

two errors, one due to faulty centring of the lenses, the other due to atmospheric dispersion. Providing that the de-centring of the lenses is constant throughout the series, this error should be eliminated in differencing morning and evening observations; the second may be avoided by a rigid adherence to observation on the meridian, but there is a certain temptation to observe past the meridian in the evening and to anticipate in the morning.

A possible source of error may be due to bias of the measurer. The earliest attempts at photographic parallaxes produced values that were too large. The measurer argued that the positive results *might* be right, the negative values *must* be wrong and rejected them accordingly, but failed to reject the largest positive values, with a wholly erroneous result. It is still equally necessary to avoid rejecting negative results just because they are negative.

Without drawing any conclusion as to the validity of van Maanen's proposed corrections, it may be pointed out that, bearing in mind the probable errors of the parallaxes, the a_0 and ϕ terms alone, will give a curve which fits the observations and, as a seasonal term, is least open to objection. However, the undoubted value of the paper lies in the Tables IV. and V., in the first of which is given the mean differences $\pi_t - \pi_s$ for different spectral types for the several observatories, and, in the second, a comparison of trigonometric and spectroscopic parallaxes for each hour of Right Ascension. The several observatories concerned may well derive valuable knowledge from a careful study of their own results.

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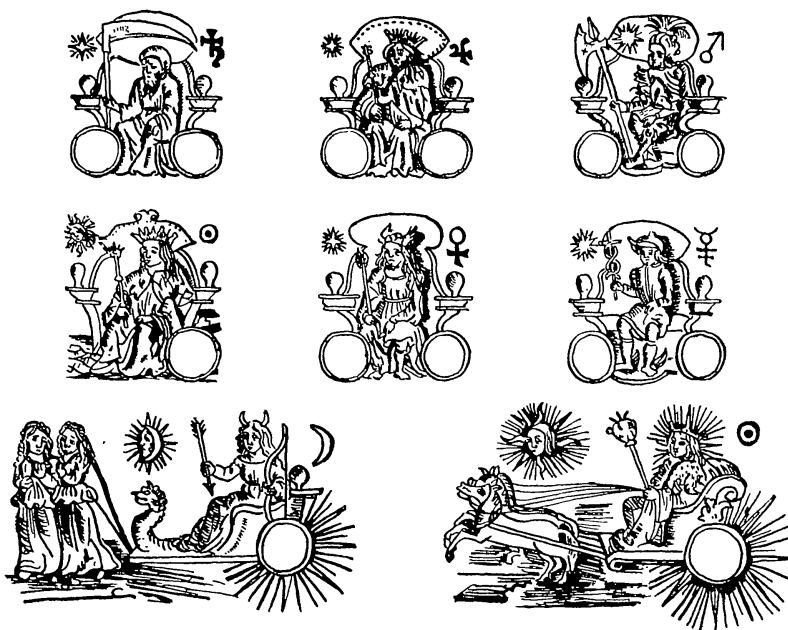
The Origin of the Symbols of the Planets.

WE may take it that the symbols of the planets as given on p. 476 of the *Nautical Almanac* for 1934 are those now accepted*. How far back can they be traced before their form is seriously modified? I asked Dr. Dreyer, about fourteen years ago, this question, and he placed their origin in the late Middle Ages. To test this, my

* See fig. 4, row e.

husband * and I began a search for them in the earliest *printed* scientific books, and in the Library of the Royal Observatory, Greenwich, we found a copy of Abū Maʿšar's "Great Introduction", printed in Latin at Venice in 1506, which, in its text, contains woodcuts of the planetary symbols and of the Chariots of the Sun and Moon †. The symbols for Sun, Moon, Venus, Mars and Jupiter are unmodified, but Mercury and Saturn each have the addition of a cross-bar. Therefore, as early as the beginning of the 16th Century, the planetary symbols were already stereotyped—not originated.

Fig. 1.



In this connection a Greek *manuscript* of a somewhat later date is significant. It is one of a pair of cryptograms in the *Anecdotum Parisinum*, named P¹ and P² by Boll ‡, P² being about the date 1550. The planets named in P² are Aphrodite, Hermes, Ares, and Kronos, their symbols also being given; here Venus has lost her cross-bar, Mercury is left with but a single one, Mars,

* See our paper on "The Origin of the Planetary Symbols" in *J. B. A. A.* 30. 219 (1920).

† See fig. 1. Acknowledgment is made to Miss Margaret Dougharty for her kindness in preparing the sketches and table reproduced in this article.

‡ "Sphæra" by Franz Boll, published by B. G. Teubner, Leipzig (1903).

again, is the same as to-day, and Saturn retains his cross-bar *. About this time there seems to have been an attempt to give a savour of Christianity to the symbols of the old pagan gods † by the impress of a cross. Note that in the "Great Introduction" woodcut of Mars, though no cross-bar is placed upon his spear (since this would have made it an arrow), a cross is impressed on the battle-axe that he bears in his other hand ‡. We have retained the cross on Venus and Jupiter to this day, seeing that it makes them more distinctive symbols.

A century later than the Parisinus manuscript, an Englishman, Peter Mundy, voyaged to India, and made notes of such astronomical phenomena as came to his notice §. In his "third voiage to India, 1655" on 25 July, he writes "This evening wee saw the . . . moone, Mercury, Saturne and Venus, four planetts, all within the space of 15 degrees, the two farthermost being about 15 degrees asunder; the . . . Sun not farre off[f]." The symbols that he gives for these five are, as regards Venus and the Sun, exactly of the form given in the "Great Introduction" woodcut; the moon, however, is here turned with her bow to the left hand; Mercury has got his serpent's heads and his cross-stave both askew to the middle loop, as if the Caduceus was held all aslant as in the Bianchini; Saturn retains his cross as in the woodcut, but it is a manifest scythe—not a sickle.

Going backward three and a half centuries, from the "Great Introduction" woodcut, we come to Johannes Kamateros—that "Byzantine coiner of verses" . . . "the latest and worst of all the authorities cited" . . . "the latest Greek author to whom nothing matters beyond the Sphæra Barbarica." So Boll speaks of him

* See fig. 4, row *d*.

† Such was also common at a much earlier date. Thus it is related in "Egil's Saga" concerning King Athelstane the Victorious of England (grandson of Alfred the Great), that "the king bade Thorolf and his brother that they should let themselves be *prime-signed*, because that was then greatly the fashion both with chapmen and with those men that took war-service with Christian men, because those men that were prime-signed had use of all matters in common alike with Christian men and with heathen, but had that to trow in which was most to their liking. Thorolf and Egil did that according to the king's asking, and let prime-sign them both." Thorolf and Egil, sons of Skallagrim, one of the first settlers in Iceland, were all worshippers of Thor. *Primsigna* is to give the *prima signatio* or *signaculum crucis*.

‡ See fig. 1.

§ 'The Travels of Peter Mundy' are not yet published, but I have the kind permission of the India Office to make use of his manuscript.

more in anger than in sorrow, but small blame to him for he had to wrestle with the "Compendium [save the mark] of Astrology", an interminable poem which owed its preservation solely to the laudatory verses incorporated in it and dedication to that champion of astrology, his sovereign lord, Manuel Komnenos, living in the middle of the 12th Century. The poetry of Kamateros is bad, but his setting forth of his pseudo-science is worse; to satisfy the metre he sacrificed on occasion both grammar and important syllables of technical terms.

Astrological planispheres were common enough throughout Eurasia up to a later date than that of Kamateros; one such was lately discovered by Dr. Mingana and attributed by him to Dionysius Barsalibi, a celebrated Syrian astronomer*, who died in 1171, thus being a contemporary of the Byzantine Kamateros. Barsalibi's planisphere has an indication of the north point, and Dr. Mingana gives a translation † of the text on the two sectors lying nearest on the left hand to the north-and-south line; it is evident from the content of the southern sector that even the learned Barsalibi had made a mistake and had mixed up the order of the Arabic "mansions of the moon" ‡.

Kamateros has in his Compendium a diagram which is evidently a single sector from a planisphere of the same order as Barsalibi's, but with quite different objects (real or imagined) as its content. Apparently he had not the whole planisphere before him, nor any indication of the north-and-south line; in fact, he did not know whether the sector was north or south, so he intimated that this is his private *arcanum*. As this sector § (which Boll has figured in his book ||) is obviously of the greatest importance for this particular research on the planetary symbols, I struggled, by the aid of a Greek dictionary ¶, to translate the "explanation" (!) of the diagram given by Kamateros, and it was with a feeling of relief that I found later that Boll had chosen this particular passage as "an awful example" to translate into kindly German.

* He wrote treatises on the Eclipse of the Sun, the Cause of Winter, etc.

† The text on the planisphere is in both Syriac and Garshuni characters.

‡ See *J. B. A. A.* 43. 339 (1933).

§ See fig. 2.

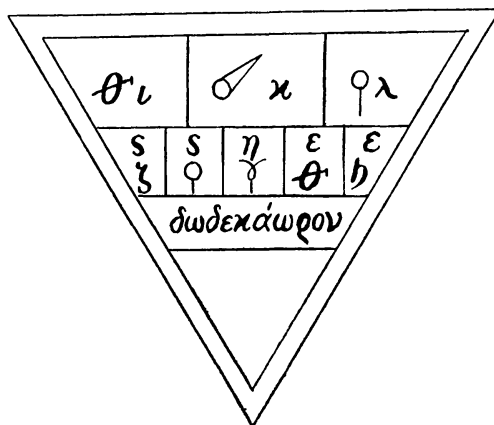
|| 'Sphæra,' p. 308.

¶ I have little Latin and less Greek.

Even so, I could not understand the "explanation", though I could, perhaps, understand the diagram*. It became evident that Kamateros was more ignorant in such matters even than I am; he could not have made the diagram for himself in whole or in part, he must have copied it from someone else. Boll thinks it was from Rhetorius the Egyptian who lived about the 6th Century of our era, for though Kamateros borrowed right and left from the more ancient astrologers, frequently he quoted Rhetorius word for word.

We have therefore gone back a thousand years from the Greek Parisinus cryptogram to the planisphere sector of Rhetorius the Egyptian, and it gives us six out of our seven planetary symbols in a rudimentary, but recognizable form. In the middle row we have five of them

Fig. 2.



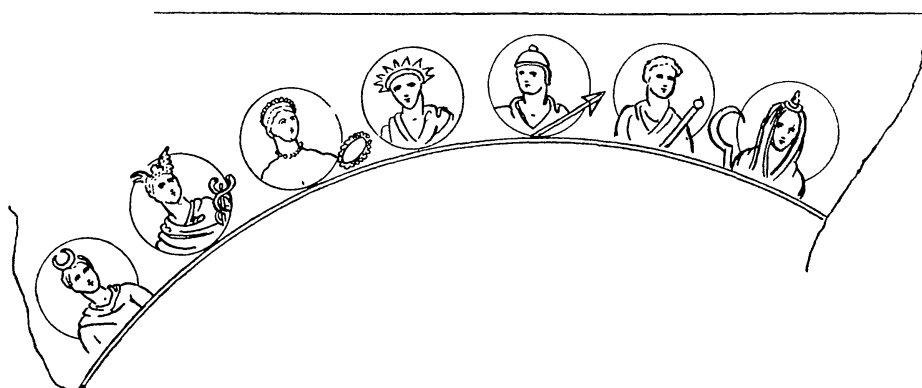
beneath the Greek numerals, $\sigma\sigma\eta\epsilon\epsilon$, namely Jupiter, Venus, Mercury, Mars and Saturn; in the row above we have the Sun between Mars and Venus. The symbol for Jupiter is without doubt the Greek small letter zeta (ζ) indicating that in the Abū Ma'shar woodcut is the same Greek letter, but as a capital (Z), rendered a cross by the addition of a vertical line to the lower bar. This Z is the initial letter of Zeus, so that, at least, one planetary symbol is undeniably of Greek origin. The symbol of Venus is like the one in the Parisinus MS.; Mercury's Caduceus, or intertwined serpents, is reduced

* I have no knowledge at all as to the arguments on which such horoscopes were constructed, nor of their interpretation for the prediction of the future history of countries, nations or individuals. The "interpretation" is, I understand, the private *arcantum* or secret of the astrologer—it is psychological, not astronomical.

to a single loop ; the spear of Mars is laid obliquely along his shield—not simply projecting from it as in the Parisinus or in the *Nautical Almanac*. Saturn's form is like our own symbol, but without any cross-bar, and perhaps with more resemblance to a worn-out sickle ; the Sun is a disk with but a single ray. The sector of Rhetorius, preserved like " a fly in amber " in the poem of Kamateros, seems to indicate that we should look for planetary symbols in yet more ancient planispheres. It does more ; it serves directly as a link to the Bianchini planisphere, the most famous and beautiful of them all.

We have only a fragment of this, but it is enough to show its form and content. There are seven circular concentric zones of which the innermost consists of the two Bears with the intertwined Dragon ; the second is

Fig. 3.



a zone of twelve animals named the *dōdekaoros* * ; the third and fourth are duplicates of the Zodiac ; the fifth, a zone of Greek numerals giving the *oria* † or limits of the planetary influences in the several signs of the Zodiac ; the sixth contains 36 figures, with Egyptian dress and characteristics, which show forth the demigods influencing the dekans (3 to a sign) ; the seventh is a zone of medallions in which are repeated over and over again the *prosōpa* of the seven planets, and enough of the broken planisphere is left to show the *prosōpa* or " presentments " of all seven, and these also seem to be distributed 3 to a sign, that is 1 to a dekan ‡. Lines drawn from the circumference

* For the *dōdekaoros*, see *J. B. A. A.* 30. 219 *et seq.* (1920).

† See the "Tetrabiblos" of Ptolemy.

‡ As the planets are 7 in number and the dekans 36, one must be reduplicated, but we do not know which this was.

of the central circle, through the limits of the zodiacal signs, divide the whole planisphere into twelve sectors.

One of the sectors—that of the Ram—preserved in the Bianchini planisphere is fortunately the same as that of the Kamateros diagram which bears on its side the script: “*dōdekātemōrion tou areos*”; the *oria* are the same, and the planets also. The probable date of the Bianchini marble is not earlier than the second century of our era. At this date therefore, or somewhat earlier, the symbols now in use became on the whole severally connected with the seven planets.

The Bianchini planisphere shows the *prosōpa* * of the planets as of Greek form; each planet bears a distinctive symbol, and they are repeated always in the following order:—1. Saturn with a cowl and bearing a sickle; 2. Jupiter with a sceptre; 3. Mars with helmet and bearing a slanting spear; 4. the Sun with a circlet of many rays; 5. Venus with a *necklace* which is attached by a cord to another necklace beyond her shoulder; 6. Mercury with winged headdress, and a caduceus of at least three loops; 7. The Moon with headdress of an upturned crescent.

In fig. 4 we see the symbols throughout the ages back nearly to the beginning of our era. There are no fundamental changes in them; Saturn's deformed 5 was always meant to be a sickle, and the printers of the “Great Introduction” in 1506 had not forgotten it, for they gave him a very obvious scythe, and so does Peter Mundy; Jupiter's sceptre as king of the (Greek) gods was not distinctive, so the initial letter of Zeus was substituted either as a small or as a capital letter, and finally was “christened” (to use the term from Egil's Saga) by a vertical bar rendering it an ornate 4; Mars, the god of war, has kept his spear and shield even after the introduction of gunpowder; the Sun remains a circle, but has successively diminished his many rays to none; Venus's necklace has been mistaken for a mirror; Mercury's twined serpents are as distinctive as ever; so is the horned moon, and—as ever—she is sometimes very new and sometimes very old.

Throughout these ages the planets and their symbols








* See fig. 3.

have clung to each other, each to each. Our symbol for Jupiter is Greek in origin and could apply to the planet Zeus only; the Moon must have been symbolized by her horns always; but for the connection between the planets and their symbols earlier we cannot be sure. For example, in Babylon the planets were observed at least 4000 years ago, and several of the symbols can be traced back there also to the same period, but in most cases we cannot correlate.

The Caduceus is perhaps the widest spread of all the signs; it is interesting to find it as far west as England

Fig. 4.

Saturn Jupiter Mars Sun Venus Mercury Moon

(a) <i>Bianchini</i>							
(b) <i>Kamateros</i>	♄	ζ	♈	♏	♀	♿	
(c) <i>Abu Masar</i>	♄	♄	♈	\odot	♀	♿	♁
(d) <i>Parisinus</i>	♄		♈		♀	♿	
(e) <i>N.A.</i>	♄	♄	♈	\odot	♀	♿	♁

in the very first years of our era. Cunobelin was a British prince, lord of the town which the Romans named Camulos, after the Celtic Mars (now called Colchester). On one of his silver coins*, there is engraved on the obverse a seated male figure holding a Caduceus in his right hand and with his left arm extended on his knee, just as we find the Mercury of the "Great Introduction" woodcut †. We find the Caduceus as far east as Babylonia, upon a seal as early as 2000 B.C. I think that Cunobelin's

* 'The Coins of Ancient Britain' by John Evans, F.R.S., etc., published by B. Quaritch, London. See plate xxii. no. 9. The coin was found in the "Central District" of England.

† A stater struck shortly after 400 B.C. in the Cretan city Sybrita shows Hermes with head-dress and slanting Caduceus similar to the Bianchini Mercury. See plate i. fig. 8 of the 'Guide to the Department of Coins and Medals in the British Museum'.

coin was probably intended for the *planet* Mercury (the reverse showed a winged horse, which is probably the constellation Pegasus), but the Babylonian Caduceus we may not connect with any planet.

Similarly, the necklace of the planet Venus finds its prototype in the necklace of Fate worn by Ishtar, the Lady of the Gods, as a remembrancer. She is speaking to the other gods * :—

163. “ Now when the Lady of the Gods came in.

164. “ She lifted up the priceless jewels which Anu had made according to her desire.

165. “ O ye Gods here present, as I shall never forget the priceless jewels of my neck.

166. “ So shall I ever think about these days, and shall forget them never more.”

Ishtar was at one period certainly associated with the planet Venus, and *may be so* associated here.

The sickle and the sceptre, *both*, were borne by Marduk on the Babylonian representation of his contest with the Dragon, but here—though we may not connect them with the *planet* Saturn—we may find a correlation with the *planet* Jupiter. For one of the Babylonian names for Jupiter was *Nibir*, “ He who transits ”, and on the 5th tablet of the Fight between Bel and the Dragon † we are told of the Lord [Marduk] that :—

1. “ He appointed the stations for the great gods.

2. “ He set in heaven the stars of the Zodiac which are their likenesses.

3. “ He fixed the year, he appointed the limits thereof.

4. “ He set up for the twelve months three stars apiece.

5. “ According to the day of the year he . . . figures.

* ‘ The Babylonian Story of the Deluge ’, etc., by C. J. Gadd. Printed by Order of the Trustees of the British Museum, 1929, p. 39. By a strange coincidence (I cannot think it more) the Norse Freya who gave her name to our Friday, was also noted for her debatable necklace of the Brisings, forged by the Dwarfs.

† ‘ The Babylonian Legend of the Creation and the Fight between Bel and the Dragon as told by Assyrian Tablets at Nineveh ’ by E. Wallis Budge. Printed by Order of the Trustees of the British Museum, 1921.

6. " He founded the Station of Nibir (Jupiter) to settle their boundaries.

7. " That none might exceed or fall short "

And this is just what the *planet* Jupiter does, more or less precisely, for he spaces out about a twelfth of the Zodiac in one year, and, by his stationary points, divides that twelfth (one sign) roughly into 3 parts or dekans.

There were many versions of the Creation legend, some of them Sumerian and therefore old. This version is Assyrian and was found in the ruins of the Royal Library at Nineveh which was destroyed in 604 B.C. The legend was therefore written prior to that date. But whatever may be the date of the rest of the poem, it is certain that this tablet must have been written between 700 and 600 B.C. For this tablet describes, as plainly as can be, the re-division of the unequal and irregular twelve *constellations* of the Zodiac into equal and regular twelve *signs*. The boundary between the constellations of Taurus and Aries was taken as the place where the Sign Aries began, and this boundary was, at the epoch when the signs were made, just 8° from the position of the spring equinox. That epoch must therefore have been very close indeed to 700 B.C. This then is the *earliest* date to which we can assign the making of the signs (and therefore of the dekans also). The 8th degree of the Sign Aries was adopted as the position of the Spring Equinox, both by astronomers and astrologers, down to the time of Hipparchus; by astrologers also to a very much later date still.

Even though this 5th tablet must have been written well within a century from the division of the Zodiac into signs and dekans, I think that the Lord Marduk was taking to himself credit for more than he actually did do. He may have, perhaps, divided the 12 signs into 36 dekans but he did *not* " fix the boundaries of the stations of Nibir ". That was (I believe) done by Hindu astronomers at a date very close indeed to 700 B.C. *. The men who did the actual work were the three sons of Sudhanvan, and they were deified for it under the names of Ribhu, Vaja and Vibhvan.

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* See *J. B. A. A.* 43. 122 (1933).