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# Ancient TL

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THERMOLUMINESCENCE RESEARCH IN INDIA: A REVIEW  
OF APPLICATIONS TO ARCHAEOLOGY, SEDIMENTS AND METEORITES

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Although several groups in India specialize in research on thermoluminescence as a phenomenon, only three institutions have active applications programs. Three more institutions have definite plans to initiate research on thermoluminescence application. This review is intended to provide a glimpse of activities of these institutions.

Bhabha Atomic Research Centre, Bombay (Dr. C.M. Sunta/Dr. K. S. V. Nambi)

The Health Physics Division, Bhabha Atomic Research Centre, Bombay, has a strong group on thermoluminescence research, active for almost two decades. The primary mandate of the group is personnel radiation dosimetry, survey of natural radiation environment and development of new TL phosphors for gamma and mixed-field dosimetry. The group has provided an excellent survey of natural radiation field on the monazite rich Kerala Coast (SW-India) having analyzed TLD data on 2,500 dwellings and 10,000 persons. The group has now initiated a TLD survey of natural radiation fields throughout the country. Another important contribution from this group has been the detailed studies on the role of rare earth impurities doped in a variety of phosphors ( $\text{CaSO}_4$ ,  $\text{CaF}_2$ , etc.). Research in TL applications have included archaeological dating, depositional rates of beach sands, dating of authigenic minerals such as gypsum, and mineral prospecting. A particular mention may be made of a new approach developed by this group for estimating the firing temperature of materials based on temperature dependence of predose sensitization.

Indian Institute of Technology, Kharagpur (Dr. I. K. Kaul)

Another institution, where TL application was also initiated more than two decades ago is IIT, Kharagpur. The group has to its credit, one of the first ever TL dating results, where they reported dating of smoky quartz crystal formed within a radioactive mineralized zones. Owing to doubts on the validity of TL in dating long term events, the group has since concentrated in studies on minerals and on factors cardinal to dating long term events. The group has also proposed use of TL sensitivity and glow curve shapes as an indicator of the diagenetic fabric in the case of deep sea carbonate oozes.

Physical Research Laboratory, Ahmedabad (Dr. A. K. Singhvi)

Installed during 1978-79, the activities of this group are (1) Archaeological dating, (2) Dating of sediments, (3) Thermal and irradiation history of meteorites. Of the eight archaeological sites dated by the group the dating of Ochre Colour and Pre-Northern Black polished ware pottery from Sringaverapura, has helped assign a date to the antiquity of Indian epic Ramayana to 750BC. Similarly, dating of Megalithic pottery to 1120 BC is significant since they ascribe the megaliths significantly older antiquity than believed hither-to. In another study, it was shown that, in marbles, low temperature ( $76^\circ\text{K}$  - Room temperature) TL characteristics and their annealing behavior are correlatable to their provenance.

In the area of sediment TL, the group has reported two new applications of thermoluminescence in, (1) the dating of dune sands and (2) glacier dust and has plans to extensively apply TL to the understanding of the dynamics of dunes wind regimes and the antiquity of Indian Thar Desert. The group has also dated several

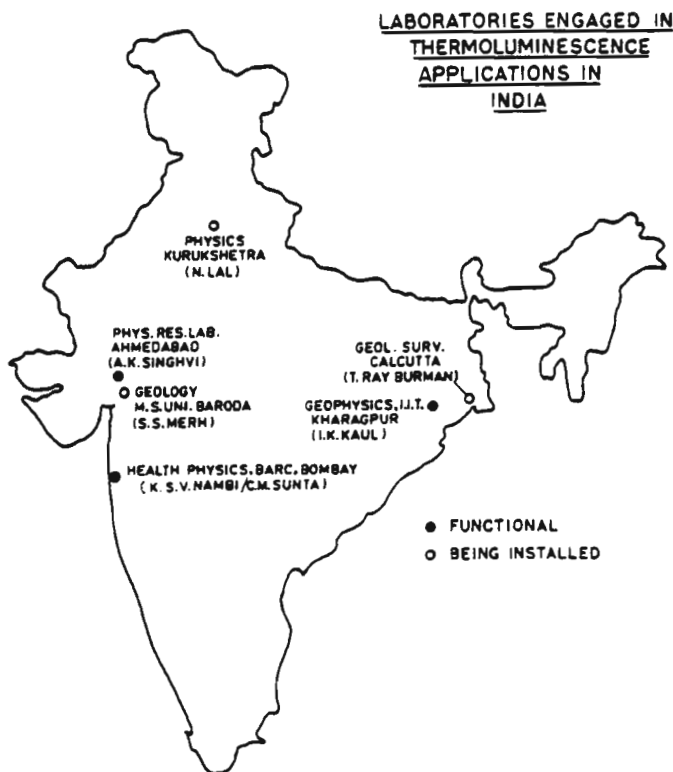
loessic horizons in Kashmir valley.

The research on Lunar and Meteorite TL has been aimed to understand the ablation mechanisms, orbital parameters, etc. of a meteorite body and the group has described a new mechanism for the assymetric TL depth profiles in some meteorites, based on their oriented passage through the earth's atmosphere.

Among those who have recently initiated research in TL the emphasis of the Department of Physics, Kurukshetra, will be towards solving some of the archaeological problems and that of the M. S. University, Baroda, will be to apply TL in quaternary studies.

Much of the information on Indian TL work can be obtained from the following sources:

1. Proceedings of the National Symposium on Thermoluminescence and its Applications, Bhabha Atomic Research Centre, Bombay, 1975.
2. Bulletin of Radiation Protection: Special issue on Thermoluminescence: Dosimetry and Applications, Vol. 2 (4), 1979. (Ed. K. S. V. Nambi, Published by Indian Association for Radiation Protection, BARC, Bombay 400 085).
3. Proceedings of 1st, 2nd and 3rd Specialist Seminars on TL/ESR dating held at Oxford (1978), Oxford (1980), and Helsingor (1982).
4. Natural Radiation Environment (Ed. K. C. Vohra et al 1982) Wiley Eastern Ltd.



[Editor's note: The preceding is a condensed version of the original poster paper appearing at the XV Pacific Science Congress, Dunedin, N.Z.]