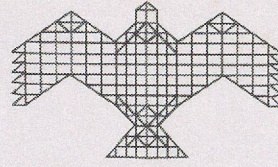


About the
NIAS
Emblem



The NIAS emblem can be traced back to a remarkable Sanskrit work called the Śulva-sūtras, which, while being one of the four Kalpa-sūtra texts concerned chiefly with vedic ritual, displays a deep knowledge of geometry from pre-Euclidean times. Śulva (or śulba) stands for rope, string or cord, and is derived from the root śulv, meaning "to measure"; the Śulva-sūtras are therefore literally "The Rules of the Cord". (To this day a cord is part of the basic equipment carried by an Indian mason, to be used in surveying or in laying out a structure in any construction activity.) The text is in fact a handbook of ritual geometry, and describes a series of geometric 'constructions' or procedures (using only strings and pegs) for the lay-out of sacrificial altars and fires of various shapes and dimensions, usually specified with extraordinary precision.

There are four extant versions of the Śulva-sūtras, but the one attributed to Baudhāyana is considered to be the oldest as well as the most systematic and detailed. Scholars are not agreed on the precise date of the Sūtras, but the text clearly pre-dates Pāṇini and must have been composed before the 6th century B.C. The procedures described in the text, however, must have been known very much before its composition, as the text itself acknowledges.

The NIAS emblem displays the arrangement of bricks in the first layer of an altar called *śyēna-cita*. This altar has the shape of an eagle or falcon (= *śyēna*), and is described in Chapter 11 of the *Baudhāyana* text (SB). The construction of the altar needs a total of 200 bricks of five different shapes in the first layer. The second layer is similar in shape and also needs 200 bricks, but five additional brick types are required. In constructing the altar, the bricks were laid in such a way that no brick rested on another of the same size and shape. Generally there were five layers, the odd ones being replicas of the first layer and the even ones of the second.

Using the dimensions of the bricks given in *angulas* in the text, and taking 1 foot = 16 *angulas* (as suggested by Fleet), I estimate the span of the altar-falcon as 40.5 feet or 12.3 metres. The altar would have been knee-high. Its area is quoted as $7\frac{1}{2}$ square *purushas*; as a *purusha* is the height of a man with uplifted arms (given as 120 *angulas*, i.e. $7\frac{1}{2}$ feet or 2.3 metres), the area works out to 56.25 square feet or 5.29 square metres.

Vedic fire-altars were of two kinds: there were the perpetual ones (*nitya*) and the optional ones (*kāmya*). The *śyēna-cita* is an optional fire, meant for those who desire heaven (*suvarga-kāma*, SB 8.1). It is constructed in the likeness of the falcon, after the shadow cast by it as it takes wing (*utpatatam chāyay".ety.arthah*, SB 8.5). The falcon shape is symbolic; the *Taittirīya Samhita* says,

He who desires heaven may construct the falcon-shaped altar; for the falcon is the best flyer among the birds; thus he [the sacrificer] having become a falcon himself flies up to the heavenly world.

Although the word *śyēna* is generally used for a falcon, it is actually a comprehensive term for eagles, falcons and hawks, which constitute one of the three groups into which birds of prey were classified in ancient Indian texts. (All birds of prey are supposed descended from the primeval *garuḍa*.) In fact *śyēna* is often used as a

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synonym for the vedic *suparṇā*, the celebrated golden eagle that is the strongest and fastest of the family. The female golden eagle, which is larger than the male, can have a wing span of over seven feet. The female is preferred by falconers for the chase, and is also known as the *gāyatrī*; *śyēna* (although a word that is masculine in gender) is in fact thought to stand for the female. Indeed the *Kapisthala Kathā-samhitā* speaks of a *gāyatrī-cita*.

Fire rituals in such altars are still occasionally performed; a detailed account of one such performance, carried out over twelve days in 1975, has been given by Staal (1983/86).

Although the *Sūtras* basically constitute a manual of applied geometry, it is remarkable that, apart from "the formidable geometrical problems solved" there (Barrow 1992), many general geometrical propositions are stated (even more are implied) and frequently used. For example, the theorem now commonly attributed to Pythagoras (ca. 540 B.C.; "proved" in Euclid, ca. 300 B.C.) is explicitly stated in the following form in the very first section of the work (SB 1.12, translation of Sen & Bag 1983):

The areas [of the squares] produced separately by the length and the breadth of a rectangle together equal the area [of the square] produced by the diagonal.

Such results were essential for constructing altars to specified shapes and sizes, especially when there were such requirements as (for example) the construction of an altar with double the area of but exactly the same shape as a smaller one. In fact one of the central geometrical problems handled in the *Śulva-sūtras* is the construction of geometrical figures of a given shape (e.g. circle) equal in area to a figure of another shape (e.g. square); the mathematics of the *Sūtras* is driven by the philosophy of equivalence through area, so methods had to be found to make 'equivalent' altars of different shapes.

Recent research (Seidenberg 1983) shows that the geometry of the *Śulva-sūtras* is very ancient – at least 1st millennium BCE, possibly earlier.

The *śyēna-cita* was therefore a creation for the spirit, founded on (or utilizing, or even inspiring?) great mathematics and engineering – an apt symbol for all the things that NIAS stands for.

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