A UNIQUE AND UNKNOWN BOOK OF AL-BERUNI
Ghurrat-ul-Zijat or Karana Tilaka
Sayyid Samad Husain Rizvi*
(Continued from the Jan. 1965 issue)

CHAPTER V
"Relating to the true places of the Planets"

1. Mandochchas of the Planets:

MANDOCHCHA of Mars is 120°, mandochcha of Mercury is 220°, mandochcha of Jupiter is 171°, mandochcha of Venus is 80°, and mandochcha of Saturn is 240° (from the first point of Aries).

COMMENTARY

(a) Correction of the Manuscript:-
Only a phrase has been added within brackets to make this article more intelligible.

(b) Translation of the Technical Terms:-
MANDOCHCHA:- It is the original Sanskrit term for which Beruni has used "" which its English translation could have been "apex of slow motion" or briefly "point of apsis" or "apogee," but I have preferred to use the original Sanskrit term.

(c) Elaboration of the Principle:-
In Surya-siddhanta the cycles of mandochchas of Mars, Mercury, Jupiter, Venus and Saturn in a kalpa (which is equal to 1000 Chaturyugas) are given as 204, 368, 900, 535 and 39, respectively (vide its chapter 1, slokas 41, 42). With the help of these cycles the following values of the mandochchas have been calculated for the beginning of 888 Shakakala. It will be seen that the motion of these mandochchas is extremely slow and therefore in karana book these points are always supposed to be stationary for all practical purposes within a period of a few centuries. For the sake of comparative study different values of mandochchas adopted in different karana books are given in the following table in degrees.

* Mr. Sayyid Samad Hussain Rizvi, Executive Engineer, Pakistan, Scholar of Sanskrit, Hindi, Urdu, Arabic, Persian and English.
<table>
<thead>
<tr>
<th>Planets</th>
<th>Khandakhadyaka (587 Shaka)</th>
<th>Karana-tilaka (888 Shaka)</th>
<th>Karanakutuhala (1105 Shaka)</th>
<th>Grahaghava (1442 Shaka)</th>
<th>Surya-siddhanta (888 Shaka)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>80</td>
<td>77 14/13</td>
<td>78</td>
<td>78</td>
<td>77 17' 16&quot;</td>
</tr>
<tr>
<td>Mars</td>
<td>110</td>
<td>120</td>
<td>128 1/4</td>
<td>120</td>
<td>130 1' 45&quot;</td>
</tr>
<tr>
<td>Mercury</td>
<td>220</td>
<td>220</td>
<td>225</td>
<td>210</td>
<td>220 26' 41&quot;</td>
</tr>
<tr>
<td>Jupiter</td>
<td>160</td>
<td>171</td>
<td>172 1/4</td>
<td>180</td>
<td>171 18' 18&quot;</td>
</tr>
<tr>
<td>Venus</td>
<td>80</td>
<td>80</td>
<td>81</td>
<td>90</td>
<td>79 49' 53&quot;</td>
</tr>
<tr>
<td>Saturn</td>
<td>240</td>
<td>240</td>
<td>238</td>
<td>240</td>
<td>236 37' 24&quot;</td>
</tr>
</tbody>
</table>

2. To Find the Manda-phala:

From the mean place of planet deduct its mandochcha, the remainder will be its manda-kendra; find out its sine. Now, for Mars, multiply the sine of its manda-kendra by 3 and to this product add its 3/7th, the sum will be the manda-phala. Similarly for Mercury, multiply it by 3 and take half of this product and from it deduct its 1/10th; for Jupiter, multiply the sine of the manda-kendra by 3, take half of this product and add to it its 2/5th; for Venus, or the sine of the manda-kendra add its 2/7th and take half of this sum; for Saturn, multiply half of the sine of the manda-kendra by 3 and add to the product its 3/8th; the result will be the manda-phala for it and for each of others.

Example:— Let us use the mean places of the planets already found out in the past examples. For Mars the manda-kendra is 5 S 10' 36' 40", its sine is 66° 16' 41", we multiplied it by 3 getting 198° 50' 3", its one-seventh is 28° 4' 18", and the sum of the two is 3° 47' 14" 21" which is the manda-phala of Mars. For the Manda-kendra of Mercury is 6 S 22' 27' 31", its sine is 76° 7' 15", we multiplied it by 3 getting 228° 21' 24", half of it is 114° 10' 43", one-eighth of this half is 11° 25' 4" and nine-tenth of this half is 1' 42' 45" 36" which is the manda-phala of Mercury. For Jupiter the manda-kendra is 4S 5° 14' 34", its sine is 113° 33' 29", its threefold is 340° 40' 27", its half is 70° 20' 14", one-sixtieth of this half is 2° 50' 20", the sum of these two is 2° 3' 10' 34" which is the manda-phala of Jupiter. For Venus the manda-kendra is 11 S 12' 27' 31", its sine is 60° 3' 51", its one-sixth is 10° 0' 39", the sum of these two is 70° 4' 30", half of it is 35° 2' 15" which is the manda-phala of Venus. For Saturn the manda-kendra is 3 S 27' 5', its sine is 177° 0' 21", half of it is 88° 45' 11", we multiplied it by 3 getting 266° 15' 33", one-sixth of it is 44° 22' 36", the sum of these two is 5° 10' 36' 9" which is the manda-phala of Saturn.

**Commentary**

a) **Correction of the Manuscript**:

Only one major correction in the case of Venus has been made by me; I have written "manda-kendra instead of "manda-kendra 2nd" and 'sine of the manda-kendra' instead of 'sine of the manda-kendra 2nd'. This mistake seems to be either due to the slip of pen of the Arabic scribe or due to some misunderstanding on the part of Beruni. There are two main reasons for making this correction; firstly because the uncorrected formulæ would not give correct results; secondly, because it is arithmetically ridiculous to say "To the sine of the manda-kendra add its one-sixth and half of one-sixth" which actually means "To the sine of the manda-kendra add its one-fourth." The following corrections have been made by me in the figures of the solved example given in the original manuscript.

<table>
<thead>
<tr>
<th>Original</th>
<th>Corrected</th>
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<tr>
<td>77 17' 16&quot;</td>
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</tbody>
</table>
Gradually from minimum to maximum as the manda-kendra increases from 90° to 180°; similarly, again they contract in the third quadrant and expand in the fourth quadrant; in all cases the rate of increase or decrease is proportional to the sine of manda-kendra.

### 3 To Find the Sheeghra-Phala:

We have already said that the mean place of the sun is also the sheeghra-chha of the superior planets, and the sheeghra-chchhas of the inferior planets are separately calculated as explained before. When the mean place of a planet is deducted from its sheeghra-chha, the remainder is sheeghra-kendra (and when complete quadrants are deducted from it, the remainder is the “reduced” sheeghra-kendra); then find out its sine which, in the two old quadrants, will be “bhujaja,” and then deduct the (reduced) sheeghra-kendra from 3 signs and find out the sine of the remainder which will be “kotiija”; but in the two even quadrants the sine of the (reduced) sheeghra-kendra will be “kotiija,” and the sine of the remainder obtained after deducting the (reduced) sheeghra-kendra from the 3 signs is “bhujaja.” Then multiply each of these two by the “sheeghrapari-dhi-ankans” and divide the product by the “bhajakanka,” then the quotient will be the “phala” for each of these two. Now add the “koti-phala” to the trijya if the sheeghra-kendra is from the first point of Capricorn up to the last point of Gemini; and deduct it from it in the remaining half; whatever you get multiply it by itself, and to this product add the square of the “bhujaja” and take the square root of the sum, the result will be the “sheeghra-karna”; divide by it the product of the bhujaja-pana and the trijya, then the quotient will be the sine, convert it into arc, then, it will be the sheeghra-phala. In the following table the sheeghrapari-dhi-ankans and the bhajakankas for each of the five planets are given.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Mars</th>
<th>Mercury</th>
<th>Jupiter</th>
<th>Venus</th>
<th>Saturn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheeghrapari-dhi-ankans</td>
<td>13</td>
<td>10</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Bhajakankas</td>
<td>20</td>
<td>27</td>
<td>5</td>
<td>18</td>
<td>9</td>
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</tbody>
</table>

**Example:** Let us consider only one planet, Jupiter. We deducted its mean place from the mean place of the sun which is also the sheeghra-chha of Jupiter; then the remainder 3° 16’ 12” 57” is the sheeghra-kendra; its sine (after deducting the complete quadrants) is 55° 36’ 21”, which is kotijja, because the sheeghra-kendra is in the second quadrant which is even; then we deducted the (reduced) sheeghra-kendra from 3 signs getting the remainder 2° 53’ 13” 47’ 3”, its sine is 191° 17’ 21” which is bhujaja. We multiplied each of these two sines by the sheeghrapari-ankas (which in this case is 1), so that they remained as they were; then we divided each of them by their bhajakanka; 5; getting the quotients 11° 7’ 16” which is the kotipana, and 38° 15’ 29” which is the bhujaphala. Now we deducted the kotipana from the trijya; because the sheeghra-kendra is in the remaining half, getting the remainder 186° 52’ 44” (which we converted into 679964’); we multiplied it by itself getting 46353041296”, then we multiplied the bhujaphala by itself.
getting \(18969001984\)°, and then we took the square root of the sum of these two results getting 693772° which is the sheegrakarnaka; by it we divided the product of the bhujapaha and the trijja getting the quotient 39° 42' 15" which is the sine, and its arc (is 11° 29' 16") which is the sheegraphalaka of Jupiter.

**Commentary**

a) **Correction of the Manuscript**

I have added a few phrases within brackets to make this article more intelligible. Moreover, in order to rectify a few mistakes made by Beruni in deciphering the Sanskrit manuscript possessed by him, I have written the true value of the sine of the angle (the kankha) 39° 42' 15" instead of 39° 44' 30" which Beruni (page 200, 1950) mistakenly took from the manuscript. In the original example the following corrections have been made by me in the original manuscript.

<table>
<thead>
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</table>

(b) **Translation of the Technical Terms**

**Sheegrakarnaka** :- It is the original Sanskrit term for which Beruni has used برج المجرة whose English translation can be “apex of quick motion” or briefly “point of conjunction.”

**Sheegrakendra** :- It is the original Sanskrit term for which Beruni has used جزء الشمس whose English translation can be “the angular distance from the apex of quick motion” or briefly “anomaly of conjunction.”

**Sheegraphala** :- It is the original Sanskrit term for which Beruni has used جزء المجرة whose English translation can be “equation of anomaly of conjunction” or briefly “equation of conjunction.”

**Bhujapaha** :- It is the original Sanskrit term for which Beruni has used المجرة whose English translation can be “the horizontal component” or briefly “the horizontal.”

**Trijja** :- It is the original Sanskrit term for which Beruni has used المجرة whose English translation can be “vertical component” or briefly “the vertical.”

**Sheegrparadhi-anka** :- It is the original Sanskrit term for which Beruni has used برج المجرة whose English translation of which can be “circumference of conjunction” or more appropriately “index of circumference of epicycle of conjunction.” In fact, Beruni should have used برج المجرة because the term برج المجرة actually means sheegrparadhi,” which is quite different from “sheegrparadhi-anka” as will be explained later; but I have not changed the original term برج المجرة, because as a special case we can use this term both for sheegraparadhi and sheegrparadhi-anka as the case may be.

**Bhajakanka** :- It is the original Sanskrit term for which Beruni has used جزء المجلة whose English translation can be “dividing number.”

**Bhujaphala and Kotiphala** :- These are the original Sanskrit terms for which Beruni has used تدويل المجلة and تدويل المجلة respectively, the English translation of which can be “equation of horizontal component” and “equation of vertical component” or briefly “horizontal equation” and “vertical equation.”

**Sheeghr-karna** :- It is the original Sanskrit term for which Beruni has used قطر المجرة whose English translation of which can be “radius vector for the epicycle of conjunction” or briefly “radius vector of conjunction.”

(c) **Elaboration of the Principle**

The whole process has already been explained in a previous section in the commentary of article 9 of chapter II of this book and is in accordance with Surya-siddhanta (vide its chapter II, slokas 37, 38, 39, 40, 41, 42). In fact, the sheegrparadhi of a planet indicates the value of the angle subtended at the centre of the kaksha-vritta by the circumference of the sheegr-vritta. For example, according to Karana Tilaka, the actual values of the sheegrparadhis of Mars, Mercury, Jupiter, Venus and Saturn are respectively \(\frac{13}{20} \times 360 = 234°\), \(\frac{10}{27} \times 360 = 133°\) app., \(\frac{1}{5} \times 360 = 72°\), \(\frac{13}{18} \times 360 = 260°\), and \(\frac{1}{9} \times 360 = 40°\).

In all karana books the sheegrparadhis are considered as constant, but in all sidhantas these are variable and keep on contracting and expanding just like the manda-paridhis; according to surya-siddhanta, the sheegrparadhis of Mars, Mercury and Venus contract gradually from their maximum values to their minimum values as the sheegr-kendra increases from 0 to 90°, but the sheegr-paridhis of Jupiter and Saturn expand gradually, instead of contracting. In the following table the sheegrparadhis of planets according to various karana books are shown for the sake of comparative study. It will be seen the sheegrparadhi given in Karana Tilaka are in accordance with Surya-siddhanta, the slight differences being due to the fact that in a karana book much accuracy is not needed.
Example:— For Jupiter we have computed the mean place as 10S 16' 14" 34' which we deducted from the mean place of the sun (2S 2' 27" 31') which is also the sheegrha-chraka of Jupiter, getting the (first) sheegrha-kendra 3S 16' 12" 57' whose sheegrhaphala as previously obtained is 11' 29' 16" (and the first sheegrakharnaa is 69772"), half of it is 5' 44' 36"; which we added to the mean place, (because the first sheegrakhrendra is less than 6 signs) getting 10S 21' 59' 12" which is the (first) memento. From it we deducted the manda-chracha of Jupiter (171') getting the remainder 5S 0' 59' 12" which is the (first) manda-kendra whose mandaphala is 2' 27' 44"; half of it is 1' 13' 52" which we deducted from the (first) memento, (because the first manda-kendra is less than 6 signs) getting 10S 20' 45' 20". From it we deducted the manda-chracha, getting the (second) manda-kendra 4S 29' 45' 20" whose mandaphala is 2' 39' 34"; we deducted it (as a whole without making it half) from the mean place, (because the second manda-kendra is less than 6 signs) getting the second memento 10S 13' 41' 0" (which is the corrected mean place or briefly the "equated" place of Jupiter). We deducted it from the mean place of the sun getting the second sheegrha-kendra 3S 18' 46' 31" whose sheegrhaphala is 11' 27' 16" (and the second sheegrakharnaa is 68766") we added it to the second memento, (because the second sheegrakhrendra is less than 6 signs) getting 10S 25' 8' 16" which is the true place of Jupiter.

Commentary

(a) Correction of the Manuscript:
I have added a few phrases within brackets to make this article more intelligible. In the solved example I have written 

(b) Translation of the Technical Terms:

The translation of all technical terms has already been explained in the commentary of the previous articles. An additional term مدلل السري (MDLUL AL-SIRI) is given in this article by me within brackets, the English translation of which can be "the equated place of Jupiter"; the original Sanskrit term is "manda-sphasha"
ce of Jupiter or any other planet, which actually represents its heliocentric gitude. An important point to note here is that, if we use the more urate formula of Surya-siddhanta for finding out the mandaphala just like sheegraphala, we will have to find out the manda-karna just like sheegraphala-karna as explained in the commentary of article 9 of chapter II; such a case the order in which the various karnas are to be used to find out true places of the five planets will be: the first sheeghra-karna, then the t manda-karna, then the second manda-karna, and then the second sheeghra-karna. In other words, if we consider all these karnas as various triyajas, we temporarily call them respectively as first triyaja (جيب اربع الكهف), second jiyaya (جبه ابن الفيل), third triyaja (بيب ابن الكهف), and fourth triyaja (جيبي ابن كهف). reference of the term جيب ابن الفيل will be found in the commentary oficle 1 of chapter XI of this book.

Elaboration of the Principle:-
The whole process has already been explained in the commentary oficle 9 of chapter II, and is in accordance with Surya-siddhanta (vide its chapter II, slokas 43, 44, 45). The first two stages of using half-sheeghra- nadi and half manda-phala are meant only to eliminate small errors, and this process is known as "asakrita-karma" which means "approximation". More you repeat these two stages in the same order, the more accurate gets you get, but for practical purposes it is quite sufficient to go through se two stages only once, as is shown in the above-mentioned solved mple. After this asakrita-karma is completed, we go through the third ge which gives us the heliocentric longitude or the equated place of the net; finally we go through the fourth stage which gives us the geocentric gitude or the true place of the planet.

To find True Daily Motions of Planets:-
He said find out gati-mandaphala in the same way as you have found mandaphala, (i.e., deduct mandochcha-gati from the mean daily motion the planet, the remainder will be the manda-kendra-gati of the planet, onchcha-gati for the sun and the five planets practically 0°0′ and for moon it is 6′40″; mean daily motion for the sun is 59′8″, for the moon is 19°35′, for Mars it is 31′25″, for Mercury it is 59′8″, for Jupiter it is 59′, for Venus it is 59′8″, and for Saturn it is 2′0′. Then pay your enation to the last part of arc reached during the calculation of the sine of mandaphala of that planet; divide this complete part of arc by 10, n the quotient will be the sine; find out manda-phala of the planet ending to this sine and multiply this mandaphala by the mandakendra 3, then the product will be the gati-mandaphala of the planet. This manda-phala is in the first and the first quadrants, i.e., from beginning of Capricorn up to the end of Gemini; but it is plus in the ond and the third quadrants. The result will be manda-spashtha-gati hich, for the sun and the moon, is the true daily motion, but for the five nets, find out gati-sheegraphala also in the following way). Take the difference between the sheeghra-karna and the triyaja, and multiply it by the difference between the mean daily motion of the planet and its sheeghrachcha-gati; then divide this product by the sheeghra-karna, the quotient will be the gati-sheegrapha; if the sheeghra-karna is greater than the triyaja, this gati-sheegraphala to the manda-spashtha-gati, but if the triyaja is greater than the sheeghra-karna, deduct it from it; the result will be the true daily motion. (The sheeghrachcha-gati for Mars, Jupiter and Saturn is 59°8′, for Mercury it is 245°32′, and for Venus it is 96°8′). Always remember to use half of the two phalas in the first two stages, and then the whole of the two in the last two stages, just like in the process of finding the true places of the planets.

(In other words, first deduct the mean daily motion of the planet from its sheeghrachcha-gati, the remainder will be the first sheeghrakendra-gati; find out its gati-sheegraphala with the help of the first sheeghra-karna, and add or deduct half of this phala from the mean daily motion of the planet, the result will be the first moment of. Now deduct from it the mandochcha-gati of the planet, the remainder will be the first manda-kendra-gati; find out its gati-mandaphala, and add or deduct half of this phala from the first momento. From this result deduct the mandochcha-gati of the planet, the remainder will be the second mandakendra-gati; find out its gati-manda phala, and add or deduct the whole of this phala from the mean daily motion of the planet, the result will be the manda-spashtha-gati which is the second memento. Then deduct it from the sheeghrachcha-gati of the planet, the remainder will be the second sheeghrakendra-gati; find out its gati sheegraphala with the help of the second sheeghra-karna, and add or deduct the whole of this phala from the second memento, the result will be the true daily motion of the planet).

(Example-- For the sun, we deducted its mandochcha-gati 0′0′ from its mean daily motion 59′8″ getting the mandakendra-gati of the sun 59′8″; then we paid our attention to the last part of arc 33′38″ reached while finding out the sine of the mandakendra of the sun 11°14′12″; and divided this part of arc by 10, getting the sine 3′8″; its double is 6′16″ and one-third of this double is 2′15″, its one-fifth is 0′3″ which we deducted from 2′15″, getting mandaphala of the sun according to this sine 2′15″. We multiplied this mandaphala of the sun by the mandakendra-gati of the sun, getting the gati-manda-phala of the sun 2′10″; then we deducted this gati-manda-phala of the sun from the mean daily motion of the sun, because the mandakendra of the sun is in the fourth quadrant, getting the true daily motion of the sun 56°58″).

(For the moon, we deducted its mandochcha-gati 6′40″ from its mean daily motion 790′35′, getting the mandakendra-gati 783°55′; then we paid our attention to the last part of arc 33′38″ reached while finding out the sine of the mandakendra of the moon 6°12′32″44″, and divided this part of arc by 10, getting the sine 3′6″; half of its threefold is 5′3″ which is the mandaphala of the moon according to this sine. We multiplied this mandaphala of the moon by the mandakendra-gati of the moon, getting the gati-manda phala of the moon 63°59′; then we added this gati-mandaphala of the moon
to the mean daily motion of the moon, because the mandakendra of the moon is in the third quadrant, getting the true daily motion of the moon 856' 34", which is equal to 14' 16' 34"

(For Jupiter, we deducted its mean daily motion 4' 59" from its sheeghradachaga-gati 59' 8", getting the first sheeghrakendra-gati 54' 9'; then we found out the difference between the first sheeghrakarna 693772" and the trijya 720000", which is 26228"; we multiplied it by the first sheeghrakendra-gati and divided the product by the first sheeghraka-karna getting the first gati-sheeghraphala 2' 3"; we deducted half of it 1' 32" from the mean daily motion of Jupiter, because the first sheeghraka-karna is less than the trijya, getting the first memento 3' 57. Now we deducted from it the mandochcha-gati of Jupiter 0' 0" getting the first mandakendra-gati 3' 57"; then we paid our attention to the last part of arc 31' 40" reached while finding out the sine of the first mandognendra 580' 59' 12" and divided this part of arc by 10 getting the sine 3' 10"; the mandaphala of Jupiter according to this sine is 4' 50", which we multiplied by the first manda-kendra-gati, getting the first gati-mandaphala 0' 19"; we added half of it 0' 10" to the first memento, because the first mandakendra is in the second quadrant, getting 4' 7". From it we deducted the mandochcha-gati of Jupiter 0' 0" getting the second mandakendra-gati 4' 7"; then we paid our attention to the last part of arc 28' 30" reached while finding out the sine of the second mandakendra 4829' 45' 20" and divided this part of arc by 10 getting the sine 2' 50"; the mandaphala of Jupiter according to this sine is 4' 19" which we multiplied by the second mandakendra-gati getting the second gati-mandaphala 0' 18"; we added it as a whole without making it half to the mean daily motion of Jupiter, because the second manda-kendra is in the second quadrant, getting the manda-spashaa-gati 5' 17" which is the second memento. We deducted it from the sheeghradachaga-gati of Jupiter getting the second sheeghrakendra-gati 53' 51"; then we found out the difference between the second sheeghraka-karna 687369" and the trijya 720000" which is 32631"; we multiplied it by the second sheeghrakendra-gati and divided the product by the second sheeghraka-karna getting the second gati-sheeghraphala 2' 33"; we deducted it as a whole without making it half from the second memento, because the second sheeghraka-karna is less than the trijya, getting the true daily motion of Jupiter 2' 44"

**Commentary**

(a) Correction of the Manuscript:--

I have added a few phrases and sentences within brackets in order to make this article more intelligible. In fact, Beruni has given an extremely brief description of the actual method and has avoided even the solved examples, but I have added the necessary solved examples also.

(b) Translation of the Technical Terms:--

**Mandochcha-gati:**-- It is the original Sanskrit term for which Beruni has used "daily motion of apogee" which may be translated into English as "daily motion of apogee."
MANDAKENDRA-GATI:— This is the original Sanskrit term for which Beruni has used بَيْت الْحَمْسَة which may be translated into English as "daily motion of anomaly of apsis."

GATIMANDAPHALA:— It is the original Sanskrit term for which Beruni has used حَدِيد الْحَمْسَة the English translation of which is "equation of daily motion of anomaly of apsis."

MADASPASHITA-GATI:— This is the original Sanskrit term for which Beruni has used حَدِيد الْحَمْسَة the English translation of which is "daily motion equated for anomaly of apsis."

SHEEGHROCHHA-GATI:— This is the original Sanskrit term for which Beruni has used سِرَّة الْيَوْم بِلِيَة the English translation of which is "daily motion of apex of conjunction."

GATIS-SHEEHGRAPHALA:— This is the original Sanskrit term for which Beruni has used حَدِيد سِرَّة الْيَوْم بِلِيَة which may be translated into English as "equation of daily motion of anomaly of conjunction."

TRUE DAILY MOTION:— This is the English translation of the term بَيْت الْحَمْسَة for which the original Sanskrit term is "spashta-gatii" or "sphuta-bhukti."

(c) Elaboration of the Principle:—

This whole process can be diagrammatically explained on the similar lines as given in the commentary of article 9 of chapter II, and is in accordance with Surya-siddhanta (vide its chapter II, slokas 50, 51). In fact if we calculate the true place of a planet for a particular moment and then again we calculate its true place for a moment which is either 24 hours earlier or later than the previous moment, the difference between these two consecutive true places will be the true daily motion of that planet. This true daily motion can also be found out directly without calculating the true place of the planet for another moment. To elaborate the direct method the following diagram for one quadrant only is given, with exaggerated dimensions, in which the same letters are used as in the diagram of article 9 of chapter II, except that the present diagram represents sheeghra-sanskara, instead of manda-sanskara, so that now we should suppose the point X moving clockwise, instead of counter-clockwise. A few additional letters are also given to represent new points; for example, R is on EM produced so that ER = EM, and T is on EM so that XT is perpendicular to EM.

We have already seen that in the four stages of the computation of the true places and the true daily motions of the five planets, we use the sheeghra-sanskara in the first and the fourth stages. If we consider this diagram for the first stage, the point X represents the mean place of the planet at a particular moment; but if we consider the fourth stage, the point X represents the manda-spashta place of the planet. Suppose that X moves to X' within a period of one day, then simultaneously M will move to M' within the same period, so that the angle XEX' is equal to the angle
XM'; actually these angles are very small, but in the diagram these are own greatly enlarged. The position of M corresponds to N in the kaksha-itita as seen from the centre of the earth E, but the position of M' corresponds to N', so that the angle NEN' represents gati-sheeagapha, or difference of daily motions due to the epicycle of conjunction. Now, to id out the value of the angle NEN, which is equal to the arc NN' of kaksha-itita whose trijirya is equal to EN, we may suppose that, as RM is very small, the angles at R and M are right angles; similarly, as MM' is very small, the angles at M and M' are right angles: which means that the angles MT and M'M'R are equal, because both are complementary to the inter- ediate angle EMM'. Thus the two right-angled triangles MTX and M'M'R are similar triangles so that \( \frac{MX}{MM'} = \frac{MT}{M'R} \), but by hypothesis \( \frac{EX}{XX'} = \frac{XX'}{XX'} \), therefore by combining these two equations we get

\[
N = \frac{XX'}{EM'}, \quad \text{or} \quad \frac{EN}{N'T} = \frac{XX'}{XX'}, \quad \text{because } EX = EN.
\]

Again, by hypothesis \( \frac{EM'}{MT} = \frac{EM'}{MT} \), therefore by combining the last two equations we get \( \frac{NN'}{EM'} = \frac{XX'}{EM} \), where \( XX' \) represents the mean daily motion of the planet in the first stage of the computation of true daily motions of planets, but in the fourth stage it represents manda-spashita-gati; similarly \( EM' \) represents the first sheeghra-karna in the first stage, and the cond sheeghra-karna in the fourth stage; and \( MN + NT = (EM - EN) \), \( NT = (EM - EX) + NT = (sheeghra-karna-trijirya) + \text{versed sine of the sheegrapha XEN, because EX is taken as trijirya or sinuses totus.}

In the formula of Karana Tilaka as well as of Surya-siddhanta the versed sine of sheegrapha has been ignored considering it to be very small, but at times the value of the versed sine of sheegrapha is considerably high, if ignored, it causes an appreciable error in the final result. That is by Ranga-Natha, the famous commentator of Surya-siddhanta, has said at in sloka 50 of Surya-siddhanta the meaning of "trijirya" should be taken "kotijirya," i.e., cosine of sheegrapha; he has, however, not given any planation for assuming this "special" meaning of trijirya in this sloka; thus the formula according to this "special" meaning of trijirya is given below,

\[
NN' = XX' \cdot EM' - ET, \quad \text{because } MT = EM - ET. \quad \text{Diagram}
\]

But Beruni, in his solved example, has not accepted this "special" meaning trijirya, therefore I have also not given the above-mentioned formula in his article; the formula given in Karana Tilaka is

\[
NN' = XX' \cdot EM' - EX, \quad \text{EM'} - \text{NT is being small.}
\]

To show the difference in the final results obtained by these two formulas, I take the example of Mars; if we use the approximate formula of Karana

Tilaka, we get the true daily motion of Mars 23' 28" according to the values given in the previous solved examples; but if we use the more accurate formula suggested by Ranga-Natha, the true daily motion of Mars comes to 13' 54", which is considerably higher than the above-mentioned result. An important point to be always kept in mind is that if the value of the true daily motion of a planet comes to be "minus," then the planet is moving backward, or, in other words, its motion is retrograde; if the true daily motion comes to be "plus," then the planet is moving forward, or, in other words, its motion is direct; this will be explained further in the next article.

I have also calculated the true daily motions of Mercury, Venus and Saturn with the help of the formula of Karana Tilaka respectively as 11° 10', 71' 28" and 4° 27"; the readers may calculate these values independently and compare their results with these results; the true daily motions are generally expressed in min. and sec. only.

6. To Find Retrogression and Direction of Planets:

Pay your attention to the equated second sheeghra-kendra obtained in the fourth stage of the process of computation of the true places of the planets; if it is equal to the "first limit" of that planet, the planet is just beginning its retrograde motion; if it is less than that, the planet is direct; if it is more, the planet is retrograde. Similarly, if the second sheeghra-kendra is equal to the "second limit" of that planet, the planet is just beginning its direct motion; if it is less than that, the planet is retrograde; if it is more, the planet is direct. The limits for the planets are given in the following table (in degrees).

<table>
<thead>
<tr>
<th>Planet</th>
<th>Mars</th>
<th>Mercury</th>
<th>Jupiter</th>
<th>Venus</th>
<th>Saturn</th>
</tr>
</thead>
<tbody>
<tr>
<td>First limit</td>
<td>163</td>
<td>146</td>
<td>130</td>
<td>165</td>
<td>116</td>
</tr>
<tr>
<td>Second limit</td>
<td>197</td>
<td>214</td>
<td>230</td>
<td>210</td>
<td>244</td>
</tr>
</tbody>
</table>

(Example:- For Jupiter the second sheeghra-kendra, obtained in the fourth stage of the process of computation of the true places of planets, 108° 46' 31" is less than the first limit of Jupiter 130°, therefore the planet is direct.)

Commentary

(a) Correction of the Manuscript:

No correction is required in this article except that the solved example has been added by me within brackets for Jupiter.

(b) Translation of the Technical Terms:

Equated Second Sheeghra-kendra:- For this, Beruni has used the term خاصية الكلمة المشتركة the English translation of which is "equated second anomaly of conjunction"; the original Sanskrit term for it is "dwatiya manda-phala-sanskrit sheeghra-kendra." It is exactly the same as the term "second sheeghra-kendra" used in previous articles; the adjective "equated" (جمع) does not change the basic meaning of the term.
Retrograde — This is the English translation of the term جزء الرجوع used by Beruni; the original Sanskrit term is "vakrī." Direct — This is the English translation of the term جزء المذهب used by Beruni; the original Sanskrit term is "ma'argī."

Elaboration of the Principle:

With the help of a diagram, similar to that given in the commentary of article 9 of chapter II, it can be shown that, when the second sheethra-kendra of a planet is equal to 180°, the planet appears to be moving backward which is known as the retrograde motion; this retrograde motion starts when the second sheethra-kendra is a few degrees less than 90° and stops when the second sheethra-kendra is more than 180° by the same few degrees. For example, Jupiter starts its retrograde motion when second sheethra-kendra is 50° less than 180° and stops when the second sheethra-kendra is 50° more than 180°. Thus the limits of retrogression, according to Karana Tilaka for Mars, Mercury, Jupiter, Venus and Saturn are respectively, 17°, 34°, 50°, 15° and 64°; the same limits according to Suryasiddhanta are 16°, 36°, 50°, 17° and 65°, respectively (vide its chapter II, loka 53). The following mathematical formula has been derived with the help of Differential Calculus to find out the first or the second limit indicated by the planet in degrees,

\[
\theta = \cos^{-1}\left\{ -\frac{mx^2 + sy^2}{xy (m+s)} \right\},
\]

where m = mean daily motion of the planet in sec., s = sheethra-kch-sati of the planet in sec., x = kaksha-paridhi in deg. which is always equal to 360°, and y = sheethra-paridhi of the planet in deg. In this formula if we substitute the values of m, s, x and y, as given in Karana Tilaka, for each planet, we get the "first limits" for the five planets respectively 16°, 27°, 145°, 34°, 4°, 58°, 167°, 2°, and 133° 42′, using the modern tables of Trigonometrical functions; the "second limits" can be found out by deducting the "first limits" from 360° respectively as 196° 33′, 214° 26′, 235° 2′, 192° 58′, and 246° 18′.

Nodes of the Planets:

Mars 40°, Mercury 20°, Jupiter 80°, Venus 60°, Saturn 100°.

Commentary

(a) Correction of the Manuscript:

No correction is required in this article except that I have added a sentence within brackets to complete the actual process.

(b) Translation of the Technical Terms:

Equated Node — This is the English translation of the term جزء المذهب used by Beruni; the original Sanskrit term is "spashta pata."

(c) Elaboration of the Principle:

The method explained in this article is exactly in accordance with Surya-siddhanta (vide its chapter II, loka 56). If we add ayanansha to these equated nodes, we get their sayana values.

8. Equation of the Nodes of the Planet:

Take the second sheethra-kchala obtained in the last stage and pay your attention to it: if it was deducted in the process of computation of its true place of the planet, deduct it also from the node of the planet; and if it was added there, add it also to the node; this method is for the three superior planets only. For the two inferior planets, use the second mandaphala in the same way as you have used the second sheethra-kchala; (but if it was deducted in the process of computation of its true place of the planet, add it to the node of the planet; and if it was added there, deduct it from the node).

Example: — For Jupiter, the second sheethra-kchala is 11° 27′ 16″ and we had added it in the process of computation of its true place, therefore we added it to its node also getting 91° 27′ 16″ which is the equated node of the planet Jupiter.

9. To Find the Latitude of the Planet:

Deduct the equated node of the planet from its true place in the case of the three superior planets, but in the case of the two inferior planets deduct it from their sheethra-kuchlas which represent the mean values, the remainder in each case will be the anomaly of latitude; find out its sine and multiply it by the minutes of the mean latitude of the planet, which for Mars is 80°, for Jupiter it is 60°, and for each of the remaining planets it is 120°. Divide the product by the (second) sheethra-karna obtained in the process of finding out the second sheethra-kchala, the quotient will be the latitude of the
planet; it will be in the north if the anomaly of latitude is less than 6 signs, and it will be in the south if the anomaly of latitude is more than 6 signs.

Example:—For Jupiter, we deduced its equated node from its true place getting the anomaly of latitude $7^\circ S 23^\prime 41^\prime 0^\prime$ whose sine is $160^\circ 33^\prime 28^\prime$; we multiplied it by $60^\prime$, which is the mean latitude, getting $3460.460^\prime$; we divided it by the (second) sheekha-karna $687369^\prime$ getting the quotient $50^\prime 27^\prime$ which is the latitude of Jupiter in the south, because the anomaly of latitude is more than 6 signs.

Commentary

(a) Correction of the Manuscript:—

In the solved example the following corrections have been made by me.

Original Corrected


(b) Translation of the Technical Terms:—

Anomaly of Latitude:—This is the English translation of the term used by Beruni; the original Sanskrit term is "vikshepa-kendra."

Minutes of the Mean Latitude:—This is the English translation of the term used by Beruni; the original Sanskrit term is "ma-lhya-vickeha-liptika."

(c) Elaboration of the Principle:—

The latitude of a planet is the angular distance between that planet and the ecliptic, whether towards the north or towards the south. The principle described in this article is exactly in accordance with Surya-siddhanta (vide its chapter I, sloka 70; and chapter II, sloka 57).

10. To Find the Latitude of the Moon:—

Deduct Rahu from the true place of the moon; the remainder will be the anomaly of the latitude; find out its sine, multiply it by 27 and divide the product by 20; the quotient will be the latitude of the moon in the direction depending on the anomaly of latitude as already explained in the case of the planets.

Example:—The anomaly of latitude, as found out from the true places of Rahu and the moon, is $4^\circ S 26^\prime 59^\prime 44^\prime$ whose sine is $108^\circ 33^\prime 46^\prime$; we multiplied it by $27$ and divided the product by $20$ getting $2^\circ 26^\prime 34^\prime$ which is the latitude of the moon in the north, because the anomaly of latitude is less than 6 signs.

Commentary

(a) Correction of the Manuscript:—

In the solved example the following corrections have been made by me.

(b) Translation of the Technical Terms:—

No new terms have been translated.

(c) Elaboration of the Principle:—

The principle is the same as already explained in the previous article except that instead of the "mean latitude" we use here the "maximum latitude" or "parama-vickeha-liptika," which for the moon is equal to $\frac{27 \times 200}{20}$ min. or 270 min.; this value exactly tallies with that given in Surya-siddhanta (vide its chapter II, sloka 68) In this case if the place of the moon is Sayana, the place of Rahu should also be Sayana; if one is Nirayana, the other should also be Nirayana.

11. To Find the True Declination of the Moon:—

The following are the "parts of declination": from these calculate the declination according to the degrees of the moon and find out its direction. Now, if the latitude of the moon is also in the same direction, add both of them, but if these two are in the opposite directions, deduct the smaller of them from the bigger; the result will be the true declination of the moon. The following is the table of the parts of the minutes of declination.

<table>
<thead>
<tr>
<th>Parts</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes of Declination</td>
<td>242</td>
<td>236</td>
<td>225</td>
<td>204</td>
<td>180</td>
<td>150</td>
<td>110</td>
<td>69</td>
<td>24</td>
</tr>
</tbody>
</table>

Example:—The true place of the moon is $1^\circ S 3^\prime 51^\prime 52^\prime$; according to its degrees the declination is $13^\prime 1^\prime 50^\prime$ in the north, because it is in Taurus which is the northern sign. Its latitude as already obtained is in the north, therefore we added it to the declination of the degrees getting $15^\prime 28^\prime 24^\prime$ which is the true declination of the moon in the direction of the bigger, that is, in the north.

Commentary

(a) Correction of the Manuscript:—

In the manuscript the table of declination is given after the solved example, but I have shifted it to the place before the solved example. Moreover, a few figures of the table are overwritten in the manuscript which shows the carelessness of the Arabic scribe; in view of it I have taken the liberty to change three figures and have written 236 instead of 234, 69 instead of 67, and 24 instead of 27. In the original table the sum of all the parts of declination comes to $1439^\prime$ which is wrong, but now in the corrected table the sum comes to $1440^\prime$ or $24^\prime$ which is the maximum declination of the
elliptic and is in accordance with Surya-siddhanta (vide its chapter II, sloka 8). Further justification of the corrections made by me can be given from the figures of the solved examples of chapter VI; for example, in articles 1 and 3 of chapter VI Beruni has calculated the declination for 90° as 11° 43′ which is only possible if we use the corrected table. In the solved example he following corrections have been made by me:-

Original Corrected Original Corrected

Translation of the Technical Terms:-

b) TRUE DECLINATION:— This is the English translation of the term ميل المدار used by Beruni; the original Sanskrit term is "spashta-kranti."

c) Elaboration of the Principle:-

The above-mentioned table is actually meant to find out the true declination of the sun, because the sun moves exactly on the ecliptic; but or the remaining planets including the moon the ecliptic is only the mean path, because they move sometimes to the north of it and sometimes to the south of it. Therefore for these planets, including the moon, we must first find out their mean declinations from the table and then after adding or deducting their latitudes to or from their mean declinations we get their true declinations. It is very important to note that, to find out the declination from the table, we must use the "sayana" place of the planet, and not the true place; but in Karana Tilaka the true place of the planet is used, because in this book the "ayananaha" has been ignored, as already explained in the commentary of section 9 of chapter I.

The formula to find out the declination δ is given below:

\[ R \sin \delta = \frac{R \sin \chi \times R \sin \omega}{R} \]

where \( R \) is trijyja, \( \chi \) is the bhuta of the planet, and \( \omega \) is the maximum declination of the ecliptic which is always supposed to be 24°. If we use the modern table of sines and take \( \chi \) equal to 10°, 20°, ... 90°, we get the following table of declinations, which may be compared with that given in the text of this article.

<table>
<thead>
<tr>
<th>Parts</th>
<th>Minutes of declination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>243</td>
</tr>
<tr>
<td>2</td>
<td>337</td>
</tr>
<tr>
<td>3</td>
<td>224</td>
</tr>
<tr>
<td>4</td>
<td>205</td>
</tr>
<tr>
<td>5</td>
<td>180</td>
</tr>
<tr>
<td>6</td>
<td>149</td>
</tr>
<tr>
<td>7</td>
<td>110</td>
</tr>
<tr>
<td>8</td>
<td>69</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
</tr>
</tbody>
</table>

CHAPTER VI

"Relating to the three Problems"

1. To find the duration of a day:—

Find out the sine of the degrees of declination of the sun, multiply it by itself, deduct the product from the square of the trijyja, and take the square-root of the remainder; the result will be the "diurnal radius." Then multiply the palabha by the sine of the declination of the sun and again by the trijyja; divide this product by the product of the diurnal radius and 12, the quotient will be the sine; find out its arc in minutes of angular measure and divide it by 360, the quotient will be the ghati of Chara in the direction of the declination. Now put 15 at two places; deduct these ghatis from one of them, and add these to the other. If the sun is in the north, the bigger value will be the half-day and the smaller value will be the half-night; make these values double to get the full durations. If the sun is in the south, the order of these two will be reversed.

Example:— For the sign of Aries whose declination is 11° 43′, the sine of declination is 40° 28′ 25'"; the square root of the difference between its square and the square of trijyja is 195° 51′ 43" which is the diurnal radius. Then we multiplied the palabha, which we have supposed to be 71 angulas, by the sine of the declination of Aries, and again by the trijyja, getting the product 218557000", we divided it by the product of the diurnal radius and 12, i.e., 8451236", getting the quotient 25° 49′ 50" which is the sine and the minutes of its arc are 49° 38′; we divided it by 360 getting the quotient 1 ghati 14 palas 26 vipalas which is the chara in ghatis. Now we put down 15 at two places; we added this chara to one of them getting 16 ghatis, 14 palas, 26 vipalas which is the half-day; because the declination of Aries is in the north, then we deducted the chara from the other place getting 13 ghatis, 45 palas, 34 vipalas which is the half-night; we doubled these two, getting the total duration of the day 32 ghatis 28 palas 52 vipalas and the total duration of the night 27 ghatis 31 palas 8 vipalas.

Commentary

(a) Correction of the Manuscript:—

In the original text, "طيل الاستوا" is written instead of "طيل الاستواء," obviously this mistake is due to the slip of pen of the Arabic scribe, but he, however, has written the correct term in the solved example. The following corrections have been made by me in the figures of the solved example:

Original Corrected Original Corrected

... 219957000, 219957000...

(b) Translation of the Technical Terms:—

DIURNAL RADIUS:— It is the English translation of the term تفصيل الظهار used by Beruni; the original Sanskrit term is "dina-vyasardha" or "ahorartadha-karma." It actually means the "radius of the diurnal circle" and is equal to cosine of declination.
HALF-DAY AND HALF-NIGHT:— It is the English translation of the terms 
and “ratardha.” The full durations of a day and a 
ght are called “dnamana” and “ratirama,” respectively, the duration 
between one sunrise and the midnight is known as “mishramana,” and the 
ration between one sunset and the next sunrise is known as “ahorama-
ana,” which is always taken as 60 gathis.

Elaboration of the Principle:—
In this chapter the three problems, i.e., time, place and direction, are 
salt with.

The principle to find out the exact durations of day and night is the same 
described in Surya-siddhanta (vide its chapter II, slokas 60 to 63). An 
approximate formula for the same has already been given in article 1 of chap-
III of this book, and in its commentary the following general formula is 
so given, R sine chara = \( \frac{12}{6} \times \) palabha, or R sine chara = \( \frac{12 xn}{6} \times \) R sine \( \frac{12}{6} \) \( \times \) palabha, but R cosine \( \frac{12}{6} \) is the diurnal radius, therefore we have R sine 
ara = \( \frac{12 xn}{6} \times \) R sine \( \frac{12}{6} \times \) palabha. This is the same formula as given in the 
xt of this article. In this formula “R” is trijya and “s” is declination of 
the Sun. In modern Astronomy we have,

Sine ascensional difference = tan \( \frac{s}{6} \times \) tan—latitude of place.

To find the Meridian—Line:—
Make a horizontal plane on the ground, draw on it a circle, and install 
gegnom at its centre; observe its shadow till it enters the circle, and put 
ion indication on the point of its entry in it; then again observe it till it comes 
it the circle, and put an indication on the point of its exit from it. Now, 
ith each of the two indications as centre draw two circles intersecting each 
er and leaving between them a fish-like space; from its head and tail find 
it the directions of the north and the south.

Commentary

Correction of the Manuscript:—
I have written \( \frac{12}{6} \) instead of \( \frac{12}{6} \); and \( \frac{12}{6} \) instead of \( \frac{12}{6} \); these errors may be due to the slip of pen of the Arabic scribe; 
eruni has written correct terms in his book (vide its Hyd. Ed. 
ge 107, lines 2 & 3).

Translation of the Technical Terms:—
Gnomon:— This is the English translation of the term 
used by 
eruni; the original Sanskrit term is “shanku.”

Fish-like space:— This is the English translation of the term 
ted by 
eruni; the original Sanskrit term is “timi,” “matsya” or “meena.”

Elaboration of the Principle:—
The method described here is exactly in accordance with Surya-siddhanta 
vie its chapter III, slokas 14 & 15; this formula can be proved easily with the help of 
pherical Trigonometry. Small errors of calculation are due to the fact 
that the table of sines used is not very accurate, because the intermediate 
values are calculated with the help of simple proportion which is an 
approximate method.
To find out the latitude of the place from the Palabha:

Put trijya at two places; multiply the first of the two by 12, and the result of the two by the palabha; divide each of these two results by the potenuse of the palabha, then the quotient in the first case will be the sine of the perpendicular which is the co-latitude of the place, and in the second case the quotient will be the sine of the latitude of the place; find out the cos of each of these two.

Example: We have given the palabha 7 angulas 30 viangulas, and we intend to find out the latitude of the place. We multiplied this palabha by itself and added to it 144 getting 200 angulas 15 viangulas whose square root is 14 angulas 9 viangulas 3 pratviangulas. This is the hypotenuse of the palabha. Now we put trijya at two places and multiplied the first of the two by 12 getting 2400 which is always the same and then we multiplied the last one by the palabha getting 1500. We divided each of these two results by the hypotenuse of the palabha getting the quotients in the first case 49' 16' 50" whose arc is 58° 11' 24", which is the co-latitude of the place, and in the second case the quotient is 3° 15' 10" whose arc is 32° 7' 20" which is the latitude of the place and its complement is 57° 53' 40''.

Commentary

(a) Correction of the Manuscript:

In the solved example the following corrections have been made by me:

Original | Corrected | Original | Corrected | Original | Corrected
-----|-----------|-----|-----------|-----|-----------
کب ایا | کب ایا | زنج کبد | زنج کبد | اموها | اموها
ب بملا ترو | بملا ترو | ج زوح | ج زوح | ج یو | ج یو

(b) Translation of Technical Terms:

No new terms have been translated.

(c) Elaboration of the Principle:

The method is exactly in accordance with Surya-siddhanta (vide its chapter III, sloka 16); it is just the reverse of the formula already mentioned in the previous article.

6. To find the co-altitude of the sun at noon:

If the declination of the sun is northern, deduct it from the latitude of the place, if it is southern, add it to the latitude of the place; whatever is obtained is the (co-) altitude of noon. When the declination is equal to the latitude of the place, the shadow of noon disappears; when the latitude of the place exceeds the declination, the co-altitude of noon is in the south from the zenith and the shadow is towards the north; if we get the declination greater than the latitude of the place, the co-altitude of noon is in the north (from) the zenith and the shadow changes its direction towards the south.

Example: We have given the northern declination of the sun 11° 45' and the latitude of the place 32° 6' 20". We deduced this declination of the sun from the latitude of the place getting 20° 23' 20" which is the co-altitude of noon in the south from the zenith, and the shadow is towards the north, because the latitude exceeds the declination.

Commentary

(a) Correction of the Manuscript:

I have added a few words and also the solved example within brackets.

(b) Translation of the Technical Terms:

Co-altitude: This is the English translation of the term کب ایا used by Beruni; the original Sanskrit term is "natansha."
(c) Elaboration of the Principle:

The method described here and in previous articles is only meant for the northern hemisphere of earth and is exactly in accordance with Surya-sidhanta (vide its chapter III, sloka 20); its truth can easily be proved with the help of Spherical Trigonometry.

7. To find the Antya:

Find out the sine of the chara; if this chara is northern, add its sine to the trijya, and if it is southern, deduct it from it; the result will be the antya.

Example: The chara for the first point of Taurus is 1 ghati 14 palas 26 vipalas; we added its double to 30 ghatis getting 32 ghatis 28 palas 52 vipalas which is the duration of the day, but it is in ghatis, etc. Now, we multiplied the chara by 6 getting 7'26'36" which is in degrees, etc., and whose sine is 25°49'42". As the chara is northern, we added its sine to the trijya getting 225°49'42" which is the antya.

Commentary

(a) Correction of the Manuscript:

In the solved example the following corrections have been made by me:

<table>
<thead>
<tr>
<th>Original</th>
<th>Corrected</th>
<th>Original</th>
<th>Corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>225°49'42&quot;</td>
<td>225°49'42&quot;</td>
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<td>20°50'30&quot;</td>
</tr>
<tr>
<td>14°50'50&quot;</td>
<td>14°50'50&quot;</td>
<td>1°50'20&quot;</td>
<td>1°50'20&quot;</td>
</tr>
</tbody>
</table>

(b) Translation of the Technical Terms:

Antya: This is the original Sanskrit term for which Beruni has used the term جبر مكرس; its English translation can be "versed-sine of half the day."

(c) Elaboration of the Principle:

The method described here is exactly in accordance with Surya-sidhanta (vide its chapter III, sloka 34); its truth can be proved easily with the help of Spherical Trigonometry.

8. To find the past period of the day from the shadow at a given time:

Multiply the antya by the hypotenuse of the shadow of noon and divide the product by the hypotenuse of the shadow at the given moment; deduct the quotient from the antya, then the remainder will be the versed-sine; find out its versed-arc from the last parts of arc to the first part, and divide the minutes of this arc by 360, the quotient will be ghatis. We add these to the half-day if the sun is towards the West, and deduct these from it if the sun is towards the East; thus we obtain the past ghatis of the day.

Example: The antya is 225°49'42" and the hypotenuse of the noon-shadow is 12 angulas 48 viangulas 58 prativistangulas. At a given moment in the forenoon we have found the shadow equal to 30 angulas, its hypotenuse being 32 angulas 18 viangulas 40 prativistangulas; we multiplied the antya by the hypotenuse of the noon-shadow getting 37509365316°, divided it by the hypotenuse of the shadow at the given moment getting 89°34'37", deducted it from the antya getting 136°15'15" and found out its versed-arc from the last parts of arc to the first part getting 71°21'50"; we divided it by 6 getting 11 ghatis 53 palas 38 vipalas which is the remainder upto the midday, because the given moment is before it. Then we deducted it from the half-day, i.e. 16 ghatis 14 palas 26 vipalas, getting 4 ghatis 20 palas 48 vipalas which is the past period of the day in ghatis etc.; the reverse of it is (the future duration of the day).

Commentary

(a) Correction of the Manuscript:

In the solved example the following corrections have been made by me:

<table>
<thead>
<tr>
<th>Original</th>
<th>Corrected</th>
<th>Original</th>
<th>Corrected</th>
</tr>
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<tbody>
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<td>20°50'30&quot;</td>
<td>20°50'30&quot;</td>
</tr>
<tr>
<td>14°50'50&quot;</td>
<td>14°50'50&quot;</td>
<td>1°50'20&quot;</td>
<td>1°50'20&quot;</td>
</tr>
</tbody>
</table>

(b) Translation of the Technical Terms:

versed-sine: It is the English translation of the term جبر مكرس used by Beruni; the original sanskrit term is "utkramajyai. Similarly I have used the word versed-arc for the term متوازٍ مكرسا. These two terms can also be translated as "versed-sine" and "versed-arc," respectively.

(c) Elaboration of the Principle:

Although the principle of this article is based on Surya-sidhanta (vide its chapter III slokas 36 to 38), yet the actual procedure described here is exactly in accordance with Brahmasphuta-siddhanta (vide its chapter III slokas 44, 45) and the same two slokas have been repeated in Khanda-khadyaka also (vide its chapter III slokas 15, 16).

9. To find the length of shadow at the given moment from the past period of the day:

Find out the antya; then multiply the difference between the given moment and the midday by 6, the product will be degrees etc.; find out its versed-arc and deduct it from the antya, the remainder will be bhajakanka; divide by it the product of the antya and the hypotenuse of the noon-shadow, the quotient will be the hypotenuse of the shadow at the given moment; multiply it by itself and from the product deduct the square of the gnomon and take the square root of the remainder, the result will be the length of shadow at the given moment.

Again, if it is desired, deduct the northern chara from the past period of the day in the forenoon, and from the remaining period of the day in the
ternoon; or add the southern chara to both of these. Find out the sine of it, then after converting it from ghatis to degrees, and add to it the sine of the northern chara, or deduct from it the sine of the southern chara; vide (by it) whatever is obtained as the product of the anya and the hypotenuse of the noon-shadow, the quotient will be the hypotenuse of the adow at the given moment (and from it find out the length of the shadow).

Example: The remaining period up to midday in degrees is 7.11.21'50" and its versed sine is 136°15'15"; the difference between it and the anya 225°42" is 89°34'21"; by it we divided 37509365316" which is the product of the anya and hypotenuse of the noon-shadow, getting the quotient 32 angulars 18 viangulas 40 prativiangulars; we multiplied it by itself getting 135303-400", and from it we deducted 144 angulars (i.e. 186624000") getting the same of the remainder 30 angulars which is the length of the shadow at the given moment.

Again, we deducted the northern chara 1 ghati 14 palas 26 vipalas from the past period of the day (which is 4 ghatis 20 palas 48 vipalas) getting 3 atis 6 palas 22 vipalas which we multiplied by 6 getting 18°38'12"; its sine 69°44'53" to which we added the sine of chara (which is 25°49'42") getting 34°33"; by it we divided 37509365316" getting 32 angulars 18 viangulas prativiangulars which is the hypotenuse of the shadow and from which the length of the shadow is found 29 angulars 59 viangulas 57 prativiangulars.

Commentary

1) Correction of the Manuscript :

In the Arabic manuscript the above-mentioned two alternate methods are given separately one after the other along with their respective solved examples, but I have combined these two methods at one place, and their solved examples have also been combined at another place; I have also added a few phrases within brackets. In the solved examples the following corrections have been made by me:

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2) Translation of the Technical Terms:

Bhajakanka: It is the original Sanskrit term for which Beruni has used \( ज़रातः स् \); its English translation can be "the divisor."

Elaboration of the principle:

Although the principle is based on Surya-siddhanta (vide its chapter III \( वहा 35 \)), yet the actual procedure described here is exactly in accordance with Khandakhadyaka (vide its chapter III slokas 13,14). The truth of this article and the previous article can be proved easily by the help of spherical Trigonometry. The small error in the result of the second solved example is due to the fact that the table of sines used here is not meant to give very accurate values of sines, as already explained in the commentary of the articles 3 and 4 of this chapter.

10. To find the Lagna-Manas at any place:--

The following are the lagna-manas in palas at Lanka which is the dome of earth at the equator. If you want these for your own locality, take from the previously mentioned parts the chara of the signs, which is the difference of the lagna-manas; for Aries take it from the lagna-mana at the equator, the remainder will be the lagna-mana for Aries as well as Pisces; then add it to the same, the sum will be the lagna-mana for Virgo as well as Libra. Now, take for Taurus the difference of the lagna-manas and deduct it from the lagna-mana at the equator, the remainder will be the lagna-mana for Taurus as well as Aquarius; then add it to the same, the sum will be the lagna-mana for Leo as well as Scorpio. Adopt the same procedure for Gemini so that by deducting you get the lagna-mana for Gemini as well as Capricorn, and by adding you get the lagna-mana for Cancer as well as Sagittarius. The following is the table of the lagna-manas at Lanka:

---

Commentary

(a) Correction of the Manuscript:

In the Arabic manuscript the above-mentioned two tables are given jointly just before the solved example, but I have shifted one table and have written it at the end of the solved example; the first table is a part of the text, and the second table is a part of the solved example.

(b) Translation of the Technical Terms:

Lagna-Mana: This is the original Sanskrit term for which Beruni has used the term \( ज़रातः स् \); its English translation can be "duration of ascendant" or "duration of rising of sign of zodiac." Only the northern hemisphere is dealt with in this article.
Elaboration of the Principle:-

Although the principle is based on Surya-siddhanta (vide its chapter III slokas 41 to 44), yet the procedure described here is exactly in accordance with Khanda-khadyaka (vide its chapter III sloka 4). The truth of this method can be proved easily by the help of spherical Trigonometry as given below:

The formula for chara has already been explained in the commentary of ticle 1, chapter VI and an approximate formula has also been given in ticle 1 of chapter III which can be used only for lower latitudes ranging om \(0^\circ\) to \(40^\circ\). The formula to find out the lagna-mana at Lanka, which is actually the right ascensional difference expressed in palas, is given below,

\[
R \sin M = \frac{R \sin \chi \times R \cos \omega}{R \cos \delta},
\]

where \(R\) is the ascension of the lagna, \(\chi\) is the longitude of the lagna, \(\omega\) is the maximum declination of the ecliptic which is always equal to \(24^\circ\), and \(\delta\) is the declination of the lagna. Now, taking \(\chi\) equal to \(0^\circ, 30^\circ, 60^\circ, 90^\circ\), and \(120^\circ\), and using the table given in the commentary of ticle 11, chapter V, we can find the declinations \(\delta_1, \delta_2, \delta_3, \text{and } \delta_4\), as \(0^\circ, 70^\circ, 2,38^\circ, \text{and } 144^\circ\), respectively. Substituting these values in the above-mentioned formula and using the modern mathematical tables, we get \(M_1, M_2, M_3, \\text{and } M_4\) equal to \(0^\circ, 27^\circ 49^\prime, 57^\circ 43^\prime\), and \(90^\circ\) respectively, so that we have \(M_1 - M_2 = 27^\circ 49^\prime, M_2 - M_3 = 29^\circ 54^\prime, \text{and } M_3 - M_4 = 32^\circ 17^\prime\). When we convert these values in minutes, we get 1669, 1794, and 1937; and after dividing these minutes by 6 we get the values in palas as 278 palas, 299 palas, and 323 alas, respectively, which are the lagna-manas at Lanka as given in this article. All the values used here are “Sayana” and NOT “Nirayana”; the insignificance of “ayanansha” has already been explained in article 9 of chapter I.

1. To Find the Lagna from the Past Period of the Day:-

Find out the true place of the Sun for the given moment and convert the remaining portion of its sign into its lagna-mana at the place; deduct it from the past period of the day and then deduct the lagna-mana of the sign next to the sign of Sun. In this way go on deducting one by one till it becomes impossible to deduct the full lagna-mana of the next sign; at that stage convert the remaining value into the degrees of the angular measure of the sign up to which you had reached; then the same will be the lagna and its degree.

Example:- The past period of the day in ghatis is 4 ghatis 20 palas 48 vipalas or in palas it is 269 palas 48 vipalas; the Sun is at 20 degrees of Aries we converted the remaining portion into its local lagna-mana so that we multiplied it by the full lagna-mana getting 2030 palas and then divided it by 30 getting 67 palas 40 vipalas which is the lagna-mana of the remaining 0 degrees of the sign Aries. We deducted it from the past portion of the day and from the remainder we intended to deduct the lagna-mana of Taurus, but its full lagna-mana could not be deducted from the remaining 193 palas.

Commentary

(a) Correction of the Manuscript:-

Original Corrected Original Corrected

के ये लगा के दे लगा

दे लगा के दे लगा

(b) Translation of Technical Terms:-

Lagna:- This is the original Sanskrit term for which Beruni has used the term “Laguna”; its English translation can be “ascendant.” It indicates that point of the ecliptic which is touching the eastern horizon at a particular moment in Indian Astrology Nirayana lagna is generally used; first of all the Sayana lagna is calculated and then the ayanansha is deduced from it to get the Nirayana lagna.

(c) Elaboration of the Principle:-

The method described here is exactly in accordance with Surya-siddhanta (vide its chapter III slokas 45 to 47). Actually in this case the Sayana place of the Sun should be used which is obtained by adding the ayanansha to the true place of the Sun, as already explained in the commentary of the article 9 of chapter I. By using the Sayana place of the Sun, the value of Sayana Lagna is obtained; but for astrological purposes we require the Nirayana Lagna or Spashta Lagna which is obtained by deducting the ayanansha from its Sayana value. In any case, we should start with the Sayana place of the Sun and Not with its true place, and after getting the Sayana Lagna we may deduct the ayanansha from it to get the Nirayana Lagna. It will be seen that for the latitudes higher than 66°, many signs, either partly or wholly, never come above the horizon; in very high latitudes a few signs appear moving sometimes forward and sometimes backward with respect to the horizon; in all such cases we should use additional special formulas to find out the correct lagna; such methods have not been described in this article.

I2. To Find the Past Period of the Day from the Lagna:-

Convert the degrees of the given lagna into the local lagna-mana; also convert the remaining portion of the sign of the sun into the local lagna-mana. Add these two, and to the sum add the lagna-manas of the signs which are between these two. The sum will be the past period of the day up to the moment of that lagna.

Example:- Suppose that the lagna is Gemini 24° 14′ 34″ and the sun is at 3rd of Aries, the remainder being one-third. We converted the remaining
degrees of angular measure of the sun in Aries, getting 67 palas 40 vipalas; also converted the degrees of the lagna into lagna-mana, getting 239 palas vipalas. We added these two, getting 307 palas 28 vipalas; to it we added lagna-mana of Taurus which is between these two signs, getting 9 ghatis 28 vipalas' which is the past period of the day.

**Commentary**

*Correction of the Manuscript:*

In the solved example the following corrections have been made by mementa:

<table>
<thead>
<tr>
<th>Corrected</th>
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<th>Corrected</th>
</tr>
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<tbody>
<tr>
<td>كبد له</td>
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<td>۰۷۰۷</td>
</tr>
<tr>
<td>طوم</td>
<td>۰۷۰۷</td>
<td>۰۷۰۷</td>
</tr>
</tbody>
</table>

Translation of the Technical Terms:

No new term has been translated.

**Elaboration of the Principle:**

The method described here is exactly in accordance with Surya-siddhanta (its chapter III sloka 49). In this case the values both for the sun and lagna should be "Sayana" and NOT "Nirayana"; if the given values Nirayana, these should be made "Sayana" by adding the ayanamsa values in the above-mentioned formula. The significance yanamsha has been described in article 9, chapter 1.

In the solved example Beruni has supposed the given lagna as Gemini 14° 34'; although in the previous article he had calculated the lagna as 21° 14° 34'; this difference of one sign has been intentionally introduced in order to give an example of the intervening signs also. If we take lagna as Taurus 24° 14° 34', there is no intervening sign between the lagna and the sun, so that we get the past period of the day as 260 palas 48 vipalas 4 ghatis 20 palas 48 vipalas. The past duration of the day is always toned from sunrise, and is generally expressed in ghatis palas vipalas; the final Sanskrit term for it is "Ishta-kāla."
والذين لم تعطيهما شيئاً وإن كانت أكثر فرصةً على المخلص الحقيقي، وأقنعهم من سرعة الكوكب.

في الحالة الثانية واستمرت عديدة من الموت الفريد من هذه الحالة. ثم نجحوا في إصدار الكوكب واستمرت عديدة من الموت الفريد من هذه الحالة.

ذلك لا يعني أن الكوكب لم يقع في أي حالة. في حالة اسمها، ثم تم تجاوزها، وتم تجاوزها.

(ب) معركة استخراج: تتم تجاوز الكوكب الحالة.

أما في الحالة الأخيرة، فقد صدر الكوكب من مسرة الشمس، وأما في الحالة الأخيرة، فقد صدر الكوكب من مسرة الشمس. هذا المعركة لاستخراج النوع الأول من الوضع الأول. لا تتم تجاوز الكوكب في حالة الفريد من هذه الحالة يمكن أن يكون الكوكب من مسرة الشمس. وفي حالة الفريد من هذه الحالة.

(ج) معركة الوضع الأول:

فإن كانت الكوكب في وضع ثلاثية، ثم يتم تجاوز الكوكب في حالة الفريد من هذه الحالة. ثم يتم تجاوز الكوكب في حالة الفريد من هذه الحالة.
وأضرم هذا التدجيل في وقت حصة الكوكب فيمنع تدجيل بيت حصة الكوكب (ولكن تقضاء التدجيل في الربع الأول والربع الثاني من الوقت إلى آخر الجملة، والرد öd في الربع الثاني وثالث يشير إلى وقت حصة الكوكب) وهو يمتزج في قشرة سطحية. وهو يمتزج في قشرة سطحية.

وذلك عندم القداميل الحصة القمرية من هذا الباب، وضمن هذا التدجيل الدقيق في وقت الحصة القمرية فاجتمع التدجيل الحصة القمرية في نقطة قمرية ودزا هذا التدجيل الدقيق القداميل الحصة القمرية عن مضمنا.

القمر 797 ينمو نظرا إلى أنقرة الأخرين يجب أن يكون على استعداد جذب الحصة القمرية.

(القمر ينمو نظرا إلى أنقرة الأخرين يجب أن يكون على استعداد جذب الحصة القمرية).

(القمر ينمو نظرا إلى أنقرة الأخرين يجب أن يكون على استعداد جذب الحصة القمرية)

(التقرير والقرن وفي وقت المشتري يوم بليرة تميز نم من سparseIntة الشتاء.

(التقرير والقرن وفي وقت المشتري يوم بليرة تميز نم من سparseIntة الشتاء.

(التقرير والقرن وفي وقت المشتري يوم بليرة تميز نم من سparseIntة الشتاء.)
 muestra Juz' al-Kur'ah con la extrema precisión, por ejemplo, en la sección 42 (1) mencionada. Se ha propuesto que esta sección es una de las secciones más complejas y difíciles de la Quran, debido a la gran cantidad de detalles que se proporcionan en ella. Ignoro cómo se puede aplicar estas interpretaciones a otras secciones del Quran. Sin embargo, resulta notable que muchos de los detalles que se proporcionan en esta sección son utilizados en otras partes del Quran para proporcionar una visión más completa del mundo divino. En este sentido, esta sección puede ser vista como una parte integral de la Quran, que nos permite entender mejor el propósito del Quran en su conjunto.

Other annotations: 1. In order to understand the Quran, it is necessary to have a good knowledge of the Arabic language. 2. The Quran contains many references to heavenly bodies, such as the sun and the moon. 3. According to some scholars, the Quran was compiled by the Prophet Muhammad during his lifetime. 4. The Quran was written in the 7th century AD and is considered by Muslims to be the ultimate authority in matters of faith and practice. 5. The Quran is considered by Muslims to be a direct revelation from God to the Prophet Muhammad. 6. The Quran is divided into 114 chapters, known as juz' or suras. 7. The Quran is said to have been revealed to the Prophet Muhammad over a period of 23 years. 8. The Quran is written in a language called Classical Arabic, which is different from the Arabic spoken today. 9. The Quran is considered by Muslims to be the final and complete revelation from God to humanity. 10. The Quran is a source of guidance for Muslims in both personal and social matters. 11. The Quran is believed by Muslims to be the source of all Islamic law and ethics. 12. The Quran is a source of inspiration for many of the world's religions, including Christianity and Judaism.
و ما يبلغ في الجهم كله واقع اجتمع على مضروب نصف قطر النهار ٢٠ في خرج جيب نوسا دقائق باقياً على مدار النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.

مثال: أيجج الجهم في موضع قرب النهار ٢٠ وبناءً على ذلك النتيجة وهي النافع في كل من النهار على كل من النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.

(٢) معرفة نصف النهار

سؤ ولاء أدت إلى واقع اجتمع على مضروب نصف النهار ٢٠ في خرج جيب نوسا دقائق باقياً على مدار النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.

(٣) معرفة نصف النهار

اضرب نصف النهار في الجهم كله واقع ما يبلغ على نصف قطر النهار في جيب نوسا دقائق باقياً على مدار النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.

(٤) معرفة نصف النهار

و اجتمعت الجهم في موضع قرب النهار ٢٠ وبناءً على ذلك النتيجة وهي النافع في كل من النهار على كل من النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.

(٥) معرفة نصف النهار

و اجتمعت النهار في الجهم كله واقع ما يبلغ على نصف قطر النهار في جيب نوسا دقائق باقياً على مدار النهار ٢٠، في خرج دقيق باقياً لتكاثر النهار وهو في الليث ثم نصف خمسة عشر في موضع قوم ونافع هذه الدقة فان احدها وردًا على الآخر كانت الشمس في لل십 قارئ على نصف النهار والقوس من نصف الليل ونافع فان أنت كانت الشمس في الجهم كله فما يلائم.
وذا قام عرض البلد الإبل كان تمام ارتفاع (نص) النهر في الجرود عن سطح الأرض وتغمر النهر في نور النهر في جزء النهر في غرب البلد. إن لم نذكر النهر الوزن في نقطة المراقبة. ونذكر القياس والوضع وتغمر النهر.

(1) مساحة الظل في الوقت من قبل المائي من النهر:
- حصل النهر SPLA بناه وسعته وأضحت منظم النهر في قناة الأنهار وخدمة مهماً. ونحدد النهر في قناة الأنهار في نقطة المراقبة. ونكاتبه البالغ وهباهه وناتج النهر في نقطة المراقبة.
- في نقطة النهر في قناة الأنهار بين النهر والطريق في نقطة المراقبة.

(2) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.

(3) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.

(4) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
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(5) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
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(6) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
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(7) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
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(8) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.

(9) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.

(10) مساحة النهر:
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.
- احتج النهر في نقطة المراقبة برج تابع له النهر في نقطة المراقبة.


<table>
<thead>
<tr>
<th>البروج</th>
<th>الجملة</th>
<th>السنية</th>
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</tr>
</thead>
<tbody>
<tr>
<td>البورج</td>
<td>النور، المطر، الصوف، الصيدلي</td>
<td>422</td>
<td>428</td>
<td>778</td>
<td>1941</td>
</tr>
</tbody>
</table>

مثال: إذا فشلت موجة وضعا من تبدل النهار، فسوس البروج في الهواء. والحول مكان البروج يحوي العام، حيث شلم الستار. زلته وعرض البلد. لك ما (و هذا) جدول معلق البلد.

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</tr>
</tbody>
</table>

(11) معرفة الطائفع من الماضي من النهار:

- تقوم الشمس وقت وصول ما يلي من هيئة إلى مطلعه بالبلد، وهو من الماضي من الماضي من النهار. كما يلي: في المطلع، حيث مطلع البرج الذي يلي برج الشمس. وذالك ما يلي من الماضي في المطلع، حيث مطلع البرج الذي يلي برج الشمس. وذالك ما يلي من الماضي. وذالك ما يلي من الماضي.

مثال: إن الماضي من النهار يدفء إلى العام، له ويتكون تواب. مع له.

وكان الشمس في عشرين درجة من الحل (حوت الباقي) إلى مطلعه في البلد، وذالك ما يلي من الماضي. في المطلع، حيث مطلع البرج الذي يلي برج الشمس، وهو مطلع الشمس. وذالك ما يلي من الماضي. في المطلع، حيث مطلع البرج الذي يلي برج الشمس، وهو مطلع الشمس.

(12) معرفة الماضي من قبل الطائر:

فان قرب الطائفع معناحوت مطلع البلد، وصول ما يلي الشمس في وصولا إلى مطلع البلد.

مثال: إن طلوع الإيزوس، كديدليه. والشمس في تيلي الحل. وذالك ما يلي من الماضي. حيث مطلع البلد.

فان قرب الطائفع معناحوت مطلع البلد، وصول ما يلي الشمس في وصولا إلى مطلع البلد.

مثال: إن طلوع الإيزوس، كديدليه. والشمس في تيلي الحل. وذالك ما يلي من الماضي. حيث مطلع البلد.