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GHERARDO GNOLI

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# KAYD

## STUDIES IN HISTORY OF MATHEMATICS, ASTRONOMY AND ASTROLOGY IN MEMORY OF DAVID PINGREE

Edited by
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David Pingree

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# IN MEMORY OF DAVID PINGREE
(JANUARY 2, 1933 – NOVEMBER 11, 2005)

It is a great honour for the Istituto Italiano per l'Africa e l'Oriente to publish part of the papers presented during the "David Pingree Memorial Seminar *Empires and Exact Sciences in Pre-Modern Eurasia*", held at Council Room of the Leiden University on May 29-30, 2006. This meeting was organized by Dr. Kim Plofker, to whom we express our gratitude. Some of the participants of that commemorational symposium decided that a witness of such an event should remain for ever; and for this reason Prof. Antonio Panaino offered the possibility of editing the texts in the framework of the IsIAO quarterly *East and West*. Since all the contributions were at disposal, it appeared more appropriate to publish a volume in order to underline the deep admiration and recognition felt by us toward David (corresponding member of our Intitute), who gave some lectures in Rome in 1995, later published in the "Serie Orientale Roma"[1]. In addition to these contributions the present volume contains also some articles written by scholars connected with the IsIAO, who in different times were in close contact with our late and regretted colleague and friend. We thank Dr. Stefano Buscherini, who has followed the various steps of the editorial preparation of this volume. We may also recall that our regretted friend did not fluently speak Italian, even if he perfectly understood and read it thanks also to his far Italian origin from the side of his mother. The same we can say about his kind wife, Isabelle Sanchirico, while their daughter, Amanda, has a masterly competence in this language. David, in addition, had many collaborations with various Italian colleagues, some of them Orientalists, who have enormously learnt by him. May this volume be another expression of our gratitute for the kind support given by this great scholar to the development of the history of Oriental sciences also in our country.

Professor David Edwin Pingree was born on January 2, 1933, in New Haven, Connecticut, as son of Daniel and Elizabeth Maconi Pingree, but

[1] D. Pingree, *From Astral Omens to Astrology. From Babylon to Bīkāner*, SOR, LXXVII, Rome 1997.

received his initial education in Providence, where he attended the Moses Brown School until the age of 13. When his family moved to Massachusetts, Pingree entered the Phillips Academy in Andover (MA), where he started not only to develop his seminal interests in Classical studies and mathematics but also to learn by himself Sanskrit; there he graduated in 1950. We can affirm that, when Pingree moved to Harvard University, his intellectual interest on the cultural interrelation between East and West in the fields of mathematics and astronomy was basically focussed on. His first travel to India in order to enforce the knowledge of Sanskrit dates back to 1958. When Pingree returned to Harvard, he had the ideal opportunity to study under the authority of two remarkable protagonists of history of mathematics: Otto Neugebauer and Daniel Ingells. In 1960, he finally took the Ph. D. degree in Classics and Sanskrit with a dissertation entitled *Materials for the Study of the Transmission of Greek Astrology to India*, a subject on which he dedicated an enormous number of fundamental studies along his decennial scientific activity.

It was in a Harvard library that Pingree had the chance to meet his future wife, Isabelle Sanchirico.

Very soon after his dissertation, Pingree was enrolled in the teaching staff of the Oriental Institute in Chicago, but ten years later, in 1971, Otto Neugebauer was able to convince the young Pingree to accept a tenure at the prestigious Department for the History of Mathematics of Brown University. This way Pingree came back to Providence, where he remained until his sudden death, and where he joined one of the most influent scholarly groups of researchers in the field of Ancient and Oriental astral sciences. This wonderful research staff was gathered by the infatigable efforts of Otto Neugebauer (1899-1990) starting from the late 1940s. In this department Pingree was given the chance to collaborate with such colleagues and friends as, e.g. the famous Assyriologist Abraham Sachs and Gerald Toomer (thanks to whom we have the best commented translation of Ptolemy's *Almagest*). There the "Elephant" (Neugebauer), the "Home-Ox" (Toomer, because he was a *Homo oxoniensis*), the "Owl" (Sachs) and "Abū Kayd" (Pingree) formed an extraordinary intellectual club, which radically changed the history of ancient sciences, opening new paths also in the description of the ramification of the exact sciences as well as of the pseudo-sciences in Antiquity and Middle Age. We may just recall that Pingree's nickname, as explained by the editors of his *Festschrift*[2], "was inspired by the similarity of his family name to that of Alexandre Pingré, the great eighteenth-century authority on comets (*Cométographie*, 2 Vols,

[2] *Studies in the History of the Exact Sciences in Honour of David Pingree*, ed. by Ch. Burnett, J.P. Hogendijk, K. Plofker & M. Yano, Leiden 2004, p. xii.

Paris 1783-1784). The Arabic *kayd* in the sense of 'comet' is derived from the Sanskrit *ketu-*, which originally meant 'brightness, rays of light', but it came to be applied both to a 'comet' (called the 'tailed star' in Arabic and Mediaeval Latin) and the 'descending node', which was regarded as being the tail of a dragon". Here he succeded Neugebauer and assumed the chair of Professor of History of Mathematics and Classics.

Unfortunately, nothing is eternal in our world, and, in fact, already in 1986, only Pingree remained at Brown, because his colleagues retired or changed university. Practically alone for long time, Pingree directed the department, training a small group of students in various fields of ancient sciences, and collaborating with an impressive number of scholars who came from all the parts of the world to learn from him or to discuss their own works.

For many reasons, by 1986, all the professors belonging to that Institute – with the exception of Pingree – moved to other universities or had to retire. Who visited Brown from that moment on, found a dinamic Institute where only one scholar, Abū Kayd, was teaching undergraduates and graduate students, organizing seminars and projects, but also following the inevitable management of the administration without the help of any secretary. Notwithstanding these difficulties and an early disease which accompanied his life, he was continuously working in his extraordinary personal library (more than 20.000 volumes) among an ocean of manuscripts and sources in various languages he usually mastered (Greek, Latin, Arabic, Sanskrit, Persian, Akkadian, etc.).

The highest standard of his scholarly competence was an example for many scholars, collaborators and pupils, to whom his personality represented a kind of old fashion model. For instance, he never used a computer and gently refused the potential help coming from these new electronic means, although he knew and respected the current trends, to which, however, he never surrendered, simply relying on his traditional methods and on his skill and competence. This attitude did not limit the progress of Pingree's hard work, which is represented, as already noted by various colleagues, by about 43 books and monographs and over 250 articles, reviews and communications. Some others of his papers should still be in print, while in particular his scientific *Nachlass* would offer a few of relevant contributions, we hope to see as soon as possible. In few words, because of the number of his publications, but even more because of the wide-ranging area of his interests and the patent philological competence Pingree did alone the job of an entire staff, in addition stimulating new fellows to continue some topics of research started by him. No doubt, he has offered to a generation of scholars so many sources, which we can now study with a certain degree of confidence, after his first investigation.

We must recall[3] that in 1975 Pingree was given the Guggenheim Fellowship, and in 1981 he received a MacArthur Fellowship. He became also Member of the Society of Fellows at Harvard, of the American Oriental Society, the Institute for Advanced Study, the American Academy of Arts and Sciences, the International Academy of the History of Science, the American Philosophical Society. In 1992 the University of Chicago gave him the Honorary Degree of Doctor of Humane Letters, while he became A.D. White Professor-at-Large at Cornell University from 1995. Furthermore, Pingree was very active in the promotion of scholarly associations and projects: for instance, he was co-founder of the Association of Members of the Institute of Advanced Study and, in 1994, created the American Committee for South Asian Manuscripts.

When he died on Friday, November 11, 2005, at the age of 72, he left a tremendous void in our community and in our hearts. But the smile of this scientific humanist will last in our memory and the results of his scholarly production will remain as a milestone in many academical fields. Although he took the nickname of a comet, his brightness has been certainly much stronger.

ANTONIO PANAINO GHERARDO GNOLI

[3] See also the obituary entitled "In memoriam David Edwin Pingree (2 Jan 1933 - 11 Nov 2005)", *Aestimatio*, 2, 2005, pp. 71-72, by K. Plofker & B.R. Goldstein.

SREERAMULA RAJESWARA SARMA

# PERSIAN-SANSKRIT LEXICA AND THE DISSEMINATION OF ISLAMIC ASTRONOMY AND ASTROLOGY IN INDIA

The translation of Arabic or Persian astronomical texts into Sanskrit presupposes the existence of bilingual individuals and, at least ideally, of technical dictionaries. The oldest Persian-Sanskrit dictionary that we have constitutes the first prakaraṇa of the *Pārasīprakāśa* composed by Kṛṣṇadāsa in the late sixteenth century for the Emperor Akbar. While it contains a number of words that occur in astronomical texts – for example, the names of the planets and words designating measures of time – it is bereft of all the technical vocabulary of mathematical astronomy. More detailed information concerning the Persian calendar, and, after an excursus on technical terms of astrology, the Persian words used in arithmetic, trigonometry, and astronomy can be found in a second *Pārasīprakāśa*, that was written by Mālajit in 1643, a work for which the title Vedāṅgarāya was bestowed on him by Shah Jahan. However, in the manuscripts that I have examined, this unpublished text contains only vocabulary contained in the *Risālah dar hay'ah* up to the end of the third bāb of the first maqāla; the next bāb takes up the planetary models, whose technical vocabulary Mālajit does not discuss. (Pingree 1996: 474-75).

## *Introduction*

To David Pingree, Indian historiography of science should be immensely grateful for his fundamental contributions, and also for the three excellent and indispensable tools he provided to this historiography, namely, the history of mathematical astronomy in India (Pingree 1978b), the history of *Jyotiḥśāstra* (Pingree 1981a), and the monumental *Census of the Exact Sciences in Sanskrit* (*CESS*). He also published a series of seminal papers on the transmission and diffusion of Islamic astronomy in India (Pingree 1963, 1978a, 1992, 1996, 2000; Kusuba & Pingree 2002), an area almost untouched by others because nobody else commands – as Pingree did – the

necessary linguistic, scientific and historical competence to be able to tackle simultaneously the Sanskritic and the Islamic traditions of learning.

Having spent a lifetime teaching Sanskrit at Aligarh Muslim University, I am naturally interested in the social history of these intellectual exchanges between the Islamic and Sanskritic traditions. Who were the actual participants in this process? Who were the people who translated or adapted Arabic or Persian texts into Sanskrit? Who were their Muslim interlocutors? What method did they adopt in translating? How did Muslims learn Sanskrit or Hindus and Jainas learn Arabic or Persian? I sought answers to these and similar questions.

It was again David Pingree who drew attention to one Muḥammad ʻĀbid who, at the court of Sawai Jai Singh of Jaipur in the early eighteenth century, explained Arabic astronomical texts, sentence by sentence in a local dialect, to Nayanasukha who wrote these sentences down in Sanskrit immediately and polished them later on[1]. This insight into the physical procedure of the knowledge transmission was useful to me when I worked on the *Yantraprakāra*, a collection of descriptions of various astronomical instruments, similarly rendered into Sanskrit for Jai Singh but not polished or edited by any of the contemporary astronomers (Sarma 1986-87).

The meagre information we have about the method of translation at the *Maktabkhāna* of the Mughal emperor Akbar, where a large number of Sanskrit works were rendered into Persian, also points in the same direction. A Sanskrit pandit prepared a paraphrase of the Sanskrit text to be translated in the local dialect of Delhi, which some junior scholars converted into Persian. This raw Persian rendering was passed on to one of the more accomplished courtiers who polished it and released it under his own name (cf. Sarma 1998: 71-72, and the literature cited there).

### *Sanskrit Manuals for Learning Persian*

Does this mean that there were no scholars competent both in Persian and Sanskrit? The available information on such bilingual or multilingual persons is more legendary than historical. Further probing into this matter led me to the discovery of more than a dozen Sanskrit manuals for learning Persian (*pārasīka-bhāṣā*, but also *pārasī°*, *yavana°*, *yāvanī*, *turuṣkī*, or

[1] Cf. Pingree 1987: 319; 2000; Sarma 1986-87: 6; 1998. The Arabic texts thus rendered into Sanskrit were the *Spherica* of Theodosius in the Arabic version of Qusta ibn Lūcā al-Ba'abakī, and the 11th chapter of the second book of Naṣīr al-Dīn al-Ṭūsī's *Tadhkira* with Birjandī's commentary. The second work has now been published, cf. Kusuba & Pingree 2002.

*tauruṣī*), which were composed during the four centuries between A.D. 1374 and 1764 (cf. Sarma 1996; see also Sarma 2002). The most famous of this class of writings is Bihāri Kṛṣṇadāsa Miśra's *Pārasīkaprakāśa*, which was dedicated to Akbar. But such works began much earlier.

The Jainas appear to have taken a leading role in the propagation of the Persian language through the medium of Sanskrit. Many of the early texts of this class were composed by them. This is not surprising. I have argued elsewhere (Sarma 1987: 86-87) that in the eleventh and the twelfth centuries, banking and minting in the Gujarat-Rajasthan-Delhi region were controlled by the Jainas. Their cooperation was, therefore, eagerly sought by the early Sulṭāns of Delhi for conducting their banking and minting operations. Owing to these commercial and monetary reasons, the Jainas had better relations at the Delhi court. Even before the establishment of the Delhi Sultanate, contacts existed between the Jainas and Muslims on the west coast of India, which area had a long history of maritime relations with the Persian Gulf and the Arabian Peninsula (cf. Pingree 1981b). It is here that the first works on Islamic astrology were composed in Sanskrit and it is here that the first bilingual dictionaries in Sanskrit and Persian made their appearance.

Several Jaina Ācāryas are also said to have mastered Persian and composed poems in this language. Thus Jinaprabhasūri, a contemporary of Sulṭān Muḥammad Tughluq, composed a hymn entitled *Ṛṣabhajinastava* in Persian, but employing Sanskrit and Prakrit metres[2].

The earliest Sanskrit manual that I found for learning Persian is the *Yavananāmamālā* composed in 1364 by Vidyānilaya who appears to be a Jaina. Three manuscripts are said to be available of this text in some private Jaina manuscript collections (cf. Velankar 1944: 318). Fortunately more information is forthcoming about the next work, the *Śabdavilāsa* or *Pārasīnāmamālā* produced a year later, i.e. in 1365, in Gujarat. It was composed by Salakṣa, who was a minister of King Haribrahma[3]. Modelled after Amarsaṃha's famous Sanskrit lexicon, the *Nāmaliṅgānuśāsana* (but more popularly known as the *Amarakoṣa*), the *Śabdavilāsa* is divided into two sections called *Devakāṇḍa* and *Manuṣyakāṇḍa*, and consists of 557 stanzas spread over 21 sections. Salakṣa justifies the compilation of a lexicon of foreign terms by claiming, quite rightly, that proficiency in

[2] Printed with an English translation in Jain 1950; see also Balbir 2007.

[3] Shah 1992; this study is based on the manuscript preserved in the Śrī Nītivijaya Jaina Pustakālaya, Cambay. At the L.D. Institute of Indology, Ahmedabad, MS no. 8311 is catalogued as the *Yavananāmamālā* of Pratāpabhaṭṭa but, on closer examination, I find that it contains two incomplete copies of the *Śabdavilāsa* of Salakṣa.

several languages leads to high honour at the royal courts[4]. As examples, he cites Varāhamihira who popularised Greek astronomy and astrology by employing Greek terms like *kreya* and *tauri* in the place of *meṣa* and *vṛṣa* in his works, and a certain Pratāpabhaṭṭa who spoke and wrote in the Arabic language.

The next work in the series is the *Pārasībhāṣānuśāsana*, composed by Vikramasiṃha. He was a Jaina, belonging to the Prāgvāṭa clan. Banarsi Das Jain, who edited this text, places its composition before 1554. It contains about one thousand Persian terms and their Sanskrit equivalents, arranged in five chapters devoted successively to *jāti*, *dravya*, *guṇa*, *kriyā*, and miscellaneous (cf. Jain 1940).

The three Mughal emperors Akbar (r. 1556-1605), Jahāngīr (r. 1605-27) and Shāh Jahān (r. 1628-58) sponsored a lexicon each. Later on, at the provincial courts of Shivājī at Pune[5] and of Jai Singh's son Madho Singh at Jaipur[6], Persian-Sanskrit glossaries of mainly administrative terms were compiled. There exist also several anonymous compendia for learning Persian through Sanskrit, such as vocabularies, grammatical paradigms etc. All these works contain mostly bilingual vocabularies in verse, in the style of traditional Sanskrit lexica.

Among these manuals, two stand out because they are exclusively devoted to the special vocabulary of astronomy and astrology. These are the *Saṃskṛta-pārasīka-padaprakāśa* composed by Vedāṅgarāya at the court of Shāh Jahān in 1643 and the *Phārasīvinoda* by Vrajabhūṣaṇānanda in 1659.

[4] sarvabhāṣāsu kauśalyaṃ ke necchanti narottamāḥ /
yato vijñānasampat prāpyate rājasaṃsadi //3//
sarvadeśaprasiddhā ye sarvaśāstraviśāradāḥ /
naite kaśyāṃ hi bhāṣāyāṃ jāyante doṣabhāṣiṇaḥ //4// as cited by Shah 1992: 31.

[5] About 1676 Shivaji commissioned the compilation of the *Rājavyavahārakośa* by Raghunātha Paṇḍita. This work, also known as *Rajakośanighaṇṭu*, or simply as *Rājakośa*, contains administrative and other terminology in Persian / Arabic together with Sanskrit equivalents. It was divided into the following ten sections (*varga*): *Rājavarga*, *Kāryasthāna°*, *Bhogya°*, *Śastra°*, *Caturaṅga°*, *Sāmanta°*, *Durga°*, *Lekhana°*, *Janapada°*, *Paṇya°*. It was published by the Shivaji Press, Poona 1880; also printed in the *Śivacaritrapradīpa*, Bharat Itihas Samsodhak Mandal, Poona 1925; the latest edition is Bharadwaj 2007. Cf. Patkar 1981: 148-50; and Gode 1960, 1961, 1969, who frequently cites from the work.

[6] At the instance of Sawai Madho Singh, Dalapatirāya composed the *Yavana-paripāṭyanukrama* or *Patraprašasti* in about 1764. The first six of the seven chapters of this work contain model documents of various kinds. The final chapter entitled *Rājanītinirūpaṇaśataka* provides administrative terminology in Persian and Sanskrit. Often long definitions of Persian terms are also given. Cf. Patkar 1938: 53-57; Patkar 1981: 160-62; Bahura 1976: 415-20.

As I have shown elsewhere (Sarma 1992: 254-60; 2000), Akbar began the custom of appointing Hindus as royal astrologers with the title Jyotiṣarāja (which became Jotik Rāi in Persian). Akbar had at his court other Muslim astronomers too like Mullā Chānd (cf. Abū'l Faẓl 1910: I.19, II.506; Rahman 1982: 335) and Faṭhu'llāh Shīrāzī (cf. Alwi & Rahman 1968), but it is not known whether they enjoyed any titles similar to Jyotiṣarāja. Akbar's son Jahāngīr continued this custom of designating Hindu astronomers as Jotik Rāi. The Jotik Rāi cast the horoscope of the emperor and his sons, advised the emperor on the astrologically propitious moments for his undertakings, made occasional forecasts, and even answered the "interrogations" (*praśna*) concerning lost objects and so on. Following the same tradition, Shāh Jahān appointed Śrīmālajit as the royal astrologer but gave him the more impressive title of Vedāṅgarāya which means the same, for *Jyotiḥśātra* is one of the six *Vedāṅgas* or auxiliaries to the Veda. Shāh Jahān's court boasted of other notable astronomers like Farīdu'ddīn who compiled the astronomical tables *Zīj-i Shah-Jahānī* (cf. Rahman 1982: 306-307) and Nityānanda who, among others, rendered this *Zīj* into Sanskrit (cf. *CESS* A-3: 173-74; A-4: 141; A-5: 184).

Besides appointing Hindus as Royal Astronomers, Akbar also began another custom of commissioning Persian-Sanskrit lexica, which was likewise emulated by his two successors Jahāngīr and Shāh Jahān. At Akbar's court, Bihāri Kṛṣṇadāsa Miśra composed the bilingual dictionary *Pārasīkaprakāśa*[7]. There are two sections in this work. The first contains a bilingual vocabulary (*kośa-prakaraṇa*) in 269 stanzas spread over 22 sections. The second section teaches grammar (*vyākaraṇa-prakaraṇa*) through 398 *sūtras*. This is the first work to provide a systematic grammar of the Persian language. Akbar's son and successor Jahāngīr encouraged Karṇapūra to produce another manual called *Saṃskṛta-pārasīka-padaprakāśa* in 528 stanzas (Karṇapūra 1952; see also Sharma 1986). This too is divided into two sections: vocabulary and grammar. Karṇapūra's exposition of Persian grammar in simple verses is extremely lucid in comparison to Kṛṣṇadāsa's. Emulating his royal predecessors, Shāh Jahān also commissioned the Vedāṅgarāya to compose a bilingual dictionary.

[7] Bihāri Kṛṣṇadāsa Miśra 1965. It was first published by Mannālāla Śarmā in a lithographed edition from Varanasi in Saṃvat 1923 (A.D. 1866-67), and soon afterwards by Weber, who made it widely known; cf. Weber 1887, 1889.

From the full citations conveniently provided by the *CESS*, we can draw a brief outline of the Vedāṅgarāya's life and works[8]. At the conclusion of two of his works – the *Giridharānanda* and the *Kuṇḍakṣetraphalodaya* –, the Vedāṅgarāya mentions his native place and his ancestors[9]; so does his son Nandikeśvara in the final verses of his *Gaṇakamaṇḍana* (*CESS* A-4: 131). In all these sources, his real name is mentioned variously as Śrīmālajī, Śrīmālajit or Mālajit[10]. In the *CESS* he is listed under M as Mālajit. But I suspect that his name was probably derived from the place name Śrīmāla, situated on the border between Gujarat and Rajasthan, which is an important cultural and religious centre both for the Hindus and Jainas. Even today Hindus and Jainas bear surnames such as Śrīmālī. In the case of our author's personal name, the word Śrīmala is followed by *-jī*, which is an ubiquitous suffix today in northern India, being added to names *honoris causa*. In the medieval documents from Western India, we find the *-jī* sanskritized to *-jit* or *-jīka*, so that the name could easily be declined in other cases[11].

The sources mentioned above inform us that Śrīmālajī was born in Gujarat at a place called Śrīsthala about the end of the 16th century or the beginning of the 17th century. He was an Audīcya Brahmin belonging to Vatsa gotra. His father Tigalabhaṭṭa was well versed in poetry, *mīmāṃsā* and all other branches of learning; the grandfather Ratnabhaṭṭa was said to be an expert in astral science (*Jyotiḥśāstra*), among other subjects. Looking for munificent patrons, Śrīmālajī appears to have moved to the neighbouring Rajasthan where he received the patronage of Giridharadāsa, the ruling prince of Ajmer. It is possibly on the recommendation of this prince that Śrīmālajī was admitted to the court of the Mughal emperor Shāh Jahān as the royal astrologer and received the title Vedāṅgarāya, some time before 1643. This is no mean honour

[8] In fact, from the wealth of information provided in the *CESS*, many such biographies of astronomers and their peregrinations can be mapped towards the reconstruction of the intellectual history of medieval India.

[9] *Giridharānanda* 72-74 as cited in *CESS* A-4: 421-22, and the last two verses of the *Kuṇḍakṣetraphalodaya*, as cited in *CESS* A-5: 308.

[10] Giridharānanda: nāmā *Śrīmālajī*ti sphuradakhilaguṇaṃ prāhur āryāḥ pravaryāḥ /
Kuṇḍakṣetraphalodaya: tatsūnur dvijadevabhaktiniratah *Śrīmālajid* rājate
Gaṇakamaṇḍana: tatputro *Mālajit*-saṃjño vedavedāṅgapāragaḥ /

[11] Thus in a Sanskrit astrolabe produced in 1673 and preserved now in the Pitt Rivers Museum of Ethnology at Oxford, the owner's name is engraved as *jośī iṃdrajīkasya yaṃtraṃ*, "this instrument belongs to Jośī Indrajī".

and was proudly proclaimed by him and by his son in their respective works[12].

At Shāh Jahān's court at Agra, the newly designated Vedāṅgarāya composed his bilingual lexicon, which, as he states, is useful with its vocabulary of astronomical and astrological terms (*jyotiḥśāstrapadopayogi*), for the pleasure and good will of Shāh Jahān (*śrīmac-chāhijahā-mahendra-paramaprīti-prasādāptaye*).

In this work, immediately after the preamble, the Vedāṅgarāya proceeds to teach the method of converting the Śaka dates into Hijrī dates and vice versa. As an example, he converts the month [*śuklādi*] Śrāvaṇa in the Śaka year 1565 to the month Jamād al-awwal in the Hijrī year 1053, and vice versa. In both cases he says these years are current (*vartamānasannaḥ*, *vartamānaśākaḥ*). The month Śrāvaṇa in Śaka 1565 covers roughly the period from 6 July to 4 August 1643; and the month Jamād al-awwal of AH 1053 from 8 July to 6 August 1643. Therefore we can safely assume that the lexicon was written some time in July 1643.

Śrīmālajī also expressed his gratitude to his immediate patron Giridharadāsa by composing an astronomical work with the title *Giridharānanda*, "Giridhara's Joy". Here also he refers to himself by the title Vedāṅgarāya, and states expressly that he received the title from the lord of Delhi (*dillīnāyaka*). Therefore this work too must have been composed after he was admitted to the imperial court of Shāh Jahān. The *CESS* lists two more works by him: a *Kuṇḍakṣetraphalodaya* on the areas of sacrificial pits, and a commentary called *Niṣekodāharaṇa* on the *Iṣṭakālaśodhana* of his colleague Nityānanda.

### *Pārasī-Prakāśa*

The Vedāṅgarāya commences his bilingual dictionary *Saṃskṛta-pārasīka-padaprakāśa*, also known as *Pārasī-Prakāśa* (= *PP*), the "Persian Light", with the following claim

> If you know Sanskrit, you will learn Persian.
> If you are well versed in Persian, you will acquire Sanskrit.
> If you know neither, you will learn both the tongues.
> Read therefore this book of mine very well.[13]

[12] Giridharānda: yaṃ dillīnāyako 'yaṃ vyaracata vibhudoddāma-*Vedāṅgarāyaṃ* /
Kuṇḍakṣetraphalodaya: yaṃ dillīndramaṇiḥ sunāmakṛpayā *Vedāṅgarāyaṃ* vyadhāt /
Gaṇakamaṇḍana: yena *Vedāṅgarāyeti* prāptaṃ dillīśvarāt padam //

[13] saṃskṛtoktividi pārasījñatā pārasīvidi ca saṃskṛtajñatā /
taddvayāvidi ca taddvayajñatā jāyate 'tra tad adhīyatām idam //
This verse occurs also at the commencement of the printed version of the *Saṃkṛta-*

The *CESS* enumerates some 45 manuscript copies of this work (*CESS* A-4: 421-22; A-5: 307-08). I have been able to consult four of these: from the Bhandarkar Oriental Research Institute, Pune; the British Museum, London; the India Office Library, London, and the Sanskrit University, Varanasi. Two of these are dated. The one from Pune is dated A.D. 1717 and that from Varanasi was copied in 1849. The oldest manuscript from Pune appears to be rather complete; as compared with this, the others are full of lacunae. But those from Varanasi and the British Museum have additional passages. The manuscript from the India Office Library breaks off in the middle, and will not be referred to any more in this paper.

Those who have worked with Sanskrit manuscripts know how corrupt they can be in orthography. But in the present case, the corruptions multiply many more times when the Arabic-Persian vocables are transliterated in Devanāgarī script[14].

The *PP* is not just a versified glossary of Arabic-Persian technical terms related to astronomy and astrology and their meanings in Sanskrit. Aside from the lexical part, it offers much information on Islamic calendar and Islamic astrology. Both Bihāri Kṛṣṇadāsa and Karṇapūra neatly separate the vocabulary from the grammar in their respective works. But the Vedāṅgarāya, for reasons not yet clear, jumbles up everything. I cannot discern any pattern or scheme in this jumble. Maybe an examination of more manuscripts will establish a better organised text, but I suspect that it will not be much different from what I have gleaned in the three manuscripts.

The *PP* begins with a *maṅgalācarana* and a preamble. Immediately thereafter follow the rules and examples for conversions of aka dates into Hijrī dates (*sva-śākopari sanna-māsa-jñānopāyaḥ*) and the reverse process (*sannopari hiṃdūka-śāka-māsa-jñānopāyaḥ*); then some elements of the Ilāhī solar calendar, interspersed with elements of the Islamic lunar calendar; into this mixture are sprinkled here and there diverse kinds of vocabulary. I shall try to arrange this jumble into three separate groups and then describe the contents of each group. The first consists of the Islamic lunar calendar based on the Hijrī era and the astrological beliefs connected with this calendar. The second group relates to the Ilāhī calendar. And the third group consists of vocabulary. In the first two groups, the verses are followed generally (but not always) by a simple gloss entitled *Pañjikā*.

*Pāraśīka-Padaprakāśa* of Karṇapūra (p. 2). Though Karṇapūra's work is definitely older, mutual contamination of manuscripts cannot be ruled out. Interestingly, among the various languages enumerated by Karṇapūra, we find the mention of the Russian, German, Chinese and Japanese languages (*rauṣī śārmaṇyabhāṣā salilacaragiraś cīna-jāpāna-bhāṣāḥ*).

[14] Weber 1887: 21-22 already drew attention to this aspect.

*Islamic Calendar*

Conscious that diverse calendars are in use in India, the Vedāṅgarāya lays down briefly the differences between these in the following couplet

> amāntā turakī tārīkhāś candrodayata ārabī /
> ilāhī sāyanārkāc ca jñeyā granthānusārataḥ //
>
> The Turkish dates (actually months) terminate at the new moon's day (*amāntā*); the Arabic (i.e. Hijrī lunar months) commence from the moon's rise (actually, the first visibility of the moon). The Ilāhī months commence from the tropical sun's (*sāyanārkāt*) [entry into a sign of the zodiac].

The elements of the Islamic calendar taught in the *PP* are the names of Islamic lunar months commencing with Muhurrum (*muharmmādi cāṃdra-māsanāmāni*), the Persian names of the weekdays (*vārā ravyādayaḥ*); the Arabic names of the 28 lunar mansions, the Arabic names of the 12 zodiac signs, the Arabic names of the 9 "planets" including Rāhu and Ketu, the Arabic-Persian names of the cardinal and intermediate directions (*pūrvādi-dik-nāmāni*). The names of the intermediate directions are formed, we are told, by adding *mābain*, e.g. SW is called *mābain janūb maghrib*[15].

All these names are given in verse form, so that these can be easily memorised, of course within the constraints of Sanskrit phonology. This is how Vedāṅgarāya teaches the names of the Islamic lunar months

> muharaṃ sapharaś cānyo ravil avalas tathākhiraḥ /
> jāmādil avvalas tadvaj jāmādil ākhiraḥ smṛtaḥ //
> rajaba-śāvāna-ramajānāḥ savvālo jilakādi ca /
> jilahijja ime māsāḥ kṣapeśodayataḥ sadā //

*Conversion of Dates*

But more important and original than these are the formulas to convert the Śaka dates into Hijrī dates and vice versa. This has been an important area since the time when Muslims began to rule parts of India and to issue their own coinage (Sarma 1990). Since the time of Maḥmūd of Ghazna, the coins of Muslim rulers in India generally bore the year of issue in the Hijrī era. Maḥmūd's silver *Dirhams* struck at Lahore carried the date in Sanskrit thus: *tājikīyena saṃvatā 418* "in Tājik year 418", i.e. A.H. 418, corresponding to A.D. 1027. These coins were issued in Sanskrit, because at first

[15] *diśor madhyabhāge tu* mābain *vācyaḥ*, "for intermediate directions, *mābain* should be employed".

the Muslim rulers availed of the locally available minting techniques and organisation, instead of starting their own operations. In this period, the Jainas of the Śrīmāla clan dominated the minting and banking operations in North Western India. Thus it came about that the earliest Muslim coins in the 11th-13th centuries were struck on the prevailing fabric with Hindu religious motifs. The only thing added was the king's name in Devanāgarī letters in Sanskrit phonology and the year of issue. Often the date is given both in Vikrama era and in Hijrī era. Thus a coin issued by Iltutmish in A.D. 1226 bore on one side an Arabic legend with the year A.H. 626 and on the other side a Sanskrit legend *Śrī Sulatāna Īlititimisi saṃ 1283* (Wright 1936: 30, nos. 121 ff.; 74; pl. II, no. 121). Some forty years later, the well known Verāval inscription, which records in Sanskrit an endowment by a ship owner Nūruddīn Fīrūz from Hermuz for a mosque constructed at Verāval on the Gujarat coast, mentions the year of issue in several eras: Vikrama 1320, Valabhī 945, Siṃha 151, and finally the Hijrī era in these words: *janānām bodhaka rasūla mahammada saṃvat 662*, i.e. "the year 662 of the teacher of people (meaning Prophet) Rasūl Muḥammad." This corresponds to A.D. 1264 (Sircar 1961-62).

This simultaneous use of the two eras (i.e. Indian luni-solar and the lunar Hijrī) in India from the eleventh century onwards brought in its wake the problem of converting dates from one system to the other. Perhaps the first attempt to formulate a rule for such conversion was made by Ṭhakkura Pherū (*fl.* 1291-1323), a Śrīmāla Jaina employed at the treasury and mint of several successive Sulṭāns of Delhi, starting from Alāuddīn Khaljī[16]. As the assay master at the Delhi mint, he had occasion to decipher the years of issue of some 260 types of coins delivered to the mint for recasting or valuation, as the assay records in his work *Dravyaparīkṣā* suggest. It is possibly in connection with this work that he formulated the conversion rule, and this is perhaps the earliest instance where the Islamic calendar is discussed. The rule is given in his book of arithmetic called *Gaṇitasāra* (Pherū 1961: 63; Sarma 1985).

The Hijrī era commenced on Vikrama 679 (expired) Śrāvaṇa śukla 2 (i.e. Friday, 16 July 622) and the years are lunar. The Vikrama years, on the other hand, are luni-solar, lunar months being adjusted to solar years by the addition of intercalary months. Hence, Pherū first transforms the solar years in the Vikrama era into lunar years by adding the intercalary months from the beginning of the Vikrama era[17]. From the sum, he subtracts the

[16] I discovered Pherū while leafing through the third volume of the *CESS*. Some years later when I sent him my translation of Pherū's book on gemmology, Professor Pingree wrote me a charming letter.

[17] Pherū obtains the intercalary months by dividing the elapsed solar/civil days with 976.

difference between the commencement of the two eras (expressed in lunar years) to obtain the Hijrī years. The reverse process yields the Vikrama date corresponding to a given Hijrī date.

The Vedāṅgarāya too adopts a similar procedure for his conversion. Pherū computes the intercalary months from the beginning of the Vikrama era or the Hijrī era as the case warrants. But the Vedāṅgarāya adopts Śaka 1500 = A.H. 986 as the gauge year, these two years having commenced at the same lunation, and calculates the intercalary months for the remaining period. In this way one operates with smaller numbers and the process becomes simplified[18]. Similar conversion rules are to be found in the Islamic *Zījs* prepared in India.

### *Ilāhī Calendar*

For administrative and fiscal reasons, Akbar introduced a solar calendar in 1584 and called it Ilāhī, or divine, calendar. It was to commence retrospectively from a few days after his accession, i.e. the Nauroz of the year 1556. Faṭhu'llāh Shīrāzī was entrusted with the task of devising this new calendar by suitably improving upon Ulūgh Beg's tables. This new calendar served as the official calendar of the Mughal empire for about three quarters of a century from its introduction in 1584 and many documents and chronicles are dated according to this era.

Unfortunately, not many details are available about this calendar. Faṭhu'llāh who devised it, did not leave any records. Akbar's chief chronicler Abū'l Faẓl gives a very brief and inadequate account in his *Ā'īn-i Akbarī*[19] and in the *Akbarnāma*. Akbar's *firmān* introducing the new calendar (reproduced in the *Akbarnāma*) is also silent on essential technical details[20].

From these contemporary records we learn that the Ilāhī year was a true solar year without any intercalation. The year had 365 days, starting from

[18] Cf. Sarma 1985. Vedāṅgarāya derives the intercalary months (*im*) from the solar month (*sm*) by the formula: $im = 2\ (sm + 23)\ (1 - 1/900) \div 65$, and from the lunar months (*lm*) by the formula: $im = 2\ (lm + 23)\ (1 - 1/900) \div 67$.

[19] Cf. Abū'l Faẓl 1949: 29-30: "His Majesty had long desired to introduce a new computation of years and months throughout the fair regions of Hindustan in order that perplexity might give place to eagerness [...]. Amir Fathullah Shirazi, the representative of ancient sages, the paragon of the house of wisdom, set himself to the fulfilment of this object, and taking as his base the recent Gurgāni Canon, began the era with the accession of his Imperial Majesty [...]. The years and months are natural, solar, without intercalation and the Persian names of the months and days have been left unaltered. The days of the month are to be reckoned from 29 to 32, and the two days of the last are called *Roz o Shab* [Day and Night]".

[20] Abū'l Faẓl 1910, II: 19-24: "Firmān of Jalālu-d-dīn Muhammad Akbar Pādshāh Ghāzī".

the vernal equinox. The names of the months were the same as those current in the Persian Yazdjardi era but were distinguished by the appellation of "Ilāhī", e.g. *Farvardin mah-i Ilāhī*, *Ardibihist mah-i Ilāhī* and so on. The months did not have a fixed number of days, the numbers varying from 29 to 32. There were no weeks, instead each day of the month had a different name, the same as current in the Persian system, with two additional terms *Rūz* and *Shab* for the 31st and 32nd days.

But these contemporary records do not mention the exact length of the year that had been adopted, the method of computing the commencement of the era and that of each year thereafter. Likewise, there is no information how to determine the commencement of each month within the year.

On all these issues, our Vedāṅgarāya provides useful information. V.S. Bendrey analysed this information and on its basis reconstructed the Ilāhī calendar for 120 years from 1556 to 1675 (Bendrey 1972). Bendrey states that the

> Vedāngarāya [...] had recorded not only the exact astronomical constant for calculating the Ilāhī years but has explained in detail the method of ascertaining the first days of the months, I'ds etc. (Bendrey 1972: 7-8).

(i) According to the Vedāṅgarāya, the length of the Ilāhī year was

365 days, 14 *ghaṭīs*, 33 *palas*, 7 *vipalas*, and 32 *pratipalas*, corresponding to

365 days, 4 hours, 49 minutes, 15 seconds, 0 thirds, and 48 fourths.

(ii) As regards the determination of the Nauroz, the Vedāṅgarāya states that if the sun's transit (*tahwīl*) takes place before midday, then that day is counted as the first day of the new month (*gurrah*). If the transit takes place after midday, then that day will be the last day of the current month; and the next day will be the first day of the next month[21]. Bendrey confirms this on the basis of actual dates recorded in the *Akbarnāma*.

(iii) About the starting point, Bendrey observes as follows

> Unless a definite moment of the Sun's transit for any one year according to the scheme of the New Ilāhī Era is known, any mathematical calculations made, even with the correct constant, are not likely to produce a correct result. [...] Vedāngarāya [...] has not only given the exact moment of the Sun's entry into Aries for one year, but he has given the moments of the Sun's entry into each of the signs of the zodiac for two years, namely, 79th and 88th Ilāhī years. (Bendrey 1972: 12).

[21] māsārambhe ca tahvīlo gurrā māsādime 'hani /
tasvīlaś ced dinārdhāt prāk tadā gurrā tu taddine //
anyathā tu pare 'hṇi syāt salakh (?) māsāntimaṃ dinam //

(iv) Akbar's *firmān* declares that, besides the Nauroz, 14 other days should be observed as holidays, and mentions these serially. The Vedāṅgarāya gives a simple formula to show the logic behind this arrangement of holidays; namely, that, if a day happens to have the same name as the current month, then that day will be a holiday[22].

Thus the most important section in Vedāṅgarāya's work is obviously this one dealing with the Ilāhī calendar. Besides these four crucial points without which the Ilāhī system would have remained wholly obscure, the Vedāṅgarāya enumerates the names of the 12 solar months, the names of the 32 days in a month, the months in which the maximum and minimum lengths of days and nights occur, pairs of months according to day-lengths, and similar information.

*Islamic Astrology*

The section on astrology deals with the classification of the zodiac signs and planets from several points of view. But the most important topic is the prescription of auspicious (*śubha*/*nek*), inauspicious (*aśubha*/*badah*) and middling (*madhyama*/*myān*) periods for various kinds of activities. Important festivals are also seen from this point of view. A table at the end of the text informs about the effect of the moon's station in each of the 12 signs for various undertakings. Thus for weddings, the moon in Aries (*meṣa*/*hamal*), Taurus (*vṛṣa*/*saur*), Gemini (*mithuna*/*jaujā*), Leo (*siṃha*/*asad*), Sagittarius (*dhanuṣ*/*kaus*), Aquarius (*kumbha*/*dalw*) is good (*nek*); the moon in Cancer (*karka*/*sartān*), Virgo (*kanyā*/*sunbulā*), Pisces (*mīna*/*hūt*) is middling (*myān*); but the moon in Libra (*tulā*/*mījān*), Scorpio (*vṛścika*/*akrab*), Capricorn (*makara*/*jadī*) is bad (*badah*).

*Vocabulary*

The vocabulary, though ostensibly Persian, contains many Arabic terms as far as they are scientific technical terms; sometimes Arabic terms occur in the Persianized forms as used in India. But a large group of Persian terms are those that formed the basic core of Urdu and are now part of the common Hindi vocabulary.

In the Pune manuscript, the vocabulary is given in three instalments. The first group of 7 verses contains what is called common terms (*kiyantaḥ sādhāraṇaśabdāḥ*). These are indeed very common words, today part of the

[22] māsanāmnā tu yā tārīkhā tasyām īdas tu māsikā /

basic vocabulary in Hindi. For example, the first verse explains the Persian term *awwal* (the first), *vasat* (middle), *ākhir* (last) and *hameśaḥ* (always) in the following manner

> *awwalaḥ* prathame bhāge madhyabhāge *vasat* smṛtaḥ /
> *ākhiraś* cāntime bhāge *hameśaḥ* satatārthake //

This is the general pattern of versified vocabulary. The Sanskrit equivalent is given in locative singular, the Persian substantive in nominative but always with a Sanskrit case termination, usually of the *a*-stem. Thus *awwal* becomes *awwalaḥ*; *ākhir* becomes *ākhiraḥ*, and because of the *sandhi*, it changes further to *ākhiraś*. A few times the form of the Persian word with the final consonant is correctly reproduced. The problem however lies in the reproduction of Arabic/Persian consonants for which there are no exact equivalents available in Devanāgarī. The metre used for the vocabulary is *anuṣṭubh*, each foot mentioning a single Persian word and its Sanskrit meaning. Thus a full stanza covers four vocables. Line fillers like *tu*, *ca*, *tathā*, *smṛta*, *prokta* and the like are often employed *metri causa*.

The second and the largest group of vocabulary (in some 70 verses and covering 280 terms) comprises terms which are styled as *bhāvaphalopayogi*, i.e. useful in explaining the configuration of the planets in different houses of the horoscope. This is the area where the astrologer has to be articulate and voluble, when, after casting the horoscope, he explains to the client the significance of the planetary positions in different houses. In the vocabulary given by Vedāṅgarāya for this purpose, however, there are no technical terms; most of them are taken from the daily life.

This group is followed by a smaller group of 16 verses devoted to about 64 terms, designated as words used in connection with the gifts (*dāna*) for the pacification of the adverse planets (*grahadāna-prasaṅge kiyantaḥ śabdāh*). The gifts are naturally given to the astrologer, and the section contains the names of various valuable objects coveted by the astrologer: animals such as elephants (*gaja*/*fīl)*, horses (*aśva*/*asp*), camels (*uṣṭra*/*sutar*); fabrics like silk (*kauśeya*/*reśam*), shawls from Kashmir (*kāśmīrapaṭṭa*/*shāl*); perfumery such as sandal wood (*candana*/*sandal*), musk (*mṛga-nābhika*/*mushk*), saffron (*kuṃkuma*/*zāfrān*); cereals and pulses; metals; precious stones like the ruby (*māṇikya*/*lāl yāqūt*), diamond (*hīraka*/*ilmās*), or emerald (*gāruḍa*/*zamurrad*), and so on. At this point the Pune MS breaks off.

But the two manuscripts from the BM and Varanasi continue further with another set of vocabulary which is indeed interesting: *gaṇitopayogi kiṃcil likhyate tatra aṅkasaṃjñā*, "some material useful for mathematics will be written here; first the names of numbers." The numbers taught are naturally the Persian numbers from 1 to 20 (*ekādi-nakhānta*), followed by the decades

from 20 to 100 (*nakhādi-daśamāṅka-saṃjñā*); also some examples of others such 21, 22, 31, 32, 41, etc. (*nakhādi-daśakānta-saṃjñā*).

I may show how the Persian numbers sound in Sanskrit verification

ekādito nakhāntānām ekasaṃjñākrameṇa ca /
yaka duḥ śe cahāraś ca paṃja śaś haphta hastakāḥ //
nuha daha iyājdaha dvājdaha sejdahas tathā /
cahārdaha paṃjadaha śaśdaha haphtadaha-saṃjñakāḥ //
hastadaha nudahaś caiva sadaḥ syāc chatavācakaḥ /[23]

This is followed by a short introduction to the *abjad* system of alphabetic representation of numbers which is termed simply as *gaṇite akṣaraika-saṃjñā*. This is told in a single verse, incorporating the first half of the standard Arabic mnemonic formula

abajada havvaja hūtīyāś caikādito daśa /
tataś ca daśakair jñeyā kalimana sa-ā-phasāḥ //

Thus the verse teaches the alphabetic symbols for 1 to 10 (*a-ba-ja-da-ha-wa-ja-hu-ti-yā*), and for the decades 20 to 90 (*ka-li-ma-na-sa-ā-pha-sa*)[24]. There should at least be one more verse enumerating the symbols from 100 to 1000, and perhaps a gloss on these two verses (as in the case of the verses on the common Persian numbers); but these are wanting in our manuscripts.

The Varanasi manuscript stops here. In the British Museum manuscript, there are three more short sets of vocabularies; dealing respectively with arithmetic, geometry, trigonometry and astronomy (*gaṇita*), eclipses (*grahaṇa*), and spherics (*gola*). These too are not systematically constructed vocabularies but appear to have been compiled somewhat at random.

### *Pārasī-Prakāśa and Hayatagratha*

On these three sets of vocabulary, David Pingree made the observation cited at the beginning of this paper. It is the third section on spherics that contains the vocabulary from the *Risālah dar hay'ah*, or more precisely from the Sanskrit translation of this work entitled *Hayatagrantha* (Bhattacharya 1967). Pingree adds further on the same page (475)

[23] Karṇapūra 1952: 60-63 also teaches Persian numbers.

[24] This expression is the best example to show the difficulty of reproducing Arabic-Persian consonants in Devanāgarī. Here the first "sa" (س) represents 60 and the second "sa" (ص) 90. These two can be distinguished in Arabic-Persian script but not in the Devanāgarī. Likewise in (*a-ba-ja-da-ha-wa-ja-hu-ti-yā*), the first "ja" (ج) represents 3 while the second "ja" (ز) stands for 7.

> I should only report that the transliterations found in the *Hayatagrantha*'s prose are not always identical with those in the Vedāṅgarāya's poetry, but that this fact obviously can not be used to substantiate a claim that the Vedāṅgarāya did not know the *Hayatagrantha*.

But the selection of the terms as given in the *PP* appears to have been made rather at random. At this stage it is difficult to say whether these sections were compiled by Vedāṅgarāya himself or by a later copyist. In works of this nature, it is not unusual that subsequent copyists or users of the book make their own additions and that the texts "grow" in course of time. All that is certain at the moment is that it is not the anonymous scribe of the British Museum manuscript who made these additions. Twice in the course of these three sections, he remarks that the manuscript from which he was copying has a lacuna (*truṭi*) at the respective place (*ṣoḍaśapatra vyaṃka?pṛṣṭānte truṭī*; *atratya truṭi saptadaśame patre*). Therefore, the extraction of the terms from the *Hayatagrantha* took place much before the British Museum manuscript was copied; and the Sanskrit rendering of this work must naturally anti-date this extraction. At present, these are imponderables.

*Vrajabhūṣaṇānanda*

After this long discussion of the Vedāṅgarāya's *Pārasī-Prakāśa* or the "Persian Light", I can be brief on the second work of this genre, namely the *Phārasī-Vinoda*, or the "Persian Delight" by Vrajabhūṣaṇānanda (or Vrajabhūṣaṇa, a short form which he uses in the very first verse). The *Phārasī-Vinoda* was composed in 1659, i.e. barely 16 years after the Vedāṅgarāya's compilation. We do not know much about this author, except that his father was called Raghunātha. The *Pharasī-Vinoda* is extant only in one single manuscript at the Bhandarkar Oriental Research Institute, Pune. It was copied by one Kālidāsa Śarmā Gauḍa for his own use in A.D. 1858. In this manuscript there are 104 verses; this is about half the size of the Vedāṅgarāya's work.

Vrajabhūṣaṇa states at the very outset that his work is an adaptation of the Vedāṅgarāya's work with some additional material by himself[25]. It is difficult to determine from the only available manuscript how much Vrajabhūṣaṇa had abridged the material from the *PP* and how much was lost in the repeated copying during the course of the two centuries. Like the Vedāṅgarāya, Vrajabhūṣaṇa too teaches the conversion of the Śaka dates

[25] The very first verse, not very well transmitted, reads thus:
vedāṅgarāyasya kṛtoktito mayā viracyate sad-Vrajabhūkhaṇena /
yuktā svapadyāni vicārayitvā saṃjīveno (?) daivavidāṃ hitāya //

into Hijrī dates; for the conversion, he gives the same formula and wording as the Vedāṅgarāya, but gives his own example of Śaka 1580 (= A.D. 1658). But unlike the Vedāṅgarāya, he does not teach the reverse process of converting the Hijrī years in Śaka years. The situation is the same with regard to the other aspects of the Hijrī and Ilāhī calendars. Here too we do not know how much Vrajabhūṣaṇa himself abridged and how much was lost in transmission.

On the other hand, we are certain about the nature (if not the extent) of Vrajabhūṣaṇa's additions. We have mentioned that Vedāṅgarāya's work concludes with a table showing the good, bad and middling periods for various activities according to the moon's passage through the different signs of the Zodiac. Vrajabhūṣaṇa versifies this table, enumerating the good, bad and the middling signs, and enlarges the list of activities, in some 66 verses which constitute two-thirds of his work.

The activities are many for which prescriptions are given here: meeting the king or high dignitaries (*rājadarśana*), immediately followed by shaving (*śmaśrukṛtya*), study (*adhyayana*), wearing new clothes (*vastraparidhāna*), entering a town (*nagarapraveśa*), going on a journey (*mārgayātrā*), working with metals (*lohakṛtya*), gold, or silver (*suvarṇaraupyakṛtya*), buying or riding for the first time a new elephant (*gajakarma*), horse, or camel; love making (*strīsaṃgama*), name giving (*nāmakaraṇa*), giving milk to the infant (*śiśudugdhapāna*), weaning the infant from milk (*bālānāṃ dugdhamokṣaṇam*), circumcision (*liṃgācchādane sunnati-kṛtyam*), and so on and so forth. For all these and more matters, Vrajabhūṣaṇa prescribes good, bad and middling zodiac signs which are occupied by the moon. In these enumerations, he uses sometimes Sanskrit names for the signs, at some other times Persian names, sometimes a mixture of both. Likewise he has also two set of terms for good, bad, and middling: in Sanskrit *śubham*, *aśubham*, *madhyamam*; in Persian *nek*, *badah*, *myān* respectively. He is comfortable with both sets of vocabulary. I may give a few examples. First for the commencement of studies

> For the commencement of studies (*vidyādhyayana*/*tālīm*), good (*śubha*) are the periods when the moon is in Gemini (*yugma*), Taurus (*vṛṣa*), Sagittarius (*cāpa*) or Leo (*hari*); middling (*myān*) are when the moon is in Scorpio (*alibha*), Aries (*meṣa*) or Pisces (*jhaṣa*); the rest are told by wise men as bad (*badah*).[26]

[26] tālīma vidyādhyayanaṃ gatendau yugme vṛṣe cāpa-harau śubhaṃ syāt /
myān ālibhe meṣajhaṣe 'tha nakre badas tathā vai kathitaḥ sudhībhiḥ //41//

For wearing ornaments

> For wearing ornaments (*bhūṣaṇa*), it is middling (*madhyama*) when the moon (*yāminīśa*) is situated in Aries (*hamal*) or Pisces (*hūt*); good when he is in Gemini (*jaujā*), Leo (*siṃha*), Virgo (*kanyakā*), Sagittarius (*kaus*), Aquarius (*kumbha*), or Cancer (*karka*). The rest are bad (*badaḥ*).[27]

*Impact of the Lexica on Hindu Jyotiṣīs*

The Vedāṅgarāya's claim notwithstanding, it is doubtful if anybody could learn Persian with the help of these lexica, or with the help of the two commissioned earlier by Akbar and Jahāngīr. The large number of Hindus who distinguished themselves through their mastery over Persian must have learnt the language directly as the Muslims did[28]. These Sanskrit manuals, on the other hand, fulfilled rather the intellectual curiosity of the Sanskrit-using elites who, by composing Sanskrit works on the language and learning of the Muslims, gave the stamp of approval to the intellectual exchanges with the Muslims.

These versified lexica may have indirectly facilitated the composition of Sanskrit works on Islamic astrology such as the works on *Tājika* and *Ramala*, which also contain Arabic-Persian terms incorporated within Sanskrit verses[29]. Even outside the realm of the *Tājika* and *Ramala*, some poets produced Sanskrit works, employing occasionally Arabic-Persian terms. Thus in the first half of the eighteenth century, Lakṣmīpati of Kumaon composed in Purāṇic style two historical accounts of the Mughal rulers Farrukh Siyar (r. 1713-18) and Muḥammad Shāh (r. 1719-48), entitled respectively *Nṛpatinītigarbhitavṛtta* and *Abdullāhcarita*, interspersing his Sanskrit verses with an occasional Persian term (Lakṣmīpati 1947, 1959).

[27] hamale hūte madhyamaṃ bhūṣaṇasya jaujā siṃhe /
kanyakāyāṃ ca kauśe kumbhe karke yāminīśe /
sthite nek śeṣe badaḥ syāt kārya rīnāhi kṛtyam (?) //53//

[28] H. Blochmann, in his translation of the *Ā'īn-i Akbarī* (cf. Abū'l Faẓl 1949: 352), observes thus: "[Akber's Vakīl] Todal Mall ordered that all government accounts should henceforth be written in Persian. [...] Todal Mall's order, and Akbar's generous policy of allowing Hindus to compete for the highest honours [...] explain two facts, *first*, that before the end of the 18th century the Hindus had almost become the Persian teachers of the Muhammadans [...]". On the Hindus who wrote on scientific subjects in Persian, see Ansari 2004, 2005.

[29] The most notable example is the *Kheṭakaukuta* composed by Khān-i-khānān 'Abdur Raḥīm Khān towards the end of the sixteenth century. This work has been published several times. For the Sanskrit text, an English translation, glossary, and other Sanskrit works by this author, see Chaudhuri 1954.

The Persian-Sanskrit lexica compiled by the Vedāṅgarāya and Vrajabhṣaṇānanda, in particular, equipped the Hindu jyotiṣīs with some Arabic/Persian astrological terminology. This was important in the context of Hindu astrology receiving prominence at the Mughal court. Besides the emperors, perhaps other Muslim nobility too began to patronise Hindu astrologers; a smattering of Persian would certainly have been of advantage here. The very fact that Vrajabhūṣaṇa compiled a dictionary within 16 years of the Vedāṅgarāya's work and the fact that these texts were copied until the 19th century shows that there was a demand for dictionaries of this nature.

It would be interesting to know whether the same situation prevails today. In the astrology practised by the Hindus, there are certainly many elements borrowed from Islamic astrology, but I have no idea whether the Hindu astrologers still have Muslim clientele. Nor do I have any idea what kind of astrology is practised by Indian Muslims. It is worthwhile that somebody conducts a field work on the astrological practices among the Hindus and Muslims of the subcontinent[30].

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[30] For an interesting project on the astrological practices among the Hindus, see Beinorius 2004.

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*PP = Pāraśī-Prakāśa*, see Vedāṅgarāya.

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