*Indian Journal of History of Science*, 26 (1), 1991

# MISIDENTIFICATION OF SOME INDIAN NAKṢATRAS

K.D. ABHYANKAR

Astronomy Department
Osmania University, Hyderabad

*(Received 1 August, 1990)*

It is shown that the *nakṣatras* from Abhijit to Satabhiṣaj got misidentified when the Abhijit nakṣatra was dropped from the original list of 28 *nakṣatras*. After making their correct identification, the original 28 *nakṣatra* division have been listed along with their *yogatārās*. All the *yogatārās*, then, fall within their respective *naksatra* divisions.

## 1. INTRODUCTION

The Indian *nakṣatra* system, which dates back to the Vedic period, is a unique contribution of India, although, it has its counterparts in the Chinese *hsius* and the Arabic *manazils*. It may be noted that the *nakṣatras* have been and are being used for naming the days and synodic lunar months in India *pañcāṅgas* (calendars) from very early period, which is not the case with the other two systems. It is, therefore, important to identify the India *nakṣatras* unambiguously for reconstructing the history of Indian astronomy in general, and for tracing the evolution of the Indian calendar in particular.

*Nakṣatras* are the conventional divisions of the ecliptic, the path followed by the sun, moon and planents among the stars. They are used for specifying the positions of these objects at a particular moment. Originally, there were 28 *nakṣatras* which are listed in the Yajurveda, along with the deities assigned to them. The number was 28, because the moon appeared to complete one round among the stars in more than 27 days. They are represented mostly by bright naked eye stars, called the *yogatārās* or juction stars. *Nakṣatras* are used for naming the day according to the position of the moon near these *yogatārās*. Later, the *nakṣatras* were defined by dividing the circumference of 360° into equal divisions of about 13°. Sometimes around 1500 B.C. one of the *nakṣatras*, viz Abhijit, was dropped, thus reducing their number to 27, because it was found that the period of moon was 27.32 days, which is closer to 27 than 28. Since then, each *nakṣatra* occupies an arc, and the associated lune, of 13°20′. The ecliptic was also later divided into 12 divisions of 30° each. They are called *Rāśis*, each *Rāśi* being equal to 2.25 *nakṣatras*.

## 2. THE TRADITIONAL 27 NAKṢATRAS

*Table 1* lists the traditional 27 *nakṣatras* as given in the Report of the Calendar

Reform Committee (Saha and Lahiri, 1955). In addition to the ecliptic longitudes λ (1950) of the *yogatārās* (junction stars) for the epoch 1950 A.D., it also gives their nirayaṇa longitudes for the two principal schools: (i) *Citrapakṣa* of epoch 285 A.D. in which λ (285) of Citra (α Vir) is taken as 180°; and *Revatipakṣa* of epoch 574 A.D. —, in which λ (574) of Revati (ζ Pis) is taken as 0°. In both of them the *yogatārās* of Swātī (α Boo) and Uttarāṣāḍā) (σ Sgr) are very much out of their respective nakṣatra divisions. We shall comment on this later. Leaving them out for the present, we find that the *yogatārās* of Ārdrā, Jyeṣṭhā, Mūla and Śravaṇa are out of their respective divisions by more than 20′ in the case of Citrapaksa. Similarly the *yogatārās* of Aśvinī, Bharani, Puṣya, Śatabhiṣaj and Uttarā Bhadrapadā are out of the respective divisions by more than 20′ in the case of Revatipaksa.

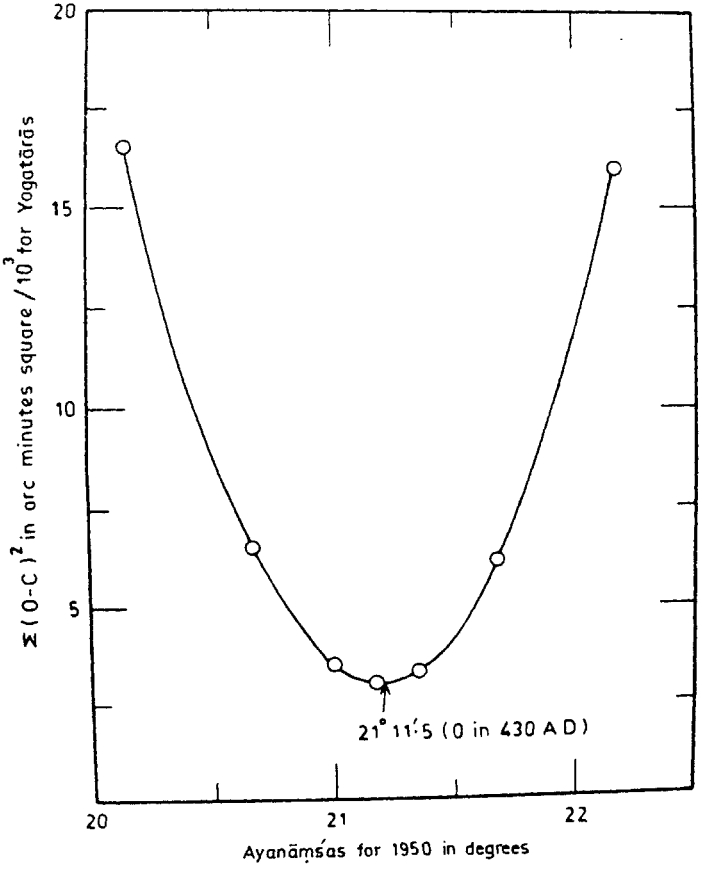


FIG. 1. Least squares solution for *ayanāṃśas*

We can find the best epoch, which makes the deviations minimum with the use of the method of the least-squares by adopting various ayanāṃśas A for 1950, where A = λ (1950) − λ (epoch), as shown in Fig. 1. Here we have omitted Svātī and Uttarāsādā

## Table I

### Traditional Indian Nakṣatras

| S. No. | Nakṣatra** | Star group yogatārā | | λ (1950) | Citrā Pakṣa | | | Revatī Pakṣa | | | Least-Squares Ayanāmsa | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | λ (285) | | Position of Yogatārā | λ (574) | | Position of Yogatārā | λ (430) | | Position of Yogatārā |
| 1. | Aśvinī | α, β Ari | β Ari | 33° 16′ | 10° 08′ | | Within | 14° 05′ | + 45′ Out | | 12° 04′ | | Within |
| 2. | Bharaṇī | 35, 39, 41 Ari | 41 Ari | 47° 30′ | 24° 22′ | | Within | 28° 19′ | + 1°39′ Out | | 26° 18′ | | Within |
| 3. | Kṛttīkā | Pleiades | η Tau | 59° 17′ | 36° 09′ | | Within | 40° 06′ | + 0°06′ Out | | 38° 05′ | | Within |
| 4. | Rohiṇī | Aldebaran | α Tau | 69° 05′ | 45° 57′ | | Within | 49° 54′ | | Within | 47° 53′ | | Within |
| 5. | Mṛgaśīrṣa | λ, $\phi^1$, $\phi^2$ Ori | λ Ori | 83° 01′ | 59° 53′ | | Within | 63° 50′ | | Within | 61° 50′ | | Within |
| 6. | Ardrā | Betelgeuse | α Ori | 88° 03′ | 64° 55′ | | − 1°45′ Out | 68° 52′ | | Within | 66° 51′ | | Within |
| 7. | Punarvasu | α, β Gem, α, β CMi | β Gem | 112° 31′ | 89° 23′ | | Within | 93° 20′ | | Within | 91° 19′ | | Within |
| 8. | Puṣyā | Praescepe | δ Cnc | 128° 01′ | 104° 53′ | | Within | 108° 50′ | + 2° 10′ Out | | 106° 40′ | + | 9′ Out |
| 9. | Āśleṣā | η,σ,δ,ε,ζ,θ Hya | ζ Hya | 133° 53′ | 110° 45′ | | Within | 114° 42′ | | Within | 112° 41′ | | Within |
| 10. | Maghā | ε,μ,ρ,γ,η,α Leo | α Leo | 149° 08′ | 126° 00′ | | Within | 129° 57′ | | Within | 127° 56′ | | Within |
| 11. | P. Phālgunī | δ,θ Leo | δ Leo | 160° 37′ | 137° 29′ | | Within | 141° 26′ | | Within | 139° 25′ | | Within |
| 12. | U. Phālgunī | β, 93 Leo | β Leo | 170° 55′ | 147° 47′ | | Within | 151° 44′ | | Within | 149° 43′ | | Within |
| 13. | Hasta | α, β, γ, δ, ε Crv | δ Crv | 192° 48′ | 169° 40′ | | Within | 173° 37′ | + 17′ Out | | 171° 36′ | | Within |
| 14. | Citrā | Spica | α Vir | 203° 08′ | 180° 00′ | | Within | 183° 59′ | | Within | 181° 58′ | | Within |
| 15. | Svātī | Arcturus | α Boo | 203° 32′ | 180° 24′ | | − 6°16′ Out | 184° 21′ | − 2°19′ Out | | 182° 20′ | − | 4°20′ Out |
| 16. | Viśākhā | α, β Lib | α Lib | 224° 23′ | 201° 15′ | | Within | 205° 12′ | | Within | 203° 11′ | | Within |
| 17. | Anurādhā | Dzuba | δ Sco | 241° 52′ | 217° 44 | | Within | 221° 41′ | | Within | 219° 40′ | | Within |
| 18. | Jyeṣṭhā | Antares | α Sco | 249° 04′ | 225° 56′ | | − 44′ Out | 229° 53′ | | Within | 227° 52′ | | Within |
| 19. | Mūla | ξ,μ,ζ,η,Θ, i,K,λ Sco | λ Sco | 263° 53′ | 240° 45′ | | + 45′ Out | 244° 42′ | | Within | 242° 41′ | | Within |
| 20. | Pūrvaāṣāḍā | δ, ε Sgr | δ Sgr | 273° 53′ | 250° 45′ | | Within | 254° 42′ | | Within | 252° 41′ | | Within |
| 21* | Uttaraāṣāḍā | ζ, σ Sgr | σ Sgr | 281° 41′ | 258° 33′ | | − 8°07′ Out | 262° 30′ | − 4°10′ Out | | 260° 29′ | − | 6°11′ Out |
| 22* | Śravaṇā | α, β, γ Aql | α Aql | 301° 04′ | 277° 56′ | | − 2°04′ Out | 281° 53′ | | Within | 279° 52′ | − | 8′ Out |
| 23. | Dhaniṣṭhā | α,β,γ,δ,ε,ζ Del | β Del | 315° 38′ | 292° 30′ | | Within | 296° 27′ | | Within | 294° 26′ | | Without |
| 24. | Śatabhiṣaj | Aquarius | λ Aqr | 340° 52′ | 317° 44′ | | Within | 321° 41′ | + 1°41′ Out | | 319° 40′ | | Within |
| 25. | P. Bhādrapadā | α, β Peg | β Peg | 352° 47′ | 329° 39° | | Within | 333° 36′ | + 16′ Out | | 331° 35′ | | Within |
| 26. | U. Bhādrapadā | γ Peg, α And | γ Peg | 8° 28′ | 345° 20′ | | Within | 349° 17′ | + 2° 37′ Out | | 347° 16′ | | Within |
| 27. | Revatī | | ζ Pis | 19° 10′ | 356° 02′ | | Within | 360° 00′ | | Within | 357° 59′ | | Within |

* In earlier days there was one more nakṣatra, called Abhijit, between these two nakṣatras

** Nirayaṇa longitude limits of nakṣatras n = 1 to 27 are: (13° to 20′) (n − 1) to 13° 20′) n.

from the least-squares solution because of their large deviations. It is clear that we get the best fit for the epoch 430 A.D. As can be seen from Table I that, in this case, the deviations are less than 40′ for all *yogatārās*, except those for Svātī and Uttarāṣāḍā as noted earlier. However it is to be pointed out that the imported star α Ari of Aśvinī *nakṣatra*, with λ (430) = 15°44′, remains outside of the Aśvinī division by 2°. We shall, therefore, base our discussion on the most widely used *Citrapakṣa* epoch of 285 A.D., which is also the one recommended by the Calendar Reform Committee. The corresponding *nakṣatra* and *rāśi* divisions are shown in the lower part of Fig. 2 (a) and (b).

## 3. Synodic Lunar Months

According to the wellknown criterion, the *mukhyamān* i.e. the *amānta* synodic lunar month, which contains the *Meṣa saṅkrānti* of the sun, (corresponding to the *nirayaṇa* longitude* of the sun equal to zero), is called Caitra. Hence, the *nirayaṇa* longitude of the full moon of the *Caitra month* must lie between 165° and 195°. The corresponding limits for all the twelve months are given in Table II, and they are marked at the top of Fig. 2 (a) and (b) for the epoch 285 A.D. we see that these limits are very nicely defined by certain bright stars as given in *Table II*. Now, in olden days, when the measurement of stellar position was not accurate, such limits set by bright stars would certainly have been in vogue for practical purposes. Actually, these limits would divide the ecliptic into 12 equal parts. Their midpoints were later made the basis for division into *Rāśis*, that were borrowed from the Greeks. In this respect, the *nakṣatra* system based on the *Citrapakṣa* epoch of 285 A.D. is more in correspondence with the system of bright stars which ought to be prevailing in the older times.

*Table II* also gives the position of the *yogatārā* of the *nakṣatra*, after which the months is named, vis-a-vis the nirayaṇa longitude limits of the full moon in that month. We see that all the relevent *yogatārās* lie within the prescribed limits, except Śravaṇa (α Aql) which is out by 7°. The situation does not improve much even if use the best epoch of 430 A.D. or the *Revatipakṣa* epoch of 574 A.D., because then the *yogatārā* of Śravaṇa would still be out by 5° and 3°, respectively. This is a clear indication that our identification of Śravaṇa *nakṣatra* must be wrong. Now, Śravaṇa comes after Abhijit in the earlier list of 28 *nakṣatras*. Hence it is most likely that some misidentification had occured when Abhijit was dropped from the list of *nakṣatras*, whose number was reduced to 27 by this process. That this is the case, is evident from the mismatch of the *yogatārās* with respect to their *nakṣatra* divisions in the range Jyeṣṭhā to Śravaṇa, according to their *Citrapakṣa* positions.

*I have based my discussion on the celestial (*Nirayaṇa*) longitudes of *Nakṣatra Yogatārās* instead of their polar (*nirayaṇa*) longitudes. It is true that the Siddhantic astronomers used polar longitudes and polar latitudes for specifying the positions of *yogatārās*. However, this non-orthogonal system of coordinates is not useful, for fixing the boundaries of the *Nakṣatras* for all epochs. Because, on transformation from one epoch to the other, the position of a *yogatārā* shifts within the *nakṣatra* division, and it may even cross over into the adjoining *nakṣatra* division.

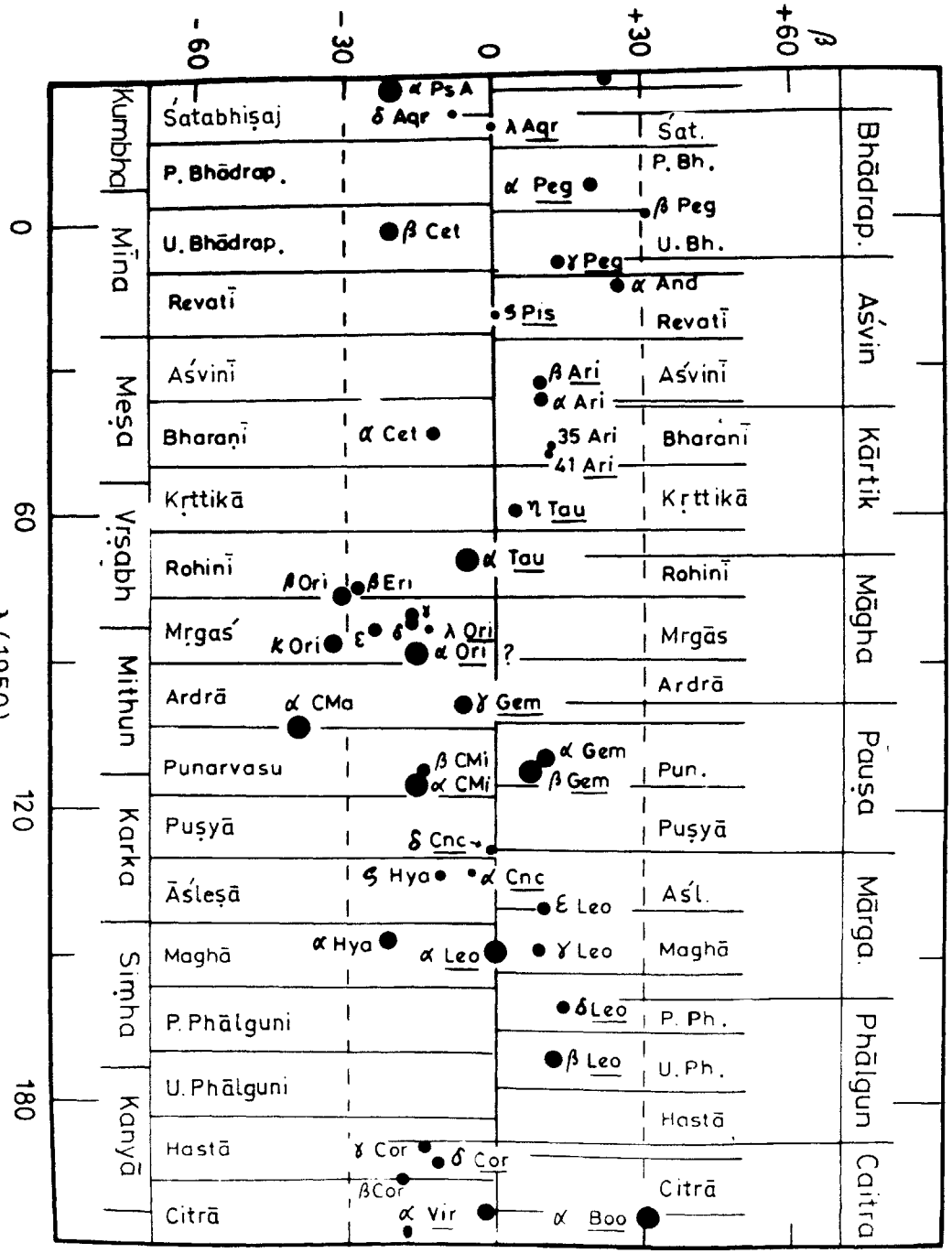


FIG. 2(a). Old 28 and new 27 nakṣatras (First half)

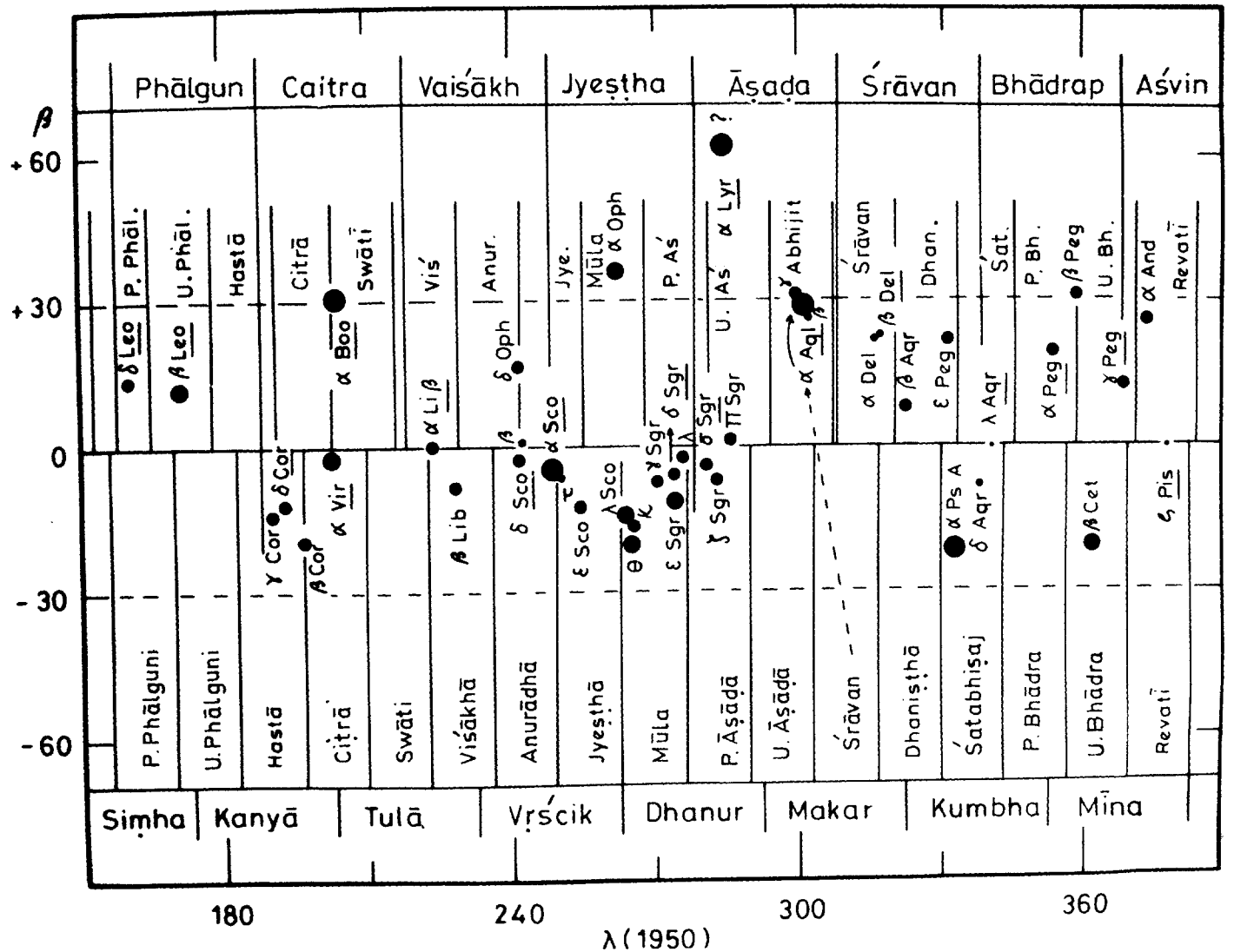


FIG. 2(b). Old 28 and new 27 nakṣatras (Second half)

## Table II

### Monthwise Position of Moon

| *Month* | *Nirayaṇa Longitudes* | *Bright Star Limits (old)* | *Position of month Nakṣatra* | |
|---|---|---|---|---|
| | | | λ *(285)* | λ *(430)* |
| Aśvina | 345° — 015° | γ Peg to α Ari | β Ari in, γ Peg at end[2] | β Eri in, α Ari 1° Out |
| Kārtika | 015° — 045° | α Ari to α Tau | η Tau in, α Tau 1° out | η Tau in, α Tau 3° out |
| Mārgaśirṣa | 045° — 075° | α Tau to Gem | λ Ori in γ Gem at end | λ Ori in, γ Gem 2° out |
| Pauṣa | 075° — 105° | γ Gem to δ Cnc | γ Gem & δ Cnc at end | δ Cnc 2° out |
| Māgha | 105° — 135° | δ Cnc to δ Leo | α Leo in | α Leo in |
| Phālguna | 135° — 165° | δ Leo to Crv | δ, β Leo in | δ, β Leo in |
| Caitra | 165° — 195° | α Vir ± 15° | α Vir at centre | α Vir in |
| Vaiśākha | 195° — 225° | 30° up to α Sco | α, β Lib in | α, β Lib in |
| Jyeṣṭha | 225° — 255° | 30° beyond α Sco | α Sco at beginning | α Sco in |
| Aṣāḍha | 255° — 285° | — | σ Sgr in, δ Sgr out | δ, σ Sgr in |
| Śrāvaṇa | 285° — 315° | — | α Aql 7° out | α Aql 5° out |
| Bhādrapada | 315° — 345° | δ Aql to γ Peg | α Peg in, γ Peg at end | α Peg in, γ Peg 2° out |

[1]They correspond to *Citrāpakṣa* epoch of 285 A.D.
[2]α Ari 1° in

## 4. Misidentified Nakṣatras

Abhijit is traditionally identified with Vega (α Lyr). However it is too far from the ecliptic as it has an ecliptic latitude β = 61°.7. From Fig. 2 (a) and (b) we see that all the *nakṣatras* lie within a broad band of ecliptic latitudes between + 30° and − 30° Hence, Vega could never have been a part of the *nakṣatra* system. We suggest that Altair (α Aql) was the original Abhijit nakṣatra and it was misidentified with Śravaṇa when Abhijit was dropped from the list.

This brings the question: What was the original Śravaṇa? Logically we can say that the next nakṣatras, viz., the present Dhaniṣṭhā or Śraviṣṭhā, was the original Śravaṇa. This can be corraborated with the following facts: (i) Dhaniṣṭhā now refers to the constellation of Delphinus; the bright stars α, β γ, δ ϵ and ζ of this group together resemble the figure of *Śroṇa* i.e. ear which is the earlier name of Śravaṇa. (ii) The *yogatārā* β Del lies within the range of *nirayaṇa* longitude of the full moon in the month of Śrāvaṇa. (iii) In Jain literature, the Śrāvaṇa month is called Śrāviṣṭhā, which indicates that when Śravaṇa nakṣhatra was renamed as Dhaniṣṭhā (old Śraviṣṭhā) the month name was also changed from Śrāvaṇa to Śrāviṣṭhā.

Now, we are left with the redientification of Dhaniṣṭhā and Śatabhiṣaj nakṣatras. Considering the bright stars of Fig (b) we identify Dhaniṣṭhā with β Aqr and Śatabhiṣaj with Fomalhaut (α PsA). From a Parsi mythological story described in *Tiṣtraya Yaṣaṭ*, in which the names of several stars associated with the rainy season are found, it can be inferred that the Parsi name of Fomalhaut was Śataveśa, which is an exact transliteration of Śatabhiṣaj.

The proposed reidentification of these four nakṣatras is given in Table III. The

Table III

Misidentified Nakṣatras

| Nakṣatra | Traditional identification | Correct Identification | Remarks |
|---|---|---|---|
| Abhijit | α Lyr | α Aql | α Lyr too far from ecliptic |
| Śravaṇa or Śroṇa | α Aql | β Del | α Aql within old Abhijit division Delphinis resembles Śroṇa (Ear) |
| Dhaniṣṭhā or Śraviṣṭhā | β Del | β Aqr | Jain name of Śrāvaṇa month is Śrāviṣṭhā |
| Śatabhiṣaj | λ Aqr | α Ps A (Fomalhaut) | Parsi name of Fomalhaut is Śataveśa |
| Ārdrā | α Ori | γ Gem | α Ori is outside of both old and new Ārdrā, γ Gem old stellar limit of Mārgaśirṣa |

renaming of the three deviant nakṣatras, viz Ārdrā, Svātī and Uttarāṣāḍā will be discussed in the next section.

## 5. The Original 28 Nakṣatras

After re-identifying the Abhijit, Śravaṇa, Dhaniṣṭhā and Śatabhiṣaj nakṣatras, it is easy to reconstruct the lunar zodaic of 28 *nakṣatras*. Here, each *nakṣatra* division

Table IV

The Original 28 Nakṣatras

| S. No. | Name | Limits of λ (285) | Yogatārā with λ (285) | Position | Magnitude |
|---|---|---|---|---|---|
| 1. | Aśvinī | 1° — 14° | β Ari (10°) | Within | 2.7 |
| 2. | Bharaṇī | 14° — 27° | 41 Ari (24°) | Within | 4.8 |
| 3. | Kṛttikā | 27° — 40° | η Tau (46°) | Within | 3.0 |
| 4. | Rohinī | 40° — 53° | α Tau (46°) | Within | 1.1 |
| 5. | Mṛgaśīrṣa | 53° — 66° | λ Ori (60°) | Within | 3.7 |
| 6. | Ārdrā | 66° — 79° | γ Gem (75°) | Within | 1.9 |
| 7. | Punarvasu | 79° — 92° | β Gem (89°) | Within | 1.2 |
| 8. | Puṣya | 92° — 105° | δ Cnc (105°) | Within | 3.9 |
| 9. | Āśleṣā* | 105° — 117° | ζ Hya (111°) | Within | 3.3 |
| 10. | Maghā | 107° — 130° | α Leo (126°) | Within | 1.3 |
| 11. | P. Phālgunī* | 130° — 142° | δ Leo (137°) | Within | 2.6 |
| 12. | U. Phālgunī | 142° — 155° | β Leo (148°) | Within | 2.2 |
| 13. | Hasta | 155° — 168° | γ Crv (167°) | Within | 2.8 |
| 14. | Citrā* | 168° — 180° | α Vir (180°) | Limit | 1.2 |
| 15. | Svātī | 180° — 193° | α Boo (180.4) | Within | 0.2 |
| 16. | Viśākhā | 193° — 206° | α Lib (201°) | Within | 2.9 |
| 17. | Anurādhā | 206° — 219° | δ Sco (218°) | Within | 2.5 |
| 18. | Jyeṣṭha | 219° — 232° | α Sco (226°) | Within | 1.2 |
| 19. | Mūla | 232° — 245° | λ Sco (241°) | Within | 2.1 |
| 20. | P. Aṣāḍa | 245° — 258° | δ Sco (251°) | Within | 2.8 |
| 21. | U. Aṣāḍa | 258° — 271° | σ Sco (251°) | Within | 2.1 |
| 22. | Abhijit | 271° — 284° | α Aql (278°) | Within | 0.9 |
| 23. | Śravaṇa (Śivnā) | 284° — 297° | β Del (292°) | Within | 3.6 |
| 24. | Dhaniṣṭhā | 297° — 310° | β Aqr (300°) | Within | 3.1 |
| 25. | Śatabhiṣaj | 310° — 323° | α PsA (310° **) | Limit | 1.3 |
| 26. | P. Bhādrapadā | 323° — 336° | α Peg (330°) | Within | 2.6 |
| 27. | U. Bhādrapadā | 336° — 349° | γ Peg (345°) | Within | 2.9 |
| 28. | Revatī* | 349° — 1° | α And (350°) | Within | 2.2 |
| | | | as also | | |
| | | | ζ Pis (356°) | Within | Faint |

* 12° interval for minor adjustment

** Also λ Aqr (318°) — within

would have 13° approximately, which correspond to the 13 days sojourn of the sun in each *nakṣatra*. The reconstructed list of 28 *nakṣatras* is given in table IV and the *nakṣatra* division are shown in the upper part of Fig. 2 (a) and (b). We see that all the traditional *yogatārās*, except that of Ārdrā (α Ori), lie within their respective nakṣatra divisions. Even the *yogatārās* of Svātī and Uttarāṣāḍā are now in their respective nakṣatra divisions. The exception of Ārdrā can be removed if we make γ Gem as the *yogatārā* of Ārdrā as shown in *Table IV*. This identification has validity in the sense that γ Gem represents the limit of the position of the full moon in Mārgaśīrṣa month as given in Table II.

The *yogatārās* of Table IV are mostly bright naked eye stars with magnitude $m<3.5$. The only exception are Bharaṇī, Mṛgaśīrṣa, Puṣya and Śravaṇa later (Dhaniṣṭhā), which however, are members of prominent groups of stars. Thus the original *nakṣatra* system was based on prominent bright stars as is to be expected from the naked eye astronomers of the ancient times. This is the reason why we have identified Revatī with α And, which is a bright star, instead of ζ Pis which is rather faint.

It may be noted that the Citrā division ends at α Vir, the *yogatārā* of Citrā, and Svātī division starts from there. Hence α Boo, the *yogatārā* of Svātī, lies at the begining of the Svātī division, and not outside it according to traditional 27 divisions. Actually we can say that the almost common longitude passing through these two bright stars divides the lunar zodiac exactly in two parts, almost like the date-line on the surface of the terrestrial globe. There is reason to believe that the two parts represented the Uttarāyaṇa (Aśvinī to Citrā) and Dakṣināyaṇa (Svātī to Revatī) division of the zodiac at the epoch when the *nakṣatra* system was established around 6000 B.C., We shall discuss the rise of the Indian *nakṣatra* system in another article.

## References

Saha, M.N. and Lahiri, A.C. (1955). *Report of the Calendar Reform Committee*, Council of Scientific and Industrial Research, New Delhi.