

THE TOTAL SOLAR ECLIPSE DESCRIBED BY PLUTARCH¹

Introduction

In his dialogue *On the face on the moon*,² the Greek biographer, historian and philosopher, Plutarch (ca. AD 45-120), gives a vivid description of a major eclipse of the sun. On the not unreasonable assumption that this description refers to a real historical observation of an eclipse which was fully total, there have been several attempts to date the event by astronomical calculation: notably those by Ginzel,³ Fotheringham⁴ and Sandbach.⁵ Dates that have been proposed range from AD 71 to 83, all in the early part of Plutarch's life. The Loeb editors give a useful survey of the debate.⁶

Several decades have now elapsed since the dating of the eclipse was last considered in detail. Recent studies of earth's past rotation⁷ enable the exact dates and fairly precise local circumstances (e.g. magnitudes and local times) for all eclipses in a selected period and at a given place to be computed. In the light of this new research, it seems appropriate to reconsider the eclipse which Plutarch mentions in the *De facie*. It will here be argued that the eclipse of March 20, 71, is by far the most likely of the various possibilities and is indeed virtually certain; the investigation should also put the exact nature of the eclipse beyond doubt, vindicate Plutarch's description as (by classical standards) an extremely accurate observation rather than a mere literary construction, and (hence) provide us with a fixed point (one of the very few fixed points) of Plutarch's own biography.⁸

¹ We thank the *Histos* team for detailed criticism and helpful advice on presentation.

² Plut. *De facie in orbe lunae* 931D-E, translated by H. Cherniss & W. Helmbold, *Plutarch's Moralia XII* (Loeb ed. 1957) 117.

³ F. K. Ginzel, *Spezieller Kanon der Sonnen- und Mondfinsternisse* (Berlin 1899) 202-4.

⁴ J. K. Fotheringham, 'A solution of ancient eclipses of the Sun', *Monthly Notices of the Royal Astronomical Society* 81(1920) 104-26.

⁵ F. H. Sandbach, 'The date of the eclipse in Plutarch's *De Facie*,' *Classical Quarterly* 23 (1929), 15-16.

⁶ Cherniss-Helmbold (n. 2) 9-12. Contrast the minority view of R. R. Newton (n. 17).

⁷ F. R. Stephenson and L. V. Morrison, 'Long-term fluctuations in the Earth's rotation: 700 BC to AD 1990', *Philosophical Transactions of the Royal Society of London: A* 351 (1995)165-202; F. R. Stephenson, *Historical eclipses and Earth's rotation* (Cambridge 1997).

⁸ 'It is characteristic that the author of over fifty biographies has left no autobiography. The story of his life, as was already observed in antiquity, can only be pieced together from hints scattered throughout his works': C. P. Jones, *Plutarch and Rome* (Oxford 1971)

Plutarch's description of the eclipse

In this account, which is to be found in sections 931D-E of the *De Facie*, the speaker is not Plutarch himself, who does not appear directly in the dialogue, but a certain Lucius.⁹ We give the translation of Cherniss and Helmbold:¹⁰

‘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. If you do not recall it, Theon here will cite us Mimnermus and Cydias and Archilochus and Stesichorus besides and Pindar, who during eclipses bewail “the brightest star bereft” and “at midday night falling” and say that the beam of the sun “<is sped> the path of shade”.’

This will hereafter be referred to as ‘text 1’. Plutarch characteristically illustrates a remarkable real-life phenomenon (that of solar eclipse) by a series of literary allusions. The eclipse descriptions by Archilochus and Pindar were well known in the ancient world and remain extant; evidently, the eclipse description of Stesichorus was also well known in the ancient world (Plin. *NH* 2.12.54). The first and third of the brief quotations which Plutarch gives here come from Pindar (*Paeon* 9.2-3, 5); the second may come from Stesichorus.¹¹ But these literary allusions are there to help the audience (formally Lucius’ audience within the dialogue but also of course Plutarch’s own readers), should they not recall the recent eclipse: the allusions do not detract from the historicity of that eclipse, rather, both the allusions and the mem-

13, cl. Eunap. *Vit. Philosoph.* 454. In his famous article, ‘Towards a chronology of Plutarch’s works’, *JRS* 56 (1966) 61-74, at 70 (= B. Scardigli [ed.], *Essays on Plutarch’s Lives* [Oxford 1995] 115) Jones disposes of misconceived datings of the *De facie* on the basis of 931D.

⁹ For discussion of Lucius and his role in the dialogue see Cherniss-Helmbold (n. 2) 6-7; D. Babut, *Plutarque et le stoïcisme* (Paris 1969) 121ff. Plutarch is, however, present at one remove, since not only (of course) is he the author of the whole dialogue but also the ‘comrade’ (ἐταίρος) of the earlier discussion referred to (921F, 929F) is presumably code for Plutarch himself (Cherniss-Helmbold 15; 48 n. a).

¹⁰ Cherniss-Helmbold (n. 1) 117-18; note, however, that on one crucial point our arguments bring us closer to the translation and interpretation of A.O. Prickard, *Selected Essays of Plutarch* (Oxford 1918) II 282.

¹¹ Documentation in Cherniss-Helmbold (n. 2) 117-18.

ory (however imperfect) of the recent eclipse are evidence for the general phenomenon of solar eclipse.¹²

The recent eclipse is itself described with fair precision. Although the phrase ‘this conjunction recently’ does not itself guarantee an allusion to the complete disappearance of the sun, no other phase would render *many* stars visible by day, hence scholars rightly agree that the reference is to a total solar eclipse (though some fail to realise the physical implications of such an eclipse). Lucius’ subsequent allusion to the corona, which we shall next consider, also entails a total solar eclipse. To the implications of the phrase ‘tempered the air in the manner of twilight’ we shall later return.

Later in the dialogue (932B), Lucius makes an intriguing point about a total solar eclipse:

Even if the moon, however, does sometimes cover the sun entirely, the eclipse does not have duration or extension; but a kind of light is visible about the rim which keeps the shadow from being profound and absolute.

It is plausible to associate this account, which will be cited as ‘text 2’, with the previous description of the total eclipse itself. Here Plutarch, uniquely among classical authors, mentions the corona, the extended outer atmosphere of the sun. This is only visible at an eclipse which is either total or virtually so. True, Cherniss¹³ argues that if Plutarch is indeed referring to the corona in text 2, his description is ‘remarkably tame’. He suggests instead that the account is more likely to refer to an annular (i.e. ring) eclipse. However, within the ancient context, such an appeal to general ‘likelihood’ is misconceived. Surprising as it may seem to modern astronomers who have witnessed total obscurations of the sun, the corona appears to have made very little impression on observers in ancient and medieval times. Before AD 1600, only one other account of a total eclipse (AD 968) definitely mentions the corona, even though many detailed descriptions of great eclipses are preserved in medieval European and Arabic chronicles.¹⁴ The record from

¹² The literary allusions do, however, suggest that ‘recently’ (a notoriously slippery term) should be understood as ‘not that recently’: Cherniss and Helmbold (n. 2) 12: ‘[“recently”] seems in this passage not to be used of the immediate past, for Lucius expressly reckons with the possibility that his audience may not recall ‘the recent conjunction’ and may have to fall back upon literary evidence for the impression made by a total solar eclipse’.

¹³ Cherniss and Helmbold (n. 2) 11 n. c. Cherniss’ anxiety that the text should not allude to the corona stems from his need to uphold the claims of the eclipse of 75, since ‘no one in or near Rome would have seen [the corona] in 75’.

¹⁴ F. R. Stephenson, *Historical eclipses* (as in n. 7).

AD 968, which originates from Constantinople, was written by the contemporary historian Leo Deaconus.¹⁵ His account likens the corona to ‘a certain dull and feeble glow, like a narrow headband, shining around the extreme portion of the edge of the disk’. Plutarch’s description is quite similar to this much later record. By contrast, during a central annular eclipse the unobscured portion of the sun is dazzling in brightness. Such an event could not be described as preventing the shadow from becoming ‘profound and absolute’, since often there is hardly any noticeable reduction in daylight, even during the ring phase. Again, we should be struck by the acuteness and precision of the observation which Plutarch puts into Lucius’ mouth. The fact that Plutarch here alludes to the corona guarantees that the eclipse was total.

Historicity and nature of the eclipse

In Plutarch’s dialogue, the eclipse is the basis of an intellectual—if somewhat entertaining—discussion. Most of the characters identified in the text are known to have been associates of Plutarch himself.¹⁶ Newton¹⁷ is of the opinion that text 1 is merely a product of Plutarch’s imagination, but he seems to be very much a lone voice. By contrast, Ginzl,¹⁸ Fotheringham,¹⁹ and Sandbach²⁰—and more recently Cherniss and Helmbold²¹—all regard the account as a reference to a real event. Muller,²² who has personally witnessed several total eclipses from various sites, thinks that the account has ‘the definite flavour of personal experience and eye-witness description’. He adds that ‘the probability that this is a real record is very high’.

There are sound reasons for believing that the eclipse was indeed authentic. As we have seen, Plutarch is the only classical author to mention the corona. And only two other classical writers besides Plutarch note the visibility of stars in the daytime during a large eclipse at all. These are Thucydides (2.28), who casually notes the appearance of ‘some stars’ at a solar eclipse in

¹⁵ *Leo Deaconis Historiae* 4.11; ed. B.G. Niebuhr, *Corpus Scriptorum Historiae Byzantinae* (Bonn 1828) vol. 33.

¹⁶ Discussion in Cherniss and Helmbold (n. 2) 3-9.

¹⁷ R.R. Newton, *Ancient Astronomical Observations and the Accelerations of the Earth and Moon* (Baltimore 1970) 115-17.

¹⁸ Ginzl (n. 3).

¹⁹ Fotheringham (n. 4).

²⁰ Sandbach (n. 5).

²¹ Cherniss and Helmbold (n. 2) 9-12.

²² P. M. Muller, PhD Thesis, University of Newcastle upon Tyne, 1975.

431 BC,²³ and Phlegon of Tralles,²⁴ who asserts that ‘stars actually appeared in the sky’ at an eclipse which probably occurred in AD 29. But in comparison with these reports, Plutarch’s statement that the eclipse ‘made many stars shine out from many parts of the sky’ is unrivalled in its graphic detail.

Another important point arises from Plutarch’s claim that the eclipse ‘tempered the air in the manner of twilight’. What is meant by this ‘tempering’ (*krasis*)? Most scholars (including Amyot, Wytttenbach, Raingeard and Cherniss and Helmbold) have taken the reference to be to the degree of colour or light, in which case the clause glosses the preceding mention of stars shining out during the eclipse in terms of the ‘mixing’ of darkness and light which occurs at twilight. But Prickard²⁵ takes the *krasis* to refer to the degree of heat, translating ‘produced a chill in the temperature like that of twilight’. This translation, unlike Cherniss-Helmbold’s studiously neutral ‘tempered the air in the manner of twilight’, is very prejudicial. Nevertheless, in our view a reference to the ‘tempering’ of the colour or light at twilight would underplay the very dramatic effect of a total solar eclipse, during which the sky brightness falls to little more than one millionth of its normal level—a spectacular event indeed. By contrast, the application of the concept of *krasis* to ‘air’ naturally leads the reader to take *krasin* in the very common climatic sense of ‘temperature’ (*LSJ* s.v. 2), and the point is further to heighten the paradoxical nature of a total eclipse: a drop in temperature at midday, the hottest part of the day.

If so, Plutarch is again uniquely perceptive among ancient authors: during a major eclipse the temperature may drop by several degrees Celsius; however, not until recent centuries do we find similar effects recorded. It seems that the main concern of most early observers was to describe the awe-inspiring darkness which accompanied the disappearance of the sun. Plutarch thus emerges as the only ancient writer to note a fall in temperature at an eclipse.

Although we have no way of knowing what sources Plutarch might have had at his disposal other than those which he explicitly cites, he could not have obtained access to details such as the above from any literary source which is extant today. In fact, Plutarch’s whole account in (1) and (2) above is so original that it must derive from an eye-witness account. And given that Plutarch himself is the author of the whole *De facie*, that within the dialogue Lucius functions, at least to some extent, as Plutarch’s philosophical mouth-

²³ F. R. Stephenson and L.J. Fatoohi, ‘The Eclipses recorded by Thucydides’, *Historia*, in press.

²⁴ Phlegon, *Olympiades*, fragment 17; see Eusebius, *Chronicon*.

²⁵ See n. 10.

piece,²⁶ and that Lucius voices the possibility that others besides himself may remember the eclipse, it should be clear that the real eye-witness to the remarkable events which Lucius so vividly and knowledgeably describes is Plutarch himself.²⁷ Accordingly, in the remainder of this paper we shall assume that the eclipse to which Plutarch refers was indeed a real event and occurred during Plutarch's own lifetime. However, both the place of observation and the date require careful discussion.

Place of observation

The beginning of Plutarch's *De Facie* is lost and, with it, any solid indication of dramatic date or location or date of composition.²⁸ These controversies lie outside the scope of the present study, except for two points: (1) none of the possible eclipses is excluded by any of the suggested dates or periods of composition, all of which post-date the latest possible eclipse (that of 83); (2) secure identification of the eclipse (on the basis of the astronomical data) will necessarily have implications for the dramatic location.

In principle, the eclipse could have occurred at any time in Plutarch's adulthood.²⁹ He was born at Chaeronea in Boeotia around AD 45 and died ca. 120. Although he was normally resident in Chaeronea throughout his life, he is known to have travelled throughout much of Greece. He also paid at least two official visits to Rome, where he lectured on philosophy. Plutarch had close links with the Athenian Academy, while from about AD 95 he held a priesthood for life at Delphi—not far from Chaeronea. Plutarch's many dialogues are usually set in various places in Greece, but sometimes in Rome—the places with which he himself was familiar. In view of the fact that 'this conjunction recently' was so clearly remembered by Lucius/Plutarch, it seems highly likely that totality was witnessed at one or other of these locations. There is a small possibility that the eclipse was seen instead at Alexandria, which Plutarch visited at some point in his career.

²⁶ Babut (n. 9) 121.

²⁷ Cherniss and Helmbold's claim (11) that 'there is no reason to assume that Plutarch himself saw the eclipse' seems to us very perverse.

²⁸ For discussion of these matters see Jones, *JRS* 56 (1966) 70; Cherniss and Helmbold 8-14. Sandbach's argument, accepted by Cherniss and Helmbold, that the dramatic location is Rome is (we believe) refuted by the correct identification of the eclipse. As to dating, the solidest pointers are the connections between the *De facie* and the *De defectu oraculorum* and the *De genio Socratis*, but these connections can hardly yield anything more precise than 'after 100', a date that one might simply guess on very general grounds.

²⁹ On Plutarch's life and career see Jones, *Plutarch and Rome* (n. 8).

The place of observation of the eclipse will thus be assumed to be either Greece, or Rome—or with less likelihood—Alexandria.

Computational results

It may be computed that during the lifetime of Plutarch, only four eclipses could have been total in the central or eastern Mediterranean: April 30, 59; March 20, 71; January 5, 75; and December 27, 83. The first of these occurred when Plutarch was aged only about 14, and could have scarcely been described as ‘recent’ (however elastic that term) when he wrote the *De Facie*. Although we shall consider this further, it already appears as an unlikely choice. Of these three, that of 71 was propounded by Ginzl, followed by most scholars until Sandbach, that of 75 by Sandbach, followed by Cherniss.

Two annular eclipses were also visible in this same general period (May 31, 67, and March 10, 80) but neither of these was very large. For the first of these events, no more than 90 per cent of the sun’s disk would be covered, even where the ring phase was visible, so that the loss of daylight would be scarcely noticeable. In the eclipse of AD 80, up to 96 per cent of the solar disk would be obscured by the moon but the fall in daylight would not be very significant. On this occasion, among the bright planets and stars only Venus would be above the horizon; certainly ‘many stars’ would not ‘shine out from many parts of the sky’.

In all probability, then, a choice must be made between one of the four total solar obscurations listed above (59, 71, 75 or 83). On the basis of the detailed investigation of earth’s past rotation by Stephenson and Morrison³⁰, we have listed in Table 1 the following details for each eclipse: computed magnitude (as a percentage of the sun’s diameter), local time (in hours and minutes) and solar altitude (in degrees) for each eclipse. We have made calculations for three selected locations: Athens (taken as representative of Greece), Rome and Alexandria. The corresponding tracks of totality in the central and eastern Mediterranean are shown in Fig 1. In interpreting these maps, it should be borne in mind that due to irregularities in the earth’s rate of rotation, it is not possible to compute the geographical positions of ancient eclipse tracks with high precision. We estimate that errors of up to about 2 degrees in longitude for a given latitude remain a possibility. As a result, the eclipse tracks shown in Fig 1 could plausibly be displaced in an easterly or westerly direction by this amount. Without immodesty, we would like to emphasise that our data are significantly more accurate than Ginzl’s. We now proceed to discuss in chronological order the circumstances of each of the four eclipses of AD 59, 71, 75 and 83.

³⁰ Stephenson and Morrison, ‘Long-term fluctuations’ (as in n. 7).

If we refer to Table 1, the eclipse of 59, which occurred when Plutarch was a boy, can only have been partial in all three cities of Athens, Rome and Alexandria. As depicted in Fig 1, the track of totality lay far to the south of Rome and the Italian peninsula, and much to the north of Alexandria. Since this track ran almost parallel to the equator, allowances for uncertainties caused by variations in the Earth's rotation rate would have negligible effect on visibility. In particular, the eclipse can never have been total north of latitude 36.0 deg. The track thus passed significantly to the south of the Peloponnesus, and at Sparta (the scene of several dialogues by Plutarch)—which on this occasion was much better placed than Athens—the magnitude cannot have exceeded 96 per cent. This is far from sufficient to produce the effects described by Plutarch. It is therefore clear that the eclipse of AD 59 cannot be that described by Plutarch.

The eclipse of 71 was small in both Alexandria (80 per cent) and Rome (78 per cent). No stars would be visible at either location. In particular, the track of totality passed far to the south of the Italian peninsula. However, at Athens the computed magnitude was as large as 99.5 per cent; only a little to the south of this city the eclipse would be total. The only difficulty with the eclipse of 71 as seen from Athens or neighbouring cities in Greece, is that the greatest phase would occur around 10;50 h, rather than 'just after noonday'. However, at 10;50 h, the Sun would then be almost at its maximum height—altitude 48 deg, or only 3 deg less than the meridian altitude. There is no suggestion in the record that time was carefully measured; to the casual bystander this eclipse would be regarded as occurring close to midday. (We might also allow for an element of rhetorical exaggeration in the phrase 'just after midday'.) Although the duration of totality would be very short—not exceeding 15 seconds—this would be sufficient to render several stars visible, with Venus and Sirius prominent to the east of the Sun.

The circumstances in 75 are unfavourable at all three selected locations. At Alexandria, only 61 per cent of the solar disc would be covered. The magnitude was larger at both Athens (87 per cent) and Rome (91 per cent), but far from total at these locations. The zone of totality fell far (about 350 km) to the south-east of Rome. Further, in those areas of the Mediterranean where the eclipse was indeed total, the greatest phase would occur only about an hour before sunset. The event could thus scarcely be described as 'beginning just after noonday', while it would seem inappropriate to compare a sunset eclipse with a sunset. We therefore feel that this date, like 59, can be eliminated. It must follow (*pace* Sandbach) that the dramatic location is not Rome.

Finally, the eclipse of 83 would not have been total in Italy or in Greece. At Rome, the computed magnitude was only 70 per cent, while at Athens the magnitude was only slightly larger (80 per cent). On the other hand, at

Alexandria computations show that the eclipse was very large indeed—nearly 98 per cent at about 14:45 h—and just possibly might have been total there. Although this identification cannot be ruled out on astronomical grounds, Plutarch seemingly only once visited Alexandria and in general seldom appeals to his Alexandrian experiences in his numerous dialogues. It is true that Sandbach speculates that the banquet given for Plutarch after his return from Alexandria and at which Plutarch's grandfather was present (*Quaest. Conv.* 678Cff.) could have been after 83; but within the dialogue itself there are clear contrasts between Egypt and the current location (939C-D). Since the description of the eclipse in passages 1 and 2 gives no hint that the place of observation was other than the current location, these contrasts count strongly against the eclipse of 83, total, or nearly so, only in Egypt.

Conclusion

From an astronomical point of view, there are only two contenders for 'the eclipse of Plutarch': 71 and 83. Again from a strictly astronomical point of view, there is nothing to choose between them. Not only, however, is the eclipse of 71, which was total in Greece—the centre of Plutarch's cultural life, by far the more likely of the two on general grounds, but the eclipse of 83 seems positively excluded by the fact that the dramatic location is certainly not Egypt.

On a general level, to students of Plutarch in a literary or philosophical sense, Plutarch's utilisation of this particular eclipse provides cogent proof of his skill in interweaving life, literature and philosophy. But our study has, we hope, established some more concrete conclusions: (1) by classical standards Plutarch was a remarkably acute observer of celestial phenomena; (2) the eclipse of *De facie* 931D-E was that of March 20, 71; (3) the dramatic setting of *De facie* cannot be Rome but must be Greece; (4) on March 20, 71, Plutarch himself was in Greece, not Rome or anywhere else.

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Table 1				
	Date AD	Magnitude (%)	Local Time (h;m)	Altitude (deg)
Athens	59 Apr 30	94	15;10	42
Alexandria		88	15;50	35
Rome		81	14;05	51
Athens	71 Mar 20	99.5	10;50	48
Alexandria		80	11;15	56
Rome		78	10;00	39
Athens	75 Jan 5	87	16;05	7
Alexandria		61	16;35	5
Rome		91	15;10	12
Athens	83 Dec 27	80	14;05	22
Alexandria		98	14;45	22
Rome		70	12;55	23

