



LETTER TO THE EDITOR

Ramsey CB, Dee MW, Rowland JM, Higham TFG, Harris SA, Brock F, et al. Radiocarbon-based chronology for dynastic Egypt. *Science* 2010;328:1554



To the Editor,

We have read with great attention Ramsey et al. article that was published in *Science* in 2010 [1] regarding the Carbon dating of Dynastic Egypt using short lived plants. The article raised some concerns that we would like to point them out; first: Ref and note 30 jointly merge the acknowledgment and specimens collection; the description which is vague and needs more justification. Second the chronological parts: on P.1554. The authors described the ancient Egyptian chronologies by the word “floating” negating that many of these chronologies are based on true evidences registered in most, adding – on the same page “the New Kingdom started between 1570 and 1544 B.C. and the reign of Djoser in the Old Kingdom started between 2691 and 2625 B.C., giving – although referring to the accuracy of timing – a difference of 26 and 36 years, “Building on the surviving evidence from Manetho’s and the king lists dating from the pharaonic era”, “undocumented years at the ends of some reigns and overlaps between successive monarchs create uncertainties of the order of a few years” actually the ancient Egyptian history was stable and these undocumented years or overlaps happened only a few well known times noting that the intermediate periods were not ever the base of determining the length of ancient Egyptian kings reigns, and concerning the last two phrases we would like to mention the following:

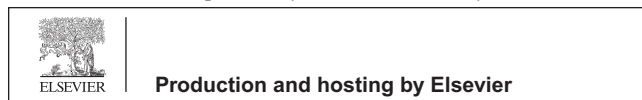
“Unlike the other cultures which surrounded the Nile Valley and remained, pharaonic civilization developed writing in Early Dynastic times and so was able to systematize its complex society around key historical and chronological events. Our present historical schema of dividing the history of Egypt into periods called “Kingdoms” (Old, Middle, and

New) is a modern one; it is based on the Egyptian eras of political unity. Developed by Egyptologists, this division depended on a wealth of textual and pictorial data (since many inscriptions deal with chronological matters) that emanated from economically and politically viable epochs [2]. Manetho, an Egyptian priest, wrote in Greek his king lists formed the basis of the classical era’s understanding of Nile Valley history. It can be shown that many of his divisions were not based on sources contemporary with those dynasties. For Egyptologists, the major outline of Early Dynastic history remains the fifth dynasty Palermo Stone that covers, in a very schematic fashion, the reigning years of the pharaohs [2]. The years of reign of the kings were reorganized so that they coincided with civil calendar years of 365 days not a lunar year (beginning from the Old Kingdom as the Palermo Stone clearly indicates) [2]. Unfortunately, the Palermo Stone breaks off in the mid-fifth dynasty, so other sources were used; the Karnak list, the Abydos list, the Saqqara list, and the Turin Canon of kings.

Significantly, all of these early lists do not provide demarcations that coincide with Manetho’s account. One major problem with Manetho as a late source – and it is an intractable one – is that the text is mainly preserved in excerpts drawn up by later chronographers; what matters are the dynasties, the names of the kings, and their lengths of reign. Even with the additional problems of textual corruption over the centuries, Manetho presents a very confused arrangement of dynasties when he covers Egypt’s periods of disunity. Nevertheless, it was mainly the Turin Canon, the king lists (the full king lists simply list the names of successive kings with the number of years that each had ruled), Manetho’s works (a thousand years after the Turin Canon was written), and an important series of dated monuments and texts that helped establish a relatively accurate arrangement of the pharaohs and their reigning years.

Finally, no useful synchronisms exist for Egypt and her neighbors in the Old – Middle Kingdoms, and attempted synchronisms of the New Kingdom with Babylon and the Hittites have not yielded precise dates” [2].

Peer review under responsibility of Cairo University.



As for the astronomical parts the authors mentioned (P.1554): “a few ancient astronomical observations”; “which remain a source of debate”; ... has been based on the interpretation of a small number of ancient astronomical observations in MK and NK and is therefore considerably less certain”; “many of the relevant celestial and lunar phenomena repeat at regular intervals, giving different possible chronologies and their timing is dependent on the location of the observer, which may also add to the uncertainty”; (P.1556): “the absence of astronomical observations in the papyrological record for the OK”.

Connecting the historical events with celestial phenomena and celestial bodies leads to give them precise timing; and the ancient Egyptian astronomical texts referred to a number of these phenomena away from being “a few”; plus what really matters here is the number of phenomena or their accuracy?; and how come that the astronomical observations “remain a source of debate? Notably the authors themselves made it clear that “many of the relevant celestial and lunar phenomena repeat at regular intervals”. As for “only 3 in a... The interpretation of a small number ...” it was not ever an interpretation of a small number of astronomical observations but it was a registration and documentation of the movement of celestial bodies and celestial phenomena as there is a great difference between “observations and phenomena”; the authors mentioned the MK and NK what about the OK , the titles of the astronomer priests, and the astronomical accuracy of the constructions and the pyramids which lead to a complete understanding for their astronomical knowledge.

As for “many of the relevant celestial and lunar phenomena” there is a great difference between lunar phenomena and lunar phases which were used in the calendars and yearly time measurement. The timing of celestial and lunar phenomena did not ever depend on the location of the observer as the authors mentioned, for example the rising of the sun is a clear celestial phenomena for people who live in the same country at least not mentioning people on the same latitudes, for Egypt the difference is a few minutes only between the North and the South, the same thing goes for other great celestial phenomena like the moon phases and the rising and setting of distinct stars which do not require an observer (or priest) sitting on a temple’s roof as the authors said, for this was the case when the astronomer priests measured the hours of the night using transit stars in the “star tables” of the Ramesside period. Finally the papyrus was not ever the suitable material for registering the ancient Egyptian astronomical texts which were recorded for example on coffin lids, tombs/temples ceilings, and water clocks; for the astronomy in the OK the previous opinions (above) are enough. To make it more clear we prefer to add the following:

Unlike agriculturally significant events such as the inundation and the harvest, astronomical events often occur at fixed times in the year; for the purpose of measuring time we have four cosmic cycles:

- (1) The earth’s revolution on its axis in its relation to sunlight.
- (2) The moon’s revolution around the earth in its relation to sunlight.
- (3) The combination of the earth’s revolution around the sun and of the inclination of the earth’s axis to the plane defined by its path around the sun in its relation to sunlight.

- (4) The earth’s two revolutions on its axis and around the sun in their relation to the light of certain stars.

These four cosmic cycles present themselves as follows to the human observer:

- (1) The alternation of light and dark.
- (2) The phases of the moon.
- (3) The solar year or the cycle of the seasons.
- (4) The risings and settings of stars [3].

Many evidences confirm that ancient Egypt had a long practice in astronomy since the Old Kingdom; some astronomical events and celestial bodies such as the sun, the moon, and famous stars especially Sirius and Orion (the Egyptian Spdt – S3 h), all were widely mentioned in the pyramid texts, the titles of the astronomer priests, angles of the pyramids (especially the Great Pyramid), and the observation of stars or decans to determine the hours of the night. Measurements took place on the temple terraces. The appearance of Sirius on the ivory plaque of king Djer from the first dynasty, in the form of a cow, shows that the Sothic calendar was established from early times onward.

An example of an astronomical event that naturally presents itself as a yearly beginning is the heliacal rising of the star Sirius, as it occurs at an approximately fixed point in time in the solar year [3].

The Sothic year is the time between two heliacal risings of Sirius at the same latitude; it is about 365.25001 days long. As a fact the length of the Sothic year increases very slowly over time. For example in the years:

- 4231 BC it was 365.2498352 days (d).
- 3231 BC it was 365.2500000 d.
- 2231 BC it was 365.2502901 d.
- 1231 BC it was 365.2505225 d.
- 231 BC it was 365.2508804 d.
- 770 AD 365.2513026.

So we can see that from the year 4000 BC till 770 AD the increase was only 0.0015 day only [4].

The timing of the rising of stars changes according to the latitude, but for Egypt, which extends in its length in the northern hemisphere on the long of the Nile valley, the difference is nothing but days between the north and the south of the country. The annual reappearance of Sirius can be seen first in the south and it delays when going north about a day for each degree of latitude (the difference then is 7 days only).

And since the heliacal rising of Sirius (prtSpdt) announced – according to the texts – the new year , it is difficult to assume that the beginning of the year varied from a region to another, it is logical to infer, then – like most prior authors – that a specific latitude of reference was chosen from the first beginning. However, prior authors gave four choices as the chosen city of reference ; 1 – Elephantine , 2 – Heliopolis , 3 – Thebes, and 4 – Bouto, providing each choice with strong reasons. Thus, when Censorinus referred to the beginning of the Sothic cycle in the year 139 AD he said “the heliacal rising of Sirius in Egypt”, makes us understand that the date was valid for the whole country [4–8].

The location of the observer of the sky caused some timing problems in what we call “the Ramesside star clocks” that

were registered on the walls of three Ramesside king tombs; Ramses 6, 7, and 9. Nevertheless we cannot say the same about the location of the observer of great astronomical events such as the rising of the sun, the phases of the moon and the heliacal rising of Sirius.

Other major comments regarding the materials

- The use of carbon-14 (^{14}C) for dating of seeds, basketry, and plant based textiles, plant stems and fruits does not always give the same date as that of the royal tomb that it was found in. This may be due to that these materials, especially seeds may have been used for a considerable period prior to the reign of King. Especially if we take into account that the ancient Egyptians had their methods of materials preservation throughout the history of the ancient Egypt especially at the end of the middle kingdom and during the New Kingdom periods.
- The authors mentioned that they avoided mummified material because of concerns about contamination from bitumen. We confirm that bitumen has not been used in the Middle Kingdom, or even the New Kingdom, it was used since the late period and Greco-Roman periods.
- We confirm that there is no doubt or fear of contamination of the linen bandages of some famous kings mummies, especially in the New Kingdom (study period).

In conclusion the study of Dynastic Egypt using plants needs more explanation with deep scientific evidence for different varieties of plants in order to confirm the slight change of dynastic structure. Further studies should be pursued before changing the history timing for any country. Of note is the change in flowering date of many plants that has occurred in the last century [9].

Conflict of interest

The authors have declared no conflict of interest.

Compliance with Ethics Requirements

This article does not contain any studies with human or animal subjects.

References

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