

ŚULBA-SŪTRAS: EARLIEST STUDIES AND A NEWLY PUBLISHED MANUAL

One of the earliest modern western scholars to point out the importance of the *Śulba-sūtras* was Arthur Coke Burnell. As early as in 1869, he remarked that “we must look to the *śulva* portions of the *Kalpa-sūtras* for the earliest beginnings of geometry among the *Brāhmaṇas*”. He had noticed the ancient Indian tradition of mensurational geometry while preparing a catalogue of Vedic manuscripts and especially noted the significance of the *Kāṅkaciti* altar.

A few years later, Aufrecht Weber (1835-1901) gave a description of the *Caturasra-śyenacit* in his “Zur Kenntniss des vedischen Opferrituals” (About knowledge of Vedic sacrificial rituals) which was published in the *Indische Studien*, Vol. 13, pp. 215-292. In 1875 the famous paper, “On the *Śulba-sūtras*” by G.F.W. Thibaut (1848-1914) was published in the *Journal of the Asiatic Society of Bengal*, Vol. 44, pp. 227-275. At that time he also brought out the first English translation of the *Baudhāyana Śulba-sūtra* (= *BSS*). The *Kātyāyana Śulba-sūtra* (= *KSS*) was also partially published by him with English translation in 1882. The full text of the *KSS* appeared as part of the *Kātyāyana Śrauta-sūtra* which was edited with the commentary of Karka (13th century), by M. M. Pathak (2 vols. Benaras, 1900). Similarly the *Āpastamba Śulba-sūtra* (= *ASS*) is a part of *Āpastamba Śrauta-sūtra* which was edited by Dr. Garbe as *Bibliotheca Indica*, Vol. 92 (1882-1902).

In the beginning of the 20th century, an edition of *ASS* with German translation was brought out by Albert Burk in the *Zeitschrift der deutschen morganlandischen Gessellschaft*, 55(1901) 543-591 and 56(1902) 327-391. He also included a masterly introduction, valuable notes, and relevant extracts from some sanskrit commentaries. As a part of the *Baudhāyana Śrauta-sūtra*, the text of the *BSS* was published in the third volume of the edition of the former by W. Caland (Calcutta, 1913).

The above various editions and translations of the three important *Śulbas* (*ASS*, *BSS* and *KSS*) soon encouraged some European scholars to publish their

studies of the manuals. These include M. Cantor, “Über die älteste indische Mathematik”, *Archiv der Mathematik und Physik* (1904); G. Milhaud, “La géométrie d’Apastamba”, *Revue generale des Sciences* (1910); and C. Muller, “Die Mathematik der Śulba-sūtra”, *Abhandlungen aus dem mathematischen Seminar* (1929).

In India N.K. Mazumdar read his paper on “*Mānava Śulba-sūtram*” before the Asiatic Society of Bengal in 1921. It was published in the *Journal of the Department of Letter* (Calcutta Univ), Vol .8(1922), 327-342. One may like to know as to what happened to the ‘English edition’ of the *ASS* (then undertaken by the Calcutta University) mentioned by him (p.328).

The pioneering work, *The Science of the Śulba: A Study in Early Hindu Geometry* (Univ of Calcutta, 1932) by Bibhutibhusan Dutta was intended to highlight “the knowledge and achievement of the Hindus in the science of mathematics, more particularly in its branch of geometry”. The work comprises of the six Readership Lectures for the year 1931 which were delivered to fulfil the wish of his teacher Prof. Ganesh Prasad. Datta considered *BSS*, *ASS*, and *KSS* as class one *Śulbas* and did not include the *Mānava Śulba-sūtra* (= *MSS*) in this category. Now it is a common practice to regard all the above four manuals as major *Śulba-sūtras*.

Several printed editions and translations of the four major *Śulba-sūtras* *ASS*, *BSS*, *KSS*, and *MSS* are now available. Some handy combined editions are also there. These include S. Prakash and U. Jyotishmati’s *The Śulba-sūtras: Texts on the Vedic Geometry* (Allahabad, 1979) with introduction; S. N. Sen and A. K. Bag’s *The Śulba-sūtras* (Delhi, 1983) with introduction, English translation and commentary; and the Hindi version called *Cāra Śulba-sūtra* (Ujjain, 2000) by Raghunath P. Kulkarni who died recently.

As a gift of the millennium, Dr. Damodar Jha of the VVRI, Hoshiarpur, has given us his edition of a new *Śulba*, namely *The Maitrāyaṇīya Śulbasūtram* with the commentary of Śāṅkara (Hoshiarpur, 2001). Śāṅkara (son of Nārada Moḍhamaitra-bhaṭṭa) was the younger brother of Śivadāsa who wrote a commentary on the *MSS*. Jha is an expert in *Śulba* studies having edited the *ASS* with four commentaries of Kapardi, Karavinda, Sundararāja, and Gopal (Koari Madan, 1988) and written a *History of Śulbasūtras* (in Hindi).

The *Maitrāyaṇīya Śulba* is said to be an appendix to the *Vārāha Śrauta Sūtra* which belongs to the *Maitrāyaṇīya* Branch of the Black Yajurveda. It is based on the *Maitrāyaṇīya Saṃhitā*. Since the *Mānava Śulba* (=MSS) as part of the *Mānava Śrauta Sūtra* is also based on the same *saṃhitā*, there is often confusion between the MSS and the *Maitrāyaṇīya Śulba Sutra* although they are not the same. The MSS has 16 sections (grouped into 3 chapters) while the *Maitrāyaṇīya Śulba* has only 4 sections (*khaṇḍas*). Of course there are many similarities of the topics and commonness of the passages. To discuss detailed contents of the new *Śulba* will need a separate study.

In this short note some new features and information about the Vedic square-circle conversion may be mentioned. After the introductory passage the *Maitrāyaṇīya Śulba* gives the verse:

*āratniścaturasrastu pūrvasyāgneḥ kharah smṛtaḥ /
rathacakṛkṛtiḥ paścāccandrārddha iva dakṣiṇaḥ // I.2//*

It states that the shape of the Eastern Fire (*Āhavanīya*) is a square of side one *aratni* (=24 *angulas*), the Western Fire (*Gārhapatya*) is circular, and the Southern Fire (*Dakṣiṇa*) is semi-circular. Of course, the same verse is found in the MSS. Now as the areas of all the Fires (*agnis*) are to be same, a rule for converting a square into a circle of equal area (approximately) follows. The MSS rule is the traditional classical rule according to which the radius OG of the desired circle is to be taken as (Fig. 1)

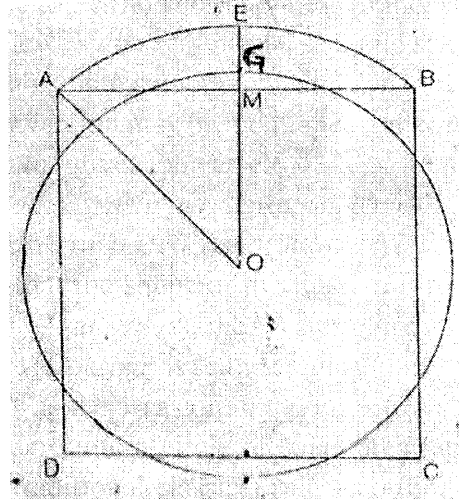


Fig. 1

$$OG = OM + ME/3 \quad \dots (1)$$

But the *Maitrāyaṇīya Śulba* (I.3a) asks us to take OG to be
 $(14 - 1/6)$ or $83/6$ *āṅgulas* (2)

It is interesting to note that the above mentioned verse I. 2 is quoted by the Jain scholar Bhāvaratna in his commentary on Kālidāsa's *Jyotirvidābharāṇa* 18.15 (see R.C. Pandeya's edition, p.544). But the rule for the *Gārhapatya* circle prescribes OG to be taken as $13\frac{1}{2}$ *āṅgulas* instead of (2). However, this numerical value is obtainable from another rule found in the *Maitrāyaṇīya Śulba* at II. 9 which asks us to take OG to be $OM + AB/16 = 12 + 1.5$. Mathematically correct value is $24/\sqrt{\pi} = 13.54$ nearly.

In the end it may be mentioned that a new interpretation of *MSS* 11.15 has yielded a new *Śulba* value 3.125 for pi (see *Centaurus*, Vol.31, 1988, pp.120-122).

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