

## Star kings

### The astronomical meanings of the royal names of the Zero and First Dynasties

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## 1 Ancient Egyptian astronomy

The Egyptian civil calendar is based on the solar year, which was divided into three seasons of four months each. A month consisted of three 10-day periods, called “decans”. The total of 360 days was supplemented by five epagomenal days, which were assigned to gods, but considered days of potential misfortune.<sup>1</sup> This solar calendar most likely originated in the Predynastic Period.<sup>2</sup> Ramesside star clocks in the royal tombs of the 20th Dynasty<sup>3</sup> divide the civil calendar year into 24 half-month intervals. Each interval is characterized by the rising and setting of 12 “hour” stars.<sup>4</sup>

The Egyptians developed their calendar by observing the apparent paths of the sun and fixed stars. C. Leitz (1989) presented eight independent astronomical arguments indicating that the observation site was always located near Lower Egypt, most likely in Memphis or Heliopolis.<sup>5</sup> The Egyptian sky-watchers, presumably priests, divided the night sky into the “northern” and “southern” skies.<sup>6</sup> V. L. Davis (1985) convincingly argued that these terms did not refer to the cardinal directions but rather to the regions within and outside the arc of the Milky Way.<sup>7</sup> They identified a wide range of asterisms and constellations as anthropomorphic figures, animals, symbols, or groups of these.<sup>8</sup> Our knowledge of these constellations comes from pyramid texts, papyri, coffin lids, especially those from Asyut and El-Bersheh from the 10th through 12th Dynasties, and astronomical depictions in tombs and temples from the New Kingdom onwards.<sup>9</sup> In the northern sky, the Egyptians mainly observed the constellations that “never set,” (*jhmw-sk*),<sup>10</sup> i. e. circumpolar constellations. In contrast, the constellations of the southern sky, which “never tire,” (*jhmw-wrd*)<sup>11</sup> marked the beginning of each of the 36 decans with their

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<sup>1</sup> By the Middle Kingdom, the five epagomenal days were dedicated to Osiris, Horus, Seth, Isis, and Nephthys (Ref 1, p 28).

<sup>2</sup> Ref 1, p 27; Ref 2.

<sup>3</sup> Tombs of Ramesses VI, VII, and IX (Dyn. 20), Kings' Valley, Thebes,

<sup>4</sup> Ref 3, vol 2, p 3. Unlike the modern hour, the ancient Egyptian “hour” (*wnwt*) was a variable interval of time (Ref 3, vol 2, pp 9–15).

<sup>5</sup> Ref 4, summary in pp 90–92.

<sup>6</sup> Ref 5, pp 1478, 1483; Ref 6, pp S102–S103. This must not be confused with the northern and southern celestial hemispheres.

<sup>7</sup> Ref 6, pp S102–S103.

<sup>8</sup> Ref 7, pp 375–479; Ref 5; Ref 6, p S102.

<sup>9</sup> Ref 8, pls 1–11; Ref 9.

<sup>10</sup> Ref 10, p 112 (3747).

<sup>11</sup> Ref 10, p 111–112 (3741).

heliacal rising.<sup>12</sup> Individual stars also had names.<sup>13</sup> The heliacal rising of the star  $\Delta \overline{\star} spdt$ <sup>14</sup> (*Sopdet*; Greek: Sothis or Seirios) on the eastern horizon in summer signaled the imminent arrival of the Nile flood and marked the start of the year.<sup>15</sup> There must have been intercalary days to keep the civil calendar synchronized with the Earth's orbit around the sun, which lasts approximately 365¼ days. Otherwise, the day of the heliacal rising of Sothis and the natural events would gradually shift throughout the 365-day civil calendar year, coinciding with the designated calendar days only once every 1,461 years.<sup>16</sup> That would make a civil calendar meaningless.

Ancient Egyptian astronomy was closely tied to religious beliefs and agriculture.<sup>17</sup> Many curious passages in the Pyramid and Coffin Texts make sense when viewed in the context of stellar movements and constellations.<sup>18</sup> However, the meaning of the names of some decanal constellations has been lost over time due to inconsistent spellings, phonetic shifts, and copying errors.<sup>19</sup> During the Ptolemaic Period, the astronomical systems of the Egyptians and Greeks partially merged, as seen in the astronomical ceilings of temples at Denderah, Esna, and Edfu.<sup>20</sup> The 36 Egyptian decanal constellations can be traced through Hellenistic astronomical and astrological writings into the early modern period.<sup>21</sup>

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<sup>12</sup> Ref 1, pp 35–36; Ref 11, p 68. "Helical" refers to an appearance at dawn. Unfortunately, the word "decan" is used inconsistently in literature. It can refer either to the 10-day period or to the corresponding constellation.

<sup>13</sup> Interestingly, stars always have five points in Egyptian art and writing.

<sup>14</sup> In the oldest decan lists, Sothis had his name in the masculine form, *spd* (Ref 12, pp 8–9).

<sup>15</sup> Ref 1, pp 27–28; Ref 13, p 376; Ref 14, p 52 (§ 261). Sirius belongs to the modern constellation Canis Major.

<sup>16</sup> Ref 15, p 36. Proposed solutions to this problem are complicated (see, for example, Ref 4, pp. 22–34, and Ref 14, pp. 51–54 [§§ 255–272]). The simplest explanation is that the intercalary days were never mentioned in the texts, because they were considered days of "chaos" (*jsfi*), which disrupted the beautiful order. Even the five epagomenal days were considered demonic and rarely mentioned (Ref 4, pp. 5–6).

<sup>17</sup> An overview can be found in Ref 1 and Ref 8. There were also lunar festivals (Ref 1, pp 38–39).

<sup>18</sup> Ref 16.

<sup>19</sup> Ref 8, pp 3–6. Shifts between the semivowels *w* and *j*, and between the plosives *t*, *ṭ*, and *tj*, and *d* and *ḍ* are of particular concern.

<sup>20</sup> Ref 3, vol 3, pp 78–85; Ref 17; Ref 18; Cf. Ref 19, p 2.

<sup>21</sup> Ref 8, pp 92–93; Ref 19, pp 1–2, 11–14, 53.

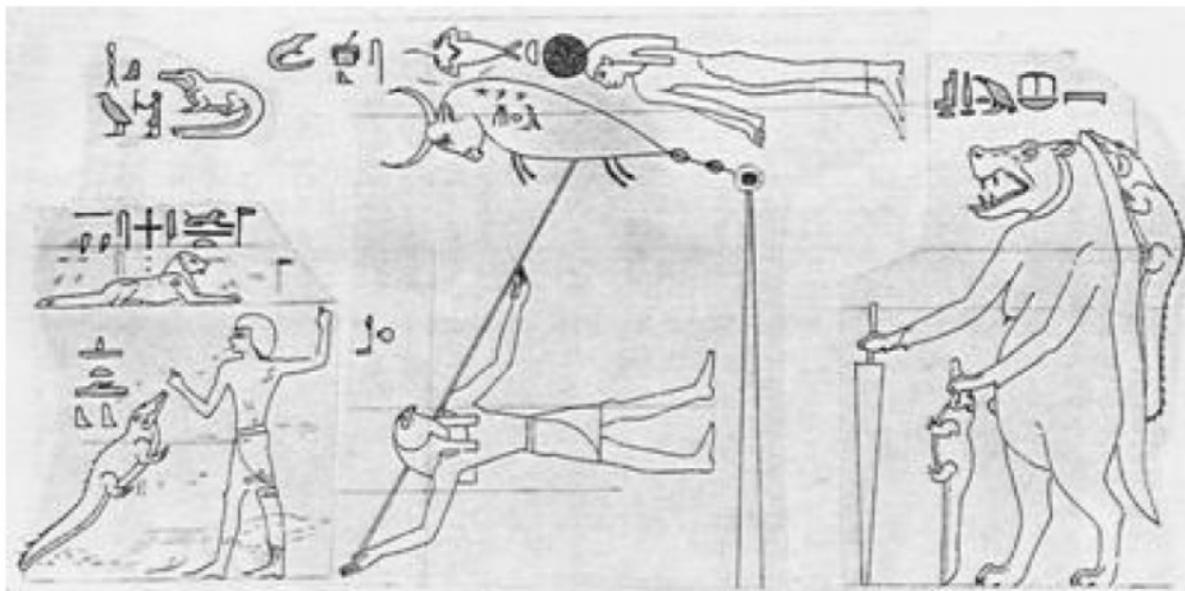


Fig. 1: Constellations depicted in the tomb of Senenmut (TT 353, Dyn. 18).<sup>22</sup>  
 These constellations include two crocodiles, Divine Lion, Man With Raised Arm, Scorpion (goddess *Serqet*), Bull, Harpooner, and Female Hippopotamus holding the Mooring Post.

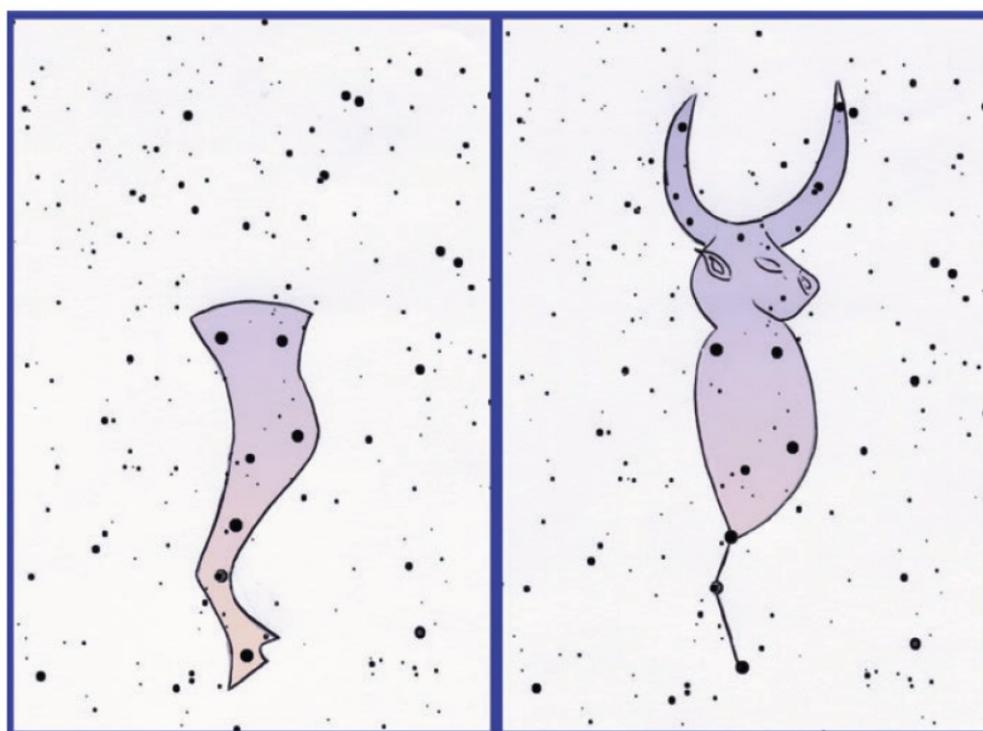


Fig. 2: The constellation *Meskhetyw* (modern Ursa Major) as viewed in the Middle (left) and New Kingdoms

<sup>22</sup> The arrangement of the figures is not original. See the layout of the entire mural in Ref 20, p 139 (fig 2).

## 2 Hypothesis: The kings of the Zero and First Dynasties were named after constellations

The complete titulature of an ancient Egyptian king developed during the Early Dynastic Period and the beginning of the Old Kingdom. By the middle of the Fourth Dynasty, five canonical categories of royal names had been established: The  Horus name, the  *nbtj* name (Two Ladies), the  Golden Horus name, the  *njswt-bjtj* name (throne name or prenomen in a cartouche), and the  *zʹ-Rʹ* name (Son of *Re*; birth name or nomen in a cartouche).<sup>23</sup>

From the late Predynastic Period onwards, the Horus name was framed by a stylized palace courtyard, the *serekh* (*srh*, lit. “disclosure”<sup>24</sup>), above which the sky god Horus usually perched in his falcon shape. Thus, the king presented himself as a representative of Horus and a mediator between the earthly and heavenly realms. Until the end of the First Dynasty, Horus names were spelled using single animal-shaped ideograms or groups of two to three phonograms.<sup>25</sup> I have long held the view that the animal-shaped ideograms were a concession to the largely illiterate population.

My new hypothesis is as follows:

The Horus names of these early kings are based on constellations. Perhaps the constellation that rose on the day an heir to the throne was born or was crowned determined his Horus name. Alternatively, an astrologically knowledgeable priest at the royal court may have used rituals and prophecies to determine which stars would govern the new king's reign. This astronomical association may also apply to the early throne names by which the kings are listed in the Abydos King List.<sup>26</sup>

The subsequent sections delve into this hypothesis in greater detail. Translations of the kings' names without source references are my own. The ancient Egyptian constellations are taken from the publications of M. G. Daressy (1900), O. Neugebauer and R. A. Parker (1960–1969), R. Böker (1984), and J. Lull and J. A. Belmonte (2006 and 2015).<sup>27</sup> Regarding the positions of the constellations, I arbitrarily followed the opinions in the 2015 paper by J. Lull and J. A. Belmonte, because experts are very divided on this issue.<sup>28</sup> The

<sup>23</sup> Ref 21, pp 7–12; Ref 22, pp 283–284. The king certainly had always a birth name, but it was not introduced into the royal titulature until the reign of King *Djedefre* of the 4th Dynasty.

<sup>24</sup> Ref 10, pp 789 (29039), 790 (29053); Ref 23, vol 4, pp 199.2, 200.3.

<sup>25</sup> Ref 21, pp 12–13.

<sup>26</sup> The Abydos King List in the second hypostyle hall of the mortuary temple of King *Seti I* (Dyn. 19) at Abydos comprises a total of 76 kings' names in cartouches from *Menes* (*Nar-mer* or *Aha*) to *Seti I*. The names in the cartouches of the First Dynasty are probably early throne names (Ref 24).

<sup>27</sup> Ref 3; Ref 5; Ref 13; Ref 25; Ref 26.

<sup>28</sup> Compare for instance Ref 6, Ref 13, Ref 19, Ref 20, and Ref 26.

hieroglyphic spellings of the names of constellations and stars are inevitably those from later dynastic eras.

## 2.1 Zero Dynasty (protodynastic kings)

The following list of Zero Dynasty kings only includes those whose Horus names appear in a serekh or next to an image of a crowned king, and/or whose existence is confirmed by a royal tomb. Therefore, the following putative kings are not included: Finger Snail, Fish, Bull, Stork, Canid, Crocodile, and *Ni-Neith*.<sup>29</sup> The order of the kings is according to G. Dreyer.<sup>30</sup>

### 2.1.1



Provisional Horus name:  
Elephant

The serekh of King Elephant is known from rock carvings in Qustul and Jebel Sheikh Suleiman.<sup>31</sup> According to G. Dreyer, the king's name was  *p(n) 3bw* (*Pen-Abu*) and should be translated as "Great One of the Seat."<sup>32</sup> L. D. Morenz has suggested that the animal depicted is a rhinoceros, not an elephant.<sup>33</sup> However, the protrusion near the back of its neck cannot be a tusk or a rhinoceros's horn. Therefore, in my opinion, the animal is either a hyena<sup>34</sup> or a hippopotamus with overly long ears, holding its head down as in the later hieroglyph .

The suggested spelling of the Horus name, , could be translated as *p Jpy* "Seat of *Ipy*," *p(3) Jpy* "Son of *Ipy*,"<sup>35</sup> or simply *(j)p(y)* with the hippo being a classifier. *Ipy*, or *Ipet*, was a

<sup>29</sup> Ref 27, pp 105–106. Finger snail, Fish, and Bull are now considered toponyms rather than royal names (Ref 28). Similarly, the stork and the canid on predynastic product labels represent particular localities, such as agricultural domains or proto-nomes. Regarding King „Crocodile,“ I agree with F. Raffaele that the sign in the serekh is the phonogram  (plucked goose, phonetic value *snḏ*), rather than a crocodile above a coil of rope as has been suggested by G. Dreyer (Ref 29; Ref 30, vol 2, p 34). The interpretation of the sign combination  as *snḏ nj Njt* (*Ni-Neith*, "He who belongs to Neith") is not broadly accepted (Ref 31, pl 13 [nos. 147, 148]; Ref 32, pp 40–42; Ref 33, p 95).

<sup>30</sup> Ref 27, p 105.

<sup>31</sup> Ref 34.

<sup>32</sup> Ref 30, vol 1, pp 177, 179.

<sup>33</sup> Ref 35, pp 114, 118.

<sup>34</sup> Compare the drawing of a hyena on a predynastic product label from the Abydos tomb U-j in Ref 36.

<sup>35</sup>  *p* "seat" (Ref 10, p 285 [10297]); For the possessive prefix *p3*, see Ref 10, p 286 (10341, 10342).

fertility goddess in the shape of a hippopotamus who appears in the Pyramid Texts.<sup>36</sup> By the New Kingdom at the latest, she had merged with the goddess *Taweret*, who also took the shape of a hippopotamus.<sup>37</sup> The Horus name may refer to the large constellation  *rrt* (*Reret*), the “Female Hippopotamus” (Fig. 1). It is believed to have encompassed the modern constellations Lyra and Boötes.<sup>38</sup>

### 2.1.2



Provisional Horus name:  
Scorpion (I)

Thanks to his tomb U-j in the royal necropolis of Abydos, King Scorpion (I) is well documented.<sup>39</sup>

His constellation was undoubtedly  *srqt* (*Serqet*), the “Scorpion,” and was associated with the goddess *Serqet* (Fig. 1). Its modern equivalent is a sector of the constellation Virgo. The fact that a grammatically female arachnid and symbol of a goddess constituted the Horus name of a male king supports the hypothesis of an astronomical basis.

### 2.1.3



Provisional Horus name:  
Falcon<sup>40</sup>

King Falcon does not meet the inclusion criteria because neither a serekh nor a tomb has been found for him. However, he appears on the 5,000-year-old Libyan Palette from Abydos<sup>41</sup> as a falcon holding a hoe above a city or fortress symbol. The hoe was a symbol

<sup>36</sup> Ref 37, pp 79, 175, 434.

<sup>37</sup> Ref 38.

<sup>38</sup> Ref 5, pp 1478, 1479.

<sup>39</sup> Ref 30, vol 1.

<sup>40</sup> According to G. Dreyer, there were two protodynastic kings with the name “Falcon” (Ref 27, p 105).

<sup>41</sup> The palette, Cairo JE 14238, CG 14238, is also known as the “City Palette,” “Town Palette,” or “Tehenu Palette.”

of foundation.<sup>42</sup> The kings Scorpion, Double Falcon, and Lion (see below) are also depicted on this palette with hoes and fortresses.

The falcon usually represents the god Horus, the god of the sky in prehistoric times.<sup>43</sup> Therefore, no specific constellation can be assigned to him. However, there was a constellation of a falcon-headed god named  *c<sub>nw</sub>* (*Anu*), the "Harpooner," who spears a bull. That bull was another constellation called *Meskhetyw* (Fig. 1; see section 2.1.7). In Lower Egypt, *Anu* was understood as "Horus the Harpooner."<sup>44</sup> His constellation encompassed parts of the modern constellations Canes Venatici, Ursa Major, and Lynx.<sup>45</sup>

#### 2.1.4



Provisional Horus name:  
Lion

Like King Falcon, King Lion is only known from his representation on the Libyan Palette, with a hoe above a city or fortress symbol.

His constellation may have been  *m<sub>j</sub>* (*Mai*), the "Divine Lion." It is depicted as a recumbent lion with a crocodile tail (Fig. 1). It is equated with the modern constellation Leo.<sup>46</sup>

#### 2.1.5



Provisional Horus name:  
Double Falcon

The unusual serekh of King Double Falcon was discovered in the northeastern Nile Delta, the Sinai Peninsula, Israel, Tura, and Abydos.<sup>47</sup> I agree with G. Dreyer that the two summits on which the two falcons stand are not due to an overly concave border of the

<sup>42</sup> Other authors have considered the hoe a symbol of destruction (Ref 39).

<sup>43</sup> Ref 40.

<sup>44</sup> Ref 41, pp 77–78.

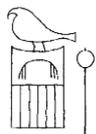
<sup>45</sup> Ref 5, pp 1478, 1480.

<sup>46</sup> Ref 5, pp 1480, 1483.

<sup>47</sup> Ref 33, p 96. An "anonymous" serekh was not uncommon. It stood for the reigning king and the royal court in general (Ref 32, pp 26–33).



## 2.1.7



Horus name:  
*Ka* or *Sekhen*

The most significant evidence of King *Ka* comes from artifacts found in tomb B7 of the royal necropolis at Abydos.<sup>57</sup> The hieroglyph in the serekh is depicted with hands pointing up or down.<sup>58</sup> Therefore, it is unclear whether this hieroglyph is the phonogram  with the phonetic value *kʷ* (*ka*) or the phonogram  with the phonetic value *shn* (*sekhen*).<sup>59</sup>

Interpreting the sign as  *kʷ* makes this Horus name phonogramatically related to the word  *kʷ* "bull."<sup>60</sup> The motif of a sacred bull was represented in the starry sky as the constellation  *mshṯjw* (*Meskhetyw*), the "Bull" or the "Bull's Foreleg."<sup>61</sup> The constellation was shaped like a bovine leg, either with or without a bull's head (Figs. 1, 2), or sometimes like a complete bull.<sup>62</sup> It roughly corresponded to the modern constellation Ursa Major.<sup>63</sup> It was one of the circumpolar constellations visible all year round. When *Meskhetyw* was closest to the northern horizon, it signaled to farmers that it was almost time to sow.<sup>64</sup> In this context, the solar calendar month  *kʷ hr kʷ* (Greek: Khoiak) is worth mentioning. It was the third (until the 18th Dynasty) or fourth month of the flood season (Akhet III/IV).<sup>65</sup>

## 2.1.8



Provisional Horus name:  
Scorpion (II)

King Scorpion II's existence is attested by his ceremonial mace head, which was excavated

<sup>57</sup> Ref 46, pp 173–175.

<sup>58</sup> Of note, the palace facade is either in the upper or lower part of the serekh (Ref 31, pls 1–3; Ref 32, pp 53–57; Ref 46, pp 38–40).

<sup>59</sup> Ref 47, p 93 (note 2); Ref 48, pp 54–56.

<sup>60</sup> Ref 10, p 943 (34887).

<sup>61</sup> Ref 5, pp 1478, 1480–1482, fig 130.2.

<sup>62</sup> Ref 3, vol 2, plt 3; Ref 11, pp 68–69; Ref 19, p 46, fig 13; Ref 49, vol 6/III, plt 137.

<sup>63</sup> Ref 5, p 1478.

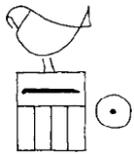
<sup>64</sup> Ref 11, pp 67, 76–80.

<sup>65</sup> Ref 14, pp 58 (§ 286), 59 (§ 293).

in Hierakonpolis. On this mace head, the king's name appears next to an image of him wearing the White Crown of Upper Egypt. The seven-petaled flower (or "rosette") above the scorpion emblem is considered an archaic symbol of kingship.<sup>66</sup>

Like his namesake, King Scorpion I, King Scorpion II is associated with the constellation  *srqt* (*Serqet*; see section 2.1.2 above).

### 2.1.9



Suggested Horus name:

*Ni-Hor*

"He who belongs to Horus"<sup>67</sup>

The chronological classification of King *Ni-Hor* within the Zero Dynasty is uncertain. He is attested on jars from Turah and archeological sites in the Nile Delta and Israel. He may have been an opponent of the Thinite elite.<sup>68</sup> However, interpreting the horizontal line in the serekh as the single-consonant hieroglyph  for "n" and reading his Horus name as *n(j) Hr* (*Ni-Hor*, "He who belongs to Horus") is tenuous.<sup>69</sup> The sun hieroglyph  beneath his serekh appears only on one clay jar from Ezbet el-Tell.<sup>70</sup>

### 2.1.10



Suggested Horus name:

*Hat-Hor*

"First one of Horus"<sup>71</sup>

The chronological position of this king within the First Dynasty is unclear. His serekh was found on a jar in the cemetery at Tarkhan.<sup>72</sup>

The hieroglyph in the serekh is , a phonogram with the phonetic value *ḥꜥt*. It may refer to the decanal constellation  *ḥꜥt dꜥt* (*Hat Djat*), meaning either "Prow of the

<sup>66</sup> Ashmolean Museum AN1896–1908 E.3632 (Ref 50).

<sup>67</sup> Ref 35, pp 31–32.

<sup>68</sup> Ref 32, pp 37–39; Ref 33, p 95.

<sup>69</sup> Ref 32, p 37; Ref 35, pp 31–32.

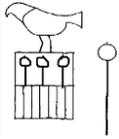
<sup>70</sup> Ref 32, pp 25, 38.

<sup>71</sup> Ref 29.

<sup>72</sup> Ref 51, pls XXV (no. 1), XXX (no. 74b).

Ferryboat” or “Forepart of the Crane.”<sup>73</sup> This ancient Egyptian constellation was located in the modern constellation Cancer.<sup>74</sup>

### 2.1.11



Suggested Horus name:

*Hedjw-Hor*

“Maces of Horus”<sup>75</sup>

The name and chronological position of this king within the First Dynasty are unclear. He is only known from two clay jugs bearing his serekh: one from Tura and one from Abu Zeidan, located on the northeastern tip of the Nile Delta.<sup>76</sup> The name, *Hedjw-Hor*, was proposed based on the assumption that the threefold sign in the serekh is the hieroglyph , which is used here as an ideogram for the word *hd* (*hedj*), meaning “mace.”<sup>77</sup> J. Kahl (2001) did not share this view and gave the king the provisional name “Trio.”<sup>78</sup>

Only the object next to the serekh is undoubtedly a mace. It was a symbol of power that also appeared alongside the serekhs of other kings (see sections 2.1.7 and 2.1.10). The threefold sign within the serekh of King *Hedjw-Hor* may be a rough sketch of the hieroglyph  (lotus plant) with the phonetic value *h3*. Among other things, this hieroglyph was used as a numeral for “1,000.”<sup>79</sup> Therefore, the king’s name may have been *Khaw*, named after the decanal constellation  *h3w* (*Khaw*), “Thousands.”<sup>80</sup> This constellation was probably a star cluster.

<sup>73</sup>  *h3t* “forepart,” “prow” (Ref 10, p 537 [19397, 19400, 19411]);  *d3t* “ferryboat” (Ref 10, pp 1066 [39425], 1067 [49378]) or  *d3t* “crane” (Ref 10, p 1068 [39479]).

<sup>74</sup> Ref 3, vol 2, p 4; Ref 10, p 540 (19535); Ref 25, p 84; Ref 26, p 200.

<sup>75</sup> Ref 21, p 23.

<sup>76</sup> Ref 52, p 44.

<sup>77</sup> Ref 21, p 23; Ref 35, p 81.  *hd* “mace”,  *hdw* “maces” (Ref 10, p 617 [22392]).

<sup>78</sup> Ref 27, p 106; Ref 33, p 95.

<sup>79</sup> Ref 10, p 621 (22558).

<sup>80</sup> Ref 10, p 622 (22574); Ref 26, p 201; Ref 3, vol 2, p 5. The coffin of Mesehti (Dyn. 12, Asyut), features a decanal constellation called  *h3t h3w* (*Hat Khau*) (Ref 25, p 84). It could be part of the constellation *Khau* (“Front part of the Thousands”). Since it is difficult to distinguish the front part of a star cluster, I consider an erroneous mingling with the constellation *Hat Djat* to be more likely (see section 2.1.10).

## 2.2 First Dynasty

From the following list of the First Dynasty, Queen *Merit-Neith*, whose royal tomb was found in the U cemetery at Abydos, is missing. She was likely the regent for her underage son, King *Den*, for several years.<sup>81</sup>

### 2.2.1



Horus name:

*Nar-mer*

“Terrifying catfish”<sup>82</sup>



Abydos King List:

*Meni*<sup>83</sup>

King *Nar-mer* is known from many rock carvings and artifacts, including a ceremonial mace head and a richly decorated ceremonial palette found at Hierakonpolis.<sup>84</sup>

There is no evidence of an ancient Egyptian constellation in the shape of a catfish or chisel. Some researchers identify King *Nar-mer* with the legendary unifier of Upper and Lower Egypt, King *Meni* (Greek: Menes).<sup>85</sup> If this is correct, his constellation could have been  *mnjt* (*Menit*), the “Mooring Post.” It is the long triangle on which the hippopotamus goddess *Ipy* rests (Fig. 1). The modern equivalent is a star triangle formed by Arcturus and Muphrid in Boötes and Alkaid in Ursa Major.<sup>86</sup>

### 2.2.2



Horus name:

*Aha*

“Fighter”<sup>87</sup>



Abydos King List:

*Teti*<sup>88</sup>

King *Aha*'s tomb in the royal necropolis at Abydos is tomb B19. His serekh is notable for the playful incorporation of the feet of the Horus falcon into the hieroglyph  *h3* in the

<sup>81</sup> E. C. Köhler, personal communication.

<sup>82</sup> Ref 53, pp 113–116.

<sup>83</sup> *Meni* could also have been King *Aha* or a purely mythical king (Ref 54).

<sup>84</sup> Ref 55, pp 9–20.

<sup>85</sup> Ref 54.

<sup>86</sup> Ref 5, p 1478.

<sup>87</sup> Ref 21, p 25.  *h3* “fighter, warrior” (Ref 10, p 165 [5720]).

<sup>88</sup> If King *Aha* was the *Meni* on the Abydos King List, then *Teti*, the second king listed, must have been a different ruler (*Teti* I) between *Aha* and *Djer*. See Ref 24 and Ref 56.

inner compartment.

One of the Egyptian decanal constellations was called  *s3h* (*Sah*).<sup>89</sup> It was located in the area of the modern constellations Orion and Lepus. Its shape and the meaning of the name *Sah* are unknown. The individual stars of *Sah* were referred to as the "shoulder of *Sah*," the "arm of *Sah*," or the "knee of *Sah*."<sup>90</sup> This suggests an anthropomorphic figure. Perhaps the name of this constellation comes from  *s3h* "one who approaches (hostilely)."<sup>91</sup> As a warrior figure, the constellation *Sah* would be an ideal explanation of the royal name *ḥ3* (*Aha*), "fighter," and would also draw a parallel with the modern equivalent, Orion,<sup>92</sup> which is seen as an archer. *Sah* was personified as a striding king in astronomical depictions from the First Intermediate Period onwards.<sup>93</sup> This could have been done in remembrance of the former king *Aha*, who had been named after *Sah*.

In addition, King *Aha* is a candidate for *Meni*, the legendary unifier of the kingdom,<sup>94</sup> to whom I have assigned the constellation  *mnjt* (*Menit*), the "Mooring Post," in section 2.2.1.

### 2.2.3



Horus name:

*Djer*

"Defender (of Horus)"<sup>95</sup>



Abydos King List:

*Iteti*

King *Djer's* tomb in the royal necropolis at Abydos is tomb O. The Horus name of King *Djer* is spelled with the hieroglyphs  or , which are considered early forms of the phonogram  with the phonetic value *dr*.<sup>96</sup>

The list of constellations in the major work by the Egyptian-Greek astronomer Ptolemy (c. 100 CE) is largely inspired by ancient Egyptian astronomy.<sup>97</sup> Ptolemy described the

<sup>89</sup> Ref 5, pp 1479, 1484.

<sup>90</sup> Ref 26, p 213.

<sup>91</sup> Ref 10, p 715 (26033); Ref 57, vol 2, p 638.

<sup>92</sup> Ref 5, pp 1479, 1484; Ref 20, pp 153–154.

<sup>93</sup> Ref 20, pp 138 (fig 1), 152 (fig 9), 153 (fig 10).

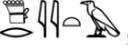
<sup>94</sup> As suggested by an ivory label from Naqada, "*Meni*" could have been King *Aha's* Nebty title (Ref 58, p 20).

<sup>95</sup> Derived from  "to stop," "to keep away" (Ref 10, p 1086, 40231, 40232], cf. Ref 21, p 25; Ref 59, p 115; Ref 60, pp 38–39. Alternative suggestion: „He who succours“ (Ref 58, p 16).

<sup>96</sup> Ref 61, p 437.

<sup>97</sup> Ref 19, p 53.

quadrangle of the modern constellation Pegasus as an "enclosing wall."<sup>98</sup> If this concept dates back to the Early Dynastic Period, the word  *drj (djeri)* "enclosing wall"<sup>99</sup> could be the origin of King *Djer's* Horus name.

Another option is  *dr(y).t (djerit)*, which was the word for a certain bird of prey.<sup>100</sup> There are indications that the modern constellation Aquila (Eagle), as named by the Greeks, was also known to the ancient Egyptians.<sup>101</sup> Even the Sumerians called it "Flying Eagle."<sup>102</sup> Similarly, the name of the Egyptian decanal constellation  *knmt* (*Kenmet* or *Kenmut*),<sup>103</sup> could refer to a bird of prey, because the root word  *mt* means "female vulture," among other things.<sup>104</sup> Furthermore,  *knmt* was an evil bird in the Pyramid Texts.<sup>105</sup>

King *Djer's* name in the Abydos King List,  *Iteti*,<sup>106</sup> is unsatisfactorily explained with the word  *jty* "ruler." My tentative suggestion is  *jtt*, a paraphrase for a divine crocodile.<sup>107</sup> In that case, the name *Iteti* would mean "He who belongs to the crocodile." There were two crocodile-shaped constellations:  *Saq*, also called *hqw (Heqw)*, a small constellation near *Serqet* shaped like a crocodile with a curved tail; and  *hetp rdwj (Hetep Redwy)*, a larger constellation shaped like a crocodile "resting on its feet," as the name says. The latter is associated with the crocodile god Sobek (Fig. 1). *Saq* and *Hetep Redwy* are equated with the modern constellations Leo Minor and Hydra, respectively.<sup>108</sup>

<sup>98</sup> Ref 19, pp 13, 17 (chart 1), 29. A. Berio (2014) drew a parallel with the ancient name of the city of Memphis, *jnbnw hqdw* "white walls" (Ref 19, p 29). The Babylonians saw the square of Pegasus as the building site or floor plan of a temple (Ref 26, p 209).

<sup>99</sup> Ref 10, p 1088 (40276).

<sup>100</sup> Ref 10, p 1087 (40238).

<sup>101</sup> Ref 62, p 249; Ref 19, pp 11, 17–19.

<sup>102</sup> Ref 63, p 429; Cf. Ref 19, p 3.

<sup>103</sup> Ref 26, pp 198, 199–200. R. Böker and others have translated the constellation name *knm(w)t* with "leopard" (Ref 26, pp 198, 199). However, aside from the lion, no images of a big cat appear in astronomical tomb depictions or Late-Period zodiacs.

<sup>104</sup> Ref 23, vol 2, 53.15.

<sup>105</sup> Ref 23, vol 5, p 132.7.

<sup>106</sup> On the Palermo Stone, Cairo fragment 1 recto, the arrangement of signs can be read as  *Iteti* or  *Iteti* (Ref 64, p 74, fig 5 after Wilkinson 2000).

<sup>107</sup> *jtt* (lit. "the one who surfaces") was a paraphrase for „crocodile“ (Ref 10, p 129 [4359]). The overlapping use of the consonants  *t*,  *t*, and  *tj* (with depalatalization of *t*) was common in the Late Old Kingdom (Palermo Stone) and the New Kingdom (Ref 24). There were likely variations in the way words were pronounced in different regions.

<sup>108</sup> Ref 5, p 1483.

## 2.2.4



Horus name:

*Serpent, Djet, Wadji*"He who belongs to the cobra goddess"<sup>109</sup>

Abydos King List:

*It-a*"Father of the vulture"<sup>110</sup>

King *Djet's* tomb in the royal necropolis at Abydos is Tomb Z. The pronunciation of his Horus name as "*Djet*" or "*Wadji*" is based on the widely accepted assumption that the snake represents the cobra goddess  *wꜣdjt* (*Wadjet*). Her name means "She who lets turn green."<sup>111</sup> In my opinion, *Wadjet* was simply an alternative name used in Lower Egypt for the archaic cobra-shaped goddess of plant growth and harvest,  *rnnwtt* (*Renenutet*).<sup>112</sup>

In light of my hypothesis, the royal Horus name is derived from the decanal constellation  *ꜥrt* (*Aret*). It is thought to be located in the region of the Hyades and Aldebaran, within the modern constellation Taurus.<sup>113</sup> The name of the Egyptian constellation, *ꜥrt*, has been inconsistently translated as "the ascending one" or "lower jaw."<sup>114</sup> However, the derivation from  *jꜥrt* (*iaret*) "uraeus", also spelled  *ꜥrt* (*aret*), is just as possible.<sup>115</sup> Nevertheless, it is unnecessary to rename the king "*iaret*," as the cobra goddess *Wadjet* is the model for the uraeus cobra anyway. A cobra goddess is shown on astronomical ceilings from the Late and Greco-Roman periods.<sup>116</sup> In a Greco-Roman tomb painting of the starry sky in Athribis, there are several upright cobras, some with human heads, which is the iconography of the goddess *Renenutet/Wadjet*.<sup>117</sup>

The king's name in the Abydos King List,  *jt ꜣ* (*It-a*), which I translate as "Father of

<sup>109</sup> Ref 10, p 1065 (39355).

<sup>110</sup>  "father" (Ref 10, p 123 [4102]) and  ꜣ "Egyptian vulture" (*Neophron percnopterus*) (Ref 10, p 1 [1]).

<sup>111</sup>  *wꜣdjt* "to be green" or "to let turn green," "to let grow" (Ref 10, p 190 [6727]).

<sup>112</sup> *Renenutet* was the patron goddess of the fourth month of the growing season (Peret IV):  *p(ꜣ)-n-Rnnwtt* (Greek: Pharmouthí) (Ref 10, pp 293 [10570], 503 [18107]; Ref 14, p 57 [§ 283]; Ref 65). Under the name *Wadjet*, she was given a cult center in the city of Buto in Lower Egypt and, as the counterpart of the vulture goddess *Nekhbet* of El Kab in Upper Egypt, she became one of the two crown goddesses ("The Two Ladies") (Ref 22, p 283).

<sup>113</sup> Ref 5, p 1479.

<sup>114</sup>  "the ascending one;"  „lower jaw“ (Ref 5, p 1479; Ref 10, p 161, [5533, 5534, 5541]; Ref 26, pp 199, 212).

<sup>115</sup> The uraeus was an emblem in the shape of a cobra above the forehead of a king and worn as an amulet (Ref 10, p 29 [1028]; Ref 23, vol 1, pp 42.1–4, 209).

<sup>116</sup> Ref 14, pp 54–55 (§§ 273–277), plt 4.

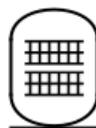
<sup>117</sup> Ref 8, plt 12.

the Vulture," cannot currently be associated with any astronomical entity.

### 2.2.5



Horus name:  
*Den*<sup>118</sup>



Abydos King List:  
*Sepaty*

King *Den's* tomb in the royal necropolis at Abydos is Tomb T.

The meaning of "*Den*" is unclear, but it tentatively brings to mind  *dnjt*, the festival of a moon phase (first-quarter and last-quarter day),<sup>119</sup> and  *dnj* "hoe."<sup>120</sup> The zodiac of the temple of Denderah depicts a canid standing on a hoe (in the center of the zodiac) and a bull-headed figure holding a hoe. These support the possibility that there may have been an Egyptian constellation in the shape of a hoe.<sup>121</sup>

Another clue is provided by the Egyptian decanal constellation called  *tmʒt* (*Tjemat*), which appeared in two forms, *tmʒt hrt* ("Upper *Tjemat*") and *tmʒt hrt* ("Lower *Tjemat*").<sup>122</sup> The hitherto unexplained constellation name, *Tjemat*,<sup>123</sup> may have originated during the First Intermediate Period from a misspelling of the word  *dmʒt* "wing."<sup>124</sup> ( and  are easily confused when the hieroglyphs are written sloppily.<sup>125</sup>) This would also explain the two forms of *tmʒt* constellations (a pair of wings). Another word for "wing,"  *dnh*,<sup>126</sup> allows a semantic connection to be made between the constellation *Tjemat* and the king's name "*Den(h)*."

The king's name in the Abydos King List,  *spʒtj* (*Sepaty*), literally means "Two Nomes" or "He who belongs to two nomes."<sup>127</sup> This is a curious royal name. I believe the writer of

<sup>118</sup> "Bringer of water" (Ref 66, pp 101–102); *dwn* "He who spreads [his wings]" (Ref 67, p 70); "He who strikes [somebody]" (Ref 58, p 16); "Severer [of heads]" (Ref 21, p 26, citing Meltzer 1972); "Mutilator" (Ref 68, pp 5–6).

<sup>119</sup> Ref 10, p 1054 (39026).

<sup>120</sup> Ref 10, p 1054 (39042), cf. p 578 (20965).

<sup>121</sup> Ref 9, p 996, fig 12; Ref 13, p 379, fig 2; Ref 19, p 37, fig 9.

<sup>122</sup> Ref 10, p 1026 (37943, 37944); Ref 25, p 84; Ref 26, p 201–202.

<sup>123</sup> Previous suggestions: box, mat, stool, mother (cf. Ref 26, pp 201–202).

<sup>124</sup> Ref 10, p 1051 (38885).

<sup>125</sup> Subsequently, the word acquired incorrect classifiers (Ref 8, p 5; Ref 26, p 201). That the constellation name was prone to errors is also shown in the astronomical ceiling in the temple of Seti I in Abydos, where it was confusingly spelled  *tmʒ* (*Tjetma*).

<sup>126</sup> Ref 57, vol 2, p 883; Ref 23, vol 5, p 468.

<sup>127</sup> Ref 10, p 749 (27414, 27431).

the Abydos list template made a mistake and that it should be  *sptj* (*Septy*), "the two boundaries."<sup>128</sup> This would establish a possible connection with the decanal constellation  *sptj hnwj* (*Septy Khenwy*), "The Two boundaries of the Resting Place."<sup>129</sup> In Senenmut's tomb, the constellation is erroneously spelled  *s3ptj*<sup>130</sup> which may have caused the confusion with *sp3tj*. According to R. Böker (1984), the constellation consisted of two chains of stars, which form arc-shaped boundaries around a star-poor area in the region of the modern constellations Ophiuchus and Hercules.<sup>131</sup>

2.2.6



Horus name:  
*Adj-ib*  
"He with an understanding heart"<sup>132</sup>



Abydos King List:  
*Meri-bia*  
"Beloved of the Iron Heaven"

King *Adj-ib*'s tomb in the royal necropolis at Abydos is tomb X.

The name *ꜥd jb* (*Adj-ib*), which I translate as "He with an understanding heart,"<sup>133</sup> is an appropriate royal name for which hardly anyone would suspect an astronomical origin. It reminds me of the star named  *ꜥq3 jb* (*Aqa-ib*) "He with a righteous heart," which defined the prime meridian in Ramesside star clocks.<sup>134</sup> This comparison is probably too far-fetched. However, the astronomers of the Thinite period also undoubtedly had a spatial reference system for observing the (apparent) movements of fixed stars.<sup>135</sup>

<sup>128</sup> Ref 10, p 746 (27286).

<sup>129</sup> Ref 26, pp 198, 204–205. Other spellings:  or  (Ref 10, p 714 [25985]; Ref 25, p 85). In this constellation name, the hieroglyph  (doubled to indicate the dual) is not a classifier for bone-related words, as usual, but rather the ideogram of a fish bone ( *qs* [Ref 10, p. 934, 34602]). This was used to indicate the curved shape of the two boundaries. For this reason, the constellation was also spelled with two fishes, , in the First Intermediate Period (Ref 25, p 85; Ref 69, p 261).

<sup>130</sup> Astronomical ceiling in the tomb of Senenmut, Dyn. 18 (Ref 10, p 714 [25986]; Ref 69, p 261).

<sup>131</sup> Ref 26, p 204. I disagree with J. Lull's different suggestion (Ref 69, p 261).

<sup>132</sup> Derived from  *ꜥd* "to understand," "to perceive," "to be wise" (Ref 10, p 178 [6207, 49071]) and  *jb* "heart [will, mind, spirit]" (Ref 10, p 37 [1322, 1340]).

<sup>133</sup> Other suggestions: "Safe is (his) heart" (Ref 58, p 16); "Hale-hearted" (Ref 21, p 26).

<sup>134</sup> Ref 3, vol 2, pp 8 (fig. 3), 20–66; Ref 10, p 175, (6109, 6127). This star was probably Kochab (Beta Ursae Minoris), which was the pole star from c. 1800 BCE to 300 CE (Ref 70; cf. Ref 3, vol 2, p 15, fig 8).

<sup>135</sup> The pole star from c. 3900 to 1800 BCE was Thuban (Alpha Draconis) (Ref 44).

*Adj-ib*'s name on the Abydos King List, spelled  *mr(j) bj3-p*, can more easily be linked to Egyptian astronomy. It should certainly be  *mr(j) bj3* (*Meri-bia*). Compare it to the word  *bj3* "iron heaven," the realm thought to be the source of meteoric iron.<sup>136</sup> It was probably an area of the night sky where annual meteor showers could be seen, such as the Perseid or Geminid showers.

2.2.7



Horus name:  
*Semer-khet*  
"Companion of the gods"<sup>137</sup>



Abydos King List:  
?<sup>138</sup>

King *Semer-khet*'s tomb in the royal necropolis at Abydos is tomb U.

His Horus name can be understood in the context of the eschatology of his time. According to the Pyramid Texts, the deceased king ascended to the night sky to continue to exist as an imperishable (circumpolar) star in the northern sky, the dwelling place of the gods.<sup>139</sup>

In the Abydos King List, the figure in *Semer-khet*'s cartouche is depicted wearing an uraeus, a ceremonial beard, a Sed festival robe, and a *Was*-scepter.<sup>140</sup> This figure could represent the constellation  *nht* (*Nekhet*), the "Giant," which included sectors of the modern constellations Aquila and Pegasus.<sup>141</sup>

<sup>136</sup> Ref 10 p 262 (9532). As early as the Predynastic Period, meteoric iron was used to make decorative beads (Ref 71, pp 15–19, plt 4). By the late First Dynasty, the connection between this metal and shooting stars was certainly known (cf. Ref 72).

<sup>137</sup> "Companion of the gods" derived from  *smr* "friend," "companion" and  *ht* "collectivity of gods," "pantheon" (Ref 10, pp 765 [28117], 679 [24738]; Ref 21, p 26).

<sup>138</sup> I. E. S. Edwards (2006) interpreted this figure as an abbreviation for  *smsw* "the elder" or  *jrj* "guardian" (Ref 73, p 28).

<sup>139</sup> Ref 11, p 67; Ref 74, pp 1–2.

<sup>140</sup> The hieroglyph Gardiner no. A23D is used here as a substitute to represent this figure.

<sup>141</sup> Ref 5, pp 1479, 1485.

## 2.2.8



Horus name:

*Qa-a*"He with his arm raised"<sup>142</sup>

Abydos King List:

*Qebeh(w)*"Heavenly Waters"<sup>143</sup>

King *Qa-a*'s tomb in the royal necropolis at Abydos is tomb Q.

The Horus name could be derived from an ancient Egyptian constellation shaped like a man with his arm raised, . The name of this constellation is unknown. It was likely located in the area of the modern constellation Gemini.<sup>144</sup>

In the Abydos King List, the name of King *Qa-a* is spelled  $\Delta \text{𓂏} \text{𓂏} \text{qbh}$ .<sup>145</sup> It could come from *qbhw* "Heavenly Waters." The Heavenly Waters were primordial waters believed to be the source of rain.<sup>146</sup> They may have been connected with the constellation  $\star \star \circ \text{𓂏} \text{sb}^3\text{w nw mw}$  (*Sebaw nw mw*), "Stars of Waters." This constellation is identified with Praesepe, also known as the Beehive Cluster or Messier 44. It is a large cluster of more than 1,000 fixed stars that can partly be seen with the naked eye in the modern constellation Cancer.<sup>147</sup>

## 2.2.9



Horus name:

*Senfer-ka*„May (he) perfect (his) Ka“<sup>148</sup>

This king's serekh was found on several stone bowls in tombs at Saqqara. Its chronological classification is uncertain.<sup>149</sup> He may be identical to King *Qa-a*.<sup>150</sup> Some authors classify him as belonging to the Second Dynasty.<sup>151</sup>

<sup>142</sup> Ref 21, p 27.  $\Delta \text{𓂏} \text{𓂏} \text{q}^3\text{j}$  "to be high" (Ref 10, p 915 [33862]);  $\text{𓂏}$  "arm" (Ref 10, p 133 [4473]).

<sup>143</sup> R. J. Leprohon: "The cool one" (Ref 21, p 27).

<sup>144</sup> Ref 13, p 385 (fig 7).

<sup>145</sup> With the weak plural ending "w" omitted, as is often the case.

<sup>146</sup> Ref 10, p 923 (34183).

<sup>147</sup> Ref 5, p 1480.

<sup>148</sup> Ref 59, p 117. R. J. Leprohon: "The one whom a Ka has made perfect" (Ref 21, p 30).

<sup>149</sup> Ref 75.

<sup>150</sup> Ref 33, p 99.

<sup>151</sup> Ref 21, p 30; Ref 75.

## 2.2.10



Provisional Horus name:

*Bird*

Only three fragments of vessels bear witness to this king's existence. His classification in the First Dynasty is uncertain.<sup>152</sup> The species of the bird in his serekh cannot be identified due to lack of detail. Assuming the bird is a stork, the king has been called *Horus-Ba*.<sup>153</sup> However, even in pre-dynastic times a stork was unmistakably depicted with its long beak held close to the breast ().<sup>154</sup> The bird in the serekh is more likely a duck or a goose.

The eponymous constellation could be  *ꜥpd (Aped)*, the "Bird." It was located in the area of the modern constellations Triangulum and Perseus.<sup>155</sup>

### 2.3 Concluding remarks

With the hypothesis of eponymous constellations, one could consider an early Horus title an epithet: "Horus, the one of [constellation]." Thus, Horus received a different epithet with each new Horus title. The close connection between the kings and the starry sky was abandoned when the worship of the sun god *Re* as the supreme god began with the Second Dynasty.<sup>156</sup> From then on, the kings used phrases or short sentences as their Horus names to reflect their self-perception as rulers or to express their aspirations for their reign. Horus's role as a sky god faded in favor of his role as the god of the kingship. Nevertheless, his "early" role remained evident in pyramid and historicizing texts,<sup>157</sup> and in his syncretic merger with *Re* as *Re-Harakhty*<sup>158</sup>.

The hypothesis is based on ancient Egyptian astronomical ideas handed down in the Pyramid Texts and other material sources dating from the Late First Intermediate Period onwards.<sup>159</sup> Therefore, the objection that nothing is known about the view of the night sky in pre- and early dynastic times is justified. Over the course of three millennia, of course, the positions and rise-and-set times of the fixed stars changed in relation to a sky

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<sup>152</sup> Ref 76.

<sup>153</sup> Ref 76.

<sup>154</sup> Ref 55, after Dreyer 1998.

<sup>155</sup> Ref 5, p 1479.

<sup>156</sup> Ref 77. The deceased king then became a companion to his "father" *Re* in the sun barque, and was also equated with Osiris.

<sup>157</sup> Ref 12.

<sup>158</sup> Ref 77.

<sup>159</sup> Ref 13, pp 373–374; Ref 3, vol 3, p 8; Ref 78, pp 120–121.

watcher in Egypt due to the precession of the Earth's axis<sup>160</sup>. However, their positions relative to each other always remain the same. Therefore, I do not believe that constellations were perceived fundamentally differently during the dynastic periods than during the pre- and early dynastic periods, even though the spelling of names and the mythological superstructure changed over time.<sup>161</sup> The starry sky was essential for determining the dates of festivals and rituals, providing local orientation, planning agriculture, and aligning monumental buildings<sup>162</sup>. Traditions with such vital backgrounds tend to be extremely long-lived. The best argument for the longevity of constellations is that 21st-century people still use those from early antiquity for scientific<sup>163</sup> and domestic purposes.

#### Abbreviations

AeA: Ägyptologische Abhandlungen; AOF: Altorientalische Forschungen; Archaeoastronomy J. Astro. Cult.: Archaeoastronomy, The Journal of Astronomy in Culture; Archéo-Nil: Archéo-Nil, Bulletin de la société pour l'étude des cultures prépharaoniques de la vallée du Nil; ASAE: Les Annales du Service des Antiquités Égyptiennes; AVDAIK: Archäologische Veröffentlichungen des Deutschen Archäologischen Instituts, Abteilung Kairo; BCE: Before Christian era; CE: Christian era; Cf.: Compare; CG: Catalogue général des antiquités égyptiennes du Musée du Caire; Dyn.: Dynasty; ed/eds: editor(s); EH: Egyptological Hypotheses; ENiM: Égypte nilotique et méditerranéenne; et al. et alii (and others); Fig.: Figure; GM: Goettinger Miszellen; GOF: Göttinger Orientforschungen, IV. Reihe, Ägypten; IAU: International Astronomical Union; JARCE: Journal of the American Research Center in Egypt; JE: Journal d'Entrée (du Musée du Caire); JEA: The Journal of Egyptian Archeology; JEH: Journal of Egyptian History; JHA: Journal for the History of Astronomy; KAW: Kulturgeschichte der Antiken Welt; LingAeg: Lingua Aegyptia, Journal of Egyptian Language Studies; MÄS: Münchner Ägyptologische Studien; MDAIK: Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo; MNRAS: Monthly Notices of the Royal Astronomical Society; OBO: Orbis Biblicus et Orientalis; OrSuec: Orientalia Suecana (Uppsala); p/pp: page(s); plt/plts: plate(s); Ref/Refs: Reference(s); SAEC: Studies on Ancient Egyptian Culture; SAOC: Studies in Ancient Oriental Civilisation; TT: Theban tomb; vol/vols: volume(s); WA: Writings from the Ancient World, Society of Biblical Literature (Atlanta); ZÄS: Zeitschrift für ägyptische Schrift und Altertumskunde.

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<sup>160</sup> In a cycle of 25,850 years.

<sup>161</sup> Cf. Ref 8, pp 3–6; Ref 19, pp 2–3.

<sup>162</sup> Ref 79, pp 1501–1518. According to A. Berio (2014), not only the orientation of the monumental buildings but also the division of the country into nomes was based on astronomical principles (Ref 19).

<sup>163</sup> See the list of constellations of the International Astronomical Union (IAU) in Ref 80.

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Ref 27

Ref 29

Ref 30

Ref 58, p 16

Ref 51, plt XXV (no. 1).

Fig. 1: Constellations depicted in the tomb of Senenmut (Dyn. 18). Drawing reproduced from Ref 3, vol 3, p 185, fig 28.

Fig. 2: The constellation *Meskhetyw* (modern Ursa Major). Drawing reproduced from Ref 5, p 1482, fig 130.2 (after Lull 2009).