

Deep Solar Eclipses in Ancient Egypt – a new interpretation of some New Kingdom texts.

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Abstract

Despite the fact that the sun played such a prominent part in the religion and culture of Ancient Egypt it is surprising that there is virtually no mention in Ancient Egyptian texts of solar eclipses, which would not have been understood and would have been terrifying.

This paper discusses a class of inscriptions appearing on a number of artefacts and material from the Book of the Dead from Deir el-Medina or nearby. In the past the inscriptions have traditionally been interpreted by researchers as referring to blindness, often of only a temporary nature, or of spiritual darkness and their co-incidence with the occurrence of Book of the Dead Spell 135 has not hitherto been reported.

Tentative dating of these artefacts has been attempted based upon their provenance and the individuals associated with them in relation to known regnal years from a generally accepted chronology supplemented by recent research for the Amarna period.

The hypothesis is proposed that these artefacts record the witnessing of a deep solar eclipse, which, not being understood at the time, was regarded as a punishment or omen, and was consequently interpreted in religious terms. It is suggested that in response Spell 135 was then used in a precautionary manner in the tombs of those who witnessed the event or their family.

This hypothesis is shown to be consistent with the available evidence. If further undated examples are found later this hypothesis may be a useful clue to their absolute dating and form an important element in generating an absolute chronology. Alternatively, if such texts are found which do have internal or other dating evidence, the hypothesis can be tested further.

There are no reliable data before about 1000 BC for use in the calculation of historical eclipses. This paper suggests that there may be, after all, some record of eclipse events amongst Ancient Egyptian texts, which, if properly interpreted, could reveal quantitative material potentially dating much further back and which could make a significant contribution to the study of historical eclipses and of the earth's rotation.

Deep Solar Eclipses in Ancient Egypt – a new interpretation of some New Kingdom texts.

Background

The sun played such an important role in the life of Ancient Egyptians, particularly in their religion that it is surprising that there is virtually no mention of solar eclipses in their ancient records. These events, not being understood in physical terms, would surely have been terrifying and so inevitably would have been incorporated in some way into the religious corpus. Despite this, these spectacular natural events and their likely effect on those witnessing them have hitherto received no serious academic attention.

During a deep solar eclipse, when the moon's disk more than covers the sun's disk, the light level can fall by up to six orders of magnitude and stars may become visible and it is sometimes necessary to use torches to see clearly¹. Given the importance of the stars in Egyptian Theology and Cosmology², to an Ancient Egyptian observer, used to cloudless, clear skies, without industrial atmospheric pollution, their sudden appearance during the daytime would have been of great concern. Indeed, Brewer³ remarked that "it is hard to imagine that the spectacular recurrence of total eclipses could go unrecorded, especially by a culture that so worshipped the sun".

It is however possible that such events may have been recorded on papyrus rather than on stone and although many papyri have survived, the relative rarity of these events has not yet resulted in an extant example. But, as Baines⁴ pointed out, the sources were not created and then almost randomly preserved or destroyed to supply us with a balanced picture of Egyptian religion – absence of evidence is not evidence of absence!

The proportion of the population witnessing a very deep or total eclipse will inevitably be small because of the narrow trajectory of the event and its transitory nature. If it occurred when the sun was high in the sky and it was very hot, many of the potential witnesses may have been sheltering indoors. Of those who did witness it, the vast majority would have been peasant workers in the fields and, being illiterate, such people would not have recorded the event.

¹ Smits, D.P. Observations on the 21st June 2001 Total Solar Eclipse. *Journal of Astrophysics and Space Science*, Volume 282, No. 1, October, 2002, Pp 227-234

² Parker, R.A., *Ancient Egyptian Astronomy*, *Phil. Trans. R. Soc. Lond. A.* 276, 51-65, 1974

³ Brewer, B., *Eclipse*, Seattle, Washington, Earth View 1991

⁴ Baines, J., *op. cit.*, p. 199, 1992

There may even have been strong reasons why such events were not always recorded, since the act of recording it may have been considered to endow the event with a degree of permanence. If it were recorded, therefore, it may have been referred to obliquely or in some cryptic way. Such a rare event would probably not even have had a name and thus be referred to in terms of the way the event was experienced “*seeing it get dark during daytime*”, which is precisely the kind of expression found in these texts.

One such event was recorded by Plutarch⁵:

'Now, grant me that nothing that happens to the sun is so like its setting as a solar eclipse. You will, if you call to mind this conjunction recently which, beginning just after noonday, made many stars shine out from many parts of the sky and tempered the air in the manner of twilight.'

At any given location, total eclipses will only recur on average every 375 years and are thus extremely rare events. They are generally regarded as dramatic with, some observers say, spiritually moving overtones; wildlife and domestic animals are often disturbed or disoriented by the experience – cattle go home, night birds sing and roosters crow⁶. Apparently, when an eclipse terrified the soldiers of Alexander who were fighting the Persians under Darius, appeal was made to the explanations of an Egyptian priest to calm the panic that overcame the troops⁷. Writing in the third century BC, Manetho⁸ is quoted as stating that

“a solar eclipse exerts a baneful influence upon men in their head and stomach”.

Eclipse events are highly predictable, given our knowledge of the mathematics of celestial mechanics, but this advantage may not have been enjoyed by the ancient Egyptians. Solar and lunar eclipses occur in regular cycles, known as the “Saros”, a fact that was well known in antiquity⁹. However, because of the geometry of an eclipse, whereas lunar eclipses are visible from everywhere on Earth where the moon is above the horizon, solar eclipses are only visible in specific regions of the planet, if at all. Determination of these cycles was probably gained through detailed and extensive record keeping. Thus, once understood, these cycles can be used to predict lunar eclipses but can only be used

⁵ Plu. De facie in orbe lunae 931D-E, translated by H. Cherniss and W. Helmbold, Plutarch's Moralia XII, 117, (Loeb ed. 1957).

⁶ Smits, D.P. op. cit.

⁷ Sauneron S. The Priests of Ancient Egypt. Cornell University Press, 2000

⁸ Manetho, "On Festivals" - Fr 84 (from Johannes Lydus). Translated by Waddell W.G., Harvard University Press, 1980

⁹ Neugebauer, O., The Exact Sciences in Antiquity. Brown University Press, 1957

to identify times when solar eclipses are possible or exclude times when they are impossible.

Early records of eclipses and of eclipse predictions survive from the late Babylonian period (c. 750 BC) and, later, from the Greek and Roman period, continuing into the Islamic Near East and India; the earliest Chinese records are somewhat older, dating from the middle of the second millennium BC¹⁰. The earliest references to eclipses found in Egyptian material are on papyri dating from the Roman period¹¹, most of which relate to time-keeping and the calendar. One notable exception is the Vienna Demotic Papyrus, which records solar and lunar omens. Parker¹² regards this as a copy, probably made in the late second century A.D. by a skilful scribe, of two separate books of earlier Babylonian material dating from the sixth century B.C. Later work by Parker and others¹³ confirms the likely dating of the original material.

Solar eclipses in Egypt have been discussed by several researchers in recent years. Sellers¹⁴ considered that there may have been a link between such events and Pharaonic accession, while more recently Ibrahim^{15,16,17,18,19,20} studied possible correlations of solar eclipses with key events or inscriptions, although the eclipse predictions he used are no longer accurate.

Aubourg²¹, studying the dating of the Zodiac of Dendera using the motions of the planets, has noted that it shows two disks, both in the constellation of Pisces. One of these is clearly intended to depict the moon, while the other contains a Wadjet eye. He calculated that a number of solar and lunar eclipses occurred during a range of years around the time the construction of the Zodiac, but observed that a nearly total solar eclipse occurred on a date corresponding very closely to the actual depiction of the positions of the planets in the constellations

¹⁰ Steele, J. M., *Observations and Predictions of Eclipse Times by Early Astronomers*, Kluwer Academic Publishers, 2000.

¹¹ Jones, A., *The Place of Astronomy in Roman Egypt* in Barnes, T.D., (ed), *The Sciences in Greco-Roman Society*. Academic Printing and Publishing, Edmonton, 1994

¹² Parker, R. A., *A Vienna Demotic Papyrus on Eclipse- and Lunar-omens*, Brown University Press, Rhode Island, 1959

¹³ Neuberger, O., Parker, R. A., and Zauzich, K., *A Demotic Lunar Eclipse Text of the First Century B.C.* *Proceedings of the American Philosophical Society*, Vol 125, No 4, 1981.

¹⁴ Sellers, J. B., *The Death of Gods in Ancient Egypt*, Penguin Books, 1992

¹⁵ Ibrahim A, *The Philosopher Pharaoh and the Total Solar eclipse*, <http://www.jas.org.jo/pharo.html>

¹⁶ Ibrahim A, *Wonders of the Sun*, <http://www.jas.org.jo/wsun.html>

¹⁷ Ibrahim A, *Egyptian Cosmology Part I: The Hermopolitan Cosmogony*, <http://www.eclipse-chasers.com/egypt1.htm>

¹⁸ Ibrahim A, *Egyptian Cosmology, The Oldest Eclipse Record – The Great Hymn to the Aten Describes a Total Eclipse of the Sun*, <http://www.eclipse-chasers.com/egypt2.htm>

¹⁹ Ibrahim A, *Egyptian Cosmology Part I: Solar eclipses: Mountains in the Sky*, <http://www.eclipse-chasers.com/egypt3.htm>

²⁰ Ibrahim A, *Egyptian Cosmology Part II: The Hermopolitan Cosmogony*, <http://www.eclipse-chasers.com/egypt5.htm>

²¹ Auberg, E., *La date de conception du zodiaque du temple d'Hathor à Dendera*. *Bulletin de l'Institut Français d'Archéologie Oriental*. Vol 95. 1995 pp1-10.

and the position of the disk containing the Wadjet eye in 51 B.C. This symbolism reminds us of the myth of Horus losing an eye in his fight with Set and raises the possibility that this may have had its origins in a very early observation of a solar eclipse. More recently, McMurray^{22,23} has been attempting to correlate lunar and solar eclipse dates using the latest predictions with dateable inscriptions on various monuments, to try to develop an absolute chronology.

Archaeological material and tomb inscriptions found at or near Deir el-Medina has given some rich insights into the beliefs of the workmen and women living there and texts from this material have been included in several general studies of the morals, religion and piety of the ordinary people in Ancient Egypt, for example by Gunn²⁴, Erman²⁵, Sweeney²⁶, Baines^{27,28,29}, Lichtheim^{30,31}, Pinch³² and extensively over many years by Assmann^{33,34,35,36,37,38}.

Were eclipses recorded but the evidence since misinterpreted?

This paper examines a small but specific group of eleven texts from stelae, an ostrakon, a graffito and some other relevant texts and vignettes from tombs, a coffin fragment and a papyrus, all from the New Kingdom, which may throw some light on the mystery of the apparent

²² McMurray, W., Dating the Amarna Period in Egypt: Did a Solar eclipse Inspire Akhenaten?
<http://www.egiptomania.com/EEF/EEFLibrary4.html> (2003)

²³ McMurray, W., Towards an Absolute Chronology for Ancient Egypt
<http://www.egiptomania.com/EEF/EEFLibrary5.html> (2004)

²⁴ Gunn, B., The Religion of the Poor in Ancient Egypt. JEA 3, Pp. 81-94. 1916

²⁵ Erman, A., Denksteine aus der Thebanischen Gräberstadt. Sitzungberichte der Königlich Preussischen Akademie der Wissenschaften, phil.-hist. Klasse 1911, 49. Pp.1086-1110, Berlin.

²⁶ Sweeney, D., Intercessory Prayer in Ancient Egypt and the Bible. In Sarah Israelit-Groll (Ed.) Pharaonic Egypt: The Bible and Christianity. Jerusalem: The Magnes Press, the Hebrew University. c. 1985

²⁷ Baines, J., Practical Religion and Piety. JEA 73, Pp. 79-98, 1987.

²⁸ Baines, J., Society, Morality and Religious Practice. In Byron E. Shafer (Ed.), Religion in Ancient Egypt: Gods, Myths and Religious Practice, Pp. 123-199, Ithaca NY: Cornell University Press; London: Routledge and Kegan Paul. Cornell edition reprinted 1992.

²⁹ Baines, J., Egyptian Letters of the New Kingdom as Evidence of Religious Practice. Journal of Ancient Near Eastern Religions, 1 Pp. 1-31, 2001

³⁰ Lichtheim, M., Maat in Egyptian Autobiographies and Related Studies. Orbus Biblicus et Orientalis Vol. 120. Fribourg University Press. 1992

³¹ Lichtheim, M., Moral Values in Ancient Egypt. Orbus Biblicus et Orientalis Vol. 155. Fribourg University Press. 1996

³² Pinch, G., Votive Offerings to Hathor. Griffith Institute, Oxford, 1993.

³³ Assmann, J., Ägypten: Theologie und Frömmigkeit einer frühen Hochkultur, Pp. 9-14 Stuttgart, 1984

³⁴ Assmann, J., Liturgische Lieder an den Sonnengott. Untersuchungen zur ägyptischen Hymnik I, MÄS 19, 1969.

³⁵ Assmann, J., Ägyptische Hymnen und Gebete, Zurich, 1975.

³⁶ Assmann, J., Ocular Desire in a Time of Darkness. Urban Festivals and Divine Visibility in Ancient Egypt. In Agus, A.R.E. and J. Assmann J. (eds), Ocular desire / Sehnsucht des Auges. Year book for Religious Anthropology. Berlin, Berlin Akademie Verlag, 1994, Pp. 13-29

³⁷ Assmann, J., Egyptian Solar Religion in the New Kingdom : Re, Amun and the Crisis of Polytheism, translated from the German by Anthony Alcock. London, Kegan Paul International, 1995.

³⁸ Assmann, J., The Search for God in Ancient Egypt, translated from the German by David Lorton. Ithaca and London, Cornell University Press, 2001

absence of any mention of solar eclipses. The texts from the stelae, ostrakon and the graffito considered are as follows:

Stela Cairo JE 37463	Stela Turin 50046 (KRI III, 668-9)
Ostrakon Cairo 12202	Stela Turin 50050 (KRI IV, 338, B.VIII)
Graffito Pawah (in TT139)	Stela Turin 50051 (KRI I, 373-4)
Stela Bankes No. 6 (KRI I, 413)	Stela Turin 50052 (KRI I, 390)
Stela BM 374 (KRI V, 645)	Stela Turin 50058 (KRI III, 772-3)
Stela BM 589 (KRI III, 771-2)	

Some of these texts are penitential, expressing remorse for wrongdoing and seeking forgiveness or the lifting of a punishment imposed by a god, while others are hymns and prayers. Although the form of the expressions used in the actual texts varies slightly from case to case and their translation varies from one researcher to another, all of these texts contain a form of words which seem to be trying to express the concept of darkness at a time which was unusual:

‘to see / behold darkness by day’ (of your making);
‘to see a darkness of thy / my making’;
‘in her hand by night as by day’
‘to see the darkness you create’;
‘the day-time darkness thou has made’;
‘to see day like night’;

Although there was not always complete consistency in the use of determinatives in hieroglyphic texts, it is perhaps also worthy of note that all but one of the texts on the stelae considered contain the unusual determinative hieroglyph (N46b)



depicting “night” or “darkness”, which was first used in the New Kingdom. It does not occur on Stela Cairo JE 37463, but this is relatively small and the sculptor may have chosen to omit it for reasons of space. The graffito and the ostrakon are both in hieratic although those discussing these texts have interpreted them as using the equivalent of N46b.

Maspero³⁹, and some later Egyptologists, believed that this depicts a star suspended beneath the sky, but Chatelet⁴⁰ and Hornung⁴¹ both

³⁹ Maspero, G., Histoire ancienne des peuples de l'Orient classique: Les origines, Égypt et Chaldée, p. 16, Paris 1895

⁴⁰ Chatelet, M., Une des Causes de l'Obscurité Nocturne d'après Les Idées des plus Anciens Égyptiens, Bulletin de l'Institut Français d'Archéologie Orientale, 18, Pp 21–31, 1920.

⁴¹ Hornung, E., Nacht und Finsternis im Weltbild der Alten Ägypter. Inaugural Dissertation zur Erlangung des Doktorgrades einer Hohen Philosophischen Fakultät der Eberhard-Karls-Universität zu Tübingen. 1956

studied the evolution of this glyph and Chatelet argued that this was a misinterpretation. Tracing the history of this and earlier forms of the glyph back to the Old Kingdom, she showed that the determinative for night originally represented the sky being held up by an oar, and, later, a sceptre. In particular, this support was normally broken, sometimes “mended” with a rope binding. She argued, from the continuous evolution of this sign throughout the Middle Kingdom, that this “star” is in fact simply the plan view of a base for the support holding up the sky; Egyptians did not try to show perspective, but combined different planes of view in a single depiction⁴².

Chatelet argued that the belief that this cross represented a star was apparently reinforced by the discovery of a much later form of the glyph, which appears to depict a star suspended from a rope looped over the sky, but she considered that this was due to the misunderstanding of the earlier origins of the glyph by the draughtsmen of the Ptolemaic period. She did not offer an explanation of the origin of the other small line in the glyph, but this occurs in very early forms of the glyph in the Old Kingdom and is often also shown bound with the rope to the broken support. This probably represents part of a broken support, while others still remain intact – i.e. that it is the determinative for “twilight”.

Traditional explanations for these particular texts

Gunn⁴³ discussed a number of texts, including several of those considered here, noting that some document physical ailments and in particular various forms of “blindness”. Although he considered it natural to take such expressions to describe physical blindness, bearing in mind that the working conditions and the incidence of water-borne parasites may both be detrimental to eyesight, he remarked that it was “very strange that this affliction should occur proportionally so often, and be at the same time the only one specified by the victims of divine retribution”.

Rowe⁴⁴ examined one example of these texts on Stela Cairo JE 37463, found in the Karnak cache, attributed to Huy, Viceroy of Nubia during the reign of Tutankhamun, and whilst noting the similarity between this text and others from elsewhere, commented that the “darkness” may refer either to Huy becoming blind or that he was in metaphorical darkness because of the absence of the king. Černý⁴⁵, considering Stela Bankes No: 6, also noted the similarity of the text to those from elsewhere and also shared the view that physical blindness was being described.

⁴² Robins, G., *Proportion and Style in Egyptian Art*. Thames and Hudson, 1994.

⁴³ Gunn, B., *op. cit.*

⁴⁴ Rowe, A., *Newly identified Monuments in the Egyptian Museum Showing the Deification of the Dead together with Brief Details of Similar Objects elsewhere*, ASAE 40 (1940)

⁴⁵ Černý, J., *Egyptian Stelae in the Bankes Collection*, Oxford, 1958

Mahmoud⁴⁶, covering all the examples considered here (as well as some others which do not include references to darkness or night) also considered these texts to be referring to actual blindness. He argued that the ancient Egyptians never used the words “blind”, “blindness”, or their synonyms in cases of literal blindness, probably for fear that such defects might adhere to them in their afterlife, concluding that they used symbolic ways of explaining the meaning of blindness, including such expressions as those above.

Posener⁴⁷ believed that the hieratic graffito on Ostrakon Cairo 12202 was written to give thanks to Amun-Re by someone who had previously experienced “blindness” but was cured and who clearly was alive and sighted at the time it was written! Borghouts⁴⁸ has extensively researched references to “manifestations of the gods”, including several of these texts, and also regarded it as generally agreed that, while they describe a physical state, such blindness, particularly where referred to using the expression “*darkness by day*”, was mostly only a temporary one.

Manniche⁴⁹, on the other hand, studying artistic material, noted that those said to ‘see *darkness by day*’ are all represented as having a perfectly normal eye suggesting that the expression could be figurative, citing similar biblical passages where spiritual blindness may be being inferred.

While Gardiner⁵⁰ interpreted the Graffito Pawah, written in hieratic and dating from the Amarna period, found in a chapel tomb in Thebes as being a petition to Amun written by the brother of a blind man, Reeves⁵¹ argued that it is an appeal to Amun to return, reflecting the despondency which had settled on the country during the reign of Akhenaton.

Pinch⁵², studying the use of votive eyes and ears which appear on some stelae, including several of those discussed here, recalled the suggestion by Wilkinson⁵³ that such stelae were dedicated to deities by people who had been cured of blindness. However, she also concluded that it could also be referring to spiritual blindness, adding that it is not clear whether these were produced in response to seeing visions of the

⁴⁶ Mahmoud, A., op. cit.

⁴⁷ Posener, G., La Piété Personelle avant L'Âge Amarnien. RdE 27 (1975), 195-210

⁴⁸ Borghouts, J.F., Divine Intervention in Ancient Egypt and its Manifestation (b3w), in Gleanings from Deir el-Medina, edited by Demarée, R.J. and Janssen, J.J., Leiden, 1982

⁴⁹ Manniche, L., Symbolic Blindness, CdE 53/105, Pp 13-21, 1978

⁵⁰ Gardiner, A. H., The Graffito from the Tomb of Pere. JEA 14, Pp 10-11, 1928

⁵¹ Reeves, N., Akhenaton – Egypt's False Prophet, Thames and Hudson, London, 2001

⁵² Pinch, G., op.cit. p. 257.

⁵³ Wilkinson, J. G., The manners and customs of the ancient Egyptians. New edition, revised and corrected by Samuel Birch, London, 1878.

deity, perhaps as a mark of divine forgiveness, or to being in the presence of the deity in the afterlife.

In a similar vein, Galán⁵⁴ also believed that the idea that such expressions refer to physical blindness is mistaken, arguing “rather, the alleged blind are dead; the stelae have been dedicated by one or more of their relatives, who include themselves in the *tableau*, praising the deity, and/or are mentioned at the end of the inscription”. Assman⁵⁵, too, did not consider this as referring to blindness. Using Grafitto Pawah as a model example, he coined the phrase “ocular desire” to cover the concepts expressed in texts such as these (and others). Considering the expression to be metaphorical, whilst accepting that, in the context of Ancient Egyptian religion, actual blindness may also have appeared as a metaphor itself for banishment from the face of the god, he argued that this can cover three contexts of visibility / invisibility:

“the context of the feast: the visibility of the ‘coming god’, where invisibility refers to the absence caused by the abolition of the feasts during the Amarna period,

the context of the pious life: the visibility of the god ‘taken to heart’, where invisibility refers to ignorance or even persecution, and

the context of suffering and salvation: the visibility of the merciful god, who turns his face to the sufferer and illuminates his yearning eyes”

If one accepts Assmann’s view⁵⁶ that religious beliefs pervaded entirely the everyday life of the Ancient Egyptians, metaphorical interpretations, in terms of despair or invisibility of a deity, to meet the need to find suitable expressions to describe spiritual experiences, seem equally plausible. On the other hand, there are some cases where it seems likely that sight had been lost but was indeed recovered⁵⁷.

All of these traditional interpretations and explanations for such texts are, of course, plausible. Physical blindness would have been very common in Ancient Egypt when diseases like Bilharzias were not understood and effective treatments were not available. The particularly cramped and dusty working conditions in the tombs would also have caused irritation and ulceration, in some cases leading to the permanent loss of sight. The depiction of normal eyes in accompanying imagery suggests, however, that permanent blindness does not seem to be an adequate explanation in all the cases considered.

⁵⁴ Galán, J.M., Seeing Darkness. CdE 74, Pp 18–30, 1999

⁵⁵ Assmann, J., op. cit. 1994.

⁵⁶ Assmann, J., op. cit. 1984.

⁵⁷ Posener, G., op. cit.

No single explanation therefore seems entirely adequate for all eleven expressions, despite their conceptual similarity, but there is no reason to assume that these explanations are comprehensive or mutually exclusive. In the absence of the physical explanations for the movement of the sun, moon, and stars, and of the understanding of natural everyday phenomena (such as the annual flooding of the Nile) which we now have, unusual and unwelcome occurrences and events would have been attributed supernatural causes and effects, for example being seen as punishment by or displeasure of the gods. Thus even texts which seem strongly metaphorical or spiritual may be grounded on some physical event or occurrence - indeed Assmann⁵⁸ noted the spiritual change in the New Kingdom where "God translates his nature into actions and controls creation and order".

The main problem with all the traditional explanations is that they are essentially un-testable scientifically. An explanation which, if further examples were to be found, allowed a test of the validity of the explanation, would be of greater value. Such an explanation was hinted at by Rowe when he was commenting on Stela Cairo JE 37463 (see above) adding "*like the sun during the night or at an eclipse (?)*".

This paper therefore examines the hypothesis that these expressions were in fact recording the witnessing of a deep solar eclipse, whether they were incorporated into texts written for other purposes or in response to the event, for example, in the belief that the darkness during the eclipse was a punishment for some misdemeanour for which forgiveness was being sought.

Further evidence from the other texts and vignettes from tombs, a coffin fragment and a papyrus,

Hodel-Hoenes⁵⁹ illustrated the wall decoration from several New Kingdom tombs and noted, in the case of TT1 (Senedjem), the instance of the unusual Spell 135 from the Book of the Dead. Although there may be some ambiguity between the inscription and the vignette as to whether the disk shown is the moon or the sun, she considered the spell to be providing protection against a solar eclipse occurring at the same time as a new moon - in fact, solar eclipses can only occur at the point when there is no moon since that is when the moon is directly between the earth and the sun and therefore always just before a new moon.

The spell, which may comprise a text and a vignette showing a varying number of deities (4 or 5), a disk and a varying numbers of stars (6, 7 or

⁵⁸ Assmann, J., op. cit. 1995.

⁵⁹ Hodel-Hoenes, S., *Life and Death In Ancient Egypt: Scenes from Private Tombs In New Kingdom Thebes*, Cornell University Press 2000, pp 259-260

8) against a dark background, is noted by Saleh⁶⁰ as occurring in several New Kingdom tombs all from Deir el-Medina:

Tomb	Owner	Spell 135 content
TT1	Sennedjem	Vignette only
TT5	Neferabou	Vignette only
TT218	Amennakhte	Text and Vignette
TT265	Amenemopet	Text and Vignette
TT290	Irynefer	Vignette only
TT356	Amenmuwia	Vignette only

Saleh does not actually illustrate the vignette in TT265 when discussing the text and there does not appear to be any reference to it in the main reference work on this tomb by Jourdain⁶¹.

Faulkner⁶² translated Spell 135 as dispelling “blariness of eye (of Re) with his fiery breath” – possibly a reference to the flash of the corona and the phenomenon of “Bailey’s Beads”, flashes of light occurring at the precise moment of a total eclipse. He also translated the spell as being intended for use on the first day of the month. This may be interpreted as the first day of the lunar month, since there seems no physical or logical reason why there should have been considered a special relationship between the lunar cycle and the Ancient Egyptian calendar at this time. Hornung suggested that the “eclipse” may be a new moon passing in front of the sun, although it is not clear why he ruled out a genuine solar eclipse. Stars are visible during very deep eclipses and the number seen (or remembered) would have depended when during the eclipse their presence was noted, possibly explaining the variation in numbers in the vignettes between the tombs.

Others^{63,64,65} have also recorded and discussed this spell. Budge, in particular translated this as “Osiris unfettereth (or openeth?) the storm cloud in the body of heaven” and recorded the hieroglyph used for “storm” as



recorded by Gardiner⁶⁶ more simply as



(N4)

while Davis translated the spell as “he opens the cloud that is the body of Heaven, he frees himself.”

⁶⁰ Saleh, M., *Das Totenbuch in den Beamtengrabern des Neuen Reiches*, AVDAIK, 46, Mainz, 1984, pp58-61

⁶¹ Jourdain, *La Tombe du scribe royal Amenmopet in Vandier d’Abbadie and Jourdain, Deux Tombes de Deir el-Médineh*, MIFAO, lxxiii

⁶² Faulkner R.O., *The Ancient Egyptian Book of the Dead*, British Museum Press, 2000, p123.

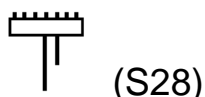
⁶³ Wallis Budge, E.A., *The Book of the Dead*, Gramercy Books, 1999, pp511-512

⁶⁴ Hornung, E., *Das Totenbuch der Ägypter*, Zürich - München 1979, pp262, 497

⁶⁵ Davis, C.H.S., *The Egyptian Book of the Dead*, London, 1894

⁶⁶ Gardiner, A. H., *Egyptian Grammar (3rd Edition)*, Griffith Institute, Oxford, 1988

Clearly shown in Saleh's illustrations of the texts of this spell, particularly that from TT218, is the hieroglyph



used for cloth, sometimes as a determinative for covering / uncovering. Although Budge⁶⁷ curiously did not seem to record the use of this hieroglyph in the version of the spell he published, he nevertheless used the phrase "and he hath made an end of the storm" in his translation. Interestingly, the text immediately adjacent to the vignette in TT290 shown by Saleh also includes an early variant of the hieroglyph N46b in the context of a variation of the text reported above on the stelae considered in this paper, but this text does not seem to have been fully documented in the literature so far.

Spell 135 also occurs on a few papyri, the earliest of which is pNeferrēpet, which contains both a vignette and text. This, as we will see later, can be dated by association with its known owner fairly accurately to the first half of the reign of Ramesses II. Milde⁶⁸ remarked that "the affinity between pNeferrēpet and the Theban tombs (especially TT1) is abundantly clear". (Several other papyri containing this spell are attributed to the 21st dynasty and further research on these and their possible association with eclipses would clearly be worthwhile.) A small fragment of Neferrēpet's coffin was found fortuitously in the entrance to TT 335 which belonged to Nakhtamun, his brother, whose own tomb (TT 336) is immediately adjacent.

Although Spell 135 first occurs in the tombs of the workers at Deir el-Medina during the 19th Dynasty (and as far as is currently known was only used in those tombs), it has echoes in Coffin Text Spell 112, translated by Faulkner⁶⁹ as "O storm, you who are cloudy! Re is covered but Horus proceeds happily every day, (even he) the great shape and weighty of striking power, who dispels cloudiness with his fiery breath."

The eight coffins bearing this spell are documented by de Buck & Gardiner⁷⁰ and are all from el-Barsha and probably come from the 11th or 12th Dynasty, but cannot be dated more precisely. None of the texts published by de Buck & Gardiner of this spell, which varies between the coffins, contain hieroglyphs of the form discussed above, but again

⁶⁷ Wallis Budge, E.A., *op. cit.*

⁶⁸ Milde, H. *The Vignettes in the Book of the Dead of Neferrēpet*, Egyptologische Uitgaven, Leiden, 1991, Pp 164-165.

⁶⁹ Faulkner, R.O., *The Ancient Egyptian Coffin Texts*, Vol. III, Spells 788-1185 & Index, Aris & Phillips Ltd., Warminster, 1978 Pp161-162

⁷⁰ De Buck, A. & Gardiner, Sir A. H., *The Egyptian Coffin Texts vol VII Spells 787-1185*, Chicago 1961, Pp 442-443.

further research on these and their possible association with eclipses would clearly be worthwhile.

These Coffin and Book of the Dead texts are notoriously difficult to interpret and hence translate. Nevertheless, we cannot overlook the structural similarity of the hieroglyphs discussed above, when they occur, and their interpretation in terms of darkness, cloudiness, storm, covering / uncovering etc. taken together with similar expressions used by those translating these texts are all terms which may be used by an observer witnessing the dramatic and extremely unusual event of a very deep or total solar eclipse. The workers at Deir el-Medina would have been in a unique position to have been aware of the earlier Coffin Text and to have seen the necessity to have constructed a Book of the Dead Spell to put in their own tombs as a precautionary measure.

Correlating these texts with known deep or total solar eclipses

This requires knowledge of the location of each text, its date and the dates of the eclipse. Stelae, ostraca, & papyri especially those bearing such expressions & spells, are rarely dated within the inscription, although in most cases the material concerned can be broadly dated by its content or its relationship to specific named individuals who were known from other references to have been present in a particular place at particular regnal dates. Even then, linking these regnal dates to an absolute date is fraught with difficulty since it is generally accepted that the chronology remains uncertain and cannot be defined precisely until about 664 BC⁷¹.

Absolute dating of the New Kingdom period is based upon two main correlations, the accession dates for Thutmose III and Ramesses II, which are associated with specific astronomical lunar and Sothic events⁷².

The texts and artefacts considered in this paper fall into two distinct groups. Several relate to specific individuals who were known to have been resident at the village of Deir el-Medina. The prosopographic study of this community by Davies⁷³ has been especially valuable in this respect. The remaining items are more disparate but individually have attributes which still make them useful in relation to the examination of the hypothesis that they were originally related to a deep solar eclipse.

⁷¹ Shaw, I. (ed.) The Oxford History of Ancient Egypt. OUP 2000

⁷² Kitchen, K.A., The Basics of Egyptian Chronology in Relation to the Bronze Age, in P. Åström (ed.), High, Middle or Low? Acts of an International Colloquium on Absolute Chronology Held at the University of Gothenburg 20th-22nd August 1987. Part 1, 37-55. Gothenburg: Paul Åströms Förlag. 1987

⁷³ Davies, B. G., Who's who at Deir el-Medina, Egyptologische Uitgaven. Leiden, 1999.

Eclipse Predictions for the period of the New Kingdom

Although the mathematics of solar eclipse prediction is now well known, there remains one parameter in the calculation which introduces an element of uncertainty into the precise path of the solar eclipse trajectory across the globe. This parameter is the changing rate of the earth's rotation, due mainly to the drag of tidal friction caused by the moon on the earth, although other complex geophysical processes, not all of which are well understood, are also involved. Currently, this parameter amounts to an increase of about 1.7 milliseconds per century in the length of the day. Although this may not seem important, the cumulative effect of this drag over a period of many centuries is significant. The effect of these complex processes is also not linear and during the period before 1900 AD back as far as about 2000 BC the length of the day was in fact declining.

Stephenson^{74,75} has made an extensive study of this phenomenon, based upon the historical records of solar eclipses and other occultation events. Based upon his work, the accumulated change in the earth's rotational position at the precise timing of an eclipse for dates in the period covered by this study can be seen to be significant. For example, for eclipses occurring around 1500 BC, this parameter, known as ΔT , amounts to about 34,000 seconds, or about 9½ hours compared with the position the earth would be in if the rotation had been constant over the entire period. Although this absolute time difference is significant in calculating precisely where an eclipse will be visible, what is of more importance is the error in the estimate of ΔT . Even a small amount of error in ΔT can significantly affect the trajectory of an eclipse and make the difference between a total or very deep eclipse and an insignificant partial one. The sensitivity of the results quoted to errors in ΔT will be considered later in the paper.

PC-based eclipse prediction software which takes into account celestial mechanics and also the empirical estimate of ΔT is now readily available⁷⁶ and with this it is easy to calculate the incidence of solar eclipses visible in Egypt throughout the New Kingdom period with a high degree of accuracy provided that a good estimate of ΔT is available. The best estimate at present for this parameter when considering historical eclipses before 1000 BC is given by Morrison & Stephenson⁷⁷ as

$$\Delta T = -20 + 31[(\text{year}-1820)/100]^2$$

⁷⁴ Stephenson F. R and Houlden M. A., Atlas of Historical Eclipse Maps: East Asia 1500 BC - AD 1900, Cambridge University Press, 1986.

⁷⁵ Stephenson F. R., Historical Eclipses and the Earth's Rotation, Cambridge University Press, 1997.

⁷⁶ Takesako S, EmapWin Ver. 1.21 downloadable from <http://www2c.biglobe.ne.jp/~takesako>

⁷⁷ Morrison, L.V. & Stephenson, F.R. Historical Values of the Earth's Clock Error ΔT and the Calculation of Eclipses, Journal for the History of Astronomy, Vol. 35 Pt. 3, pp 327–336, 2004.

In considering what depth or degree of totality should be considered as significant for the purposes of this paper, the references to darkness in the texts considered and the depiction of stars in the vignettes of Book of the Dead Spell 135 can be used as criteria. Stephenson⁷⁸ cites and discusses six specific and reliable examples of medieval records where one or more stars were said to be visible and calculates the likely maximum magnitude of the eclipse. He concludes that these provide strong evidence that even inexperienced observers could discern stars at an eclipse which falls far short of totality. In two of the six cases he examined, the magnitude calculated at the point of observation was as low as 0.84, although the central (maximum) magnitude of the eclipses was 0.92 and 0.94 in these cases. Although for a culture so focussed on solar issues such as that of Ancient Egypt any significant and unexplained level of obscuration of the sun would have been dramatic, for the purposes of this paper it will be assumed that any eclipse of magnitude approaching 0.9 or greater at the point of observation would have been particularly significant, although eclipses of magnitude as low as 0.3 would scarcely have gone unnoticed in the clear and largely cloudless skies of Ancient Egypt.

As already indicated, a potential source of error in the eclipse path prediction arises from the estimate of ΔT . Morrison and Stephenson⁷⁹ have estimated from historical data the standard error of the estimate of ΔT as:

$$\sigma = 0.8[(\text{year} - 1820)/100]^2$$

although they point out that this formula can only be reliably supported by empirical data back as far as 1000 BC and that beyond this one is relying on extrapolation.

Group 1: Evidence from Deir el-Medina

Stela Bankes No. 6 & TT 1: This stela was dedicated to Iy-neferti, wife of Sennedjem, a “servant at the place of truth” (Deir el-Medina), where the stela probably originated. Černý⁸⁰ translated this as “*For you have caused me to see darkness by day*”. Sennedjem and Iy-neferti lived during the reign of Sety I and Ramesses II and Sennedjem himself had probably died earlier in this period. Mahmoud⁸¹ believed that Iy-neferti was over 75 years old when she died which would mean that it is probable that she lived until the middle of the reign of Ramesses II. The couple and several of their sons were buried in the same tomb (TT1) and it is quite possible that decoration of the tomb continued after

⁷⁸ Stephenson, F.R. op. cit.

⁷⁹ Morrison, L.V. & Stephenson, F.R. op.cit.

⁸⁰ Černý, J., op. cit. 1958

⁸¹ Mahmoud, A., op. cit.

Sennedjem had died and spell 135 added as a matter of some concern by his widow and possibly the sons who had witnessed a significant eclipse.

Stela BM 374 & TT 218: This stela from Deir el-Medina, shows Amennakhte, scribe of Set-Ma'at, kneeling before the Goddess Meretseger, Mistress of the West. Gunn⁸² translated this inscription as "*Thou causest me to see darkness by day*" and notes that Amennakhte is a very common name in the village. This specific individual cannot be identified with certainty but Davies⁸³ identifies him as the son of Nebenmaat, whose own tomb chapel dates from the first half of the reign of Ramesses II. Amennakhte, son of Nebenmaat, also owned tomb TT218. This stela and tomb therefore probably date from the first half of the reign of Ramesses II.

Stelae BM 589 & Turin 50058 (also referred to as No: 102) & TT5: Stela BM 589, also discussed by Gunn⁸⁴ shows Neferabu, a worker, probably a painter, at Deir el-Medina. Neferabu erected a number of stelae and his tomb (TT5) are discussed by Vandier⁸⁵ who suggested that this particular stela did not come from his tomb but from a private shrine in Western Thebes. Gunn translated this text as "*(and) he caused me to behold darkness by day*", commenting that it appeared strange that the petition is to Ptah, to allow him to see Amun, rather than Amun himself. However in view of the fact that Ptah was both the god of craftsmen (of which genre Neferabou probably classed himself) and also the hearer of prayers, this is perhaps not unexpected.

Stela Turin 50058, discussed by Gunn⁸⁶, Tosi and Roccati⁸⁷ and Mahmoud⁸⁸ is also attributed to Neferabou. This stela was dedicated to Meretseger, to whom Neferabou also made a false vow. Gunn translated the text as "*I was in her hand by night as by day*" commenting that the text of this stela obviously suffered from numerous mistakes, aberrant spellings and omissions. However, this particular inscription also contains a further clue suggesting that the phenomenon being observed was a solar eclipse. Almost immediately after the sentence above, Gunn⁸⁹ reported that the inscription continues: "*I called upon the wind and it came to me not*" and, later, "*I called upon my Mistress: I found that she came to me with sweet airs*". He acknowledges that both Erman and Maspero took this reference as probably indicating a disease in which

⁸² Gunn, B., op. cit.

⁸³ Davies, B. G., op. cit.

⁸⁴ Gunn, B., op. cit.

⁸⁵ Vandier, J., *Tombes de Deir el-Médineh: la tombe de Nefer-Abou*, 49, pl. 26, Le Caire : Impr. de l'Institut français d'archéologie orientale , 1935

⁸⁶ Gunn, B., op. cit.

⁸⁷ Tosi, M. and Roccati, A., op. cit.

⁸⁸ Mahmoud, A., op. cit.

⁸⁹ Gunn, B., op. cit.

the subject suffers from lack of breath, but he suggested that it may only be a poetic figure.

This inscription may be an example of the *eclipse wind* whereby, during a total eclipse, there appear to be local changes in wind speed and / or direction as totality approaches. Aplin and Harrison⁹⁰ remarked that this is a frequently discussed, although not clearly defined, phenomenon, requiring more sensitive meteorological observations to investigate further.

A necropolis workman of the name of Neferabou was mentioned on Ostrakon BM 5634 dated to a regnal year of 40+, when he was burying his brother-in-law, so he may be placed with some certainty in the reign of Ramesses II⁹¹. It seems likely that Neferabou commissioned both stelae urgently at the same time by different stone cutters to record the placation of both gods! Both stelae and tomb can therefore also be dated with some certainty to the early to middle part of the reign of Ramesses II.

Stela Turin 50046 (also referred to as No: 318) / pNeferrenpet / Coffin Fragment: This stela was discussed by Gunn⁹² and Maspero⁹³ and shows the sculpter Neferrenpet with his wife (or sister) and daughter worshipping Luna Thoth. Gunn translated the text as “*Thou causest me to see a darkness of thy making*”. Several individuals of this name are known to have lived at the village during the 19th and 20th Dynasties. Tosi and Roccati⁹⁴ tentatively accredited this stela to the worker Neferrenpet, son of Nebre and Pashedet. However, the stela specifically stated that he was a sculptor and the only one of this name documented by Davies⁹⁵ is Neferrenpet, son of Piay, and brother of the Royal Scribe Huy. They were contemporary with (and probably slightly younger than) the scribe Ramose. Huy and Ramose were serving together under Ramesses II until year 39 of his reign. Milde⁹⁶ confirms that the ownership of pNeferronpet as this same person. This stela, the papyrus and coffin fragment therefore all date from the first half of the reign of Ramesses II.

Stela Turin 50050: This stela was dedicated to Ahmose Nefertari by Heria, a name rarely met. It also mentioned a more common name, Eie.

⁹⁰ Aplin, K.I. and Harrison, R.G. Meteorological Effects of the Eclipse of 11 August 1999 in Cloudy and Clear Conditions. Proc. R. Soc. Lond. A. 459, Pp. 353-371, 2003

⁹¹ Černý, J., Papyrus Salt 124 (Brit. Mus. 10055) JEA 15, p. 254, 1929

⁹² Gunn, B., op. cit.

⁹³ Maspero G., Recueil Vol II, p.119, 1880

⁹⁴ Tosi, M. and Roccati, A., Stela e alter epigrafi di Deir el-Medina. (n.50001-50262: Pubblicate con il contributo del Consiglio nazionale della ricerche. Turin, 1972

⁹⁵ Davies, B., op.cit.

⁹⁶ Milde, H., op.cit.

Tosi and Roccati⁹⁷ translate the text as “[Grant] that I may see the darkness you create”. The name Heria is mentioned in the year 6 of Sety II on Ostrakon Nash 1, recording the case of a woman charged with the theft of a copper utensil⁹⁸, but we do not know, of course, the result of this accusation. Because there are several instances of the name Eie, including one who was a daughter of Neferabu (see above), Tosi and Roccati⁹⁹ argued that it is not possible to be sure of the precise individual, but concluded that the stela belonged to the 19th Dynasty.

Mahmoud¹⁰⁰, on the other hand suggested a date at the end of the 18th Dynasty, but this seems unlikely if one accepts that the Heria mentioned was the same person as the one accused of theft. It therefore seems more likely that this stela was produced during the reign of Ramesses II, especially if one assumes that the Eie mentioned was indeed the daughter of Neferabu.

Stela Turin 50051 (also referred to as No: 279) & TT290: Gunn¹⁰¹ and Maspero¹⁰² both discussed this stela which was in honour of Irynefer and which shows Nebtuhet, the wife of Irynefer, a servant at Deir el-Medina, worshiping Soped or Thoth and speaking. Gunn translated the text as “*Thou causest me to see a darkness of thy making*”. Nebtuhet was the second wife of Irynefer who had previously been married to Maya by whom he had had a son, Baki, who later became a foreman and headed one of the most influential families at Deir el-Medina. Baki was known to be a foreman during the reign of Sety I, but it is not known whether he continued in this role during the reign of Ramesses II. Since the inference from this stela is that Irynefer has died, leaving a younger widow to mourn him, it seems likely that it therefore probably dates to the first half of the reign of Ramesses II. Decoration of the tomb (TT290) may also have continued after his death by his widow.

Stela Turin 50052: Gunn¹⁰³ and Maspero¹⁰⁴ both discussed this stela which shows the draughtsman scribe Pai worshipping Khonsu. The stela was in honour of his mother Wadjetronpet, wife of Ipuy. Gunn translated the text as “*Lo, thou causest me to see a darkness of thy making*”. The draughtsman Pay’s name occurs in graffito number 817¹⁰⁵ in apposition to the cartouches of Horemheb, Ramesses I and Seti I and he is known

⁹⁷ Tosi, M. and Roccati, A., op. cit.

⁹⁸ Černý, J., and Gardiner, A. H., Hieratic Ostraca, Vol 1, p. 46, 2, Oxford, 1957.

⁹⁹ Tosi, M. and Roccati, op. cit.

¹⁰⁰ Mahmoud, A., op. cit.

¹⁰¹ Gunn, B., op. cit.

¹⁰² Maspero G., op. cit., 1880

¹⁰³ Gunn, B., op. cit.

¹⁰⁴ Maspero G., op. cit., 1880

¹⁰⁵ Spiegelberg, W., Ägyptische und andere Graffiti (Inschriften und Zeichnungen) aus der Thebanischen Nekropolis, p. 66, Heidelberg, 1921

to have been actively working during the early years of Ramesses II¹⁰⁶. Given that his mother was by this time dead, it seems likely that it probably dates to the first half of the reign of Ramesses II.

TT 265: This tomb belonged to Amenemopet, a scribe at Deir el-Medina, whose chapel (TT215) also exists. Davies¹⁰⁷ reported that Amenemopet named his closest colleague, Huy in this tomb chapel and that they were both in office in the early years of Ramesses II, although he may have been succeeded by Ramose in year 5. Whether he died then or simply “retired” we do not know, but it seems likely that this tomb dates to the first half of the reign of Ramesses II and decoration in it may have been continued after his death by his family.

TT 356: This tomb belonged to Amenmuwia, a worker at Deir el-Medina. He was the son of Baki and father of Amenomone. He was married to Wadjetronpet. We know very little about this person, except that members of Baki’s family were almost unique in being given the enigmatic title or office of

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the precise meaning of which has been debated but not resolved. What is certain is that Amenmuwia was active during the first half of the reign of Ramesses II, since his father, Baki, had been active in tomb administration during the reign of Seti I and his stonemason grandson Qenhirkhopshef was also active by the middle of the reign of Ramesses II¹⁰⁸.

Eclipses Relating to the Material from Group 1

It is worth making the point here the complete and unique association between the use in tombs of individuals of Book of the Dead Spell 135 and stelae bearing the hieroglyph N46b created by them or a close family member has not hitherto been reported.

All the evidence in this group comes from workers at Deir el-Medina who can be shown to have lived during the reign of Seti I and the first half of the reign of Ramesses II. Using dates given by Shaw¹⁰⁹ this corresponds to 1294 BC to 1246 BC.

There were 13 solar eclipses at Thebes of large enough magnification unlikely to have escaped notice during this period, of which 10 fell in the first half of the reign of Ramesses II (an average of one every 3 years!). Of these, there were three annular eclipses with magnitudes most likely

¹⁰⁶ Černý, J. Prices and Wages in Egypt in the Ramesside Period. Cahiers d'histoire mondiale, Paris I 1954

¹⁰⁷ Davies, B.G., op.cit.

¹⁰⁸ Davies, B.G., op.cit. p. 208.

¹⁰⁹ Shaw, I., (ed) op. cit.

to have approached or exceeded 0.90 and one total eclipse. The latter occurred at 10:58 am Jul 27th 1258 corresponding to year 22 of the 66 year reign of Ramasses II . Totality would have lasted more than 3 minutes and the time from first to last contact would have exceeded 3 hours.

An analysis of the sensitivity of this result to errors in ΔT can be carried out using the equation suggested by Morrison and Stephenson as described above. This shows that the probability that this total eclipse would have been visible with a magnitude exceeding 0.99 is 0.999 - for all practical purposes, this means that this eclipse would have been certain to have caused darkness revealing the planets Venus and Jupiter and several stars including Sirius, Arcturus and Canopus.

Group 2: Evidence from Elsewhere During the New Kingdom.

Three other texts and a tomb inscription from the New Kingdom period also contain similar evidence relevant to this study.

Grafitto Pawah: This graffito was also written in hieratic by the brother of Pawah, a “wab” priest and scribe of the divine offerings of Amun. It was found in the tomb chapel of Pere (TT139) at Thebes and can be dated more precisely than the other texts discussed in this paper because it specifically mentions a precise date:

“Day 10 of the third month of inundation in regnal year 3 of the reign of the King of Upper and Lower Egypt, Lord of the Two Lands Ankhkheprure beloved of Neferkheprure(?), the son of Re Nefernefruatn (beloved of Waenre)”.

Gardiner¹¹⁰ interpreted the determinative hieroglyph used as a slight variant of N46b (although not amongst his original classification of hieroglyphs¹¹¹) and he translated this as “*Thou causest me to behold darkness by day*”. Ankhkheprure / Nefernefruatn is normally assumed to be Smenkhare, but more recent research^{112,113} has questioned whether this may actually have been Nefertiti, ruling jointly with Akhenaton but residing at Thebes during the last few years of his life.

Pawah himself was probably not in Thebes at that time - Redford¹¹⁴ argued, citing examples, that many of the priests from Karnak and other cities were re-employed and resided at Akhetaten. Some may have

¹¹⁰ Gardiner, A. H., op. cit. 1928

¹¹¹ Gardiner, A. H., op. cit. 1988

¹¹² Allen, J.P., Akhenaten's 'Mystery' Coregent and Successor, in AL, Vol. 1, Pp. 74-85, 1991

¹¹³ Dodson, A. M., Amarna Sunset: the late-Amarna succession revisited. Paper read at The Bloomsbury Academy Summer School 28th October 2006: Mysteries of Amarna.

¹¹⁴ Redford, D. B., Akhenaten – The Heretic King, p. 152., The American University in Cairo Press 1989.

done so willingly, grasping the opportunity to continue their career, while others may have been kept there under “supervision” at Akhenaton’s instruction so as to suppress any dissent. The content of the graffito suggests that Pawah, still espousing Amun, may have been amongst the latter. If so, after witnessing a solar eclipse and regarding it as a bad omen, he may have been unable to set out his own petition in a holy place for fear of being discovered and so asked his brother to do so on his behalf.

The chronology of the Armana period is extremely tentative and Shaw’s chronology may not be reliable in this case. In a recent presentation, Dodson¹¹⁵ has argued that there is evidence that Smenkhare became coregent with Akhenaten around year 13 of his reign, marrying Meyetaten, but dying fairly soon afterwards. Tutankhaten being still only a child, Nefertiti, calling herself Neferneferuaten, took on kingly titles.

Under this scenario, it seems likely that the first year of her reign could also have corresponded with year 13 of Akhenaten’s. If so, the dating of Graffito Pawah, III Akhet 10 of the 3rd year of her reign would be October 1st 1338 BC. Such a graffito would be most likely to have been written in response to and possibly shortly after an eclipse.

There was a spectacular total solar eclipse visible at Akhetaten on May 14th 1338 BC occurring at about 2:30pm. Totality would have lasted over 5 minutes and the time from first to last contact would have been nearly 2½ hours. This eclipse is so insensitive to errors in ΔT that it is certain that it occurred with a depth of 1.000 or more – i.e. total and the planets Mercury and Venus and the stars Sirius, Arcturus, Canopus and Aldebaran (and probably many others) would certainly have been visible. It would have been dramatic and seen at Akhetaten by most people there. Even at Thebes it would have been witnessed as a deep partial eclipse exceeding a magnitude of 0.95 and stars may well have been visible there.

If Dodson’s chronology is accepted as a modification of that of Shaw, the date match is excellent, with only a period of 5 months between the eclipse and the graffito. There would almost certainly have been communication difficulties and delays between Akhetaten and Thebes and a suitable opportunity would also need to have arisen for Pawah’s brother to have access to a site of appropriate significance.

Stela Museum Cairo JE 37463 / TT40: Rowe¹¹⁶ translated the text as “/ see the day-time darkness thou has made”. This Stela belonged to Huy, Viceroy of Nubia under Tutankhamun, and thus can be fairly accurately

¹¹⁵ Dodson, A. M., op. cit.

¹¹⁶ Rowe, A., op. cit. 1968

dated to his reign. Huy might have been based at Karnak or in Nubia, probably at the provincial capital, Aniba and could have been at either place during an eclipse.

The text on this stela does not contain the hieroglyph for “twilight”. Whilst this may have simply been omitted by the sculptor for reasons of space, it is also possible that the text may indeed be referring metaphorically to the absence of the king as has been suggested by Assmann¹¹⁷ but it would be ironic if this were to be so, particularly since it is one of the very few instances where the term “eclipse” has been mentioned by a recognised Egyptologist in a published source!

Although this stela was found in the Karnak cachette and Huy’s tomb is at Thebes, the poor quality of this artefact suggests that it may have been created elsewhere, perhaps while Huy was in Nubia. Interestingly, there is another reference to darkness, also using the determinative hieroglyph (N46b) in Huy’s tomb (TT40)¹¹⁸, on the ceiling, which Gardiner translated as “May thy sight be clear in the way of darkness”. Traditionally, the darkness in this case has always been assumed to be referring to the afterlife itself, but it is possible that it was intended to be a precaution against witnessing the same frightening experience (of an eclipse) again once Huy is in the afterlife.

Shaw¹¹⁹ dated the reign of Tutankhamun as 1336 BC – 1327 BC. Although there were no total solar eclipses occurring at Aniba or Thebes during this period, a very deep partial eclipse occurred on October 17th 1328, which reached a magnitude approaching or exceeding 0.95 at Aniba and exceeding a magnitude of 0.90 there with a probability of about 0.92. Even at Thebes the magnitude would probably have been about 0.90. This eclipse, although not total, would have lasted nearly 3 hours from first to last contact and could scarcely have gone unnoticed, with the possibility that some stars may have been visible.

We can therefore conclude that it is likely that Huy saw this eclipse and the fact that the degree of darkness was not very great may have been the reason why the stela, if created soon after this event, did not bear the hieroglyph N46b for twilight. If it was created in Nubia, the stonemasons there may not even have been sufficiently literate to have been aware of this rare hieroglyph, whereas the tomb builders in Thebes would certainly have been more literate in this respect hence its inclusion in the tomb there.

¹¹⁷ Assmann, J., *op. cit.*, 1994

¹¹⁸ de Garis Davies, N. and Gardiner, A.H., *The Tomb of Huy*, Theban Tomb Series No 40, EES, 1926.

¹¹⁹ Shaw, I., (ed) *op. cit.*

Ostrakon Cairo 12202: This originated from Sheikh 'Abd el-Qurna, at Thebes. It is written in hieratic and the determinative hieroglyph used was interpreted by Posener¹²⁰ as the equivalent of N46b. He translated this text as "*Thou causes me to see day like night*" and suggested for this an approximate dating, based upon the use of the two hieroglyphs which were in current use during the Middle Kingdom but disappeared under the reign of Tuthmose III while other forms, however, survived as long as the reign of Akhenaton.

Posener argued that written forms, like language, evolve with innovations and archaic forms co-existing, and he believed that the whole collection of ostraca, being similar in style and content, can be attributed to the reign of Amenhotep II, who was specifically mentioned on Ostrakon Cairo 12224. However, it could also be argued that these ostraca may have been left at a shrine over an extended period and were only later collected together into the deposit as finally found and thus only appear to be contemporary. Assuming that the narrower interpretation of the writing described above is accepted, using Shaw¹²¹ we can date this period as about 1294 BC to 1246 BC, although there remains a good deal of uncertainty in even this range. Widening this range even further would of course mean that other eclipses would also have to be considered, which does not really help as a test of the hypothesis.

There were at least 34 solar eclipses at Thebes of large enough magnification unlikely to have escaped notice during this period. Of these, there were two total eclipses. These occurred in 1523 BC and in 1478 BC. Allowing for the errors in ΔT the probability of complete totality in these cases can be calculated at 0.46 and 0.25 respectively. The probability that their magnitude would have exceeded 0.9 is 0.99 and 0.92 respectively.

Thus during the period when this ostrakon was likely to have been produced there would have been many occasions when noticeable eclipses would have been witnessed (an average of more than one every four years), two of which would certainly have produced a level of darkness when some stars may have been seen.

Conclusions

There is clear evidence that the hypothesis put forward in this paper, namely that these texts and spells were produced in response to solar eclipses, even if couched in religious terms, cannot be discounted since in every case that each of these texts and spells were used a deep solar

¹²⁰ Posener, G., op. cit., 196, 201 and pl. 19.

¹²¹ Shaw, I., (ed) op. cit.

eclipse had occurred. Indeed in the case of the artefacts in the first group, from Deir el-Medina, and also of Grafitto Pawah from group 2 the evidence seems to be quite compelling, since the dating of these can be relatively accurate and it has been shown that, even allowing for errors in ΔT , a total eclipse definitely occurred and could have been witnessed in both cases.

The evidence is less conclusive for the other two examples from group 2. In the case of the Stela Museum Cairo JE 37463 and TT40 there were certainly opportunities for Huy to have seen at least one eclipse of significant magnitude for it to have been possible that stars may have been seen whether he was in Aniba or in Thebes at the time. In the case of Ostrakon Cairo 12202, although many noticeable eclipses would have been visible during the period in which it may have been produced, of which at least two would probably have been significant enough for stars to have been visible, the wide range of uncertainty in the dating of this artefact makes it impossible to be sure that it indeed matched one of these.

The hypothesis that these texts relate to the witnessing of a deep solar eclipse cannot therefore be refuted with the available evidence and must remain viable. Indeed, if further examples of this form of text or spell are found later which are not dateable from internal evidence, this hypothesis may be a useful clue to their absolute dating. Alternatively, if such texts are found which do have internal or other dating evidence, the hypothesis can be tested further. If this hypothesis were ultimately to become accepted, solar eclipses might be used to date accurately archaeological material containing such inscriptions and thus could become an important new technique for absolute dynastic dating.

At the present time those researching historical eclipses have no reliable data before about 1000 BC which can be used for extrapolating ΔT and estimating errors in it before that. This paper suggests that the traditional interpretation of ancient Egyptian texts and spells may have been mistaken and that there is, after all, some record of eclipse events amongst these texts. A re-examination of some texts in the light of this may yet reveal quantitative material comparable to that from the Chinese Oracle bones from the Chou dynasty, potentially dating back as far as more than 2000 BC (for example if such material were to be found amongst the pyramid texts) and would make a significant contribution to the study of historical eclipses and the earth's rotation.