Indian mathematics, a source for a globalized history of mathematics

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Belgium

The mathematics developed in India is mostly unknown on this side of the Eurasiatic continent. Yet, the Indians elaborated, for more than three thousands years, several tools, sometimes comparable to those of contemporaneous civilizations. This is the case with the so called Pythagoras theorem, by instance, whose statement appears in the frame of the Vedic sacrificial ritual, elaborated more than one thousand years before Christ. The specific requirements of this ritual demonstrate geometrical knowledge which was collected in treatises, the Śulbasūtras, composed around Pythagoras'time. Other tools appeared in India long before they appeared in other civilizations, for example, the positional decimal system and negative numbers. In the first instance, the tendency to give to the powers of ten very different names, i.e. not built on the same root (as thousand), and the versification constraint in the composition of scientific texts explain the emergence of the positional system. In the second instance, the resolution of problems by numerical algorithms rather than by geometrical methods, allowed to give to negative numbers a status. These algebraic methods appeared in the first centuries of the Christian era, certainly before Āryabhaṭa, the first Indian mathematician-astronomer (5th c.) known by name.

In this lecture, I will develop these different points with the help of extracts from texts and iconography showing the role of Sanskrit, the language of the Indian literari. Indeed, this Indo-European idiom, akin to Greek and Latin, enabled Indian mathematicians to write equations before the word algebra appears in the famous book of al-Khwārizmī. The conditions for developing equations certainly already existed at Āryabhaṭa's time, as is shown by Bhāskara in his commentary to the Āryabhaṭīya (629). But the syncopated notation of these equations had especially been advanced by Brahmagupta in his *BrahmasphutaSiddhānta* (628) and by Bhāskarācārya in his entire work (12th c.). We shall note, in particular, the negative value of a number signaled by a dot above it, the arrangement in columns (second degree, first degree, fixed value) of the coefficients of an equation and the superposition of its two members, to represent an equality.

Of course, I will exemplify these points by pedagogical activities applicable in the classroom. Some of them have been tested in Belgian secondary schools, either on the occasion of the festival Europalia-India in 2013-2014 (see ESU 7 Acts, Copenhague), or by some of my students at the *Haute École de Bruxelles-Brabant* within the framework of their educational internship or their final dissertation.

References

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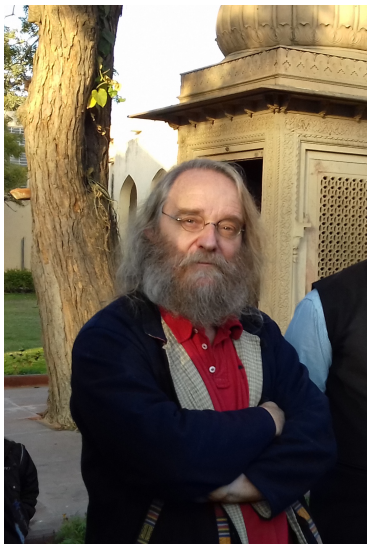

Jean Michel Delire holds a degree in mathematical sciences and a PhD in philosophy and literature from the University of Brussels (ULB), with a thesis on the oldest Sanskrit texts with mathematical content. This thesis was published by Droz, Geneva, in 2016.
For fifteen years now, he has focused his research on the mathematical and astronomical works of Raja Savai Jai Singh II (1689-1743) of Jaipur, Rajasthan, where J.M. Delire frequently resides, as well as on the contributions of Jesuit missionaries to the understanding of Indian science during the same period.
J.M. Delire has taught mathematics at the high school level and the history of mathematics at the university level. He is currently lecturing a course on History of Mathematics and on Science and Civilization of India – Sanskrit Texts, at the Institute of Advanced Studies of Belgium at ULB. He edited *Astronomy and Mathematics in Ancient India* (2012) and *Art et Savoir de l'Inde* (2015), for the occasion of Europalia-India. He is also the author of *Mathématiques multiculturelles* (vol. I, 2018) and numerous articles.