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(b. Cyzicus, Turkey, ca. 370 b. c.),

mathematics, astronomy.

One of the great astronomers of ancient Greece, Callippus belonged to the distinguished line of mathematicians and astronomers who, with Eudoxus at their head, were associated with the Academy and the Lyceum. References to him, although rare, clearly establish the magnitude of his achievements. He continued the work of Eudoxus on the motion of the planets, made accurate determinations of the lengths of the seasons, and constructed a seventy-six-year cycle to harmonize the solar and lunar years. This "Callippic period" was used by all later astronomers to record and date observations of heavenly phenomena.

The main biographical information on Callippus is found in Simplicius' commentary on Aristotle's *De caelo*. It states: "Callippus of Cyzicus, having studied with Polemarchus, Eudoxus' pupil, following him to Athens dwelt with Aristotle, correcting and completing, with Aristotle's help, the discoveries of Eudoxus" (Heiberg, ed., p. 49). It seems Callippus was in Athens in the decade before the death of Alexander in 323 b.c., Ptolemy says in the *Almagest* (Heiberg, ed., I, p. 206) that the year 50 of the first Callippic period was forty-four years after the death of Alexander, thus placing the beginning of the period in 330/329 b.c.

The discoveries of Eudoxus that Callippus corrected and completed are described by Aristotle in *Metaphysics*, Λ. In order to "save the appearances," as Plato had proposed, Eudoxus fixed each planet on a sphere that rotated on poles attached inside another sphere rotating in a different direction at a different rate, and this sphere in another until enough concentric spheres were so arranged and moving as to account by their combined uniform motions for the observed irregularities of the planet's motion. Aristotle tells us that Callippus found it necessary to add two spheres each for the sun and moon, and one for each of the other planets except Jupiter and Saturn. These changes in Eudoxus' system are perhaps testimony to Callippus' careful observations.

A papyrus, the so-called *Ars Eudoxi*, states that Callippus had determined the lengths of the seasons more accurately than Meton, giving them as ninety-four, ninety-two, eighty-nine, and ninety days, respectively, from the [vernal equinox](#). The error is much less than that in Meton's determinations, made a century earlier.

From such calculations Callippus was led to see that Meton's nineteen-year cycle was a trifle too long. He therefore combined four nineteen-year periods into one cycle of seventy-six years and dropped one day from the period. Thus he brought the measure of the year closer to its true value, and his period became the standard for later astronomers. Many of the observations cited by Ptolemy are given in reference to the Callippic period. Hipparchus, in Ptolemy's references, seems to have used that period regularly.

Although the system of concentric spheres gave way to epicycles and eccentrics, Callippus' period became the standard for correlating observations accurately over many centuries, and thus contributed to the accuracy of later astronomical theories.

BIBLIOGRAPHY

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Modern works are Sir Thomas Heath, *Aristarchus of Samos* (Oxford, 1913), which contains the best English language appreciation of Callippus and refers to the relevant modern literature on him; and Pauly-Wissowa, X, pt. 2, cols. 1662 f., which gives an exhaustive account of the seventy-six-year cycle, with full references to ancient sources and modern discussions.

