

Revd. Ridsdale.—I think the meteorite hypothesis is rather a fanciful one with which to account for the craters, etc., on the Moon. Bearing in mind the fact that gravity on the Moon is much weaker than on the Earth, and that therefore volcanic activity would have more violent effects, the craters, the walled plains, and the crater cones on the Moon all readily become intelligible as the results of volcanic action.

At the conclusion of the discussion the President moved a cordial vote of thanks to Capt. Urquhart for his paper and the meeting was then adjourned.

The Date of the Mahabharat War.

BY

PROF. JOGES CHANDRA RAY.

THE President of the Society having invited discussion on the subject (J. Vol. III, No. 2) I collect below the references, both internal and external, from which the date of the war may be conjectured. The importance of the question has led many to inquire into it, and, years ago I, like many others, attempted to come to a satisfactory conclusion from the astronomical data found in the Mahâbhârat. The result was not conclusive, and there is yet room for further research.

There is, however, some difficulty in presenting the evidence to my European readers, as its discussion involves some knowledge of Hindu astronomy and its gradual development to its present condition. I shall, therefore, content myself with an outline of the evidence, briefly indicating the lines along which the inquiry may be pushed and the pit-falls of bias and hasty conclusion which renders laudable efforts futile.

It may be well to note here the nature of the astronomical evidence sometimes found in Sanskrit works. It is rarely, if at all, the position of the planets which can be depended upon for the purpose of determining the required date. When such positions are found, and they are found in comparatively later writings, they are mostly of astrological significance as in the example quoted and discussed by Dr. T. Royds and Mr. S. Sitaramaiya (J. Vol. III, No. 2), and it is no wonder if they find the positions inconsistent, at least in the case of Venus. There are at least three places in the Mahâbhârat (Calcutta

As. Society's edition), where the positions of some of the planets at the time of the commencement of the great war are given, but the positions are neither consistent among themselves, nor the same in the three places. (Compare Udyoga Parva, Chapter 141, Bhishma Parva, Chapters 2 and 3.) The battle commenced on the first day after the full Moon in Krittika Nakshatra, that is about the middle of November; but in Bhishma Parva (Chapter 3) the Sun has been made to occupy a position possible only in May and June. The fact is that the Mahâbhârat is not a chronicle, and the poet or poets may be excused the inconsistencies, if imbued with the astrological lore of the times they begin the narrative of the war in which millions of men are said to have been killed in eighteen days with a description of the abnormal phenomena in the atmosphere, heavens and the earth. Future events are prognosticated and the planets are made to occupy such positions as indicate evil times. Nature ran wild and the curious reader will find among other phenomena the mention of sun-spots which were seen at the time of rising and setting of the Sun. (The word is *Kabandha*. Compare what I wrote in the JOURNAL, Vol. II, No. 2. For a fuller discussion of some of the unusual phenomena and the dates arrived at below the Bengali-knowing reader is referred to my history of Hindu astronomy.—*Amader Jyotishi o Jyotish.*)

The positions of the planets are given in Nakshatras. The word Nakshatra has three meanings, viz., (1) a star in general, (2) one of the 27 or 28 stars or groups of stars situated along the ecliptic, and (3) one-twenty-seventh part of the ecliptic. The use of the word to mean a star in general is rather loose, for which there is the word *Tara*—etymologically the same as the word *Star* in English. We are thus left to decide as to the sense in which the word Nakshatra is to be taken in a given passage. For this we have to turn to the history of development of the science of astronomy among the ancient Hindus. We can, however, easily see how the second meaning gave rise to the third. The Moon is seen to pass by certain well-marked stars or star-groups and to complete a circuit in $27\frac{1}{2}$ days. She is supposed to pass each night in the company of a Nakshatra, and the twenty-seven Nakshatras are imagined to be the wives of the Moon. (In Sanskrit the Moon is a male person.) At first there was some difficulty as to the number, which might be 28 as well, but it was found that the number 27 represents the fact more correctly. There was a further difficulty; the 27 stars or star-groups are not situated at equal distances and do not therefore measure the daily motion of the Moon correctly. Hence the necessity for an artificial division

of the ecliptic arose, and the word Nakshatra became synonymous with a distance of $13\frac{1}{3}^{\circ}$ of the ecliptic, the name of the twenty-seven divisions being the same as those of the stars or star-groups situated close by.

The question is not answered fully. For we must know the limit of each Nakshatra or asterism, or in other words, the beginning of the Nakshatra system. This has been a knotty point with scholars, and much ingenuity has been displayed to make it suit one's own theory, some accepting the initial point as given in comparatively modern astronomical works, others preferring a more natural method. The initial point was the vernal equinoctial point, and that asterism in which this point happened to fall formed the first of the series of the twenty-seven Nakshatras. Thus if we find the asterism Krittika (Pleides) mentioned as the first of the Nakshatra system, we should infer that the vernal equinox happened in that asterism. If this be conceded the determination of the date of the occurrence becomes an easy matter. For the precessional rate of the equinoxes is tolerably well-known, which is one Nakshatra ($13\frac{1}{3}^{\circ}$) in about one thousand years. For the convenience of reference let me reproduce the table of the Nakshatras as found in ancient Sanskrit works.

I. Krittika.	X. Uttarpal-	XIX. Uttarasharha.
	guni.	
II. Rohini.	XI. Hasta.	XX. Sravana.
III. Mrigasira.	XII. Chitra.	XXI. Dhanishtha.
IV. Ardra.	XIII. Svati.	XXII. Satavisha.
V. Punarvasu.	XIV. Visakha.	XXIII. Purvabhadra.
VI. Pusa.	XV. Anura-	XXIV. Uttarbhadra.
	dha.	
VII. Aslesha.	XVI. Jyeshtha.	XXV. Revati.
VIII. Magha.	XVII. Mula.	XXVI. Asvini.
IX. Purvaphalguni.	XVIII. Purvas-	XXVII. Bharani.
	harha.	

From the table it is obvious that if the vernal equinox falls in the 1st asterism, the autumnal does in the 14th, and the summer and winter solstice in the 8th and 21st asterism respectively.

But is the date found the date of the work in which the reference occurs? Not necessarily. The occurrence of the

phenomenon and the composition of the work may be contemporaneous, or the latter posterior to the former. We have to judge of this question from the context and many other factors. There is thus room for difference of opinion. Indeed, in interpreting the evidence one must pause and consider, as has been well pointed out by the President, whether (i) the date arrived at is the date of the war, or (ii) the date of epic, or (iii) the date of the episode in which the reference occurs. Many have been led into confusion, and, while the Indian tradition places the war somewhere near twenty-five centuries before Christ, western scholars have not hesitated to pronounce it to be a baseless exaggeration of the Indian mind which seeks to discover a hoary antiquity for the Indian culture. The war of the Pândavas may be sung by a modern poet, but obviously the date of the poem will not give us the date of the war. Similarly, a comparatively modern editor introducing a story into the epic makes the war look more ancient than it really was. On the other hand, if the name of some of the heroes of the war be found in ancient works, or if the name of the Mahâbhârat is mentioned by an ancient author, the war must be inferred to have taken place at a time anterior to the date of the work.

Now the evidence—

A. Internal :—

1. In Virat Parva (Chapter 52) the Kauravas went to take away forcibly the cattle of the Virat Raj when they noticed Arjun coming to oppose them. Arjun and his brothers were in exile for 13 years, the last they were made to stipulate to spend in concealment. Bhisma of the Kaurava party calculated the completion of the thirteen years, and found that if Arjun was there it was because 13 years had just expired. Now it is seen that the computation of the years was made exactly in the way we find in Vedanga Jyotisha—the Vedic Almanac. The year was reckoned from the winter solstice which happened in the 21st asterism. Now the age of the Vedic Almanac is about the 13th century B.C. (This is calculated in accordance with a statement by Varâha in his *Panchasiddhântikâ*.)

2. In Vana Parva (Chapter 228) it is said that Dhanistha should be made to begin the year. This means that the winter solstice at that time took place in the 21st asterism. The same fact is found in the Vedanga Jyotisha. We thus get a confirmation of the above.

3. In Anusasan Parva (Chapter 167) we read that Bhishma, the first General of the Kauravas, fell in the battle on the 10th day and though pierced with arrows continued to live for 58 days. He died on the eighth day of the lunar month of Māgh which is still celebrated by the Hindus. He waited for the expiry of the winter months, for the day when the Sun would move towards the north. In the Vedanga Jyotisha the winter solstice took place on the 1st day of the lunar month of Māgh commencing with the new Moon. Therefore the winter solstice referred to in connection with the death of Bhishma took place about 7 degrees in advance. On account of the precession of the equinoxes the solstices fall one degree behind in about 72 years. This gives us 13th century B.C. + and 5th century B.C. = 18th century B.C. as the time when the Mahābhārat's account could be true.

4. In Adi Parva (Chapter 71) and also in Asvamedha Parva (Chapter 44), Visvāmitra is said to have introduced a change in the Nakshatra system by making Sravana begin the year. This means that the winter solstice had shifted from Dhanishtha to Sravana. This happened about the middle of the 5th century B.C. This is the latest astronomical fact in the Mahābhārat.

B. External :—

1. Varāha—an astronomer of the 6th century A.D. quotes in his *Bṛihat-Samhitā* on the authority of an older astronomer the statements that during the reign of Yudhishtira the *Saptarsis* (Ursa Major) were in the Maghā Nakshatra, and that the era of Yudhishtira is obtained by adding 2526 to the era of Saka. He adds that the *Saptarsis* remain for a hundred years in each Nakshatra. We thus find that Yudhishtira ascended the throne of India 2526 years before the Saka Era (78 A.D.). The method of computing the era of Yudhishtira is peculiar, but I need not discuss it here. Suffice it to say that this era was current in parts of India when Al-Beruni visited the country, and I believe a modification known as *Laukikābdā* is still in use in Kashmir. Now accepting Varāha's statement we find that Yudhishtira flourished about $2526 - 78 = 2448$ B.C.

2. Similarly, Kahlan Pandit, the historian of Kashmir (12th cent. A.D.), wrote that the war of the Mahābhārat took place 653 years after the beginning of the Kali Yuga (3101 B.C.). Hence according to this historian the war took place $3101 - 653 = 2448$ B.C.

3. The basis of the statement is given by the historian, and it is no other than the position of the *Saptarsis* as quoted by Varâha and found in many Purans (e.g., Vishnu Puran, Bhagavata Puran). The line of the *Saptarsis* passed through the Nakshatra Maghâ at the time of Yudhishtira. The interpretation of the motion of Ursa Major at the rate of 100 years for every Nakshatra ($13\frac{1}{2}^\circ$) has been a vexed question. I take it to mean the first attempt in this country at the determination of the precession of the equinoxes. In Sanskrit astronomy we speak of the precession of the solstices rather than that of the equinoxes. I believe that the line of the *Saptarsis* became synonymous with the summer solstitial colure, and that this colure passed through Maghâ during the time of Yudhishtira; in other words Krittika marked the vernal equinox at that time.

Now what are we to understand by Krittika Nakshatra, the asterism itself or an artificial division of the ecliptic bearing that name? Fortunately all doubts have been removed by a remarkable passage in *Satapatha Brâhmana*. In this work we find mention of some of the names of the Kauravas and Pândavas including the name of Parikshita, the grandson of Arjun. "Professor Weber maintains that the war must have taken place after the *Satapatha Brâhmana* had been commenced and before the final books of that work were written." (R. C. Dutt's *History of Civilisation in Ancient India*). Now what is the date of this *Brâhmana*? Western scholars have placed the work towards what they call the end of the Vedic period, viz., 6th cent. B.C. But thanks to the labour of the late Sankar-Bâlakrishna Dikshit, we now know that the *Satapatha Brâhmana*, at least its earlier books, are very much older. In the second book of the *Brâhmana* Krittika is thus defined: Krittika alone is many-starred, all other Nakshatras consist of one, two, three or four stars. Krittika alone rises due east, all others deviate from the east. From this it is clear (i) that the word Krittika signifies the star-cluster Pleides, and not the imaginary division bearing the name, (ii) that Pleides used to rise due east at the time of the composition of the *Brâhmana*, and (iii) that the present tense of the verb leaves no doubt in our mind as to the time of the statement. Now the rising of Pleides due east means that the celestial equator passed through the star-cluster; that is to say, the star-cluster marked the vernal equinoctial point. The longitude of the middle star of the cluster is now about 59° which at the rate of 1° every seventy-two years takes us back through 4248 years - 1913 = 2335 B.C. The summer solstitial colure

passing through star Maghâ (Regulus) also points to the same antiquity. We get therefore 23rd or 24th century B.C. as the time of the war. The only doubt which may arise is the question whether the Rishis could accurately determine the east point. I should say, yes; for it does not require the aid of a modern instrument to mark the point approximately, say within a degree. Further, observations of the heliacal rising of the stars were much in vogue in ancient times.

4. Visnu Puran describes the method of finding the position of the line of the *Saptarshis* and adds that Parikshit was king when 1200 years of the Kali Yuga had expired. That is to say his date was $3100 - 1200 = 1900$ B.C. (It is to be noted that the historian of Kashmir made it 2448 B.C.)

5. In the same Puran we find it stated that there was an interval of 1015 years between Parikshit—the grandson of Arjun and king Nanda. Now we know from history that the Nanda dynasty ruled for 100 years, after which Chandra Gupta of the Mourya dynasty became the king of Magadh in 315 B.C. Hence $1015 + 100 + 315 = 1430$ B.C. was the time of the war.

It will be seen from the above that we arrive at two dates separated by an interval of about a thousand years, one pointing to the 24th cent. B.C., the other to the 13th cent. B.C. with a connecting link of the 18th century B.C. between (A 3, B 4). The earliest date accords pretty well with the Indian tradition and the era of Yudishthira. There is thus reason to maintain (1) that the great war took place some time in the twenty-fourth century B.C. (B 1, 2, 3); (2) that the greater portion of the present Mahâbhârat was composed about the 13th cent. B.C. (A 1, 2, B 5); and (3) that the latest edition of which we have any astronomical evidence was made so late as the 4th or 5th cent. B.C. (A 4).

Notes on Jupiter.

BY

REV. J. MITCHELL, M.A., F.R.A.S.

JUPITER now (25th May) rises before 10 P.M. and with its comparatively high altitude in this latitude is a very fine telescopic object. I have examined the planet several times of late, both in the early morning and late at night, but so far the sky