest, which, in the Gaitian theory, are the four ropes that hold the firmament in place (a motif also repeated in the Lingjiatan culture of the lower Yangzi River). In spatial terms, the ‘nine squares’ act as a means of replacing the missing corners of the five positions, replacing the cruciform shape with a square, which is centrally represented in Shang culture, as mentioned in the literature review. This is hypothesised to lie behind the standard octagonal star pattern (figure 6.12-4). The cultures in which the octagonal star motif is found are widespread and span the Early to Late Neolithic in China, but the exact path of transmission remains unclear.

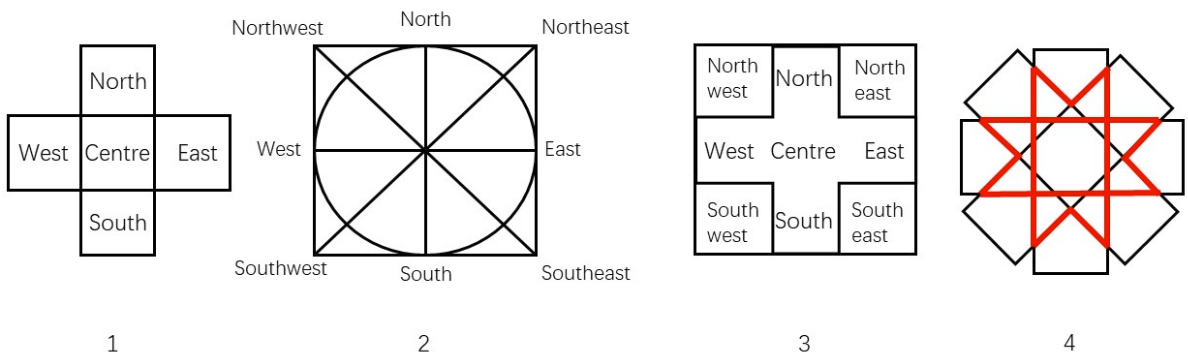



**Figure 6.12, 1. five positions, 2. eight directions, 3. nine Squares, 4. octagonal star.**

The Qujialing period is dominated by black, grey and other coloured pottery. The majority of the black pottery was manufactured as burial objects, while the grey is mainly utilitarian, with almost no white pottery. A wide variety of pottery types have been excavated from this culture, and some painted motifs have also been found, particularly on pottery wheels, which are predominantly three-quarter, four-quarter and symmetrical, with swirling, curved and linear motifs painted in the centre of the aperture of the spinning wheel, which have been repeatedly interpreted as related to sun-worship (figure 6.13). In stylistic terms, for example, the four outlines, which point to the southeast and northwest, the ends of the Sun's trajectory, also point to the four seasons and the cycles of the Sun's movement and derive from the four quadrants (Jiang, 1996; Zhang, 2006). These patterns have also been interpreted in other ways (Zhao, 2014), including as vortex patterns produced by the interaction of streams of water flowing at different speeds or in different directions (Liu, 1995), thunder and lightning (Wang, 2007), the prototype of the *taiji yin–yang* fish and various other natural phenomena (Shi, 1983). In this period, it seems that the primitive observation of celestial phenomena tended to be more abstract, embodying a spiritual need. It had moved beyond the 'shaman' props used to measure the sun and shadows to determine time and direction to a stage of praying for successful food production and expressing artistic inspiration from the ancestors through sympathetic sorcery.

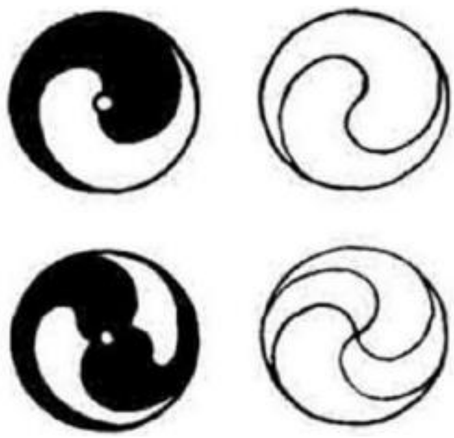


**Figure 6.13, motifs on spinning wheels (Zhao, 2014).**

During the Shijiahe period of Chengtoushan, black pottery was gradually replaced by grey and red pottery. The decoration remained predominantly plain. This culture saw the emergence of a large amount of representative art that was not used in everyday life but was supposed to be religious and conceptual in nature, such as pottery dolls and various jade carvings of gods and spirits, including different human and animal forms. Through ethnographic inspiration and reference, several possible intentions can be identified for these items: praying for productive fishing and hunting, seeking the multiplication and good health of domestic animals, as a substitute for sacrificing to the gods and directly using some mystical characteristic already conventionally attributed to an object or animal to seek blessings and avoid disasters (Ren, 2004). Similar carved symbols to those found in the Dawenkou culture have been found at Xiaojiawoji, a core site of the Shijiahe culture, so it is also thought that the Shijiahe culture was influenced by the Dawenkou and Longshan cultures in Shandong. Although the geography of the Chengtoushan site has not been surveyed for the possibility of its indicating special festivals, according to measurements of the Shijiahe site by Wu (2021b, p. 50), sunset points for the spring and autumn equinoxes and the summer solstice, indicated by the mountains, can be observed to the west of the site, apparently with the intention of using the sunset directions to develop a geodetic calendar. The Shijiahe culture was thus clearly well aware of the heavens, and the relevant astronomical knowledge can be reconciled with that of the lower Yellow River. However, too few studies exist to determine to what extent knowledge of the heavens was available.

We may ask after the octagonal star. Traces of it can be found in the traditional costumes of Yunnan's ethnic minorities today (figure 6.14), but the astronomical meaning behind this pattern may have been forgotten. It is not known whether the octagonal star pattern has been handed down on the MYangzi River since the Neolithic period or whether it has since spread back from other regions.

**Figure 6.14, octagonal stars on a traditional ethnic costumes (Acheng, 2015, p. 18).**

### 6.5.5 How do celestial beliefs in the LYangzi River basin relate to death?

The orientation of the burials at Yuchisi, Xuejiagang and Lingjiatan is variable, but those of each cemetery have a relatively concentrated range of orientations, in contrast to the scattered orientation of burials at Chengtoushan. The grave goods from Yuchisi and Xuejiagang are mainly pottery, and that is largely undecorated, with only a few stone and jade artefacts discovered. Yuchisi belongs to the Dawenkou and Longshan cultures, which are closer to the LYellow River and follow similar burial customs. The ten large-mouthed urns found in the urn burials and sacrificial pits are carved with the Sun, Moon and mountain patterns similar to those of the Dawenkou culture. Many interpretations exist of Yuchisi's carving patterns, such as the mythological view that the large-mouthed urn is a womb, and the carving indicates the creation of the universe and the cycle of life or a sacrifice to a nature deity for a blessing (Han, 2019). Wang (2014) believes that they are hereditary markers for officials of the tribe who were responsible for observing the presence of Antares and determining the agricultural schedule, as none were found in adult burials. The carved motif is also identified to be the symbolic motif of a pottery item excavated in the eastern part of the large square at the site (Lang, 2014; figure 6.15). This artefact is presumed to be an instrument used by Yuchisi's inhabitants to welcome the sunrise and pray for or celebrate a good harvest, an item called a *tao qun*, or granary, topped with a bird that 'carries the sun' to determine the exact time of spring and autumn based on the arrival of specific birds (Wang and Liu, 2012). These interpretations indicate that Yuchisi also had related celestial beliefs and rituals.

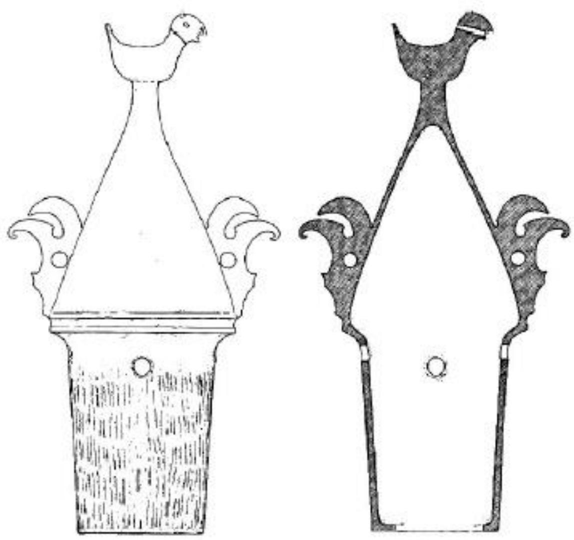


**Figure 6.15, *tao qun* (Lang, 2014).**

Pottery from the burials at Xuejiagang also displays simple surface decoration. The drilling of stone tools was more developed and the placement of this pottery in graves was deliberate. The number of jade artefacts did not increase until the Middle and Late Neolithic, and the concentration of wares in terms of type, quantity and age exceeds the rationality of normal consumption, representing instead a side effect of centralisation. The seven stone knives excavated from Xuejiagang's burials are all very large, and no similar items have been found in other cultures or at other sites in Neolithic China. They are not common to all burials, so graves with these large knives belong to more prominent clansmen (Lu, 1995). The numbers of holes drilled in the stone knives are all odd (figure 6.16). Although I doubt the consequentiality of his point, Feng Shi (2010, p. 138) adds up these odd numbers, 1+3+5+7+9+11+13, finding a total of 49, which is a multiple of 7, potentially representing the seven stars of Triones, the Big Dipper, leading him to suggest that these were ritual objects for people to worship and sacrifice to the Big Dipper. In addition, the two stone battle-axes and one nine-hole stone knife are painted with the red image of *gai tian* (of the Gaitian theory) and the four stars in the bowl of the Big Dipper, which Feng (2010, p.138) suggests that they might be also one of the ritual artefacts for worshipping the Big Dipper. The blades of the stone battleaxes, however, face in the opposite direction to the stone knife, such as northwest or southeast, instead of the cardinal north. Lu (1995), after studying the drilling technique used on the stone knives, suggested that the inhabitants of Xuejiagang had mastered the concept of the 'centre' over long periods of practice, because when drilling, they made the first hole at the midpoint of the stone knife and then expanded the series to the left and right, with the holes again drilled at a midpoint, meaning that the total number of holes must be odd. By this time, the subsistence activities of the people of Xuejiagang had long since evolved from fishing and hunting to primarily farming. The concept of the 'centre' may, therefore, be related to the previous analysis of the octagonal star pattern.

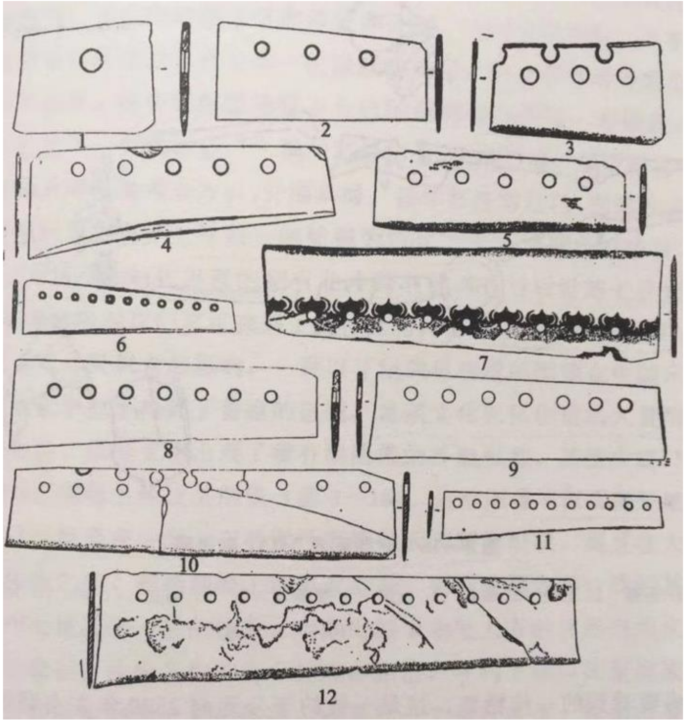



**Figure 6.16, 12 perforated stone knives from burials at Xuejiagang (Feng, 2010, p. 139).**

The grave goods of Lingjiatan show a shift from mainly pottery to mainly jade (Wu, 1990). Among the jade artefacts excavated from the first three periods, decorative artefacts account for 75.4%. The overwhelming predominance of jade at Lingjiatan suggests that the primary purpose of its people's reverence for and production of jade may have been to decorate themselves and show their status and identity (Wu, 1990). One of the most striking and most heavily analyzed items is the jade tablet, the like of which has only been found at this site (figure 6.17, left). There are also jade eagles and octagonal star motifs on ceramic spinning wheels, similar to those found on the MYangzi and LYellow River.

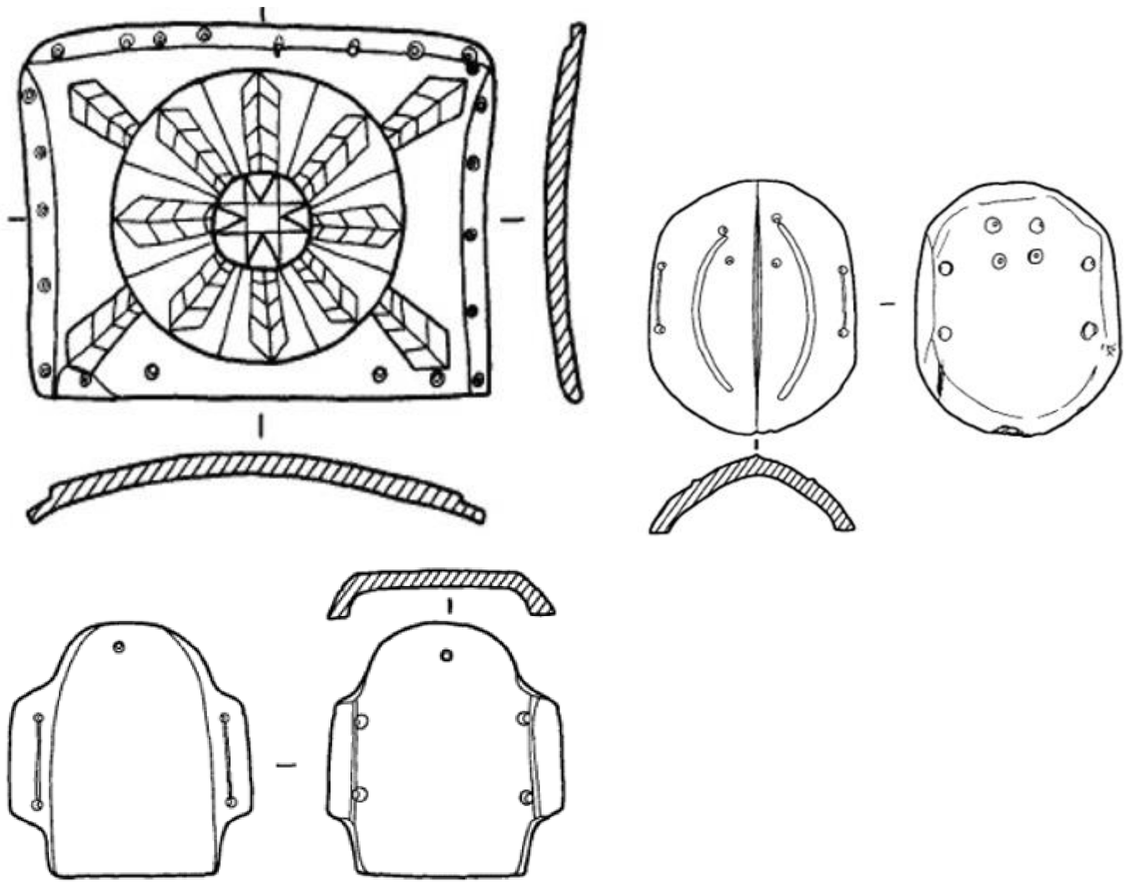


**Figure 6.17, jade tablet and jade tortoise from Lingjiatan M4 (APICRA, 2006, p. 49).**

All relevant interpretations of the jade tablet revolve around heaven and earth, space and time, celestial phenomena and cosmology. According to Wang Yucheng (1992), the nine holes at the top represent the Tail mansion of the Dragon constellation, while the octagonal star pattern represents the unbound ventral armour of a tortoiseshell. He also suggests that this was a religious vessel, used in conjunction with a jade turtle to perform divination (Wang Yucheng, 2006). Li Xinwei (2004; 2020) describes the two circles and the slightly curved cross-section of the tablet as representing the vault of heaven and the rectangular outer outline as representing the earth, with the eight arrow-shaped ornaments between the two concentric circles acting as ropes that connect the two heavens and represent the eight directions and the four arrow-shaped ornaments protruding from the outer circle representing northeast, southeast, southwest and northwest, presumably to indicate the four dimensions of heaven and earth. Shi (2024) agrees that the arrow shapes on the tablet represent the rays of the sun and the eight directions and suggests that the five pairs of round holes correspond to the eight solar terms of the four seasons (the beginning of spring, summer, autumn and winter, the spring and autumn equinoxes and the winter and summer solstices). The combination of concepts of time and space suggests that this set of jade artefacts may demonstrate the early cosmology of the inhabitants of Lingjiatan.

The octagonal pattern is also found in other cultures as described in previous sections. Li Xinwei (2004) believed it to be a symbol of the celestial pole at the zenith. Throughout the period under study, however, the North Star was at some distance from the real celestial pole, so the image may represent the imagined celestial pole. Conversely, Wu (2006) points out that although the Big Dipper had the function of fixing direction and time, and it is possible that the trajectory of the handle around the north celestial pole is related to the eight arrows around the octagonal star pattern, the placement of the jade tablet at the time of excavation makes it difficult to obtain information related to the movement of the dipper handle, so it is difficult to imagine a relationship with the Big Dipper. Nonetheless, the horizon data of the sunrise and sunset orientations at the two solstices are consistent, so the means of timing by observing the Sun's orientation on the horizon exists, although the jade tablet's pattern is not associated with ground markers, making it difficult to make simulated observations and propose astronomical dating.

Other views include that the pattern of the tablet is related to the directions and seasons, with the centre representing the Sun, the two sets of arrows representing the trigrams and the four signs and the many small holes coinciding with the *Hetu* and *Luoshu* (Chen and Zhang, 1989; Liu, 1997), or that it is a primitive dial used for telling the time and date, setting the calendar and measuring directions (Qian, 2006). Alternatively, the small circular holes may represent the stars and the arrows gods relevant to divination (Wang Yucheng, 2006). Others still propose that the tablet is a primitive sundial used to measure the Sun and the stars to set the time (Li Bin, 2006), or the cosmological concept of the circle of the sky and the octagonal star in the centre is related to *wu* (Li Xueqin, 2006; Luan, 2010).

Similar octagonal star appears on two other artefacts from Lingjiatan are also found in the Dawenkou, Liangzhu and Tangjiagang cultures. One of these has been interpreted to suggest that the celestial pole was supported by a sacred bird, while the pig's head is perhaps, as Feng (1996) assumes, a representation of the brightest stars (those of Triones; figure 6.18, left). Li (2004) explains that this is related to the rotation of the Big Dipper around the northern pole, with the sacred birds and pigs serving as animals that maintain the functioning of the heavens and the changing seasons. This jade artefact may also be a religious vessel. The pattern on the second artefact, a spinning wheel, has been interpreted as indicating that the celestial pole is the twist, the point at which the strings of the 'celestial net' are woven together (figure 6.18, right). Li Xinwei (2004; 2020) further proposes that if the hypothesis of the octagonal star as the northern pole is valid, then the idea may have been widespread around the middle and lower Yangzi River (e.g. Longqiuzhuang, Dawenkou and Xuejiagang) and Huai River basins prior to the period to which Lingjiatan belongs.

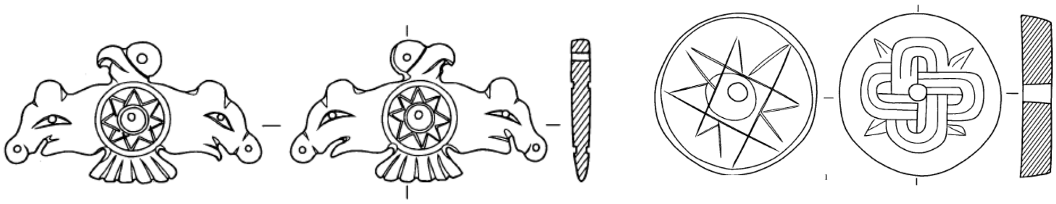


**Figure 6.18, jade artefact excavated from M29 (left; APICRA, 2006, p. 249) and a ceramic spinning wheel excavated from M19 (right; APICRA, 2006, p. 209).**

## 6.6 Summary of regional differences in celestial beliefs underlying burial orientations

Among the burial orientations seen at the 18 sites considered, covering 7 regions, westward and eastward orientations emerge as the two main options. There are certain correlations between orientation and culture, region, and chronology, for example in the Yangshao culture of the MYellow River and the Dawenkou culture of the LYellow River, both of which have strongly uniform arrangements. Burial orientations in other areas, however, show a more independent aspect that is not influenced by other sites of the same region and culture.

Analysis of the landscape around all of the sites shows that mountains or foothills were not necessarily the only factor in selection. Furthermore, in different geographical and cultural contexts, even where burials at different sites faced the same landscape features, the determining factors behind this choice may have been different. When we expand the view to the topographical features and altitude of the wider region, it becomes apparent that the topography is also a subtle factor behind burial orientation, as the topographical environment may have played an irreplaceable role in shaping the ideology and cosmology of local groups, indirectly influencing the choice of orientation. This natural environment determined, to an extent, the formation of human subsistence regimes, and different natural conditions also led to different astronomical observation habits, which influenced the formation and development of funeral customs.

In the high-altitude areas where nomadic herding was dominant, such as among the Qugong people, with their belief in sacred mountains, the direction of the graves is mostly related to mountains. In the south, the Shixia people chose settlements and burial orientations perhaps related to monsoons and tides. In the Yellow River basin, where millet farming was the mainstay, and the Yangzi River basin, where rice farming was dominant, farming activity was timed by specific celestial events and climate and phenological changes. The activities of farming life on the Yellow River coincided with the specific celestial phenomena encompassed by the respective burial ranges. Means of survival shaped living people's lifestyles and thoughts, and the view of death presented in burials was developed based on these elements. The burials on the Yangzi River do not face towards particular celestial events but embody celestial events, beliefs and perceptions of life and death in other evidence, such as funerary objects.

On the MYellow River, interpretations of ancient documents and ethnographic evidence allude to the importance of celestial and seasonal change to farming life. The consistent westward-facing (the direction of the setting sun and stars) Yangshao burials, mainly at Jiangzhai, Xipo and Qingliangsi, perhaps seek to express the natural cycle of an orderly and orientated world as perceived through farming life, a higher understanding that transcends heaven, earth and people, drawn from the daily pattern of sunrise and sunset. The most appropriate time of year for sowing and harvesting requires direct forecasts from the sky. Abstract cycles of lines on painted pottery suggest the same basic logic of the infinite cycle of life and death. There is, therefore, no direct correspondence between celestial phenomena and the orientation of burials but rather a direct relationship between the latter and the seasons and farming patterns. This was a matter of whether the community would have enough food to survive daily pressures and long and torturous winters, as well as natural and human-made disasters such as plague. Not going hungry is what keeps people alive and well. It is the foundation of human survival.

The Taosi phase was characterised by a monocentric, centralised society in which the ruling class needed to clarify the hierarchy and maintain its rule through institutional norms. The painted coiled dragon differs from the pottery motifs of the Miaodigou variant, whether or not it is to be read as the silkworm eating mulberry leaves, but it is at least a symbol of an alternative view of life and death derived or concluded by the Taosi centralisers based on the Miaodigou variant and the common objects of their lives. The essential logic also belongs to a set of understandings of the cycle of life and death derived from the observation of natural cycles, correlating sunrise or the east (the direction of the rising sun and stars) with rebirth.

On the LYellow River, whether judged from the *Classic of Mountains and Seas* records of Taihao and Shaohao or the direct interpretation of octagonal star motifs and engraved symbols, most of those motifs may be related to the astronomical and calendrical knowledge that was summarised at the time through pole-measuring and the long-term observation of time and sky signs and sublimated into beliefs as the Dawenkou culture developed, expressed in the form of such stylised motifs. By extension, the mastery of the changing laws of the heavens and time was a common phenomenon that had been passed down at least in the upper classes (Wang, 2008; Lv, 2015). Observations were made of not only the ecliptic of the Sun but also the movement of stars such as Antares and the other stars that make up the sign of the Dragon. Given the fact that burials of the Dawenkou culture consistently face east, it can be concluded that the worship of the heavens reached a consistently high level from the upper elite to the lower classes. The basic logic of the view taken of life and death may be similar to that of the Taosi people. However, the Dawenkou culture, which is earlier than the Taosi culture, may have had a simpler view of life and death. Dawenkou society had a grasp of astronomical knowledge, and the direction of the sunrise was not only an important agricultural reference point for the living (both in millet farming and rice cultivation) but also a means of fostering dependence, enabling the higher levels to achieve centralised power.

Since there is not one single celestial phenomenon required to support subsistence activities, Neolithic peoples focused not only on the path of the Sun or the movement of a particular star (e.g. Antares) but rather on the common feature of these celestial targets, their rising in the east and falling in the west, which is one of the features of the natural cycle. Societies established their views of life and death by identifying themselves as part of the universe and relating the movement of things in the sky to themselves. They thus followed a cosmology derived from the laws of nature they observed and conducted their activities at a pace consistent with changes in their surroundings. Such uniformity in Neolithic burial orientations as that found on the middle and lower Yellow River also suggests a highly centralised society, a community with a high degree of internal cohesion, in which the heavens were perhaps used not only to foretell the patterns of nature but also as a tool for the hierarchy to achieve cohesion and seek a monopoly of resources for the culture that followed.

Celestial phenomena were equally significant for the rice farmers of the Yangzi River Valley, a fact demonstrated by the ethnoastronomical evidence. At Chengtoushan on the middle Yangzi, some burials were arranged to face in the four cardinal directions, but the basis for the orientation of the others is, as yet, unclear. As a predominantly rice-cultivating culture, people at

Chengtoushan would have had a relatively sophisticated method of observing and timing and thus been able to determine planting dates based on specific celestial events. There are no natural features around the site suitable for observing sunrise to determine the seasons, so the suggestion of the Heart mansion on the altar by Wang and He (2024) is possible. It is not clear, however, whether the need for this particular astrological event was sublimated into expression through artefacts, but, white pottery declined in the Daxi culture, so I prefer to believe that fishing and hunting coexisted with gathering and farming in this period. The orientation of houses suggests at least that the Daxi inhabitants could pinpoint the four directions and that these had special significance in the cosmology of the time (Xu, 2019, p. 88). The custom of arranging houses on a north–south alignment was also carried over into the Qujialing and Shijiahe periods. From the perspective of the artefacts of the cultures to which Chengtoushan belongs and the geographical location of their other sites, it can be concluded that celestial objects were not only of interest from the early period but continued to be so into the Late Neolithic. It is the focus of attention that changed in response to changing ways of life and social institutions. It is possible that the directional indications provided by the sky became more focused on the timing of activities. Early astronomical knowledge, however, did not disappear but evolved, and in the Middle and Late Neolithic, it developed into artistic inspiration rather than purely a tool of belief.

On the LYangzi River, although there is speculation that the people of the Dawenkou culture at Yuchisi may have interacted with the Yangshao culture, the majority of burials face southeast or southwest to signify birth and the cycle of life (Tao, 2009), which is also consistent with the cult of the Dawenkou people on the LYellow River or a manifestation of the spring and autumn sunrise cult (Wang and Liu, 2012). None of this, however, explains the arrangement of the face towards the door, and burials were located around houses rather than in a separate cemetery. The positioning of the deceased to face the door may indicate the hope of the living that the gaze of the dead would always be upon them, blessing and guarding their safe entry and exit, which does not conflict with the worship of the cycle of life. It is puzzling, however, that the door facing southwest does not get as much light in winter as one facing southeast, nor does it face a special mountain range. All in all, this burial situation is very rare in prehistoric China. Differences during the transition from early to late culture suggest that even within the lifetime of a community, burial practices and the size and layout of settlements could change radically. This was also the case after the Dawenkou culture spread from the LYellow River to the Jianghuai region (Huo, 2006). Although the Yuchisi people inherited the same inscribed symbols, they displayed a slightly different view of life and death in terms of burial customs.

The overall grave orientation range at Xuejiagang is focused on the northeast rather than the north, so it can be said that it faces part of the Big Dipper but not all of it. The people of Xuejiagang may thus have had faith in the Big Dipper or celestial pole, but it is hard to say that this is reflected in their tomb arrangement. Subsistence at Xuejiagang had long evolved from fishing and hunting to mainly farming, leading to greater sedentism, as a result of which people's spatial perception gradually became self-centred, with the concept of the 'centre' established by observing the orientation of sunrise and sunset. If this is the case, however, why are the four holes not made at the top, bottom, left and right of the centre of the stone knife but spread out in the same column? Moreover, the burial faces between north and northeast, which does not overlap with the main range of sunrise. The burial objects may, then, suggest the possibility of certain celestial beliefs, while the Xuejiagang people did have their own concerns and understanding of the directions, but these cannot, for the time being, be correlated with actual celestial events.

At Lingjiatan, as at Xuejiagang, it seems that it is not currently possible to relate burial orientation to celestial events and possible observational behaviour; beliefs other than those concerned with celestial events may lie behind choices of burial orientation. As the burial materials show, however, Lingjiatan's inhabitants had a complete, articulated belief system regarding celestial events (possibly including the whole sky and earth). The tombs demonstrate that this system of beliefs was controlled by the elite, and Lingjiatan developed into a society with a strong theocratic ideology.

The development of the concept of life and death in each of the cultures of the Yangzi River was distinctive, both in its close integration with celestial beliefs and in its seeming lack of connection to them. The abundant sources of food along the Yangzi resulted in an attitude to life and death that contained less urgency, at least, than that in the Yellow River basin. Therefore, the development of farming on the Yangzi River in the Late Neolithic period took the path of high technological sophistication because even if floods submerged the arable land, the inhabitants could still rely on fishing and hunting to survive. The approach to the sky was directly related to actual needs. In the Yangzi River Valley, where fishing, hunting, gathering and farming coexisted, judging direction was a need for people in the plains-dominated forests, but the observation of the Sun and Antares was necessary both for farming and the understanding of time. The Big Dipper, Polaris, Antares and the Sun (the latter during the day) were important objects of belief, but these beliefs were sometimes not reflected in the orientation of burials. Therefore, in addition to celestial beliefs, there may have been various other beliefs on the

LYangzi River that directly influenced the inhabitants' view of life and death, which remain open to future study. What is certain is that whether they relied on fishing, hunting, gathering or farming, the people of the Yangzi River basin also considered themselves part of nature. Though the focus of their celestial observation was different and more varied than that of the Yellow River people, they followed the movement of everything they observed in nature and kept their activities in step with the changes around them to better survive.

Perhaps because of this, some artefacts from the Hemudu, Songze and other cultures in the Huai River basin show exquisite craftsmanship in the Early and Middle Neolithic, but some are crude, and there is no clear evidence of the manipulation of astronomical knowledge by the upper echelons of society. In the Late Neolithic, cosmology on the LYangzi River, for instance in the Lingjiatan and Liangzhu cultures, gradually took more complex material forms, including the construction of large altars and other ritual structures, as well as related jade artefacts. The ability and right to communicate with nature, which includes the sky, through the use of these ritual objects and facilities was monopolised by the upper classes as a means of asserting power.

One may wonder why the feet of the deceased were not used as the orientation marker in this study. From the point of view of archaeological discoveries, none of the burials at the 18 sites considered have revealed objects with openings facing in either the opposite direction to or the same direction as the skulls. The possibility of facing in the opposite direction is not excluded from the perspective of the skyscape, as celestial movements in the sky can be seen in both the east and west. With this reversed orientation, however, there are no landscape features such as those at Jiangzhai, Xipo, Qingliangsi or Dawenkou, although it was ultimately confirmed that not all landscapes played a special role in the cosmology of the Neolithic peoples. Hypotheses from the study of burials in later periods, such as the Xia, Yin, Shang and Zhou dynasties, are also tentative. Moreover, the interpretation of the excavated objects provides favourable evidence that the head was probably the marker of burial orientation dictated by the Neolithic people, as discussed above. Ethnographic sources regarding the relevant localities may perhaps provide different interpretations, but due to time and data constraints, head orientation was tentatively used as the main burial orientation in this study.

Overall, the astronomical phenomena reflected in the orientation of burials are not directly related to the concept of burial and death but to the most basic needs of the living and the concepts of life and death developed from these needs. The Milky Way may not have been reflected in concepts of life and death because it did not play a very important role in reducing the stresses of survival or in the formation of cultural identity: in other words, people might rely more on other celestial phenomena. The Milky Way was also not clearly recorded until the Han dynasty, although it is possible that it was recorded in the oracle bones or earlier documents but has not yet been identified. It is, therefore, uncertain whether it had some special role in prehistory. However, the fact that early China did not pay great attention to the Milky Way does not mean that other cultures did not pay attention to it and elevate it to their spiritual realm, as in the case of the Mississippian culture, where it was associated with their living environment (e.g. swamps and poisonous snakes) and a landscape that did not obstruct the view of the skies (Romain, 2021). In that culture, therefore, people developed a cosmological view of the Milky Way as the path to the underworld. The importance of doing archaeoastronomical research indeed lies in the fact that not every culture applies the same narrative, but rather each culture focuses on the appropriate celestial phenomena according to its subsistence activities, allowing us to trace a possible cosmology.

# Chapter 7 Conclusion

## 7.1 Introduction

The research question of this thesis concerns whether there is a hidden cosmology behind the orientation of burials in Neolithic China. This question stems from archaeoastronomical studies of Neolithic megalithic sites in Europe. European archaeoastronomers have reconstructed the cosmologies of the past by analysing these megalithic sites from different perspectives, deepening our understanding of the behaviours and social structures of the past. Exploring the concept of the afterlife in different cultures, such as those of Egypt, Greece, pre-colonial North America and pre-Qin China, reveals that the arrangement of tombs expresses people's understandings of life and death and thereby provides us with a glimpse of how they perceived the world around them, in which, in almost all cultures, the sky plays an important role. Chinese Neolithic burials are richly documented, but archaeoastronomers have long preferred to interpret Neolithic cosmology by means of excavated objects and ancient documents, and the study of orientation has always been a neglected area in Chinese archaeoastronomical studies. Therefore, this study explores the relationship between the natural environment and burial orientation by compiling and analysing the orientations of burials within 18 cemeteries across 7 regions, complemented by the interpretation of ancient documentation, ethnoastronomical evidence and excavated objects, allowing us to reconstruct the role of prehistoric cosmologies in a broader context.

## 7.2 Summary of the argument

This thesis integrates the geographical environment of sites, the surrounding natural landscapes, subsistence activities, celestial observations and celestial interpretations of excavated artefacts to determine the factors most likely to determine the orientation of burials and derive the inhabitants' cosmology or concepts of life and death. From the point of view of geographical and cultural categorisation, it is obvious that there is a strong unity in the orientation of burials of the Yangshao culture on the MYellow River and the Dawenkou culture on the LYellow River, each covering a long period. There are, however, some sites where the choice of orientation was not influenced by other sites of the same region or culture. From the perspective of topography and altitude, we can conclude that neither mountains nor plains seem to have played a decisive role, but that they may have played an irreplaceable role in shaping the ideology and cosmology of the local people, thus indirectly influencing the choice of burial orientation.

Topography and climate not only shape ideologies but also directly determine patterns of living, lifestyles and habits. Primitive beliefs are often born of this background. For example, for Tibetans, who rely on nomadic herding as their main source of income at high altitudes, the sacred mountain is a long-standing belief. Groups in the Yellow River basin, where millet farming was the mainstay of the economy, supplemented by fishing, hunting, gathering and livestock rearing, relied more on deliberately cultivated foodstuffs than those of the Yangzi River basin, where there were abundant wild resources and rice farming did not take over from fishing, hunting and gathering until the Middle and Late Neolithic period. Because the Yellow River basin lies at a relatively high latitude, it is more affected by global environmental changes than the Yangzi River basin and the south, which means that food resources there are more unstable. It can be surmised from ancient documents that the sowing and harvesting times of modern dry and rice agriculture are basically the same as those of the prehistoric period, with spring sowing and autumn harvesting. Along with climatic and physical signals, the trajectory of the Dragon sign was recorded to correspond exactly to the key yearly farming activities. Farming schedules in the Yellow River basin may, however, have been based on the signals of the Horn and Neck mansions, as well as the Heart mansion (Antares), while those of the MYangzi River were more concerned with the latter. The south, on the other hand, was dominated by fishing and hunting, with primitive farming not appearing until the late period. Therefore, its inhabitants may have been particularly concerned about the climatic phenomena associated with the monsoon and the tides, as well as celestial phenomena such as the migration of birds and the position of the moon. Due to a lack of relevant information, however, it is difficult to judge whether there is any correlation between the Sun's ecliptic, the four signs and the monsoon.

Not all decisions regarding burial orientation on the Yellow and Yangzi Rivers were bound by seasons and types of farming or even by patterns of livelihood, although the activities of farming life in the Yellow River basin roughly coincided with the specific celestial phenomena encompassed by the respective burial ranges. To judge from the interpretation of excavated artefacts from the Yellow River basin, a deeper understanding developed of the agricultural implications of the patterns of the heavens and the seasons. The Sun and the stars that served as reminders for farming activities rose and set regularly and cyclically in the range towards which the burials were orientated, and the sowing, ploughing and harvesting of the year acted as birth and death, which was also a circular motion of nature and part of its laws. The cosmology of the various cultures of the Yangzi River was more diverse, and it was displayed not solely in burial orientations but also in burial objects. The Sun, the Big Dipper, the pole star and Antares were all important objects of belief, as the cosmologies generated by the fishing and gathering and farming economies coexisted for a long period, and it was only in the late period that the use of the heavens shifted from directional judgment to an aide-mémoire for farming.

Not all burial orientations are related to celestial phenomena. Moreover, in regions that relied on celestial cues for subsistence activities, the astronomical phenomena that were incorporated into the orientation of burials are not directly related to the concepts of burial and death but to the most basic needs of the living and the concept of life and death derived from those needs. As the term 'cosmology' implies, whether in the Tibetan region, the Yellow River basin or the Yangzi River basin, people saw themselves as part of the laws of nature, perceiving the entities in their environment, following the trajectories of all they observed in nature and maintaining the pace of their activities in line with the changes around them to enhance their own survival. From the results of this study, it is clear that the peoples of Neolithic China were well versed in the laws of the heavens and time, and the concepts of cosmology and life and death that grew from this knowledge eventually formed a strong system of shared belief between societies. Behind the orientation of the burials and the grave goods is the spiritual acceptance of death by the living. In addition, celestial phenomena were used not only to set out the laws of nature but also for the higher echelons of society to achieve cohesion, to secure potential monopolies over resources for later cultures and to control the entirety of society.

## 7.3 Skyscape archaeology in prehistoric studies

The above synthesis combines four types of materials – ancient documents, ethnoastronomical data, excavated objects and astronomical calculations made in relation to burial orientation – to provide mainstream archaeology with a more comprehensive perspective than that previously available for the study of the prehistoric spiritual realm. This astronomical archaeological study reveals that while not every culture could apply the same narrative, each constructed a unique cosmology by focusing on the appropriate celestial phenomena based on its mode of existence and social patterns.

From the above summary, we can also see that all interpretations are based on the developments of life, death, food and breeding, which belong to the concept of 'natural cycles'. When interpreting the ancient astronomical perspective, we should not depart from these basic human needs. In this way, we may find ourselves able to pay attention to the simplest elements of life, which are also those subject to neglect (the darkness under the lamp, to borrow from the axiom), and thus reduce the overinterpretation or over-complication of prehistoric peoples' behaviours and spiritual world.

There are aspects relevant to this study that have not been considered in detail here, such as the orientation of houses and the role played by specific monuments (altars and sacrificial pits). The choice of location of a settlement and the layout and orientation of the houses are other extensions of the influence of the skyscape on people's lives. Although the orientation of houses at Yuchisi on the LYangzi River was addressed in this study, time constraints prevented us from referring to settlement evidence from other sites. This topic has the potential to clarify the relationship between celestial events and livelihood and social patterns. In fact, the high degree of uniformity in ways of life in the Yellow River basin must have had a profound impact on its people, not only in terms of specific features of life but also in terms of spirituality.

As we move forward, it is best to keep an open and pluralistic view, rather than defining the situation based on our own visions, knowledge and perceptions. Whether a person is western or eastern, prehistoric or modern, even if they see the same thing as another individual, their descriptions will differ because the content of their thinking differs. We must learn to conceive of a world in the way its inhabitants thought (Silva, 2022), that is, not to think about what they were thinking but to think about things as they did. The study of astroarchaeology thus not only needs to examine the vast amount of physical material left behind by prehistoric societies to construct the interactions that took place between people and their environment but must also refer to the perspectives of related disciplines to reconstruct concepts that will help us understand how different regions and groups of people saw their worlds.

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