

AN ASTRONOMICAL INSCRIPTION ON THE BERLIN *MERKHET*

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At the end of the nineteenth century an article was published by Ludwig Borchardt on two ancient Egyptian astronomical instruments in the collections of Ägyptisches Museum in Berlin.¹ Each of them is inscribed with one vertical column of hieroglyphic text. According to these texts, both instruments are dated approximately to the 6th century BC.² In this article, the attention is focused on the inscription of the instrument catalogued as No. 14085.

It is a right-angled instrument made of bone and known as *merkhet* (fig. 1). According to Borchardt's description, its total length, measured along the longer horizontal arm, is only 11.5 cm, its width is 1.3 cm and its thickness 0.4 cm. A shorter arm, perpendicular to the former, is 1.25 cm high and 0.8 cm thick. It is pierced through its length and on each side there is an opening. A plumbline cord was originally passed through the short arm for levelling the instrument in the correct position. The upper part of the horizontal arm does not carry any decoration. The hieroglyphic inscription is on the bottom part of the longer arm of the instrument (fig. 2) and is bordered by a framing line on each side. The text fills its whole length. It starts under the shorter vertical arm. The original orientation of the hieroglyphic signs is to the right. Borchardt's translation of the text reads: "Ich weiß den Gang der Sonne ["Mondes?"] und der Sterne, jedes zu seiner Stelle. Für den *Ka3* des Horoskopen *Hor*, des Sohnes *Hor-wed-a3*."³ In his translation, the word "Mond" is accompanied by a note in which he writes that: "Das zweite Zeichen ☽ ist vielleicht für ☽ "Mond" verschrieben." From Borchardt's translation it is evident that the meaning of this part of the text is not clear. The note in his translation offers an opportunity for analysing this part of the text and possibly its re-interpretation.

¹ BORCHARDT L.: *Ein altägyptisches astronomisches Instrument*, ZÄS 37, 1899, pp. 10–17.

² BORCHARDT L.: ZÄS 37, 1899, p. 11.

³ BORCHARDT L.: ZÄS 37, 1899, p. 11.

The hieroglyphic form of  is to be transliterated as *ītn.wj*. From the grammatical point of view, it is obviously a dual form of the noun (masculine) expressed by the twofold use of the determinative, i.e. the last sign standing at the end of the word.⁴ This sign related above all to the sun and was frequently used by the Egyptians in various words of different meaning. The singular of the word *ītn*, or its later form *ītn*, is determined by one sign N5 and means primarily "the sun disc", "the sun".⁵ However, monuments of the Ptolemaic and Roman Periods contain inscriptions where this word standing alone can have a different meaning, "moon".⁶ In earlier texts, such a meaning is expressed by the word *ītn* accompanied by another noun grammatically connected with it via indirect genitive as *ītn n hr̄*, literally "the disc of the moon god".⁷

Dual form *ītn.wj* or *ītn.wj* may suggest two possible interpretations. The term can stand alone or be connected with other words. Hannig's dictionary mentions both cases.⁸ The former, *ītn.wj*, the dual form without any further accompanying words, is translated as "die beiden Sonnenscheiben (die beiden Augen des verstorbenen Königs)". The latter, *ītn.wj n hrw gr̄h*, includes the accompanying words *hrw* and *gr̄h* for "day" and "night", and has the meaning "die beiden Gestirne des Tages und der Nacht (Sonne und Mond)", expressed again in the form of the indirect genitive. Egyptian vocabulary contains several terms which can refer to the sun and moon by one word, such as *fr.tj*, *m3.tj*, *h3.tj*,

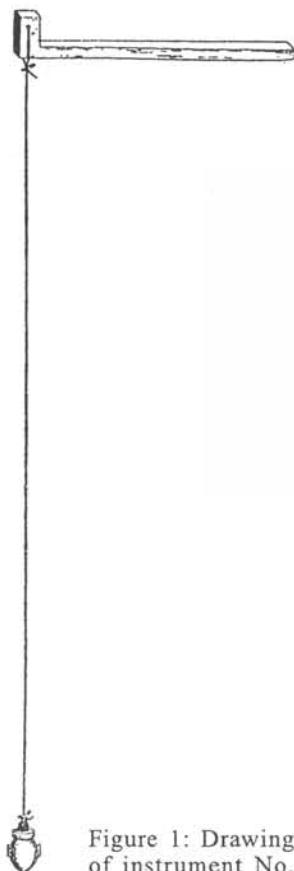


Figure 1: Drawing of instrument No. 14085 in the Ägyptisches Museum in Berlin.

⁴ It is the sign N5 of the Sign-list used for the sun disc. As for this writing of the dual, see GARDINER A. H.: *Egyptian Grammar*, Oxford 1982³, p. 58ff.

⁵ FAULKNER R. O.: *A Concise Dictionary of Middle Egyptian*, Oxford 1996, p. 33; HANNIG R.: *Großes Handwörterbuch Ägyptisch-Deutsch*, Mainz 1995, p. 112.

⁶ CHASSINAT É., ROCHEMONTEIX M. de: *Le temple d'Edfou III*, Le Caire 1928, p. 211. Cf. KURTH D.: *Treffpunkt der Götter*, Zürich, München 1994, p. 132; See also WOODHOUSE S.: *The sun god, his four bas and the four winds in the sacred district at Sais: the fragment of an Obelisk (BM EA 1512)*, p. 138, in: QUIRKE S. (ed.): *The Temple in Ancient Egypt. New discoveries and recent research*, London 1997.

⁷ *Wb I*, p. 145.

⁸ HANNIG R.: *HWB*, p. 112.



Figure 2: Hieroglyphic text at the bottom of instrument No. 14085.

šn.wj, dbnj.⁹ The first term is attested in Egyptian texts from the Old Kingdom and the others are known from later periods of Egyptian history. They come from inscriptions, mostly of religious character, written on the walls of tombs or temples, and on stelae and papyri.

Besides the text on the instrument in the Berlin Museum, there is a similar inscription¹⁰ in the Horus temple at Edfu. This inscription can be used to show the difference in the writing of the discussed terms. It mentions the movement of the sun and moon, or better, “the knowledge of the movement of the two lights, i.e. the sun and the moon”.¹¹ Compared with the text on the instrument, the writing of the term for both celestial bodies is clearly different. The transcription of the text is as follows: The last part of the phrase can be transliterated as ...nm̄t¹² n(t) h3.tj. This text is carved on the wall of the room known as the library.¹³ Unlike the text on the Berlin instrument, in the Edfu inscription both celestial bodies are expressed by the word *h3.tj*, “two lights”, meaning “sun and moon”. Two different determinatives, one for the sun (N6) and one for the moon (N62) are used.

Another text which mentions the movement of these brightest celestial bodies comes from the early Eighteenth Dynasty tomb of Amenemhat at Thebes.¹⁴ It is part of a hieroglyphic text written on a wall of the tomb. Two versions of its transcription have been given in the literature. The earlier version (fig. 3A) is included in Borchardt’s study on the measuring of time in ancient Egypt.¹⁵ The later one (fig. 3B) is included in Helck’s edition of historical and biographical texts of the Second Intermediate Period and the early Eighteenth Dynasty.¹⁶ The two versions display significant differences. The most important of

⁹ *Wb VI*, p. 142.

¹⁰ CHASSINAT É., ROCHEMONTEIX M. de: *Edfou III*, p. 351; See also SCHOTT S.: *Bücher und Bibliotheken im alten Ägypten*, Wiesbaden 1990, p. 280 (1294).

¹¹ PARKER R. A.: *The Calendars of Ancient Egypt*, SAOC 26, 1950, p. 17.

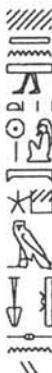
¹² SCHOTT S.: *Bibliotheken*, p. 280 (1294), note above the text.

¹³ *PM VI*, 1991, p. 134f and 130 (Plan).

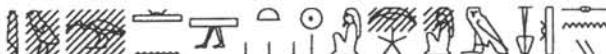
¹⁴ Tomb C2 at Sheikh aAbd El-Qurna. See *PM I*, Oxford 1994², p. 457.

¹⁵ BORCHARDT L.: *Die altägyptischen Zeitmessung*, pp. 1-67, in: BASSERMAN-JORDAN E. v.: *Die Geschichte der Zeitmessung und Uhren*, Leipzig 1920.

¹⁶ HELCK W.: *Historisch-biographische Texte der 2. Zwischenzeit und Neue Texte der 18. Dynastie*, Wiesbaden 1983², p. 111.



⇨ Figure 3A: Hieroglyphic text from the tomb of Amenemhat at Thebes, according to L. Borchardt.



↑ Figure 3B: Reconstructed version of the same text, transcribed by W. Helck.

them occurs in the middle part of the text and concerns the reconstruction of the word following the term “sun”. Despite these differences, both authors translate this part of the text in the same way “...the movements of the sun and the moon...”.¹⁷ If the reading of the reconstructed part of the text as “moon” is correct, both terms, “the sun” and “the moon”, are written differently. This does not correspond to the dual form of the word on the instrument. The conclusion which we can draw from this is that at different periods Egyptian scribes used different ways to express the sun and the moon by one word.

The recently published clear photograph of the instrument from the Berlin Museum¹⁸ shows that the part of the text discussed here does not seem to reflect any traces of re-writing or corrections. There is no doubt that it is to be read *itn.wj* and be translated as “the two discs”. If so, it still remains to be explained how this part of the text should be understood.

The solution to this problem has been suggested by Beate George.¹⁹ Whereas Borchardt tends to interpret the second sign as that used for the moon, George solves this problem with the term for the sun only. She interprets this part of the text as “the two suns”. According to her, it should be translated as follows: “Ich kenne den Gang der beiden Sonnen (⟨—○⟩, nämlich der des Tages und der Nacht)....”²⁰ In her article, George puts an emphasis upon the daily

¹⁷ BORCHARDT L.: *Zeitmessung*, p. 61; HELCK W.: *Mond*, in: *LÄ IV*, 1982, 196 note 29; Cf. also CLAGETT M.: *Ancient Egyptian Science, Volume II, Calendars, Clocks, and Astronomy*, Philadelphia 1995, pp. 459–462.

¹⁸ CLAGETT M.: *AES II*, Fig. III.20a; WELLS R. A.: *Astronomy in Egypt*, p. 37, fig. 12, in: WALKER Ch. (ed.): *Astronomy before the telescope*, London 1996.

¹⁹ GEORGE B.: *Die Bahn der Sonne am Tage und in der Nacht: altägyptische Sonnenuhren und Königsgräber*, *StAeg I*, 1974, pp. 101–116.

²⁰ GEORGE B.: *StAeg I*, 1974, p. 103.

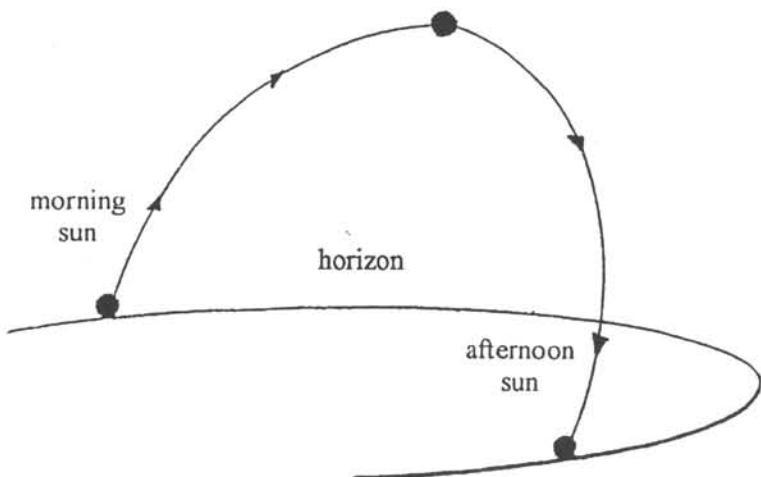


Figure 4: The path of the sun in the sky, ascending before the noon and descending after the noon.

and nightly journeys of the sun in the context of New Kingdom funerary texts in some royal tombs in the Valley of the Kings on the west bank of Luxor, and in the text from the Cenotaph of Seti I in Abydos.²¹ Besides this possibility, another, of non-religious character, will be presented later in the article.

The instrument known as *merkhet* is an astronomical device used by ancient Egyptian astronomers as an indicator of time.²² Instruments of the same form were used in ancient Egypt as shadow clocks for measuring time from the moment of the sunrise to sunset.²³ From the astronomical point of view it is reasonable to state that the meridian line plays a crucial role in the process of observing the movement of celestial bodies across the sky. The meridian line dividing the whole sky into two symmetrical hemispheres links two of the four cardinal points into one line in the north-south direction. Due to the rotation of the Earth, all celestial bodies cross this line on their paths across the sky. From the latitude of Egypt, some of them reach one or two culmination points above the southern and northern horizons respectively.²⁴ Taking as an example the sun disc, when it is in

²¹ As for the critical commentary of the latter, cf. ISLER M.: *The Merkhet*, VA 7/1, 1991, pp. 53-67.

²² BORCHARDT L.: ZÄS 37, 1899, p. 12ff; EDWARDS I. E. S.: *The Pyramids of Egypt*, London 1993, pp. 248-251; See also M. Isler's article in note 21.

²³ EDWARDS I. E. S.: *Pyramids*, p. 248f. See also BORCHARDT L.: *Zeitmessung*, pp. 26-67.

²⁴ The circumpolar stars in the northern sky have got two culmination points (upper and lower) above the northern horizon.

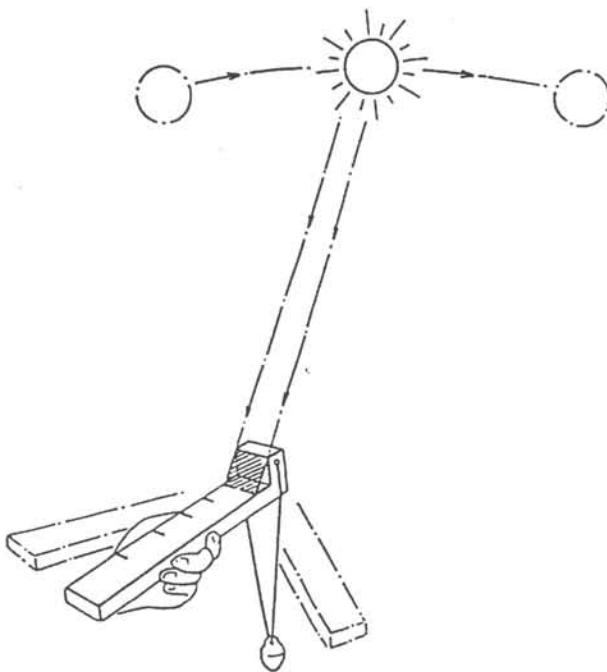


Figure 5: Isler's reconstruction of the method of following the sun with the sun clock.

the ascendant it rises higher and higher above the horizon till noon. After noon, the sun is in the descendant, coming nearer to the western horizon. The path of the sun or better its height above the horizon has consequences for the lengths and orientations of the shadows cast on the ground. The shadows of vertical objects in the afternoon reach the lengths of the shadows cast by the same objects in the morning. The directions of the morning shadows and the meridian line form together angles which are repeated in the afternoon. In other words, the shadows have twice daily the same lengths and deviations from the meridian. This is due to the fact that the sun reaches twice a day the same height above the (levelled) horizon or its zenith distance. During the first half of the day (till noon), the sun dominates the eastern part of the sky above the eastern horizon and later on it moves above the western part of the sky above the western horizon (fig. 4). In this connection, it is interesting to note that one of the methods of interpreting the use of the sun clock is based on the principle of following the sun disc with the sun clock (fig. 5).²⁵ These parts of the sky as well as positions of the sun are often mentioned in Egyptian texts. The following examples of sunrises and sunsets come from the inscriptions dated to the New Kingdom.

²⁵ ISLER M.: *VA* 7/1, 1991, fig. 8.

...*ḥr fm 3ḥt ḫbtt n(t) pt...*²⁶ “(when) he (i.e. *ḥtn*, the sun disc) rises in the eastern horizon of the sky”

...*wbn.k m 3ḥt ḫbtt nt pt...*²⁷ “(when) you (i.e. *ḥtn*, the sun disc) rise in the eastern horizon of the sky”

...*ḥtp.f m 3ḥt ḫmnnt nt pt...*²⁸ “(when) he (i.e. *ḥtn*, the sun disc) sets in the western horizon of the sky”

...*wbn.f m 3ḥt ḫbtt nt pt...*²⁹ “(when) he (i.e. Ra, the sun god) rises in the eastern horizon of the sky”

...*ḥtp.f m 3ḥt ḫmnnt nt pt...*³⁰ “(when) he (i.e. Ra) sets in western horizon of the sky”

The cosmic dimension of the basic physical characteristics of the path of the sun in the sky must have been recognized and understood by those involved with astronomy and the observation of the sky, especially those responsible for measuring time. Unlike George, who places one of the sun discs into the Egyptian underworld sky, I suggest that “the two discs” belong to the daily sky. The first represents the morning sun, i.e. the sun before noon (in the eastern sector of the sky), while the second is related to the afternoon sun (in the western sector of the sky), above the western horizon. The term *ḥtn.wj* should be understood as “the two sun discs (of one and the same sun)” in two different periods of a day and two different sectors of the daily sky, i.e. in its ascendant (till noon) and descendant (after noon). The text on the instrument which describes the knowledge of the movement of the celestial bodies (*ḥtn.wj* and *sbʒw*) continues with

and can be translated as “at its proper place”.³¹ This term, “the place” related to each of the celestial bodies, should be understood, in our opinion, as the location of each of them in the daily and nightly skies respectively.

Dating the instrument to the Late Period would enable us to read and interpret the second sign in the term *ḥtn.wj* as “the moon”, as was shown by Borchardt in his translation. Words, with this meaning and written in this form began to appear in Egyptian texts at that period and became even more frequent later, though some doubts still remain. Certainly, more texts of this kind should be collected and studied in order to provide us with the more detailed and complete terminology used by the Egyptians in their astronomical texts. It is important to say that the present stage of our knowledge of Egyptian astronomy does

²⁶ SANDMAN M.: *Texts from the time of Akhenaten*, Bruxelles 1938, p. 21.

²⁷ SANDMAN M.: *Akhenaten*, p. 52.

²⁸ SANDMAN M.: *Akhenaten*, p. 101.

²⁹ ASSMANN J.: *Sonnenhymnen in thebanischen Gräbern. Theben I*, Mainz 1983, p. 203 (Text 156).

³⁰ ASSMANN J.: *STG*, p. 215 (Text 158b).

³¹ Cf. BORCHARDT L.: *ZÄS* 37, 1899, p. 11; See *Wb V*, p. 455f; FAULKNER R. O.: *CDME*, p. 313 (for *r dmi.s* see also the reference to *JEA* 33, p. 29).

not yet enable us to show exactly how the celestial bodies were observed by the Egyptians. Unfortunately, their observation skills and practices are unknown and hidden to our eyes because of the fragmentary conditions and the lack of the relevant textual material and scenes. On the basis of some texts³² we know that the *merkhet* was used by the Egyptians to observe the stars at night. Archaeologically attested instruments of the same shape were also used as shadow clocks to measure the time during the day. The term *ftn* reflects the physical nature of the sun, the brightest source of the light in the sky, whose daily path is divided by the meridian line into two parts (ascending and descending). Stars can have paths of different shapes depending on their positions above the horizon (circumpolar and non-circumpolar). Observation of the paths of both, i.e. the sun and the stars, led in ancient Egypt to the development of methods of measuring the time using specific procedures and instruments. It is not known whether the moon was observed for the same purpose, i.e. to measure time within one day, but it played a fundamental role for the macro-scale for the calendars. If the reading *ftn.wj* as “sun and moon” should be correct, it will be necessary to show how this instrument was used in order to observe the moon, for what purpose this was done, and what is the relationship between the two uses of the *merkhet*.

³² The foundation ceremony texts preserved on the walls of the late periods temples.