

# Pride of India

## A Glimpse into India's scientific heritage

### Review

This book is made of critical write-ups in English illustrating extracts from Sanskrit literature from Vedic period to 14<sup>th</sup> century CE (Common Era – used in place of AD). The search of extracts is by a team of experts in various branches of mathematics and science and of scholars in Sanskrit. Many quotations from modern scholars found in the book add to our enlightenment and reading pleasure.

Scholars have taken 3000 BCE (Before Common Era – used in place of BC) as the Mahabharata period and calculated the Vedas as not later than 6000 BCE. A dynasty of kings and a lineage of teachers help fix a date of an event. Rare astronomical observations in literature help as markers to check on dates.

Vedic Mathematics solves problems in geometry for ritual purposes (pi, theorem of Pythagoras, quadratics, etc.) and we note the early birth of decimal numbering system and some current applications. It is remarkable that astronomy continued to develop without any religion forcing its “official” cosmology. In 5<sup>th</sup> century CE, Bhaskara is seeing a world viewed from an earth, rotating on its axis in 23 hr 56 min 4.1 sec and orbiting around the Sun in 365.57 days. (compare this with a “view” proposed 1000 years later by Copernicus and opposed by the religious order of that time in Europe).

River Saraswati flowed. Vedas flourished. Saraswati dried up. But, teachers and students continued to affirm that they will lay the Universe bare. Ruins of Harappa is shown as that of a maturing civilization on the banks of Saraswati, carbon-dating evidence fixing this period to 3500 BCE. Around time standardized kiln fired bricks were developed and used to exploit flood water to raise crops without effort of cultivation and expense on fertilizers. Concept of standardization is seen in bricks of Harappa – spread over 950 miles were the bricks of the same quality and size. Five thousand years later, the British, in 19<sup>th</sup> Century CE used them as ballast for railway.

Saraswati's drying up is documented in Sanskrit literature. We read that modern surveys, Stein's before 1940 and by US satellite in 1990, confirmed the drying up of Saraswati River but also paved way for exploiting the ground waters in an arid land. In 1998, twenty-three of the 24 wells dug up by Indian government along the dried up Saraswati yielded potable water. All this is important in another way. It has killed a fancy theory of “Aryan” invasion of India. No Aryans invaded India, if any they were natives of this land.

Ancient world wondered about man's place in the world and used observations and theory to predicting seasons, good and bad times to start a voyage and so on. Vedic Mathematics, Astronomy and Spherical Trigonometry as also Algebra progressed. Book quotes literature of Vedic as well as the later periods, for example, Aryabhatta (~500 CE), and Bhaskara (~1200 CE). Differential Calculus often attributed for its discovery to Europe of 17<sup>th</sup> Century was in use by Bhaskara II, around 1100 CE. Aryabhatta (~ 500 CE) of the University of Nalanda summarized the then known literature on Astronomy, Plane and Spherical Trigonometry, and Algebra.

Civil engineering starts with soil testing. One simple method to quantify compaction of earth is to dig an arm length and fill hole back with earth. Soil left after filling is a measure of

compaction. Methods of building temples, with halls and arches of 50 ft and of town planning are described. There are chapters on mechanical engineering, metallurgy, medicine, surgery and chemistry (kimaya, in Sanskrit). "kim ayam" means "What is this?" It makes sense - Chemistry is a study of "What is it?". (Kimi in Arabic and Chemistry in English). Crucibles, furnaces, air blowing bellows, binders, caustic alkalis, explosives, manufacture of mercury, zinc, copper and alloys was one aspect of Chemistry. Production and study of medicines and plants with their special laboratories was another.

Agatsya-samhita (14th Century CE) describes generation of electricity in a copper – zinc cell. This is sketched in the book. There is much information on medicine and surgery (methods and instruments). One example is plastic surgery – there is said to be a report in Madras gazette, 1793, of Tippu Sultan getting noses of 4 British soldiers cut and a Commanding Officer getting it fixed by an Indian doctor following ancient India's method. Seeing republication of this report in 1794 in London and getting inspired, an English and then a German surgeon did similar "Indian" nose surgeries. The art of rhinoplasty is described in a surgery book of 6<sup>th</sup> century BCE

I note an error about Nobel prizes – there is no Nobel for Maths nor one in Biology (but biologists are recognized under Medicine/Physiology). Secondly, I think adding an index would be useful.

The book might well reawaken a pride in India that started to decline in colonial days. It might inspire some of the readers to learn Sanskrit to read the originals and dig for more material.

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