

AL-BIRUNI SETS A BAD EXAMPLE

ADI BEN-ISRAEL

1. AL-BIRUNI

The Al-Biruni in the title is **Abu-Raihan Muhammad Ibn Ahmed Al-Biruni** (also **Al-Beruni**), one of the greatest minds that ever graced this planet. Had he lived 5 centuries later in Italy, or 7 centuries later in France, he would be known as a Renaissance man or an encyclopædist. He was both.

Al-Biruni was born in 973 in Khwarezm (now Uzbekistan.) He died in 1048 in Ghazna (now Afghanistan.) He wrote over a hundred books in different areas of science and knowledge, and translated major texts from Sanskrit to Arabic. He knew several other languages, including Turkish, Persian and Hebrew.

He served in the court of **Mahmoud Ghazni** (997-1030), and of his successor, Masoud. Al-Biruni's role in the Ghazni court, philosopher, astronomer, physician, historian or prisoner, is not clear, but he was apparently well provided and free to pursue his varied interests¹.

Al-Biruni came to India in 997 with Mahmoud Ghazni's invading army. While Ghazni, one of the worst predators that ever marauded India, was after its legendary treasures², Al-Biruni found his own treasures in Indian science, specially Mathematics and Astronomy.

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¹Sultan Mahmoud was less generous with **Firdausi**, author of the epic *Shāh Nāma*. When he finally paid the poet, 60,000 dinars worth of indigo (?), the payment arrived in time for Firdausi's funeral.

²Here is how Al-Biruni describes the sack of the Holy City of Mathura:

"The Sultan next directed his attacks against the sacred city of Mathura. The city was surrounded by a massive stone wall, in which were two lofty gates opening on to the river. There were magnificent temples all over the city and the largest of them all stood in the center of it. The Sultan was very much struck by its grandeur. In his estimate it cost not less than 100,000,000 red dinars, and even the most skillful of masons must have taken 200 years to complete it. Among the large number of idols in the temples, five were made of pure gold, the eyes of one of them were laid with two rubies worth 100,000 dinars, and another had a sapphire of a very heavy weight. All these five idols yielded gold weighing 98,300 **mishkals**. The idols made of silver numbered 200. He seized all the gold and silver idols and ordered his soldiers to burn all the temples to the ground. The idols in them were deliberately broken into pieces. The city was pillaged for 20 days, and a large number of buildings were reduced to ashes." See also [3, p. 107].

Although he missed the zenith of Indian Mathematics³, there was much Al-Biruni could learn in India; even more had he been less arrogant⁴.

One lasting benefit from the contact of the invaders with Indian civilization is that Indian numerals became universally known. Here is how Al-Biruni describes the new system:

”The Hindus do not use the letters of their alphabet for numerical notation, as we use Arabic letters in the order of the Hebrew alphabet. As in different parts of India the letters have different shapes, the numerical signs, too, which are called 'anka', differ. The numerical signs which we use are derived from the finest forms of the Hindu signs. The Arabs, too, stop with the thousand, which is certainly the most correct and the most natural thing to do. Those, however, who go beyond the thousand in their numeral system are the Hindus, at least in their arithmetical technical terms, which have been either freely invented or derived according to certain etymologies, whilst in others both methods are blended together. They extend the names of the orders of numbers until the 18th order for religious reasons, the mathematicians being assisted by the grammarians with all kinds of etymologies.”

Using Indian numerals, Al-Biruni could write large numbers, such as

$$2^{64} - 1 = 18,446,744,073,709,551,615$$

obtained by summing a geometric series related to the game of Chess.

2. A BAD EXAMPLE

Al-Biruni's major work, *Tahqiq-i-hind*, was translated by E.W. Sachau as [1]. There, in a technical chapter⁵ dealing with the computation of

³Aryabhata I, II, Bhaskara I and Brahmagupta were couple of centuries before, and Bhaskara II (Acaria) was a century later.

⁴His attitude is summarized in the following paragraph [2, Vol. 1, p. 239]: “They (the Indians) are in a state of utter confusion, devoid of any logical order, and in the last instance always mixed up with silly notions of the crowd. I can only compare their mathematical and astronomical knowledge to a mixture of pearls and sour dates, or of pearls and dung, ... Both kinds of things are equal in their eyes since they cannot raise themselves to the methods of a strictly scientific deduction.”

⁵Chapter XXXI: On that difference of various places which we call the difference of longitude.



FIGURE 1. Some commemorative stamps for Al-Biruni’s millenary

the diameter of earth (Al-Biruni knew that earth rotates around its axis), longitude and latitude (he was familiar with the results of Brahmagupta), he wants to illustrate the following relation between two variables, say x and y ,

$$xy = \text{constant}^6.$$

Here is how Al-Biruni illustrates this relation:

... Evidently ... we have here the same kind of equation as that which the Hindus call *vyastatrairâśika*, An example of it is the following.

If the price of a harlot of 15 years be, e.g. 10 dinars, how much will it be when she is 40 years old?

The method is this, that you multiply the first number by the second number ($15 \times 10 = 150$), and divide the product by the third number ($150 : 40 = 3\frac{3}{4}$). Then the quotient or fourth number is her price when she becomes old, viz $3\frac{3}{4}$ dinars. ([1, p. 313])

This example, relating the age and price of a “harlot”, may not seem as objectionable in places that Al-Biruni called home, where some attitudes have not changed much since his time.

REFERENCES

- [1] Sachau, E. W., *Alberuni’s India: An Account of the Religion, Philosophy, Literature, Geography, Chronology, Astronomy, Customs, Laws and Astrology of India about A.D. 1030*, Vols I, II, London, 1888. Republished by Asian Educational Services, New Delhi, 1993, ISBN 81-206-0862-3

⁶For example the **Boyle–Mariott Law** relating pressure and volume of an ideal gas.

- [2] Tharpar, R., *A History of India*, Vols 1, 2, Pelican Books, 1966
- [3] Wolpert, S., *A New History of India* (4th Edition), Oxford University Press, 1993.

E-mail address: adi@benisrael.net