

A Brief History of *Beiji* (Northern Culmen)

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Abstract. In ancient Chinese astral lore, the imperial nomenclature associated with the circumpolar stars in the Palace of Purple Tenuity points to the crucial importance of the north-pole in astrological, calendrical, and spiritual contexts. But preoccupation with this numinous region has a history far longer than the Chinese empire, founded in 221 BCE. This paper briefly surveys what is known about the pre-imperial history of the region of the 'Northern Culmen,' with particular reference to spiritual and metaphysical conceptions relating to the Northern Dipper, and to the void at the pivot of the heavens which lacked a pole star throughout much of the formative period of classical Chinese civilization. The discussion concludes with a hypothesis about the astral origins of the ancient form of the character used to denote the High God *di*.

Chinese preoccupation with astronomical orientation has a very long history. Archaeological evidence from the 5th millennium BCE Neolithic cultures of North China shows that burials and dwellings were already being oriented with particular attention to the diurnal and seasonal variations in the Sun's position.¹ By the early Bronze Age in the early 2nd millennium BCE and the inception of early state formation, such concepts had progressed to the point where ritually and politically important structures were uniformly quadrilateral in shape, and cardinally oriented, with the longitudinal axis aligned with some precision in a north-south direction.² Palatial structures and royal tombs from the earliest dynastic states in the 2nd millennium BCE, that is, Xia, Shang, and Zhou, consistently display such orientation. [Fig. 1, 2, 3] From the layout of the best preserved of these city walls and palatial foundations, it is clear that the principal access was normally via a main gate in the south facade, with the inner sanctum located far from the entrance towards the rear or

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north wall. This ritually and cosmologically significant architectural arrangement remained consistent throughout the entire history of China, most especially in edifices connected with the imperial prestige and power, as exemplified by the Forbidden City in Beijing. This much is already well-known and has been thoroughly documented by Paul Wheatley.³

What has been less well explored is the astral-terrestrial correspondence between the archaic kingship in the Bronze Age and the north-pole (*beiji*) or 'Northern Culmen', whose unique characteristics and powerful associations as the pivot of the heavens led to its becoming the celestial archetype of the cosmically empowered Chinese monarch. Already by the late 6th century BCE, some three centuries before the founding of the empire, Confucius drew on the metaphorical potency of the pole to illustrate the charismatic virtue (*de*) of the sagely ruler:

The Master said: To conduct government by virtue may be compared to the Northern Asterism: it occupies its place, while all the other stars revolve around it. *Lunyu* 2:1

The mysterious efficacy of charismatic virtue to which Confucius refers in the passage above, in the alternative, Taoist, vision becomes the efficacy of non-action, or *wu-wei*, the ultimate achievement of one who is in harmony with the force of Tao animating the universe. '*Wu-wei* does not imply absence of action. Rather, it indicates spontaneity and non-interference; that is, letting things follow their own natural course. For the ruler, this implies reliance on capable officials and the avoidance of an authoritarian posture. For the individual, it means accomplishing what is necessary without ulterior motive. Some commentators have explained *wu-wei* as "non-purposive" or "nonassertive" action.⁴ The aphoristic maxims of the Taoist classic, the *Book of the Power and the Way* (*Dao de jing*) repeatedly evoke the themes of non-action and charismatic influence (*de*) through which non-intentional purposefulness achieves its objective. So, for example, we find metaphorical allusion to the protean nature of *de* as impassive, infantile, feminine, artless, non-possessive, non-controlling, and so on:

While you
Cultivate the soul and embrace unity,
Can you keep them from separating?
Focus your vital breath until it is supremely soft,

Can you be like an infant?
Cleanse the mirror of mysteries,
Can you make it free of blemish?
Love the people and enliven the state,
Can you do so without cunning?
Open and close the gate of heaven,
Can you play the part of the female?
Reach out with clarity in all directions,
Can you refrain from action?
It gives birth to them and nurtures them,
It gives birth to them but does not possess them,
It rears them but does not control them.
This is called 'mysterious charisma.'⁵ (54/10)

Even more to the point, there is this meditation on the paradoxical usefulness of "nothing":

Thirty spokes converge on a single hub,
But it is in the space where there is nothing
That the usefulness of the cart lies.
Clay is molded to make a pot,
But it is in the space where there is nothing,
That the usefulness of the clay pot lies.
Cut out doors and windows to make a room,
But it is in the spaces where there is nothing
That the usefulness of the room lies.
Therefore,
Benefit may be derived from something,
But it is in nothing that we find usefulness.⁶ (55/11)

In contrast to Confucius, who was quite explicit about the astronomical source of his evocative image of the mysterious efficacy of charismatic virtue, the author of these essentialist Taoist aphorisms, true to form, is indirect, allusive, yet down-to-earth in his choice of images. Nevertheless, it does not require a great imaginative leap to recognize the likelihood of a common inspirational source for their respective visions of ultimate attainment in the mysterious operation of the pivot of the heavens. It can hardly be purely coincidental that during the period when the pre-classical, inchoate versions of this vision were being formed there was no distinctive pole star, no guiding light at the pivot of the heavens,

so that the marvel of an efficacious void at the center of the sky was nightly on display.

The Northern Dipper and the Imperial Power

As the most distinctive stellar formation near the pole, some of the mysterious aura of that location attached to the Big Dipper. The rotation of the Northern Dipper around the mysterious pivot at the center of the heavens [Fig. 4] for centuries enabled it to serve as a celestial clock whose changing orientation marked the passing of the hours of the night as well as the seasons of the year. As one classical text, the *Pheasant Cap Master* (*Heguan zi*), put it:

When the handle of the Dipper points to the east (at dawn), it is spring to all the world. When the handle of the Dipper points to the south (i.e., up) it is summer to all the world. When the handle of the Dipper points to the west, it is autumn to all the world. When the handle of the Dipper points to the north (i.e., down), it is winter to all the world. As the handle of the Dipper rotates above, so affairs are set below . . . (5:21/1-4)⁷

Explicit literary and graphic elaboration of the association of the north-pole and its attributes with the person of the Emperor, the ‘Son of Heaven,’ came with the establishment of the universal empire, as in this famous Han dynasty stone carving from a Wu Liang tomb shrine dating from the Later Han. [Fig. 5] Here we see the Lord-on-High or *di* dressed in the imperial garb and riding in the Dipper as if driving an imperial carriage. Like the mysterious Northern Culmen (*beiji*) at the center of the celestial dome, the formal, ritual pose of the Chinese Emperor was to sit facing south, so that all his ministers, minions, generals, and subjects approached his exalted presence and prostrated themselves while facing north. Indeed, tradition had it in the early Empire that the Han dynasty capital Chang’an had been laid out in such a way as to mimic the configuration of Ursa Major and Ursa Minor, although this has not been confirmed archaeologically.⁸ Historical accounts from the early Han dynasty lend credence to the claim that the preceding Qin dynasty capital of Xianyang did indeed contain elements of astral symbolism implying that the Emperor’s palace was in the position of the pole star relative to the constellations and the Milky Way.⁹

The *locus classicus* for the identification of the person of the Emperor, who with the inception of the imperial system is now also called *di*, with the cosmic functions of the Northern Dipper, is in the ‘Treatise on Astrology’ in the *Grand Scribe’s Records* (*Shi ji*) compiled in the late 2nd century BCE. There, in the description of the astral correlates of the imperial court in the circumpolar region of the sky, we read:

The Dipper is the Lord-on-High *di*’s carriage. It revolves about the center, visiting and regulating each of the four regions. It divides *yin* from *yang*, establishes the four seasons, equalizes the Five Elemental Forces, deploys the seasonal junctures and angular measures, and determines the various periodicities: all these are tied to the Dipper. (27:1291)

Beginning with the Han dynasty the historical record clearly reflects the crucial symbolic significance of the Dipper in the cosmo-magical imagery associated with the imperial office. Let me just cite two examples. In the Grand Scribe’s account of ritual procedures during the Former Han dynasty there is the following passage:

That autumn (112 BCE), in preparation for a punitive expedition against Nan Yue, the attack was announced in prayers to the Grand Unity (a polar astral deity). A banner decorated with images of the sun, moon, Northern Dipper, and rampant dragons was mounted on a shaft made from the wood of the thorn tree, to symbolize the Heavenly Unity and its three stars, vanguard of the Grand Unity. [The banner] was called ‘Numinous Flag’. When one prayed for military success, the Grand Scribe would hold it aloft and point in the direction of the country to be attacked.¹⁰

And then there is the slightly later account from the reign of the usurper Wang Mang, first and only emperor of the Xin dynasty, which intervened between the Former and Later Han dynasties. This occurred in CE 17:

(In the 4th year of the Tianfeng reign period) in the 8th month, (Wang) Mang went in person to the place for the suburban sacrifice south of the capital to superintend the casting and making of the Ladle of Majesty. It was prepared from minerals of five colors and from copper. In shape it was like the Northern Dipper, measuring two feet five inches in length. (Wang) Mang

intended (to use it) to conquer all rebel forces by means of conjurations and incantations. After the Ladle of Majesty was finished, he ordered the Directors of Mandates (from the Five Elements) to carry it solemnly on their shoulders in front of him whenever he went out, and when he entered the palace, they waited upon him at his sides.¹¹

Six years later, during the rebellion of CE 23, when the burning palace was invaded and Wang Mang and his retinue were about to be killed by Han dynasty loyalists, the following scene ensued:

Meanwhile, (Wang) Mang, dressed all in deep purple and wearing a silk belt with the imperial seals attached to it, held in his hand the spoon-headed dagger of the Emperor Shun. An astrological official placed a diviner's board (*shi*) in front of him, adjusting it to correspond with the day and hour. The Emperor turned his seat, following the handle of the ladle, and so sat. Then he said, 'Heaven has given the (imperial) virtue to me; how can the Han armies take it away?'¹²

Imperturbable in his faith in celestial protection, in this pose the usurper Wang Mang and his Xin dynasty met their end.

Early Antecedents

We have seen how the microcosmic-macrocosmic analogy between the Emperor and *di*, the Lord-on-High at the apex of the heavens, is abundantly documented for the early imperial period. Furthermore, as Paul Wheatley and others have shown for the Shang and Zhou dynasties, each of the basic modes of symbolism displayed by the ideal type-city throughout much of the ancient world is evident in the planning of ancient Chinese capitals. These aspects of traditional symbolism have been succinctly formulated by Mircea Eliade as follows:

1. Reality is a function of the Imitation of a Celestial Archetype.
2. The Parallelism between the Macrocosmos and the Microcosmos necessitates the practice of ritual ceremonies to maintain harmony between the world of the gods and the world of men.
3. Reality is achieved through participation in the Symbolism of the Center, as expressed by some form of *axis mundi*.

4. The techniques of orientation necessary to define sacred territory within the continuum of profane space involve an emphasis on cardinal compass directions.¹³

In addition to the cosmo-magical physical layout of the Shang and Zhou capitals and ritual centers mentioned above, abundant inscriptional evidence attests to the ancient Chinese preoccupation with each of these basic modes of symbolism. For example, the late-Shang oracle bone inscriptions integral to the Shang kings' cultic and ritual practices contain numerous examples of divinations motivated by propitiatory impulses. In addition to those concerning *di*'s manipulation of powerful natural forces such as wind, rain, and the like, numerous other divinations relate to the bestowal of good harvests, relief from natural disasters and belligerent neighbors, etc., by the spirits of the Four Quarters, the Dipper,¹⁴ and so on. These and other divinations embody the conceptualization of Shang as the symbolic center from which the royal charisma radiates in all directions. From the inscriptions it is also clear that the supernatural realm, with *di* at its apex, mirrored the hierarchy of the temporal Shang state.¹⁵ Though we have no explicit contemporary statement to that effect, it seems clear that in the Shang conception the Lord-on-High *di*'s abode, as in Confucius' day, was at the center of the heavens from which cosmic control appeared to emanate, a location made all the more mysterious by the lack of a pole star.¹⁶ This absence of a distinctive pole star at this epoch as well is an issue which deserves further exploration, both because of the orientation of monumental architecture in the landscape, and to better understand the role of the Lord-on-High *di* and the significance of the character used to write his name. First, however, a brief account of the career of the north-pole from the Neolithic through the Bronze Age is perhaps in order.

Migration of the Pole

Precession of the equinoxes may seem a rather sophisticated concept to be of concern to the Chinese in the mid-2nd millennium BCE, but for a civilization with an emphatically polar-equatorial astronomy and cosmopolitical culture, the inconstancy of the pole's location must have been problematical. Although precession as a phenomenon was not adequately understood until well after the founding of the Empire, its effects were certainly noticed and accommodated considerably earlier, most notably in the well-documented Taichu calendar reform of 104 BCE.¹⁷ Given the early focus on the Pole as the archetypal analogue of the temporal ruler, it

would be surprising if the inconstancy of such a highly symbolic location did not register with observers in the Chinese Bronze Age. This is all the more true since still earlier in the Neolithic period there was a comparatively bright star α Dra (+3.65) ideally located close to the north pole; indeed, in about 2775 BCE Thuban (α Draconis), with a declination of $89^{\circ}53'$, was closer to the pole than our own Polaris will ever be [Fig. 6]. Subsequently, however, and for much of the Chinese Bronze Age, the track of the north pole did not bring it close to a comparably bright star which might conveniently serve as a pole star. [Fig. 7]

As we saw above, however, this did not prevent the Shang rulers, throughout the latter half of the 2nd millennium BCE, from aligning their built environment with celestial north. Throughout the wide area under actual or nominal Shang control, palatial foundations, city walls, tombs, and other structures were most often laid out with their longitudinal axis aligned on the pole. [Fig. 8] To cite just one well-known example, the consistent displacement from the present true north by an average of some 5° - 12° E displayed by late Shang tombs is 'not far from what we should expect' if, as Joseph Needham has observed, the 'Shang people had taken care to site their tombs in accordance with the astronomical north of their time.'¹⁸ In what follows I would like to discuss how this northerly alignment might have been accomplished in practical terms, given the absence of a pole star, which will also lead me to propose a new interpretation of the notoriously obscure shape of the oracle-bone character used to write the name of the Shang high god *di*. [Fig. 9]

In view of the inconspicuousness of the stars near 90° N when the late-Shang dynasty royal tombs were being constructed, some technique must have been devised to orient such structures in the landscape. In speaking of a technique what I have in mind is something akin to the device commonly employed today to quickly locate a naked-eye object among the vast array of stars. First one identifies an unmistakable constellation nearby, for example, in the case of Polaris one can use Ursa Major, and then by sighting along the line formed by the two bright stars Mirak and Dubhe (α and β Ursa Major) forming the outer edge of the bowl of the Dipper, the eye is easily guided toward Polaris. This is about the simplest and most effective device one could imagine, both serviceable and, in my experience, still necessary, even in an age when we have a second magnitude star less than 1° from the pole. How much more indispensable would such a device have been in an age when there was no obvious pole star, and the comparatively bright circumpolar stars in Ursa Minor and Ursa Major were several degrees distant from true north? Indeed, we do

know that such devices were conventionally used by the ancient Chinese, as Joseph Needham has illustrated with regard to the sight-lines established by the stars of Ursa Minor.¹⁹

Of course, one could argue that the objective of locating astronomical north could have been accomplished more conveniently had structures been oriented in conformity with a north-south axis determined by the bisection of the angle between the directions of the rising and setting sun. Indeed, such a procedure may be alluded to in an ancient ode from the early Zhou dynasty,²⁰ and is explicitly recommended in the late classical text *The Rites of Zhou*, as Paul Wheatley pointed out.²¹ However, alignments established by bisecting the angle between the directions of the rising and setting sun would still be more or less accurate today, and should not have produced the easterly offset exhibited by Shang dynasty architectural remains.²² At a time when the Lord-on-High's intentions vis à vis the Shang state were still a national security concern, taking direction – literally – from the ultimate source of supernatural power, may well have called for a more direct, 'polar' method.

In view of this need for a simple device to precisely locate the astronomical pole in the absence of an obvious pole star, let us consider again the shape of the oracle-bone inscription character for *di* itself [Fig. 9]. Over the centuries lexicographers have advanced numerous etymologies purporting to explain the origin of this word and the graph used to write it, none of which has won general acceptance.²³ Indeed, the very obscurity of the etymology of the character anciently used to denote the high god at the apex of the supernatural pantheon is a bit of an embarrassment to sinology.²⁴ In my view the character *di* is representational in much the same way as depictions of certain constellations are, albeit in this case with a twist. There is precedent for this kind of representation in the oracle-bone inscriptions. For example, one can point to the resemblance between the oracle-bone script form of the character for "dragon" *long* and the constellations to which it corresponds. [Fig. 10] The Chinese Cerulean Dragon of the eastern palace of the heavens, in our scheme corresponds to constellations from Virgo through Scorpius, the dragon's two horns being marked by Spica and Arcturus and its tail by Scorpius. It is hardly surprising that the hooked array the Babylonians already saw as the tail of a scorpion should have been identified by early Chinese observers as the tail of a dragon, particularly in view of the ancient importance of the dragon and the Fire Star Antares (α Scorpius) at its heart as seasonal markers. Indeed, the Fire Star is one of the very few stars mentioned by name in the formulaic

Shang divinations, and dragon iconography, possibly totemic in origin, is ubiquitous on Shang period bronzes.

What, then does the character *di* actually depict? Fig 4 above is a chart of the circumpolar region as it would have appeared in early Shang times, showing how the bright stars of Ursa Major and Ursa Minor at some considerable distance from but bracketing the pole. Given the practical necessity to more or less accurately locate the pole, let me suggest the following as a possible device. Fig. 11 reproduces a modern star chart showing the region between the two Dippers. Superimposed on this chart is the Shang character for the high god *di* drawn to scale and connecting the bright stars in the handles of Ursa Minor (above: γ , β , 5 UMi) and Ursa Major (below: ζ , ϵ , δ UMa). By comparing this illustration with Fig. 12, it is evident that the intersection of the three longitudinal lines precisely marks the actual location of 90° N in about 2,000 BCE. We do not know the actual epoch of creation of the character *di*, except that it had to have occurred considerably before the 13th century BCE, the date of the earliest Shang inscriptions, which already give evidence of a script and written language in fully developed form. What is especially noteworthy in this connection is that crossbars, crosshatching, or circling is a very common feature of the oracle-bone script designed to draw attention to the ideational focus of particular interest (compare Fig. 9), in this case, the intersection of lines marking the location of true north. Notice, too, that in the case of the crossbar of the character *di*, one possible location of which is depicted here, the endpoints are also marked by crosshatching, which could have been intended to mark the location of Thuban, the previous, Neolithic pole star on the left, and κ Dra on the right, the Great Unity star and object of the ancient astral cult already referred to in the Han dynasty text cited above.²⁵

Needless to say, for practical purposes some sort of sightline on the ground would have to have been established in order to lay a foundation, perhaps using a front and back sight of some kind, but as a means of gauging the location of the pole the kind of device I am positing may have been quite serviceable. In all likelihood a template such as I have drawn on the star chart would have to have been fabricated to serve the purpose, possibly in bronze and mounted on a rod like a shaman's staff. And perhaps it is not too far-fetched to imagine this shape subsequently being used to denote the numinous abstraction of a supreme supernatural power resident at that strangely empty spot in the sky.

Conclusion

By the fall of the Shang dynasty in mid-11th century BCE, the evolution of the Shang ancestral cult culminated, not merely in the identification of the royal Shang ancestors with the Lord-on-High *di*, but even in the adoption of the title *di* by the living ruler. With this, it seems, the precedent was set for the assertion of a genetic relationship between the temporal authority and the Lord-on-High which was to be made still more explicit in the term Son of Heaven subsequently applied to Zhou dynasty kings, and ultimately to all Chinese emperors.

Quite apart from metaphorical associations between the temporal power and the potency of the ruler in the sky, whether in Confucian political ideology or Taoist mysticism, one is struck by a remarkably strong and persistent preoccupation with quite specific astral-terrestrial correspondences, especially concerning the North Pole. Although well-documented in the classical and imperial period, for which abundant literary sources are available, the history of this preoccupation with the pivot of the heavens and its potent symbolism have not previously been traced back to the formative period in the 2nd millennium BCE. As we have seen, however, by bringing together a variety of evidence from archaeology, Shang dynasty oracle-bone inscriptions, and the history of astronomy, it becomes possible to piece together a coherent picture that identifies the Lord-on-High with the potency of the pivot of the heavens at least by the founding of dynastic Shang in the early Bronze Age.

Fig. 1: Yanshi Shang city site plan, Henan province, early Shang dynasty. The arrow at the upper left shows true north. (after Zhang Zhiheng & Zhou Yuxing, *Xia Shang Zhou kaogu*, [Nanjing, 1995], [hereafter Zhang, *Xia Shang Zhou*], p. 49)

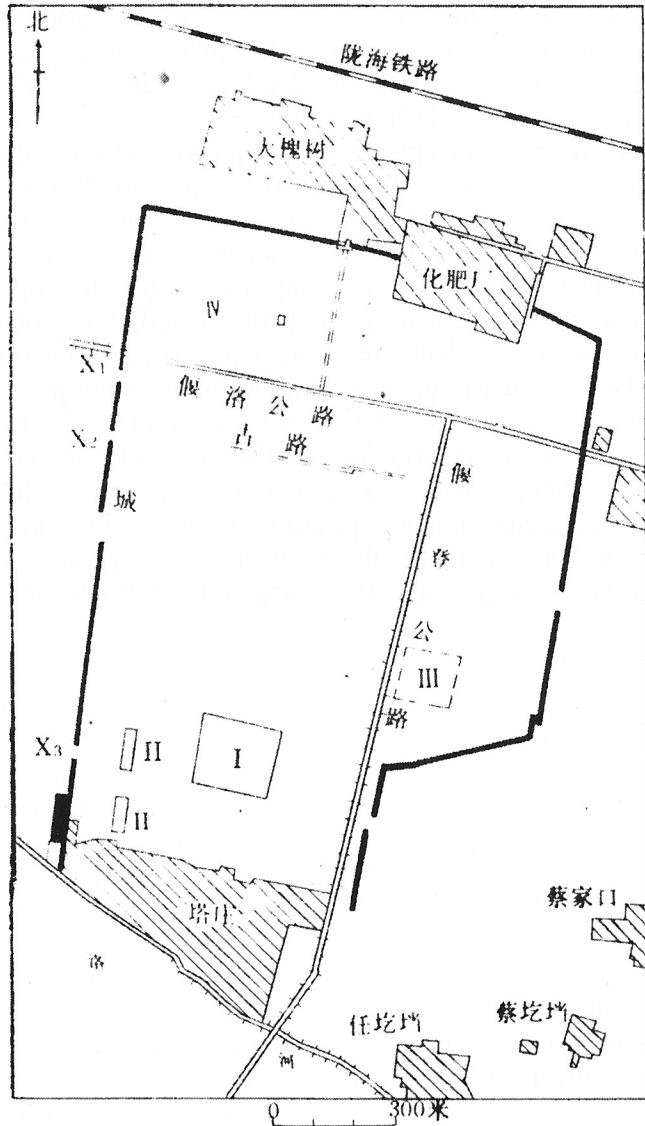


Fig. 2: Yanshi Shang City palace foundation #4 (after Zhang, *Xia Shang Zhou*, p. 51).

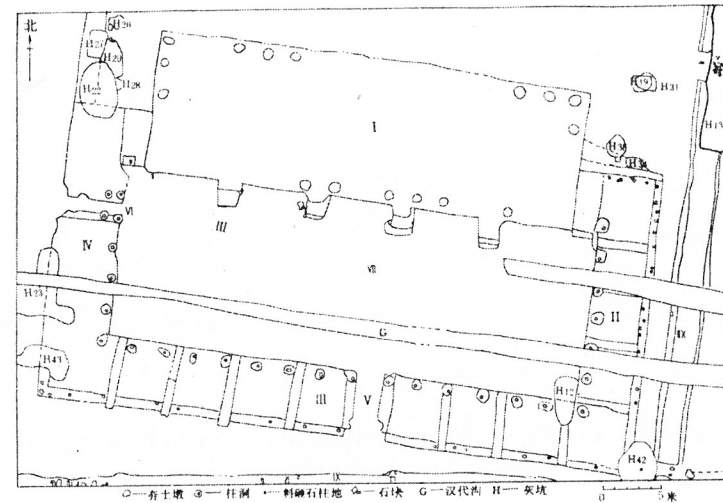


Fig. 3: Early Shang city walls at Zhengzhou, Henan (after Zhang, *Xia Shang Zhou*, p. 54).

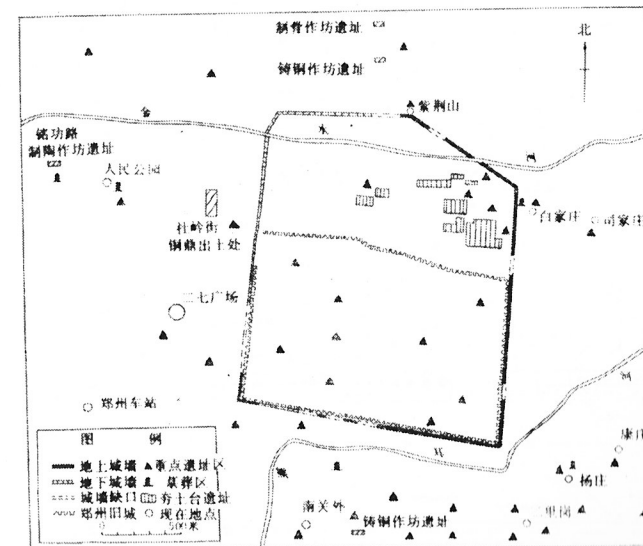


Fig. 4: Panlong town, palace foundation plan #1, Hubei province, late Shang (after Zhang, *Xia Shang Zhou*, p. 61).

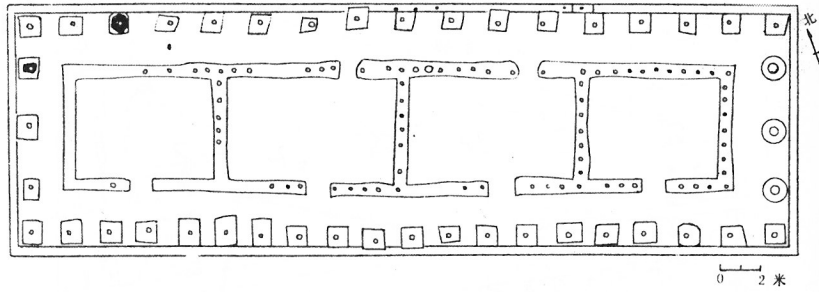


Fig. 5: Position of the Big Dipper in relation to the North Pole in early Shang (*Dance of the Planets* © ARC Software).

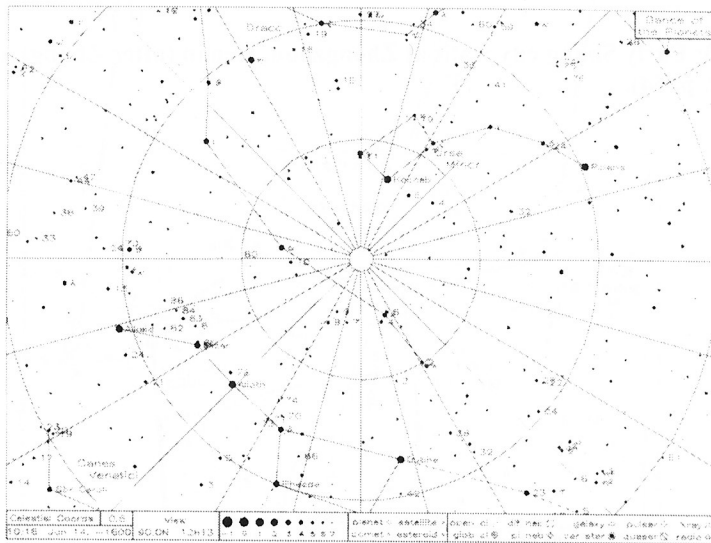


Fig. 6: Stone carving from the Wuliang Shrine, Eastern Han, showing the Celestial Thearch driving his heavenly chariot, the Dipper (after Major, *Early Han Thought*, p. 108).



Fig. 7: Thuban, the late-Neolithic pole-star, at 90° N in 2,775 BCE (*Dance of the Planets* © ARC Software).

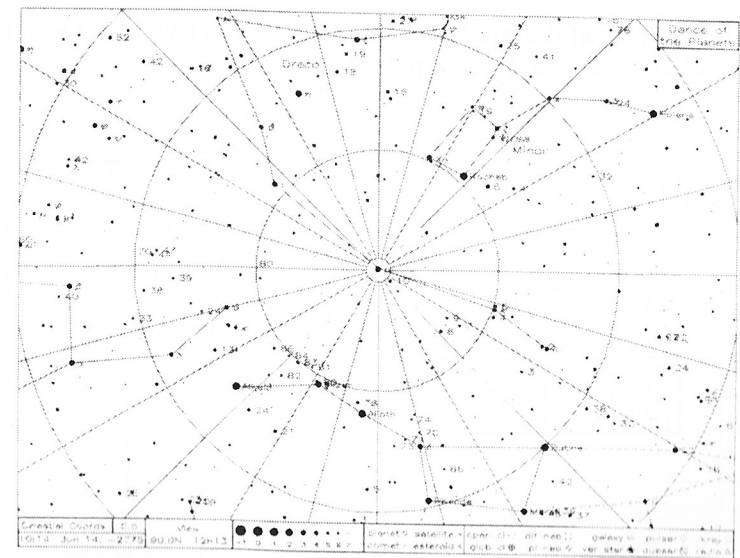


Fig. 11: Left: Shang oracle-bone script (#1-7) and Shang bronze variants (#8-9) of the character for *long* "dragon"; Right: the Eastern Dragon constellation formed by linking together stars from Virgo through Scorpius (after Feng Shi, "Zhongguo zaoqi xingxiangtu yanjiu," *Ziran kexueshi yanjiu* 9.2 [1990], p. 112).

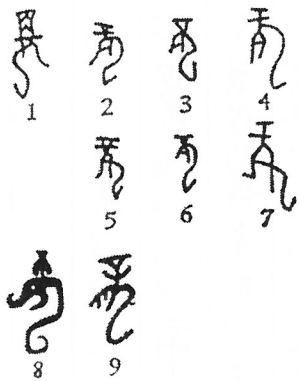


图2 甲骨文及金文“龙”字
1—7.甲骨文 8—9.金文

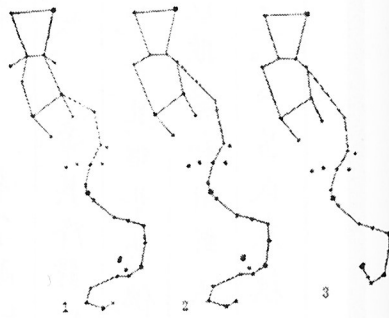


图3 苍龙之象构想图

Fig. 12: Star chart with superimposed character *di* -- the intersection of the three longitudinal lines marks the actual location of the north celestial pole in 2,000 BCE. Compare the present location of the north-pole near Polaris at the very top of the chart. (after Wil Tirion, *Sky Atlas 2000.0*, [Cambridge: Sky Publishing, 1981])

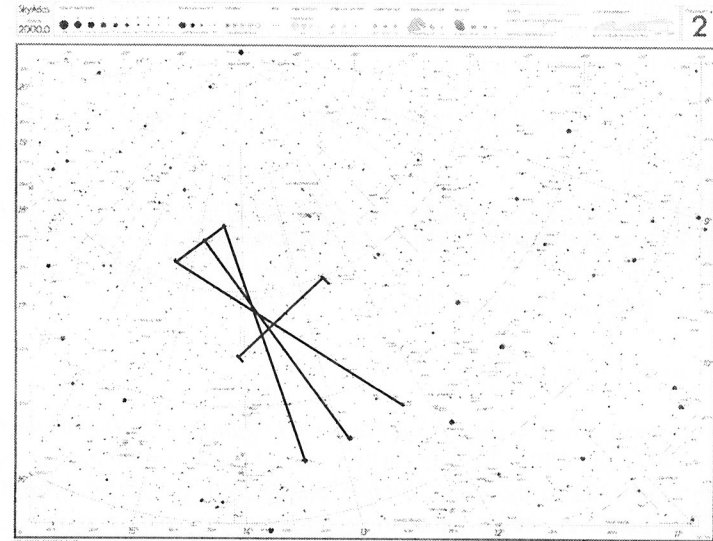
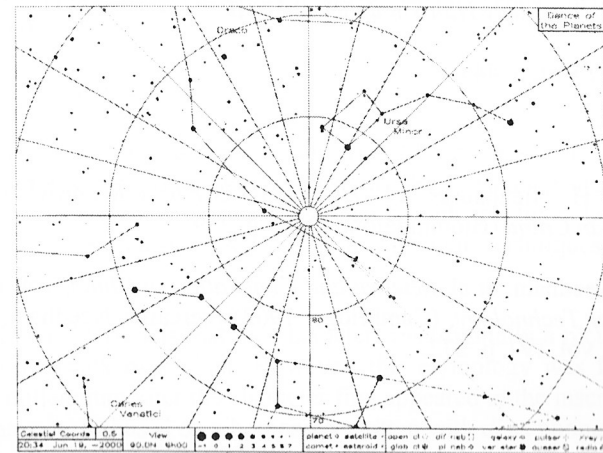


Fig. 13: Star chart showing the location of the north celestial pole in 2,000 BCE (*Dance of the Planets* © ARC Software).



Endnotes

- 1 David W. Pankenier, 'The Cosmo-political Background of Heaven's Mandate,' *Early China*, (Berkeley, 1995), [hereafter Pankenier, 'Background'], Vol. 20, p. 121, n. 2.
- 2 Paul Wheatley, *The Pivot of the Four Quarters: A Preliminary Enquiry into the Origin and Character of the Ancient Chinese City* (Edinburgh, 1971) [hereafter Wheatley, *Pivot*], p. 423.
- 3 Wheatley, *Pivot*; especially Chapter 5, 'The Ancient Chinese City as Cosmo-magical Symbol.'
- 4 Victor H. Mair, tr. *Tao Te Ching: The Classic Book of Integrity and the Way, Lao Tzu* (New York, 1990) [hereafter Mair, *Tao Te Ching*], p. 138.
- 5 Mair, *Tao Te Ching*, p. 69; modified.
- 6 Mair, *Tao Te Ching*, p. 70.
- 7 Carine Defoort, *The Pheasant Cap Master (He guan zi): A Rhetorical Reading* (Albany, 1997), pp. 189, 320. The earliest metaphorical use of stars or asterisms occurs in Ode #203 in the *Book of Odes* dating from the early 1st millennium BCE. There, however, the brilliance of several asterisms, including the Dipper, is likened to the aristocratic elite who occupy positions of importance but do not exploit their brilliance in practical ways that benefit the populace. See Bernhard Karlgren, tr. *The Book of Odes* (Stockholm, 1950), p. 153-154. For an account of the Dipper in Han times, see John S. Major, *Heaven and Earth in Early Han Thought: Chapters Three, Four, and Five of the Huainanzi*, (Albany, 1993), [hereafter Major, *Early Han Thought*], p. 106ff.
- 8 Wheatley, *Pivot*, p. 443.
- 9 Ibid, p. 442.
- 10 William H. Nienhauser, ed. *The Grand Scribe's Records*, Vol. II, *Basic Annals of Han China* (Bloomington, 2002), p. 239.
- 11 Joseph Needham, et al. *Science and Civilisation in China*, vol. IV.1, *Physics and Physical Technology*, (Cambridge, 1962) [hereafter Needham, *Science and Civilisation*, vol. IV], p. 272.
- 12 Ibid.

13 Wheatley, *Pivot*, p. 418.

14 A reflection of the protean role of the Dipper asterism whose most archaic attested identity (ca. 1300 BCE) was already as a ladle *dou*, or peck-measure.

15 Cf. Cho-yun Hsu and Kathryn M. Linduff, *Western Chou Civilization* (New Haven, 1988), p. 98.

16 The 1987 discovery of the Neolithic clamshell mosaics depicting eastern dragon, western tiger and Northern Dipper in tomb no. 45 at Xishuipo, dating from ca. 2,500 BCE, is another possible indication of the long history of ancient Chinese cosmological focus on the North Pole; see Chen Cheng-yih and Xi Zezong, 'The *Yao Dian* and the Origins of Astronomy in China,' *Astronomies and Cultures*, ed. C. L. N. Ruggles and N. J. Saunders, (Niwtot, Colorado, 1993), p. 53; but see also David W. Pankenier, 'The Mandate of Heaven,' *Archaeology* (New York, March-April 1998), Vol. 51, p. 30.

17 See Christopher Cullen, 'Motivations for Scientific Change in Ancient China,' *Journal for the History of Astronomy*, (Chalfont St. Giles, 1993), Vol. 24, pp. 185-203.

18 Needham, *Science and Civilisation*, vol. IV, p. 313.

19 See Joseph Needham et al. *Science and Civilisation in China*, vol. III, *Mathematics and the Sciences of the Heavens and the Earth*, (Cambridge, 1959), pp. 232-233.

20 Pankenier, 'Background,' p. 121, n. 2; Wheatley, *Pivot*, p. 426; see also Kwang-chih Chang, *Shang Civilization*, (New Haven, 1980), [hereafter Chang, *Shang*], p. 160.

21 Wheatley, *Pivot*, p. 426.

22 The foundation of a small shrine that originally stood atop the underground tomb of a famous consort of the 13th century BCE Shang King Wu Ding is accurately aligned to the cardinal directions, though the tomb beneath is not, showing that builders clearly used different alignment techniques to orient the two structures.

23 One widely held view is that the character was originally a pictograph of the peduncle or footstalk of a plant. However, this etymology was first proposed well over a millennium after the character first appeared in the inscriptions and is no more than a guess based on a homonym written with *di* as phonetic element.

24 As early as the 13th century BCE the same character was used in the inscriptions to denote both the Lord-on-High and the ritual sacrifice dedicated to him; later the two would be disambiguated by the addition of an 'altar' significant to the sacrificial term. From classical accounts, especially in the early imperial period, we know that this sacrifice was conducted on an altar platform very like the Altar of Heaven which still survives in the southern suburbs of Beijing. Performed in person by the Emperor, this ritual sacrifice to Heaven involved a role reversal, in that after the prayer of supplication the Emperor, now enacting the role of devoted subject, would face north and perform ritual prostrations like those prescribed for subjects entering his own presence.

25 For a recent study of the stars associated with this cult, see Y. Maeyama, 'The Two Supreme Stars, Thien-I and Thai-I, and the Foundation of the Purple Palace,' *History of Oriental Astronomy*, ed. S. M. R. Ansari, (Dordrecht, 2002, Congress of the International Astronomical Union, Kyoto, 1997: Proceedings), [hereafter Maeyama, "Two Supreme Stars"], pp. 3-18.