PART I

Parapegmata and astrometeorology

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978-0-521-85181-7 - Astronomy, Weather, and Calendars in the Ancient World: Parapegmata and Related Texts in Classical and Near-Eastern Societies
Daryn Lehoux
Excerpt
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1 The rain in Attica falls mainly under Sagitta

An' as it blowed an' blowed
I often looked up at the sky
an' assed meself the question
what is the stars, what is the stars?
Sean O'Casey

1. Calendars, weather, and the stars

For several years running now, Canada's national radio broadcaster, the CBC, has run an annual human interest piece in which they interview Gus Wickstrom, a farmer from Saskatchewan who predicts how cold the coming winter will be, how much precipitation we will have in what months, and so on. What is odd is that Wickstrom makes his prediction by looking at the thickness and texture of pig spleens. Occasionally, more sensationalist news sources claim that he also chews on the spleen, raw. He tells us that he learned the technique from his father, who learned it from his father and his father's father. Curiously, Wickstrom also claims to be very accurate, and there are websites full of testimonials from Saskatchewan residents who back him up enthusiastically.

In a similar if a little less gruesome vein, gardeners and farmers everywhere have used and handed down all kinds of indicators for seasonal weather: the widths of the bands on woolly caterpillars, the thickness of onion skins, whether the oak beats the ash into leaf in springtime, and more. A favourite story of mine centres on what are called Aunt Bertha's 'borrowing days'. I am told by my wife's grandmother, Mary McLeod, who grew up on a farm in Huron County, Ontario, that one can predict the weather for a coming season by observing the weather on the three days around the solstice or equinox. The day before the winter solstice, for example, mirrors the weather for January, the day of the solstice mirrors the weather for February, and the day after the solstice that for March. As arbitrary as this method may seem to us (not having tried it, mind you) Mary swears by it, and still prepares for each season (stocking firewood, for example) according to the prediction she

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gets in this way. She learned the technique from her aunt, Alberta Forrest, who got it from her father, and her father's father, and so on. But this 'and so on' hides an interesting detail for the historian. It turns out that a version of this same method of weather prediction can be found in Pliny's first-century encyclopedia, the *Natural History*, where he ascribes it to Democritus:

Democritus talem futuram hiemem arbitratur qualis fuerit brumae dies et circa eum terni, item solstitio aestatem.

Democritus thinks that the coming winter will be like the day of the winter solstice and the three days around it, and the same with the summer solstice.[1]

Almost 2,000 years later, this same tradition was being passed from farmer to farmer in rural Ontario as a useful rule of thumb. This is a unique kind of transmission, one not paralleled in other genres of classical literature. Aunt Bertha's borrowing days, in essence a kind of unattributed fragment of Democritus, were simply passed by word of mouth from parent to child. How far back this goes is anyone's guess. That it was an uninterrupted string from ancient times onward I rather doubt. Nevertheless, it was thought of by the Forrests as 'the sort of thing you learned at your father's knee', as one elder put it, and it must have come into the family's oral tradition well before the middle of the nineteenth century. In any case, the rule as I encountered it in Huron County did at least come bundled with a guarantee of accuracy that depended on its being time-honoured even back in Aunt Bertha's day. Its great age was meant to underscore its reliability as a method. After all, as Cicero says, 'in everything, great age brings about an extraordinary knowledge by means of continuous observation . . . since what event happens after what event is seen with repeated observation, and also what event is a sign of what thing.'[2]

There are two points I want to make here. The first is the importance of long-term weather prediction to farmers, ancient and modern alike. The second is the significance of agricultural and meteorological topics to some of the most important figures in the classical tradition. I have already mentioned Pliny and Democritus, and in the course of this book I will go on to discuss Hesiod, Homer, Vergil, Varro, Aristotle, Theophrastus, Cicero, Ovid, Aratus, Ptolemy, Diodorus Siculus, Petronius, Sextus Empiricus, Galen, 'Hippocrates', and many more.

[1] *HN*, xviii.231. All translations in the text are my own.

[2] *De div*. i.109: *adfert autem vetustas omnibus in rebus longinqua observatione incredibilem scientiam; . . . cum quid ex quoque eveniat et quid quamque rem significet crebra animadversione perspectum est.*

In classical antiquity there are two more-or-less distinct traditions of weather prediction.[3] One (which I will call *Theophrastan*, after its most famous ancient exemplar, the *De signis* often attributed to Aristotle's successor, Theophrastus of Eresus) uses rules of thumb and day-to-day observations of events like the croaking of frogs, the colour of the sky, and the appearance of haloes around the sun. The observations from which the predictions get made have two salient features. One is that they generally can be seen as fortuitous: the frogs, for example, happen to be croaking today, but we have no way of knowing when they will be croaking next. All we can do is pay attention when we hear it. The other feature is the use of earthly (which includes atmospheric) phenomena, and the exclusion of celestial phenomena (I say this because haloes around the sun, the changing dimness of certain stars, or the apparent colour of the moon are *atmospheric* rather than *astronomical* phenomena in a strict sense). These distinctions are significant because they mark a boundary between Theophrastan weather prediction and the second major ancient tradition of weather prediction, that of *astrometeorology*. This is not to say, however, that no authors brought these two traditions together (I think of Aratus here in particular) but only that the two kinds of weather prediction are conceptually distinct and follow different historical trajectories. Astrometeorology uses the motions of the stars as signs for predicting the weather and for tracking the seasons: when such-and-such a star becomes visible for the first time this year, it marks such-and-such a season, and we will have such-and-such weather.[4] To take an example from one of our earliest classical sources, Hesiod:

ἤματα πεντήκοντα μετὰ τροπὰς ἠελίοιο,
ἐς τέλος ἐλθόντος θέρεος καματώδεος ὥρης,
ὡραῖος πέλεται θνητοῖς πλόος . . . .
τῆμος δ᾽ εὐκρινέες τ᾽ αὖραι καὶ πόντος ἀπήμων

Fifty days after the solstice,
at the arrival of the end of the season of weary heat,
that is the time for mortals to sail . . .
Then are the winds orderly and the sea propitious.[5]

[3] See Taub, 2003; Sider, 2002, p. 292–6; Lehoux, 2004a.

[4] There is also a later tradition, attested in book II of Ptolemy's *Tetrabiblos*, for example, that looks at the positions and qualities of the planets as indicators of the weather. The cycles involved are considerably more complex than those of fixed-star astrometeorology, and are not tied to the seasons in the same way. *Tetrabiblos*-type astrometeorology is a distinct and later development to the fixed-star kind we will be examining in this book.

[5] Hes. *Op*. 663f. On Hesiodic time reckoning, see West, 1978, p. 376–81.

In other passages, we see the timing of various agricultural activities being determined by the appearances of the fixed stars:

πληιάδων Ἀτλαγενέων ἐπιτελλομενάων
ἄρχεσθ᾽ ἀμήτου, ἀρότοιο δὲ δυσομενάων.

At the rising of the Atlas-born Pleiades,
begin the harvest, and you should plough when they set.[6]

δμωσὶ δ᾽ ἐποτρύνειν Δημήτερος ἱερὸν ἀκτήν
δινέμεν, εὖτ᾽ ἂν πρῶτα φανῇ σθένος Ὠρίωνος

Urge the slaves to thresh Demeter's sacred corn
when strong Orion would first appear.[7]

Here the signs are celestial only, and they are not fortuitous in the same way as the Theophrastan signs are. The general sequence and timing of these stellar events was understood. Unlike the croaking of frogs, stellar risings and settings – also called stellar *phases*, and which will be more fully explained shortly – don't just happen at any time. They happen in a particular order, and they repeat from year to year in that same order. This cyclicality is an important feature of these signs. Because of their rigid cyclicality, they are useful for predicting weather, both in a short-term sense, and also in the larger sense of marking out the seasons of the year.

It is because of their cyclical nature, recurring at the same season, year in and year out, that these signs were so very useful to ancient farmers. Greece, Mesopotamia, Rome, and even Egypt all had calendars that for one reason or another were not adequately tied to the changes of the seasons.[8] In Greece and Mesopotamia, this was because the calendars in question were lunar, which inherently gives them a certain amount of wobble relative to the seasons: where the seasonal year is $365\frac{1}{4}$ days long, a lunar year would be 354 or 384 days, depending on the number of (approximately) $29\frac{1}{2}$-day months there are in a particular year. And so the (lunar) calendrical year and the (solar) seasonal year would shift about relative to each other. Add to this the notorious capriciousness with which days and months were added to the many different Greek civil calendars,[9] and one confronts a situation where over the course of a single lifetime, a Greek farmer may have seen

[6] Hes. *Op*. 383–4. [7] Hes. *Op*. 597–8.

[8] The various ancient calendars may not have been intended to track the seasons at all (this seems particularly possible for the Greek calendars: see Nilsson, 1962), in which case the 'problem' is not really the calendar's. But the farmer is still faced with a challenge: How does he know in advance when the seasons will be changing?

[9] For a fuller discussion, see chapter 4, below. See also Mikalson, 1996; Samuel, 1972; Pritchett and Neugebauer, 1947.

his civil calendar wander relative to the seasons to such an extent that it is not especially useful for the timing of agricultural activities. When would I plant my corn if the month called 'May' didn't always happen at the same time of year? Or what would I do if my 'May' was my neighbour's 'June'?

And it was not only farmers who needed to track the seasons accurately. For sailors as well, as Hesiod showed above, some seasons are more favourable to navigation than others. So Aratus, writing what was in his day (third century BC) an extraordinarily popular poem about weather signs and astronomy, also has sailors watching the fixed stars to determine weather:

καὶ μέν τις καὶ νηὶ πολυκλύστου χειμῶνος
ἐφράσατ᾽ ἢ δεινοῦ μεμνημένος ἀρκτούροιο
ἠέ τεων ἄλλων, οἵ τ᾽ ὠκεανοῦ ἀρύονται
ἀστέρες ἀμφιλύκης, οἵ τε πρώτης ἔτι νυκτός.

And the man on board ship has seen the wavy storm,
remembering dread Arcturus or another star,
which draw themselves from the ocean
in the morning dusk or at the start of night.[10]

The Roman historian Polybius (second century BC), to take another example, tells the dramatic story of what was for him the greatest marine disaster in all history, the complete loss of 284 ships under the command of Marcus Aemilius and Servius Fulvius in a storm in 255 BC, during the first Punic war. After describing this titanic disaster, Polybius says:

ἧς τὴν αἰτίαν οὐχ οὕτως εἰς τὴν τύχην ὡς εἰς τοὺς ἡγεμόνας ἐπανοιστέον· πολλὰ γὰρ τῶν κυβερνητῶν διαμαρτυραμένων μὴ πλεῖν παρὰ τὴν ἔξω πλευρὰν τῆς Σικελίας . . . ἅμα δὲ καὶ τὴν μὲν οὐδέπω καταλήγειν ἐπισημασίαν, τὴν δ᾽ ἐπιφέρεσθαι· μεταξὺ γὰρ ἐποιοῦντο τὸν πλοῦν τῆς Ὠρίωνος καὶ κυνὸς ἐπιτολῆς.

We must lay the blame of this [disaster] not on fortune, so much as on the commanders, for many of the pilots warned them not to sail along the outer coast of Sicily . . . and also warned that a shift in the weather was not yet over, and another one was coming, for they were sailing between the rising of Orion and that of the Dog Star.[11]

So we see references to storms at sea in several of the texts known as *parapegmata* (we will come to a fuller discussion of these texts shortly) and one even marks the date (17 March) on which it becomes safe to sail on the open sea again after the stormy winter.[12]

[10] Aratus, *Phaen*. 744–7. [11] Polybius, I.37.4–5.
[12] See the Clodius Tuscus parapegma in part II: sources, the texts and translations section of this book.

We also know that the astronomical determination of the seasons played an important role in Greek and Roman medicine, where the qualities of the climate could profoundly affect the humoural balance in the body. So in Hippocratic medical works like *Airs, Waters, Places*, and the *Epidemics*, we see physicians paying close attention to seasonal markers, such as the solstices, equinoxes, and the phases of the fixed stars:

φυλάσσεσθαι δὲ χρὴ μάλιστα τὰς μεταβολὰς τῶν ὡρέων τὰς μεγίστας καὶ μήτε φάρμακον διδόναι ἑκόντα μήτε καίειν ὅ τι ἐς κοιλίην μήτε τάμνειν, πρὶν παρέλθωσιν ἡμέραι δέκα ἢ καὶ πλείονες· μέγισται δέ εἰσιν αἵδε καὶ ἐπικινδυνόταται· ἡλίου τροπαὶ ἀμφότεραι καὶ μᾶλλον αἱ θεριναὶ καὶ αἱ ἰσημερίαι νομιζόμεναι εἶναι ἀμφότεραι, μᾶλλον δὲ αἱ μετοπωριναί· δεῖ δὲ καὶ τῶν ἄστρων τὰς ἐπιτολὰς φυλάσσεσθαι καὶ μάλιστα τοῦ κυνός, ἔπειτα ἀρκτούρου, καὶ ἔτι πληιάδων δύσιν.

It is necessary to be especially careful at the most important changes of season, and neither give a purgative drug, nor perform abdominal cautery or surgery until ten or more days have passed. The following are the most important and most dangerous [changes of season]: both of the solstices, especially the summer, and both of the so-called equinoxes, especially the autumnal. It is also necessary to be careful at the risings of stars, especially Sirius, then Arcturus, and again at the setting of the Pleiades.[13]

Knowing when the seasons begin and end is clearly very important in a number of ancient disciplines, and again, the calendars available to the Greeks and Romans before Julius Caesar were not ideal for reckoning this. We also find Thucydides, Plato, Aristotle, and Theophrastus, among others, using astronomical rather than calendrical markers for indicating the time of year.[14] For the Egyptians, who used a rigid 365-day calendar with no leap years, the problems may be a little less pronounced, but they are still a factor.[15]

Since their calendars were at best of limited usefulness for the timing of seasonal activities, Greeks, Romans, Mesopotamians, and Egyptians all turned to the observation of the fixed stars in order to determine the best times for planting, harvesting, pruning, sailing, and more. This is because what are called the *phases of the fixed stars* are very closely tied to the agricultural seasons, and so are good indicators of when those seasons begin and end. Indeed, Greeks and Romans would often link their seasons to particular stellar phases, rather than, as we do it, to just the two solstices and two

13 [Hippocrates] *Aër*. XI. Compare also, e.g., Galen, *In Hipp. lib. prim. epid.*, vol. XVIIA, p. 15, l. 8; *De diebus decretoriis*, vol. IX, p. 914, l. 15. The phases of the moon are also important in later medicine. See Aetius Amidenus, *Tetr*. 162.

14 See Wenskus, 1990; West, 1978, pp. 376–81; Gomme, 1956.

15 For details, see chapter 6.

equinoxes. We tend to take it for granted that the year is divided into four seasons, each of approximately equal length. But why should it be? In many locations, the schematic division of the seasons according to the solstices and equinoxes does not correspond particularly well to the actual changes in the weather. By the time 'the first day of summer' on or around 21 June arrives, southern Ontario, for example, has typically been enjoying very un-spring-like weather for several weeks. Indeed, June is about as hot as August, and has even less precipitation. But this summer weather starts earlier in the central regions of the continent than it does on the east coast, so why should we not say that the season called 'summer' starts earlier there too?

Along these lines, different ancient cultures used a variety of different schemes for dividing up the seasons. In Egypt there were three seasons in the year: that of 'inundation' (*ꜣḫt*, when the Nile flooded its banks and submerged the fields around it), 'emergence' (*prt*, when seedlings began to grow), and 'harvest' (*šmw*). From the time of the earliest Egyptian texts, the beginning of the Nile flood was associated with the heliacal rising of the star Sirius. In classical cultures, on the other hand, there were several different schemes in use, some four-season divisions, some eight, and others. Varro (first century BC), for example, gives us a fourfold division of the year that begins its seasons on the twenty-third day after the sun enters each of Aquarius, Taurus, Leo, and Scorpio. Thus spring starts on 7 February in the Julian calendar, summer on 9 May, autumn on 11 August, and winter on 10 November. He then tells us that if more precision is required, the farmer can use an eightfold scheme that divides the seasons more minutely:

primum a favonio ad aequinoctium vernum dies XLV, hinc ad vergiliarum exortum dies XLIV, ab hoc ad solstitium dies XLIIX, inde ad caniculae signum dies XXVII, dein ad aequinoctium autumnale dies LXVII, exin ad vergiliarum occasum dies XXXII, ab hoc ad brumam dies LVII, inde ad favonium dies XLV.

The first [season runs] from [the rising of] the west wind [*favonius*, the same as that called Zephyrus in the Greek sources] to the vernal equinox, forty-five days; from there to the rising of the Pleiades, forty-four days; from this to the solstice, forty-eight days; then to the rising of Sirius, twenty-seven days; next to the autumnal equinox, sixty-seven days; from that to the setting of the Pleiades, thirty-two days; from this to the winter solstice, fifty-seven days; then to the west wind, forty-five days.[16]

We see that the seasons are here divided by the solstices and equinoxes, but also by a regularly occurring annual wind, and by the risings and settings of some of the fixed stars.[17]

16 Varro, *Rust.* I.28. 17 Compare also Plin. *HN* II.122f.

The Mesopotamians also used the phases of the fixed stars as indicators of weather patterns, and stellar phases played an important role in the so-called *Uruk scheme*, which regularized their lunar calendar with respect to the solar year. As we shall see in chapter 5 of this book, direct connections between the Near Eastern material and the classical sources are often difficult to establish, but we can show that fixed-star astrometeorology was practised in one form or another in classical and Near Eastern cultures alike.

1.i. The phases of the fixed stars

I have mentioned the annual risings and settings of the fixed stars repeatedly, but since naked-eye astronomy is no longer common knowledge, it will be worth a short digression to explain what these risings and settings, the so-called *phases* of the fixed stars, are.

We all know that the sun has a motion from east to west, which it repeats every day, moving the 360° around the earth in twenty-four hours.[18] But the sun also has another, less obvious motion from west to east. This can be observed as follows: go out just at sunset and watch the sky begin to fill with stars as the brightness of the setting sun recedes. You should take special notice of the stars in the general vicinity of the recently disappeared sun. In particular, remember how far they are from the western horizon a little after sunset. The next day, go out again and observe the same stars. You may notice that they are a little closer to the horizon than they were at this exact time the day before.[19] The next day they will be closer still, until one day they will vanish entirely in the obscuring brightness of the sun. This vanishing is one of the four important 'phases' of a star, called its '*heliacal setting*', its '*evening setting*', or just its '*setting*'. It is said, in Greek terms, to be due to the slow west-to-east motion of the sun (relative to the fixed stars), which it completes in one (sidereal) year, moving at a rate of approximately 1° per day.[20]

After about thirty days (assuming the chosen star is on or near the ecliptic)[21] the star will rise from the eastern horizon just before sunrise, thus

[18] For the purposes of this work, the earth sits still in the centre of the Cosmos and the sun, stars, and planets all move around it.

[19] I say that sunset occurs 'at the same time' each day since it is one of the events which defines 'time' in the ancient world. Hours were counted relative to sunset or sunrise in antiquity, rather than from an artificially determined 'midnight' as we do it today.

[20] The measurement of this motion in degrees only began in the second century BC in Greece. For that matter, it is not even clear in the earliest sources, such as Hesiod, whether the sun or the stars were thought to be moving.

[21] The ecliptic is the path traversed by the sun through the signs of the zodiac over the course of the year. If, following classical practice, we picture the Cosmos as spherical, then the ecliptic is a

ending its period of invisibility. This first appearance is the next significant phase of the star, called its '*heliacal rising*', '*morning rising*', or just its '*rising*'. After this phase, the star will rise earlier and earlier each day until its '*acronychal rising*' (from ἀκρόνυχος, 'at nightfall'), or '*evening rising*', when it rises in the east just after the sun sets on the western horizon. A little while later, the star will set on the western horizon just before the sun rises in the east, making its '*cosmical setting*', or '*morning setting*'. Stars north or south of the ecliptic have some differences in the sequential order of these phases, but the terminology remains the same.[22]

All the phases I have discussed above, the morning and evening risings and settings, are *apparent* insofar as they are observable phenomena. Some astrometeorological texts, however, distinguish the *true* rising and setting from the observed phase.[23] The true heliacal rising, for example, occurs when the star rises at exactly the same time as the sun rather than a little before it, as in the apparent rising. Due to the brightness of the sun, the true phase is never observable, but must be calculated. Examples of the distinction between a true and apparent phase may be found in Geminus:

κζʹ Εὐκτήμονι Κύων ἐπιτέλλει.

[On the] 27th [of Cancer]: According to Euctemon, Sirius rises.[24]

And four days later, we see:

ἐν μὲν οὖν τῇ αʹ ἡμέρᾳ Εὐκτήμονι Κύων μὲν ἐκφανής, πνῖγος δὲ ἐπιγίνεται· ἐπισημαίνει.

On the 1st day [of Leo]: According to Euctemon, Sirius is visible, it becomes very hot: the weather changes.[25]

Here there is a four-day gap between the star's 'rising' and its becoming 'visible', probably referring to the difference between its true rising and its apparent rising.[26] Not all cases are so clearly worded, however, and it is often

great circle, inclined at a little over 23° to the celestial equator and intersecting that circle at two points, the equinoxes.

22 Details can be found in *HAMA*, p. 760f.

23 Bowen and Goldstein, 1988, p. 54f., disagree, but Ptolemy goes to some length to distinguish true and apparent phases in his introduction to the *Phaseis* (§3). See also Souriban, 1969, p. 208–10.

24 Geminus, 212.4.

25 Geminus, 212.16–17.

26 There is some debate about whether this is really what Geminus was intending, as there are astronomical problems with the precise dating in this instance (see e.g., Bowen and Goldstein, 1988). Nevertheless, alternate explanations seem to me to pose more difficulties than they solve, and the levels of astronomical accuracy we should expect in the writing and transmission of a text of this sort are, as attested in many other examples, not so fine-tuned as to rule out a small dating error here.