DISCUSSION

Comment

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(Comment on the paper '**Maskelynite from the Indian Impact Crater at Lonar**' by Dr. V. K. Nayak, published in the Journal of the Geological Society of India, Vol. 41, No. 4, 1993, pp. 307-312).

Nayak (1993) has made a timely contribution on the Lonar maskelynite. He has rightly pointed to the significance of the refractive index *versus* An-content data. However, there is a necessity for a larger data base, rather than a few measurements as reported, of the refractive index as well as the heating experiments on the various grades of shocked basaltic material especially the maskelynites from Lonar Impact Crater. An exhaustive study of these glasses of impact origin including those which have a close resemblence to tektites (Murali *et al.* 1986) is very much needed. In this regard another worthwhile approach would be to make a reliable and detail study on the shocked basaltic material based on their Thermoluminescence (TL) properties.

It was shown by Sears (1980) on meteoritic samples as well as the detailed work done by us on Shergottites and Lonar glasses (Sengupta *et al.* 1984; Sengupta 1986; and Bhandari *et al.* 1986) also indicate that the TL properties especially the TL sensitivity (TL response to an applied dose) is a good indicator of the extent of shock and/or post-shock recrystallisation. The results indicate that the TL sensitivity of Shergottites is very low. As compared to Dhajala it is only 10^{-2} to 10^{-4} which is consistent with the heavily shocked nature of the minerals (Sears *et al.* 1984; Bhandari *et al.* 1986). The variations in the TL sensitivity has been attributed to the changes in the phosphor from crystalline to the glassy phase. This implies that these meteorites were subjected to different amounts of shock and/or had a different extent of post shock recrystallisation. The results obtained on the Lonar glasses indicate that the TL sensitivity is lower (one-fifth to one-tenth) as compared to the surrounding basalts (Sengupta, 1986). This suggests that the TL properties of the shocked basalt and the impact glasses from Lonar belonging to various shock categories (Stoffler, 1971; Kieffer *et al.* 1978 and Mason, 1978) could be used to delineate the extent of shock and the effect of post shock recrystallisation. The TL analysis could be used along with the optical data to elucidate the mechanism of plagioclase-maskelynite transformation in an impact environment and its reversion on heating. It could also be used advantageously to understand the pressure-temperature history in an impact environment.

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Reply

I am thankful to Dr. Sengupta and appreciate his interest and comments on my paper, 'Maskelynite from the Indian Impact Crater at Lonar.' I concur with his suggestion that it would be useful to have more data on various degrees of naturally shocked Lonar basalts, which I have already emphasized in my paper to have detailed study of such shock-generated basalt material to understand pressure-temperature history in an impact environment. Based on naturally shocked and experimentally shocked Lonar basalts, five Classes showing shock characteristics and pressure estimates were suggested by Kieffer *et al.* (1976) and additional data contributed by Schaal and Horz (1977). These five classes are: Class 1 (<200 kbar)—fracturing and comminution are the evidence of damage; Class 2 (200–400 kbar)—labradorite laths are partially to completely converted to maskelynite but retain their original crystal shape; Class 3 (400–600 kbar)—labradorite is converted to glass which shows some evidence of flow and pyroxene grains are granulated; Class 4 (>600 kbar)—labradorite is melted to a clear vesiculated glass which has flowed so extensively that original shape is lost and pyroxene is fractured and altered on grain boundaries; Class 5 (>800–1000 kbar)—most of the basalt is melted to produce glass (impactite) due to mixing of labradorite, pyroxene and opaque components (represent impact generated basalt melt).

It is obvious that plagioclase is the most diagnostic mineral in naturally shocked Lonar basalts and it displays a variety of deformation features and phase transitions sensitive to specific shock pressures. Sengupta *et al.* (1984) have demonstrated that thermoluminescence (TL) sensitivity of impactite glasses from Lonar is lower than the surrounding basalt thereby indicating that TL characteristics of various Classes of shocked basalts could be used to understand the effects of shock and post shock changes. The TL technique alongwith optical, chemical and other data could be used up to Class 4 shock category to understand the true mechanism of plagioclase-maskelynite transformation and P–T regimes in an impact environment. However, it may not yield the desired results in Class 5 shock category in which all mineral constituents of basalt are melted and mixed-up to produce impactite glass. It is known that in contrast to investigation of crystalline material, it is much more difficult to obtain reliable structural and other information of amorphous material such as silicate glasses and even more difficult to comprehend details of impact-generated basaltic melt produced in shock environment.

I believe that there is a need for inter-disciplinary and inter-institutional research programmes in this exciting new area of shock metamorphism at the Indian Impact Crater at Lonar.

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Comment

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(Comment on the paper, '**Cretaceous sedimentation in the sub-surface of the Krishna-Godavari Basin**' by S. K. Mohinuddin, K. Satyanarayana and G. N. Rao, published in the Journal of the Geological Society of India, Vol. 41, No. 6, 1993, pp. 533-539.)

The authors must be congratulated for working out the Cretaceous sedimentation in the Krishna-Godavari Basin on sub-surface exploratory data. However, the following comments are offered on basic geological aspects to make a meaningful interpretation on Cretaceous sequence and its sedimentation.

1) The authors concluded that the top and bottom of the Cretaceous sequence are marked by the base of the Basalt and top of the Red Bed respectively. It is a a well established fact that in the Krishna-Godavari Basin the Deccan basalt is underlain by Infratrappean sequence of Maestrichtian-Danian age whose thickness is 70m in outcrop and 1100m in subsurface (Prabhakar and Zutshi, 1993). Field relationship shows that the Intratrappean sequence constitutes the topmost unit of the Tirupati Formation. As there is no mention of Infratrappean sequence in the paper the authors may clarify the status of 'top' of the Cretaceous sequence.

2) The sandstone sequence immediately overlying the Red Bed is a part of continental Gondwana sequence belonging to the Kota Formation of Early to Middle of Jurassic age and not of the Gollapalli sandstone as suggested by the authors. Such field relationship can be clearly seen in the Chintalapudi sub-basin in Annapureddipalli-Nallamudi area, Khammam district, Andhra Pradesh. Sandstone cores shown in Plate-I, i.e., clay clast bearing sandstone (Fig. C), channel sandstone (Fig. D) and ripple cross stratified sandstone (Fig. A) are typical of the Kota Formation in the southeastern part of the Godavari graben (Lakshminarayana and Murti, 1990).

3) The authors have not specified the outcrop area of the 'Gollapalli sandstone'. However, it is to be noted that the recent geological mapping revealed that there is no stratigraphic unit called 'Gollapalli Sandstone' in the Krishna-Godavari coastal tract. The areas earlier mapped as 'Gollapalli sandstone' actually belong to either Kota Formation or Tirupati Formation (Lakshminarayana *et al.* 1992).

4) The authors state that 'by early Cretaceous these grabens were smoothened by sedimentation as evidenced by marine transgression all over the basin.' Do the authors imply that the so-called 'Gollapalli sandstone' is also a part of graben sedimentary sequence and it is followed unconformably by the Raghavapuram Formation?

5) The marked discordance in the dip meter data, i.e., 2 – 20° NW for the so-called 'Gollapalli sandstone' and 2 – 10° SE for the Tirupati Sandstone points to the fact that there is a distinct reversal in basin gradient/depositional trend which also coincides with the change from continental Gondwana (graben phase) to Coastal Gondwana (marine) sedimentation at the beginning of Cretaceous.

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Reply

The authors are thankful to Dr. G. Lakshminarayana for critically going through the paper and for his attempt to tie the subsurface data presented on our paper to his out-crop study area. The reply is as follows point by point.

1) The top of Cretaceous sequence is mentioned as base of Basalt, which includes a major arenaceous section in the study area and termed as Tirupati Sandstone in outcrop areas. Hence it further clarifies that the Infra-trappean (base of basalt) Tirupati Sandstone forms the top of Cretaceous.

2) The paper mainly deals with subsurface data obtained from a number of deep wells, and stratigraphic nomenclature as used in ONGC has been reflected. The depositional environment of arenaceous sequence overlying the 'redbed' is of continental nature towards the northwestern part of the study area as evidenced by core photographs. The present study also indicates marginal marine conditions of deposition towards the southeastern part.

3) The sub-surface data clearly demarcates the 'Gollapalli sandstone' from its lithological, stratigraphic, petrophysical and electrolog characters from Tirupati sandstone and Chintalapudi sandstones differentiated by Raghavapuram shale and 'Red Bed' respectively. The work carried out by an individual is welcome as a suggestion but it will have to be confirmed and accepted by all geological agencies.

4) The depositional conditions of 'Gollapalli sandstone' represent both continental and marginal marine conditions in the area. The end of Gollapalli sequence represents the smoothening of all horst and graben morphology as evidenced by major marine transgression of Raghavapuram shale.

5) As explained above the deposition of Gollapalli Sandstone was within grabens and over horst blocks represented by different depositional dip patterns. However, by the end of Gollapalli stage (during deposition of Raghavapuram shale) a marked change was noticed in depositional direction which is towards southeast.

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BOOK REVIEW

ECOLOGY AND POLLUTION OF INDIAN LAKES AND RESERVOIRS. 1993.
By P. C. Mishra and R. K. Trivedy (Eds.) Ashish Publishing House, 8/81, Punjabi Bagh, New Delhi-110026, 347p. Rs. 500/-.

As there is a slowly growing awareness on the part of the public in general and environmentalists in particular to protect the natural environments from increasing human interference causing degradation (not necessarily intentional), measures to monitor changes, and take appropriate action to mitigate their effects assume great importance. Reservoirs and lakes are one of the important areas which are sources of water for irrigation, industrial needs, and domestic consumption. These are in some cases habitats of migrating birds and thriving aquatic population. Most of the pollution is due to human activities like entry of raw sewage and agricultural run-off and discharge of chemical effluents. Monitoring of quality of both water and sediment has to be done by evaluating the various parameters—physical, organic and inorganic.

This volume contains 16 papers. There is an attempt to have write-ups on some lake or reservoir from as many States as possible. The parameters studied are almost the same. Greater attention has been paid to variations in affected plant species and nutrients. The photographs, however, lack clarity and could have been omitted. The line drawings are better. The causes of the malady listed are known. The remedies are equally well known. The volume can be said to bring home to the readers the degree of degradation that has taken place in the selected areas of study.

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