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Parapegmata

Star calendars were an important part of the popular and practical astronomy of the Greeks. A star calendar (*parapegma*) listed the phases (heliacal risings and settings) of important stars and constellations in order of their occurrence in the year.

Parapegmata served as vital complements to the Greek civil calendars. Because the Greek calendars were of the lunisolar type, sometimes the calendar year contained twelve months, and sometimes thirteen. Moreover, each major city had its own calendar, with different month names and different starting points for the year. Worse yet, the civil authorities had substantial freedom to tamper with the calendar. For all of these reasons, it was impossible to specify a time in the natural year (the year of the Sun and the seasons) by stating a date in a Greek civil calendar.

But every Greek would understand what was meant by “the morning rising of Arcturus”: this was a universally accepted sign of the beginning of autumn. The purpose of a *parapegma* was two-fold: to tell the time of year and to foretell seasonal changes and shifts in the weather. Thus, in many (though not all) Greek *parapegmata*, the notices of heliacal risings and settings are accompanied by weather predictions.

Parapegmata were a major concern of the Greek astronomers. The list of those who are known to have composed *parapegmata* includes many of the great names — Euctemon, Eudoxus, Callippus, Hipparchus, and Ptolemy, whose *Phaseis* was mentioned above.³² While many *parapegmata* were written on papyrus or other portable media, *parapegmata* were also inscribed on stone and set up in public places in some cities. Thus the *parapegma* was a prominent part of the material culture of Greek astronomy.

Figure 15 shows a fragment of a papyrus *parapegma* found among the Hibeh papyri and dated to the third century B.C. Although we do have quotations from earlier *parapegmata*, this fragment appears to be the oldest extant physical specimen of this genre among the Greeks. The fragment shown in Figure 15 begins:

<Choiak 1,> ... The night is 13 $\frac{4}{45}$ hours, the day 10 $\frac{41}{45}$.

16, Arcturus rises in the evening. The night is 12 $\frac{34}{45}$ hours, the day 11 $\frac{11}{45}$. 26, the Crown rises in the evening, and the north winds blow which bring the birds. The night is 12 $\frac{8}{15}$ hours and the day 11 $\frac{7}{15}$. Osiris circumnavigates, and the golden boat is brought out.

Tybi <5,> the Sun enters the Ram.

20, spring equinox. The night is 12 hours and the day 12 hours. Feast of Phithorois.³³

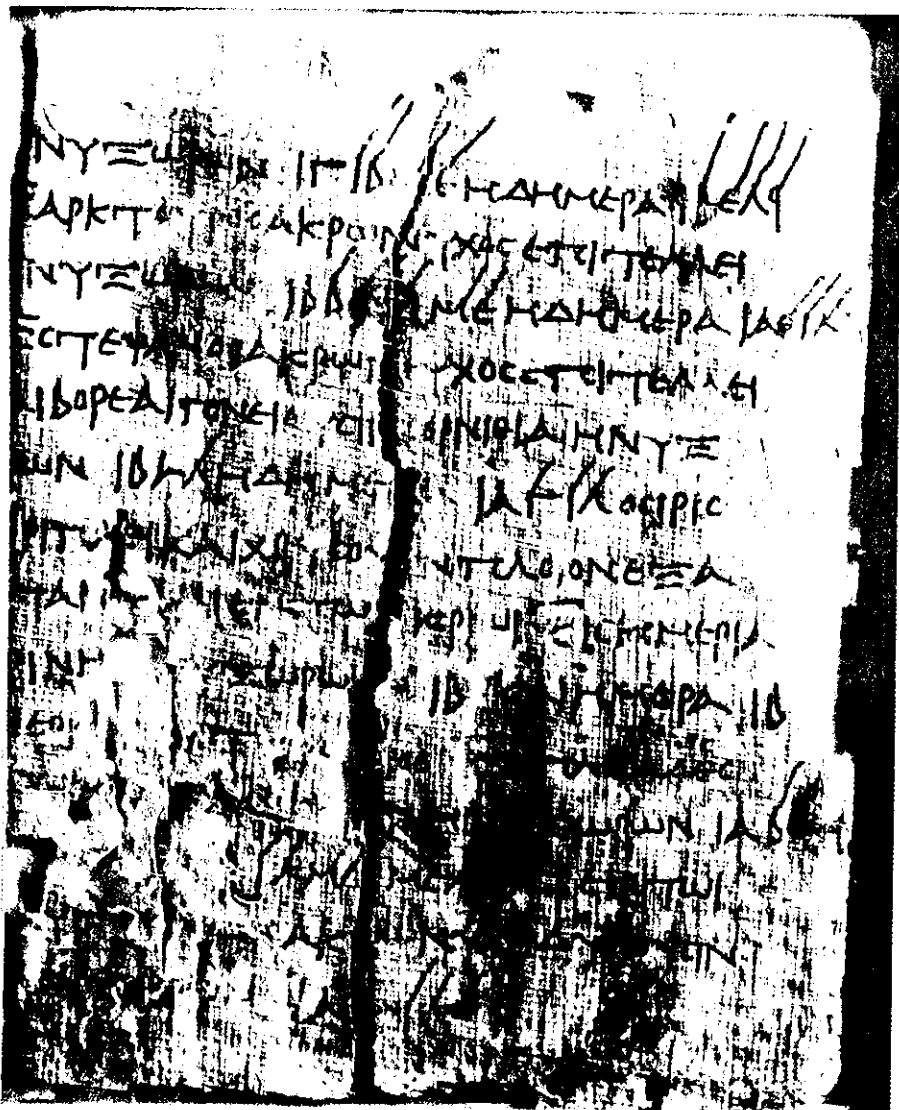
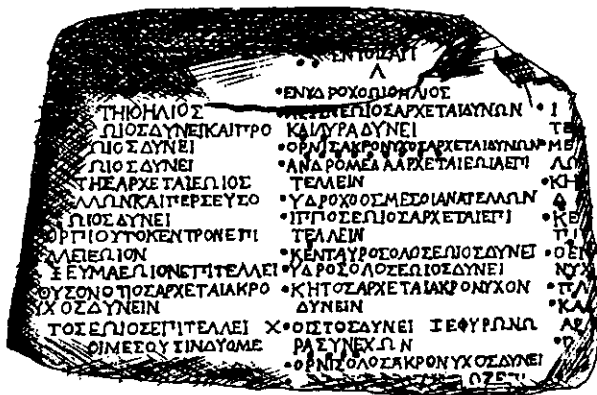


FIG. 15. Fragment of a papyrus paraepigma from Greek Egypt, third century B.C. (P. Hibeh I 27, col. iv; Trinity College Library Dublin, Pap. F. 100.)

This paraepigma is interesting for its blending of Egyptian elements with the traditional Greek subject matter. The days are indicated in terms of the Egyptian calendar. The star phases and weather predictions are accompanied by notices of festivals in the Egyptian religious cycle. Also of interest are the notices of the lengths of days and nights. According to the scheme used in this paraepigma, the shortest day



Left Column

- The sun in the Archer.
- Orion sets in the morning and Procyon sets in the morning.
- The Dog sets in the morning.
- The Archer begins rising in the morning and the whole of Perseus sets in the morning.
- ○
- The stinger of the Scorpion rises in the morning.
- ○
- The Arrow rises in the morning.
- The Southern Fish begins to set in the evening.
- The Eagle rises in the morning.
- The middle parts of the Twins are setting.

Middle Column

30

- The sun in the Water-Pourer
- [The Lion] begins setting in the morning and the Lyre sets.
- ○
- The Bird begins setting in the evening.
- ○ ○ ○ ○ ○ ○ ○ ○ ○
- Andromeda begins to rise in the morning.
- ○
- The middle parts of the Water-Pourer rising.
- The Horse begins to rise in the morning.
- ○
- The whole Centaur sets in the morning.
- The whole Hydra sets in the morning.
- The Great Fish begins to set in the evening.
- The Arrow sets. A season of continual west winds.
- ○ ○ ○ ○
- The whole Bird sets in the evening.
- [Arcturus] rises in the evening.

FIG. 16. Fragment of a stone parapigma found at Miletus. (After the photograph in Diels and Rhem, *op. cit.* (ref. 34).)

is 10 equinoctial hours and the longest is 14. The length of the day changes uniformly by $1/45$ hour from one day to the next. This crude scheme is mentioned in Egyptian sources going back to the twelfth century B.C. This parapigma is also interesting for the Eudoxan norm for the zodiac signs: the equinoctial and solstitial points are placed at the midpoints of their signs. Thus the equinox occurs 15 days after the Sun's entry into the sign of the Ram.

Figure 16 shows a fragment of a stone parapigma found at Miletus and dated to the second century B.C.³⁴ A hole for each day was bored into the stone and next to each hole were inscribed the star phases that occurred on that day. In some places, holes are bored between the lines of writing. These marked days for which there

were no celestial phenomena to be noted. A peg of wood stuck in the appropriate hole indicated the day of the year. Someone presumably had the job of moving the peg along by one hole each day (though it is also possible that numbered pegs for an entire month were inserted at one time). The stone *parapegmata* make clear the origin of the name for these star calendars: the verb *parapegnumi* means “to fix beside”.