DISCUSSION

ON SOME COMET OBSERVATIONS IN ANCIENT INDIA by R.N. Iyengar, Jour. Geol. Soc India, v.67(3), pp.289-294.

V.S. Krishnaswamy, 409, South Lexington Avenue, White Plains, New York - 10606, **Email:** ramasaranam@aol com, comments

Dr R N Iyengar deserves to be congratulated on his painstaking and continuing efforts towards the collection and dissemination of useful information, some of which has great geo-scientific value, which he has been culling periodically, from his studies of ancient Sanskrit literature of India I wish to benefit from his comments and his responses to the following queries and thoughts of mine that arose from a study of his most interesting paper on the comets of ancient India

It is not clear as to why all the 26 comets, as listed in the "Parasara Samhita", all of which had been sighted in the total time frame of 1300 years, have all been recorded only after the "Great Flood" It does not seem to be because that is the beginning of the record of comets, for, some other comets of the Vedic times have also been listed by the author The author has cited verses from the "Rig Veda" and the "Atharva Veda" that support the sighting of comets, which however, have been mentioned without any dates of their sighting It seems either before or after the "Great Flood", as the Vedas have been assessed by some researchers of Vedic literature as having been recorded orally and passed on from generation to generation or recorded on palm-leaves, by the ancient sages and thinkers of India, in the different phases of the development of Vedic literature and continuously from 6000 B C to 1000 B C Therefore, it requires clarification by the author whether nor not the comet sightings of the Vedic times, as referred to in his paper, are some in duplication of the record in the "Prasara Samhita" and that some are those that were probably seen earlier to the Samhita sightings listed in the paper, after the "great flood" The question thereafter arises as to the reliability of the date that has been computed for the "great flood", as 2500 B C Is this dating rigid or is a pre-dating of this event possible on the basis of available information in Vedic literature?

It will be a worthy attempt to arrive at the most reliable and plausible date of the "great flood" event of the Vedic times, as this is a paleo-climatic event of the Holocene that seems to have been of a great areal extent in south Asia and in the Middle East, provided this can be established as a factual occurrence on the basis of modem scientific evidence In this connection it has to be stated that other than the cometary evidence cited by the author, all available archaeological, geological and geochemical evidences that are known to me give a different date for the ancient floods which do not support the flood date of 2500 B C proposed by the author, unless it is a different flood event designated as the "great flood"

It seems possible to me to assume that the "great flood" may have taken place about 500-1000 years earlier This is because of the limitations to the accurate recording of the comet sightings by visual means alone, unaided by the type of instrumental facilities that are available in the modem times, that can permit accurate recording of such events It is to be noted that the author has also indicated the rough assessment of the dates of the comet sightings and also that a 7 degree inaccuracy in the recording of the earth's counter-clockwise axial rotation can result in a time difference of 500 years

It does not seem possible to me to date the "great flood" forward by 500-1000 years, because this brings in other difficulties, such as the limited time span that is available between the time of the "great flood" and the time of Krishna's Dwaraka, the latter having been established by modern thermo-luminiscence dating of the pottery fragments recovered from the submerged fortress of the port-city of Dwaraka, which has given a date of around 1500 B C therefore, to me, predating the "great flood" seems to be a necessity, the author's comments on this thought are most welcome

In so far as my knowledge goes, the earliest flood date that has been recorded by archaeological research in India is around 2000 B.C in the Lothal area of the present-day Cambay Basin of Gujarat, where the Harappan civilization had thrived once and where there is adequate evidence for flood of 2000 B C to have driven the people of the Lothal area to other higher places in Gujarat (S R Rao et al 1963) I have considered it necessary to record the apparent discrepancy in the dates relating to the "great flood" as evaluated from cometary evidence and the date of the flood event as indicated by archaeological studies, although it is conceivable that the flood recorded in the Cambay Basin

may not have been the same as the "great flood" of the Vedic times

Another line of evidence, namely, oceanographic sediment-dating by radioactive methods has established the occurrence of two flood events, one in 1500 B C and another in 2000 B C (Nigam and Khare, 1982)the latter being considered to be the same as the Cambay Basin flooding, cited earlier Nigam and Khare had based their conclusions relating to the two flood events of the past from their study of the C^{14} dates of the foraminiferal remains in the ocean bottom sediments deposited at the mouth of the Kalinadi river, at depths of plus 20 m off the coast of Karwar in Karnataka, in the Arabian Sea

The third line of scientific evidence on the time of occurrence of the floods in the ancient times, which is geochemical in nature, pertains to a very detailed examination of a very large number of samples of the laminated sediments in the deep sea, off the coast of Makran Coast of Baluchistan, all of which were also dated by C^{14} and Oxygen isotope ratios that were determined (Luckage et al 2001) This line of geoscientific study related certain geochemical ratios of the elements present in the laminated sediments that were considered to be indicators of the ambient temperature, the fluvial inflows and the monsoonal variation (vide Fig 2 of Luckage et al 2001) presenting graphs of the geochemical ratios versus various environmental factors for a 5000 year period, that encompassed the sediments under study This suggests possible flood flows close to 1500 and 200 B C, but none with such clear indications of significant flooding, in the time slot of 2500 to 3000 B C which was the end of the time slot encompassed by the Makran Coastal sedimentary studies

It is indeed unfortunate that so far, no studies have been taken up on land, specially in north and northwest India, to the best of my knowledge, with a view to establish the veracity or otherwise of the prevailing thoughts on the occurrence of the "great flood" and on its most likely date of occurrence, be it 2000 B C , 2500 B C or 3500 B C It remains to be seen whether or not the extensive Holocene sedimentary record that is available to geoscientists, in the northern and northwestern parts of India, specifically in the now extinct Saraswathi river basin of the Vedic times and in the present-day basins of the Indus and Ganga river systems can yield suitable dateable material that can supply useful geological and geochemical evidence on the acceptability of the "great flood" as a paleoclimatic event of South Asia and the Middle East and its date of occurrence

Another important aspect of the study of comets is the geoscientific information that it can provide on the incidence of marine transgressions and on some earthquake events of the past to which the sightings of comets have been related, and the author has made a brief reference to the same in his paper It is not clear, however, whether or not he supports the belief of some researchers, expressed in the earlier discussed literature that some comets such as the "Brahma Danda" comet of 1500 B C sighted near Dwaraka, was held responsible for the inundation of he city of Dwaraka In this connection, the author of the paper is already aware of my earlier contribution on the submergence of the city of Dwaraka (Krishnaswamy, 2005) wherein I had made a detailed evaluation of some half-a-dozen alternative explanations that had been offered by other investigators of the problem of Dwaraka's submergence, excepting, of course, the still poorly understood explanation referred to by the author that some researchers believe that there has been some relationship between the submergence of the city and the appearance of the "Brahma Danda" comet My own research of the problem of Dwaraka's submergence supported the conclusion that the most probable and scientifically most acceptable explanation would be the postulation of an earthquake of magnitude plus 8 3 and less than 9 3 on the Richter scale, that may have originated along the already well known and seismically very active Plate Tectonic junction between the continental and oceanic crust in the subduction zone in the Arabian Sea close to the Makran Coast of Baluchistan, where from, the tsunami of 1945 is recorded to have impacted the coast of Gujarat and Maharashtra

The author has cited recent scientific research by Napier in 1988 and by Mandelkhar in 2002 that support the climatological effects of comet dust blanketing the sun and affecting the climate There is however, no reference to similar scientific work for assessing the real validity of the role of comets in causing sea-level and ground-level changes, concomitantly with the sighting of comets I wonder whether the author is aware of any information in the Vedic and Post-Vedic literature in Sanskrit that can give some information on the size of the "Brahma Danda" comet of 1500 B C and the distance between the earth and the comet at time of its sighting For, such information, if at all it is available, may indeed be of some help in evaluating the doubtful, but still possible role of gravitational pull exerted by a large planetary body coming close to the earth than its closest satellite, the Moon, which, despite the distance involved, is well known to cause the lunar tides in the ocean, which are specially stronger on full moon nights Whether or not, likewise, the gravitational pull exerted by a close enough planetary body of sufficient size could have

caused the sea-swells and also land swells that are visually imperceptible but that still can disturb the prevailing balance in the primary triaxial stress fields that act on the rocks inside the earth, specially in the areas that are already vulnerable to such disturbances affecting their equilibrium, is a moot question, which the Science of the Future can alone can help to answer

R.N. Iyengar, Department of Civil Engineering, Indian Institute of Science, Bangalore - 560 012, **Email:** aareni @yahoo com, replies

I thank Shri Krishnaswamy for his appreciative words and thought provoking discussion on my paper He raises some important questions about the accuracy of dating of the Floods I confess that I have no clear cut answers to his questions Parasara's tradition holds that the era of the Flood was the initial point for the 26 comet observations ending with *dhūma ketu* Fixing the era of Parasara as the middle part of second millennium BC is based on statements, which carry some limitations The association of seasons with naksatra is based on naked eye observations prone to errors The identification of the first point of Dhanistha, with beta-delphini is not devoid of controversy The 1300-year period for the 26 comet observations is again not a rigid figure The list has a sequence of eight short period comets covering 120 years Whether, these are real observations or not can only be commented upon by astronomers Clearly, my intention was to point out that there is a tradition of the above type in our ancient literature that demands attention of the scientific community interested in palaeo-climate studies

In Vedic parlance, the word *dhūma-ketu* has been traditionally interpreted as *fire the smoke bannered* It may not be out of place to point out that meteors were denoted by a separate word *ulka* (RV IV 4 2 and X 68 3) This word is still used in Indian languages in the same sense Thus, there is a case for ketu in the Rig Veda (RV) to have referred to comets This word and its derivatives occur more than seventy times in RV However, the same word might have been used to mean differently in different places Quite interestingly this word never occurs in the second *mandala* of RV Hence in-depth study of the voluminous Vedic literature is needed before drawing conclusions about the synchronism between comets of Parasara and Vedic words indicating celestial deities

Reference to the Great Flood in Vedic literature is linked with the escape of Manu from the deluge Mahabharata refers to this as an ancient event and hence it should not be equated with the inundation of Dwaraka as Krishnaswamy rightly points out But this in no way goes against a comet having been observed and getting temporally associated with the submergence of Dwaraka (Iyengar, 2006) An information arising out of the epic (Vana Parvan 185 47) is that during the Great Flood, Manu had tied his boat to the peak famous as Nau-bandhana in the Himalayas There are strong reasons to identify this place with present day Nahan (30 5°N 77 3°E) in the Sirmur region of Himachal Pradesh (Bharadwaj, 1986) It would be interesting to see whether this region holds any dateable evidence for the Flood

References

Bharadwaj, O P (1986) Studies in the Historical Geography of Ancient India, Sundeep Prakashan, Delhi

Iyengar, R N (2006) Some Celestial Observations Associated with Krisna-lore Indian Jour Hist Sci , v 41(1) pp 1-13

Krishnaswamy, V S (2005) Active marine transgression and destruction of the port-city of Dwaraka, Gujarat, India, in the 2nd Millenium B C A geological evaluation Gondwana Geol Mag , v 20(2), December 2005,pp 79-88

Luckage, A , Doose Rolinski,H , Khan,A A , Schulz,H and von Rad, U (2001) Monsoonal variability in the N E Arabian Sea during the past 5000 years Geochemical evidence from laminated sediments Palaeogeographgy, Palaeoclmatology and Palaeoecology, Elsevier Publications, 2001, No 167, pp 273-286

Nigam, R and Khare, N (1992) Oceanographic evidences of the great floods in 2000 and 1500 B C in archaeological records New trends in Indian Art and Archaeology, Special Commemorative Volume, Vol 2, Aditya Prakashan, New Delhi

Rao, S R , Lal, B B , Nath, B , Ghosh, S S and Lal, K (1963) Excavation at Rangpur and other explorations in Gujarat Ancient India Bulletin of the Archaeological Survey of India, No 18 and 19, pp 5-207