event. But perhaps there is a more significant, and more subtle, type of balance present here. Agathon, who wished to honor his own art, tragedy—and that means also honoring tragedians—has just quoted Sophocles and Euripides. Is it not probable that the third (and final) tragic quotation should be removed from the limbo of the adespota and be assigned to the third of the great tragedians, Aeschylus? Aristophanes' *Frogs* (66–85, 758–94, 1515–23) shows that the classical triad of tragedians, though not established in 404 B.C., was well on its way to becoming such. (The only other real candidate there is Agathon himself; Iophon is hardly treated with equal respect.) As R. Pfeiffer observes, "the passionate debate about the pre-eminence among the Attic tragedians, still going on in Aristophanes' *Frogs,* must have been settled by the middle or second half of the fourth century B.C. when Heraclides Ponticus wrote Περὶ τῶν τριῶν τραγῳδοποιῶν."[8] This gives us, of course, only a demonstrable terminus post quem; there is nothing inherently improbable in the existence of the canon Aeschylus, Sophocles, Euripides already a bit earlier than Heraclides' work, that is, at the time of the composition of the *Symposium.*

The image of Zeus the helmsman in this fragment would be very appropriate to Aeschylus (see, e.g., Fraenkel on Aesch. *Ag.* 182–83), but that is not proof. It might be worthwhile, however, to call attention to another passage for the combination Plato–Aeschylus–helmsman, *Euthydemus* 291D: . . . καὶ ἀτεχνῶς κατὰ τὸ Αἰσχύλου ἰαμβεῖον [cf. *Sept.* 2–3] μόνη ἐν τῇ πρύμνῃ καθῆσθαι τῆς πόλεως, πάντα κυβερνῶσα καὶ πάντων ἄρχουσα πάντα χρήσιμα ποιεῖν.

R. RENEHAN
University of California, Santa Barbara

8. *History of Classical Scholarship from the Beginnings to the End of the Hellenistic Age* (Oxford, 1968), p. 204.

NEW EVIDENCE FOR THE DATING OF ARISTOTLE *METEOROLOGICA* 1–3

Previous attempts to date *Meteorologica* 1–3 have been based on four passages:[1]

(*a*) At 2 362b9 the text says the constellation of the Crown (Corona Borealis) appears directly overhead when it is on the meridian. J. L. Ideler claimed that this statement would place Aristotle at the latitude of Athens and would therefore imply a date after 335 or before 347, when Aristotle was in Athens.[2] This conclusion assumes an improbably high degree of accuracy in the observation: how, for example, does one determine the center of the constellation, when a

1. *Meteorologica* 4 is widely held to be a separate work; *Meteorologica* 1–3 seem to be a compilation.
2. The reference is to J. L. Ideler, *Aristotelis "Meteorologicum" Libri IV,* vol. 1 (Leipzig, 1836), p. ix, which we have not been able to see. It is cited in the Loeb *Meteorologica,* trans. H. D. P. Lee (Cambridge, Mass., and London, 1978), p. xxiv. Mathematical formulae for calculating the past positions of stars, which change because of a wobble in the earth's axis of rotation (resulting in a phenomenon known as precession), were published in German in 1830 by F. W. Bessell.

discrepancy of half a degree will vitiate the inference? Furthermore, the passage was regarded by E. W. Webster as a "learned interpolation."[3] It can safely be disregarded.

(*b*) At 3 371a31 Aristotle refers to the burning of the temple at Ephesus (356 B.C.) as occurring recently (νῦν ἐθεωροῦμεν).

(*c*) At 1 345a1 Aristotle discusses a comet that he says appeared in the archonship of Nicomachus. Nicomachus was archon in 341/40.

(*d*) At 3 372a28 Aristotle says that "we have met with" (ἐνετύχομεν) a rainbow at night only twice in over fifty years. Since Aristotle was born in 384, it might seem that he could not have made such a statement before 333. But since ἐνετύχομεν can mean "we have knowledge of," the passage need not imply that Aristotle himself witnessed the rainbow, or that it occurred in his lifetime.

To these passages we can now add another, which is so worded as to make it clear that Aristotle is referring to his personal experience. At 1 343b30 Aristotle says αὐτοὶ ἑωράκαμεν τὸν ἀστέρα τὸν τοῦ Διὸς τῶν ἐν τοῖς διδύμοις συνελθόντα τινὶ ἤδη καὶ ἀφανίσαντα: "we ourselves saw the star of Jupiter conjoin with a star in the Twins, and then hide it." In an age when men could not predict the conjunctions of planets and stars, this would have been a rare observation, as the context of Aristotle's remark makes clear: "the Egyptians say that conjunctions of the planets take place, both with one another and with fixed stars, and we ourselves saw the star of Jupiter. . . ." That is, we do not have to take the Egyptians' word for it.

Paul Burke, using Astrosoft Computerized Ephemeris on a Tandy 1000 SX computer, looked for the event Aristotle mentions. He first determined when Jupiter would have been in Gemini during Aristotle's lifetime, and the declination (the angular distance north or south of the celestial equator) of its path on those occasions. He then looked for candidate stars.

The candidates obviously must be bright enough to be visible to the naked eye. Second, the brightness of the star matters: the dimmer a star is, the more likely it will be lost to the eye as bright Jupiter approaches. Third, the closer Jupiter comes to the star, the likelier it is that the star will seem to disappear. Finally, Jupiter's position in relation to the sun (its elongation) must be taken into account: for example, a conjunction occurring when Jupiter is within a few degrees of the sun will not be visible. Burke found four possible candidates; in order of increasing brightness, these are 1 Geminorum, delta Geminorum, eta Geminorum, and mu Geminorum. Balancing the stars' brightness with the closeness of the brush with Jupiter, Burke found that 1 Geminorum is the likeliest candidate, and eta and mu, furthest from the ecliptic, the least likely. Burke also found that conjunctions between 1 Geminorum and Jupiter occurred in 372, 360, 348, and 337 B.C.

Jan Meeus, an expert in the computation of occultations, calculated all the conjunctions between Jupiter and these four stars that occurred during Aristotle's lifetime. Meeus used a program that he has written based on planetary theory VSOP 87, which was constructed in 1987 at the Bureau des Longitudes in Paris.

3. *The Works of Aristotle Translated into English*, vol. 3: "*Meteorologica*," trans. E. W. Webster (Oxford, 1931), at 362b10 (n. 2).

Meeus believes that the program is accurate to within 0.001 degree. The initial positions of the stars were taken from *XZ*, the U. S. Naval Observatory's star catalog. *XZ* gives positions in the B1950.0 system; Meeus, using the formulae on pages S34–S35 of the 1984 *Astronomical Almanac*, converted these to the new J2000.0 reference system. He then derived the positions for our dates, using the International Astronomical Union's 1976 precession expressions and correcting for the stars' proper motions. All calculated positions are geocentric. Jupiter's parallax, amounting to only two arc-seconds, was ignored. For 1 January 337 Meeus derived the following ecliptic longitude and latitude values for our four stars (rounded off to the nearest hundredth of a degree):

STAR	LONGITUDE	LATITUDE
1 Geminorum	58.49	−0.42
Eta Geminorum	61.01	−1.09
Mu Geminorum	62.80	−1.06
Delta Geminorum	76.07	−0.46

The longitude of each star increases by 0.0138 degree per year. The latitude is virtually constant during one century.

Of the thirty-four events that Meeus reported, we can ignore all those in which Jupiter and the star remained fifteen or more arc-minutes (a lunar radius) apart: Jupiter could not appear to hide the star at so great a distance. The seven remaining events all involved Jupiter and 1 Geminorum, confirming Burke's initial results. Thus the star in question was 1 Geminorum, the dimmest of our four candidate stars (magnitude 4.6).

Of the remaining conjunctions, the one that occurred on 11 May 372 can also be eliminated: Jupiter, at an elongation of fourteen degrees east, was below the horizon at 4 A.M., the time of its closest approach to 1 Geminorum. On the previous night 1 Geminorum would have been lost in the glare of the sun.

This leaves six events, listed below. In the table, UT is Universal Time; LTA is Local Time Athens. Elongation is the angle between Jupiter and the sun as seen from earth. An elongation of zero degrees means that Jupiter is in conjunction with the sun and hence not visible; an elongation of 180 degrees means that Jupiter is at opposition to the sun and hence rises at sunset and sets at dawn. Twilight occurs, on the average, when the sun is no more than eighteen degrees below the horizon. The notation Δ/B indicates the difference in arc-minutes of celestial latitude at the time of the conjunction in longitude, with + or − indicating that Jupiter was north or south of the star.

DATE	UT	LTA	ELONGATION	Δ/B
24 April 360	14	15	29E.	+9
6 April 348	5	6	47E.	+11
22 July 337	12	14	56W.	−11
5 December 337	8	9	169E.	−5
14 March 336	5	6	70E.	+14
2 July 325	11	12	36W.	−7

Any of these conjunctions might have been observed by Aristotle. The remaining considerations, then, are estimates of likelihood.

We can first rule out two of these events as extremely unlikely. The conjunction of 336 involved a separation of fourteen minutes—almost equal to the moon's radius—and Jupiter would therefore probably not have appeared to hide 1 Geminorum. During the conjunction of 360 the minimum separation between Jupiter and 1 Geminorum occurred in daylight, at 3 P.M. By the time the sky was dark, the separation would have increased, Jupiter (at an elongation of 29 degrees) would itself almost have been setting, and 1 Geminorum would have been a dim, barely visible star low in the western sky.

This leaves four candidates. Two of these, the event of 348 and that of 22 July 337, involve large separations between Jupiter and the star—eleven minutes of arc. On both occasions, therefore, Jupiter would probably not have appeared to hide the star.[4] Of the two remaining events, that of 5 December 337 is by far the more likely candidate: the separation between Jupiter and 1 Geminorum was only five arc-minutes (i.e., less than one-third of a lunar radius); and with an elongation of 169 degrees, the conjunction would have been visible during the whole long, winter night, not just for two or three hours.

It is, of course, possible that the sky was overcast that night, or that Aristotle never looked up. But of all the candidates, 5 December 337 is clearly the favorite. The latest event would push the completion of the treatise to sometime after July 325. But with a larger separation and a much smaller elongation, this event appears a priori the weaker candidate; and in early July the long twilight, beginning around 3:30 A.M., would leave only a thirty-minute "viewing window" for a morning conjunction in the eastern sky.

We conclude that *Meteorologica* 1–3 were probably not finished before December 337.

SHELDON M. COHEN
The University of Tennessee, Knoxville

PAUL BURKE
Lockheed Aerospace

4. It is of course impossible to weigh such factors as atmospheric conditions and the acuity of Aristotle's vision.

NOTES ON THREE LATIN POETS

I. CATULLUS

66. 72–74

namque ego non ullo vera timore tegam,
nec si me infestis discerpent sidera dictis,
condita qui⟨n⟩ *vere* pectoris evoluam.

"*Vere* is not an adverb naturally found with *evolvere,* which is not primarily a verb of speaking. So editors accept the early conjecture *veri,* but that still involves an imprecision that seems uncharacteristic of Catullus. Doubts about