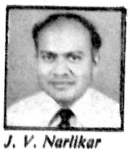
HOW OLD ARE THE VEDAS?



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THE MAJORITY of Indians know Lokmanya Bal Gangadhar Tilak as a great national leader who laid the foundations of the freedom struggle. Many people are aware of Tilak's reforms of the Hindu calendar. Not so many know that he also wrote an arithmetic text which was once used commonly in schools, or are familiar with his erudite commentary on the Gita, the *Gitarahasya*. But I suspect that very few know of Tilak's attempts to date the Vedas by astronomical methods.

The Vedas are sometimes called Apaurusheya, a word that implies that no human being authored them. They were passed on from generation to generation when the ancient Aryans crossed into India and made their home here. While one searches in vain for the originators of these literary masterpieces, one may validly ask when they were produced. The language used by any human civilisation evolves with time and extracts from a piece of literature often give clues about when it was written.

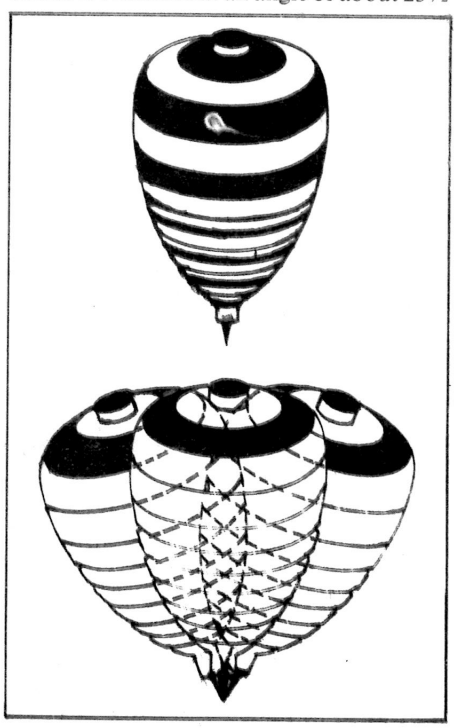
Style, sentence construction, words themselves and allusions are often used to date literature. Western scholars in the last century and early this century used such methods to fix the era when the Vedas were produced. Of course these estimates could not be precise, but for what they are worth, their conclusion seemed to be that the Vedas are about 3000-4000 years old.

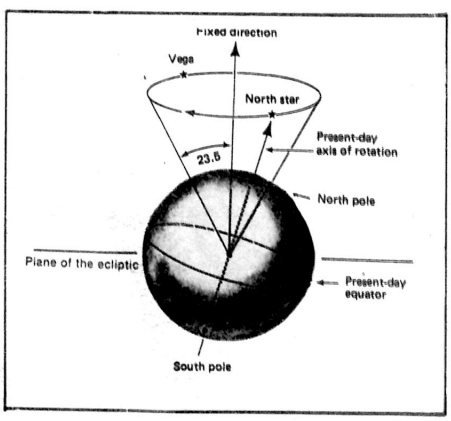
Tilak challenged these estimates and, in his learned monograph *The Orion*, gave a novel method of estimating the antiquity of the Vedas. Tilak's method made ingenious use of an astronomical clock "produced" by the motion of the Earth round the Sun. Let us first discuss this clock.

We know that the Earth moves in two main ways. It revolves round an axis through its centre once in 24 hours, the axis intersecting the Earth's surface at the two poles N and S. The equator is the great circle in the plane perpendicular to the polar axis. This plane intersects the celestial sphere in a great circle called the celestial equator. The celestial sphere is the sphere at infinity centred on the observer; he sees all the astronomical objects projected on it.

The Earth also moves round the Sun. Viewed from the Earth, the Sun appears to go round the Earth. The Sun's orbit round the Earth is an ellipse whose plane intersects the celestial sphere in a great circle called ecliptic. The Sun moves along the ecliptic in a clockwise fashion when viewed from south to north.

Thus we have two great circles on the celestial sphere—one called the equator and the other ecliptic. The planes of the two circles are inclined at an angle of about 23½ degrees. The points of intersection of the two circles are called equinoxes and are denoted by Ω for the spring equinox and ♈ for the autumn equinox.





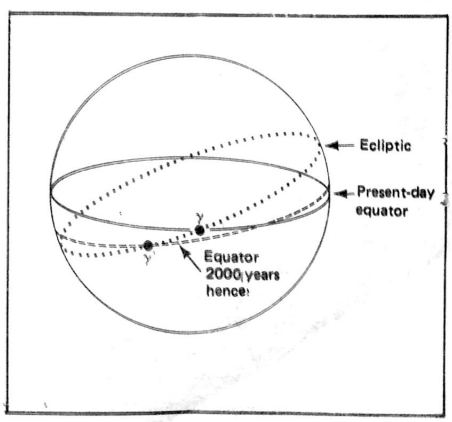
The points ♈ and Ω are also called the first points of Aries and Libra respectively. Aries is associated with spring and Libra with autumn. Indeed, we may assume that when the Sun is close to ♈ there is spring in the northern hemisphere and when the Sun is close to Ω there is autumn.

In ancient days, the Sun's position on the ecliptic was determined by stars and constellations. As the Sun moved along the ecliptic, different constellations were projected against it. These constellations were used as identifications of the time of the year. The months derived their names from these constellations lying at the antipode of the Sun (so that these constellations could be seen right through the night). Thus Chaitra corresponds to Chitra, Vaishakh to Vishakha, Ashwin to Ashwini, and so on. These groups of stars did not change their directions as seen from the Earth; it was the Sun that appeared to move against their background. (These remarks are of course in relation to the Earth's annual orbit round the Sun, not its rotation about the polar axis.)

Tilak used an important astronomical observation to date the Vedas.

When a symmetrical top is set spinning on the ground making an angle with the vertical, its spin axis does not maintain a fixed direction in space. It precesses; that is, it describes a cone round a fixed direction due to an external torque caused by the gravitational pull of the Earth. In the same way the Earth's spin axis—the polar axis—does not maintain a fixed direction due to the action of the gravitational pull of the Sun with the Moon acting on the equatorial bulge of the Earth. It also precesses in space describing a cone round the fixed direction perpendicular to the ecliptic. There is one point of difference, however, between the spinning top and the spinning Earth. Whereas the spin axis of the top goes round the fixed direction in the same sense (clockwise or counter-clockwise) as its spin, the Earth's spin axis precesses in the opposite direction to its spin. Looking from south to north, the Earth rotates from west to east, that is, clockwise. The spin axis will therefore precess in anticlockwise about the pole of ecliptic when we look at it from south to north.

The result of such a precession is that the equinoxes ♈ and Ω move along the eclip-



tic in the anticlockwise direction when looked at from south to north. The time taken for the spin axis to describe one cone is about 25,800 years. Thus the equinoxes go round the ecliptic once in this period. Notice that this motion of γ and Ω along the ecliptic is opposite to the sense in which the Sun moves along it.

Suppose we now consider the season of spring when the Sun is at γ. Since γ itself is moving along the ecliptic, the spring season will not occur every year at the same "time"—that is, according to the months designated by the Hindu calendar. In other words, the location of the Sun against the background of stars will be different from one spring to the next. The effect is, of course, hardly noticeable from year to year, but it is appreciable over a span of several centuries. The seasons gradually move backwards, beginning earlier every year with respect to months defined by groups of stars.

Tilak's idea was to compare the seasons and months in Vedic literature with their relationship at present. He was prompted to investigate this relationship because of a statement in the Gita: "Amongst the months I am Margashirsha and among the seasons I am spring." What was the logic behind such a statement? To make sense of it, we have to go far back into the past when the equinoxes were in different locations. If, in Vedic literature, we find references to where (that is, in what group of stars) the equinox γ was, we can easily determine how long ago that epoch was. Our present observations show that γ is located in the star group Uttara - Bhadrapada.

So much for the astronomical part of the argument. In his monograph *The Orion*, Tilak goes to some length to interpret Vedic allusions to seasons and months, displaying in this process the keenness of a Sherlock Holmes chasing elusive clues. Let us put forward some of those arguments below.

First we have to note that in ancient times the year used to begin at the winter solstice, which, according to the modern calendar (Gregorian), falls on 22 December. If we consider the ecliptic as a clock dial looked at from south to north and assume that the point γ falls at the location of 3, then Ω falls at 9 while the summer and winter solstices fall at 6 and 12 respectively. Thus the ancient year began when the Sun was at 12 and the spring season when the Sun was at 3. So to decide where the point γ was in ancient days we have to decide when the year began in that era.

Tilak found in *Taittiriya Sanhita* a passage which states that the "Phalgunipurna-masa is the month of the year". There are other passages in the five *Brahmanas* which also suggest that the Phalguni full moon coincided with the winter solstice and marked the beginning of the new year. Since on a full moon night, the Sun is diametrically opposite the Moon (with respect to the Earth), it follows that on the Phalguni full moon, the Moon, being in the constellation of Phalguni, must also be near the summer solstice. Thus Tilak deduced that Uttara Phalguni was at the summer



Bal Gangadhar Tilak

solstice. So the spring equinox was near the star group Orion (Mrigashiras).

At this stage Tilak sought corroborative evidence and found it in the word Agrahayana meaning the "first in the year". Did Agrahayana mean the month of Margashirsha as many scholars had interpreted, or did it mean the constellation of Mrigashiras? If the former interpretation was correct, Margashirsha mush have been the first month of the year. Tilak, however, gave grammatical, etymological and literary arguments to show that the latter meaning was implied. Since the constellations were listed from the spring equinox, it followed that "the first in the year", Orion, was at or near the spring equinox in those days.

Tilak therefore concluded that the most important period in Aryan civilisation was the so-called Orion period from about 4000 BC to 2500 BC. During this period the spring equinox γ shifted from the constellation of Ardra to Krittikas. This was the period during which the Vedic *suktas* were written and sung. During the latter part of this period, according to Tilak, the Aryans divided and went three different ways—to Greece, Persia and India. This period was followed by the Krittika period which extended from 2500 BC to 1400 BC. The latter part of this period is recorded in the *Vedanga Jyotisha*.

According to Tilak, the Vedic period extended even further back to around 6000 BC. There are references in the Vedas for commencing sacrifices at Aditi, the presiding deity of Punarvasu. Tilak argued that this epoch corresponds to the spring equinox being at or near Punarvasu.

If Tilak's arguments are correct, the Vedas must be considerably older than the indications so far from other age-determining criteria. Tilak's method itself cannot be faulted so far as its astronomical aspects are concerned. Its possible weakness lies in his interpreting Vedic statements which are, to us, very cryptic. Nevertheless, no one who has read *The Orion* can fail to be impressed by the deductive power of the author and the ingenious way he used the astronomical clock to throw light on an important mystery.

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