MEETING REPORT

The HIMPROBE workshop*

The lofty Himalayan mountain chain is an archetypical example of continent–continent collisional tectonics ranging from 55 Ma back till the present. Because of its unique coverage of the major tectonic units from the Indo-Gangetic planes up to the Karakoram mountain range, the Hoshiarpur–Mandi–Leh–Karakoram transect of the NW Himalaya was chosen for a Geotransect Programme (HIMPROBE), as a multidisciplinary and multi-institutional research under the Deep Continental Studies (DCS) programme of the Department of Science and Technology. Accordingly, a two-day HIMPROBE Workshop was organized at IIT Roorkee in which professors, scientists and research scholars from IIT Roorkee, Delhi University, Banaras Hindu University, Wadia Institute of Himalayan Geology, Indian Institute of Geomagnetism and National Geophysical Research Institute presented their recent geological and geophysical findings along this Himalayan transect.

The workshop was conducted in five sessions. In session-1 on Karakoram mountain, K. R. Gupta discussed retrospect and prospect of the HIMPROBE programme and hoped that it would provide impetus to launch similar multidisciplinary integrated programmes in other sectors of the Himalaya, with a view to understand the Himalayan collisional geodynamics. A. K. Jain discussed exhumation history of the Karakoram mountains with structural, textural and thermobarometric constraints and concluded that the Karakoram Shear Zone does not reveal any evidence of late-stage dextral movement, and that it has no significant role in the eastward extrusion of Tibet during the Holocene period. R. M. Manickavasagam elaborated prograde metamorphism of the Karakoram Metamorphic Belt at 20–25 km depth and partial melting followed by migmatization of its sillimanite–muscovite grade rocks. B. A. Patra presented the Rb–Sr biotite mineral age of leucogranites of the Pangong Injection Complex of eastern Ladakh to be 10.50 Ma.

In session-2 on Himalayan suture zones, H. Rai narrated tectonic evolution of the Shyok Melange Belt and suggested southward movement of the Karakoram microplate during the post-collisional Tertiary period. T. Ahmed described the Nd and Sr isotopic constraints of the Shyok Suture Zone rocks. From high silica content, variable enrichment in LREE–LILE and depleted isotopic characteristics of these shear zone rocks, he suggested them to be of juvenile continental origin. S. Bajpai talked about the fossil assemblages of the molassic deposits in the Ladakh Himalaya and the possible existence of a land bridge among Ladakh, eastern China and Mongolia during the Late Oligocene. S. Singh presented SHRIMP U–Pb age of Ladakh Batholith to be ~60 Ma and its solidification depth at 9 to 10 km. R. G. S. Sastry worked out gravity and magnetic data of the Indus Tsangpo and Shyok suture zones and inferred the presence of shallow crustal structural faults and shallow-level basic intrusives beneath the Ladakh Batholith and the Shyok Suture Zone.

In session-3 on Himalayan ultra high pressure terrain, A. K. Jain concluded that the Tso-Morari eclogites formed at a peak temperature of 750 to 850°C, and at a pressure of 27.0 to 29.0 kbar, both values being higher than the previously published data, and that Tso-Morari eclogites underwent medium pressure and high temperature metamorphism related to subduction of the Indian plate. H. K. Sachan discussed three-stage metamorphism (prograde, peak and retrograde) of the coesite-bearing eclogite rocks of the Tso-Morari Dome and concluded ultra-deep subduction (90–100 km) of the Indian continental crust. Based on detailed petrography and geochemistry, P. K. Verma narrated that eclogite metamorphism and metasomatism of Lake Morari rocks took place between the time gap in their subduction and subsequent rapid exhumation. Based on his petrologic and structural data, M. Joshi concluded that the Tso-Morari rocks were tectonically excavated from eclogite facies through epidote amphibolite facies to finally greenschist facies by a mechanism of tectonic transport reversal. Based on zircon U–Pb age, S. Singh presented the date of peak eclogite facies metamorphism of the Tso-Morari eclogites to be 48 ± 1 Ma; while the 400 Ma age obtained from the core of the zircons was considered to be indicative of protolith.

In session-4 on the tectonics of Great Himalaya, S. K. Parcha proposed biostratigraphic zonation based on trilobite fauna from the Cambrian sequences of the Zanskar Himalaya. O. N. Bhargava classified the Jutogh Group into eleven formations, argued for two-stage metamorphism of Jutogh and Vaikrita metasediments and identified five generations of folds within them. Solving Navier–Stokes equation at geologically realistic boundary conditions, S. Mukherjee provided a combined ductile shear and channel flow numerical tectonic model for the Higher Himalayan Shear Zone (Zanskar Himalaya) exhumation and validated it from microtextural data.

In session-5 on deep crustal structures; based on magnetotelluric data of S. G. Gokarn, N. Nagarajan reported low resistivity of 1–50 ohm-m mainly up to 25 km depth in the Pang-Phobrang profile, and 100 ohm-m up to 12 km at the north of Chusul Batholith. Nagarajan also presented 2D and 3D modelling of the MT profile across Ladakh, compared them with those of south Tibet, and gave exhumation models of the area. B. R. Arora reported high conductive zone in the upper crustal section below the Tso-Morari Dome and the Indus Tsangpo Suture Zone, and inferred post-collisional rotation of the Indian plate. R. G. S. Sastry inferred basic intrusives at Rumtse–Upsi–Leh–Panamik (Ladakh Himalaya) section by magnetic anomaly analysis, and also four density interfaces at average depths of 52.15 km. S. K. Begum discussed 2D-inversion model from MT studies subsequent to the Chamoli earthquake and the correlation between electrical conductivity parameter and aftershock activity. H. C. Tewari delineated basement configuration of the Naushera–Thanamandi in Jammu region and Babarshi–Muquam

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in Srinagar region and inferred three-layered structure of the latter. M. L. Sharma estimated spectral strong ground motion from the Himalaya and obtained a good match with the observed spectrum. M. P. Singh presented preliminary results of seismic profiles along Delhi–Chandigrah–Manali–Leh–Panamic which cut across all the major Himalayan tectonic units. GPS studies by P. Banerjee revealed convergence rate of India at 40 mm/yr. Using broadband waveform data, K. Suryaprakasam presented mapping of the mantle discontinuities in the Indian shield and the NW Himalaya.

The workshop observed some exciting discussions on whether the Karakoram Fault really exists, reasons for absence of melting of the ultra-high pressure rocks of the Tso-Morari Dome, which have been exhumed from a depth of more than 90 km; geodynamic significance of the Himalayan migmatites, and on the combined ductile shear and channel flow model of exhumation of the Higher Himalayan Shear Zone. The extended abstract volume, *Himalayan Tectonics* (*The HIMPROBE Results*), edited by S. Singh contains twenty-nine abstracts divided into the five sessions mentioned earlier.

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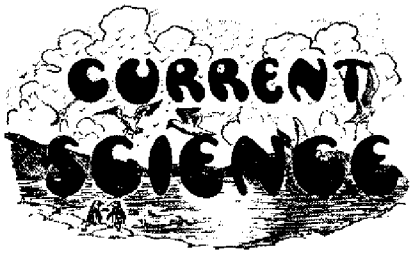
FROM THE ARCHIVES



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National Research Laboratories

The decision of the Governing Council of the Scientific and Industrial Research to urge upon the Government of India the imperative necessity for an immediate establishment of six National Research Laboratories with a view to speed up the industrial regeneration of the country, will be enthusiastically welcomed by every section of public opinion in India. The Council has recommended that a Central Fuel Research Station should be established at Dhanbad, which is expected to work in close collaboration with the Indian School of Mines. The subject of fuel is one of fundamental importance to Indian industry in general and to the metallurgical industries in particular. With their characteristic foresight and their reputed generosity, the Tatas have offered to finance the researches on the production of metallurgical coke to the extent of half the expenditure involved. Reserves of coal in India are limited; poor grades are extensive while the metallurgical quality does not occur in sufficient quantity to meet the needs of the comparatively colossal quantities of high quality iron ore.

The Council has also planned the organization of a National Metallurgical Laboratory which is to be, in all appropriateness, located at Jamshedpur. The Research Laboratory will be associated with, and draw its inspiration from, the great Iron and Steel Works of the Tatas and make use of the facilities offered by the laboratories of the Government Metallurgical Inspectorate. A central Glass Research Institute is the third which has been proposed; its location is not yet decided. The Institute will engage itself on problems connected with glass technology and conduct researches on the production of high grade laboratory, ampoule and optical glasses. The National Physical Laboratory, which, in the first instance, will house the Institute for Radio Research, and the National Chemical Laboratory, complete the six for which the plans are being drawn up. The Tatas, whose munificence has brought into existence the first post-graduate Research Institute of Bangalore, have offered to make a grant of eight lakhs and a half on condition that the National Chemical Research Laboratory is located in reasonably close proximity to the great industrial centre of Bombay. This princely offer has been gratefully accepted by the Council and the Laboratory is proposed to be located at Poona.

Considering the vastness of the natural resources with which this country is blessed, and the magnitude of the industrial problems which are awaiting solution, these six National Research Laboratories would appear absolutely inadequate; but they constitute an encouraging start. It is earnestly to be hoped that the Government of India, who have recently begun to appreciate the value and indispensability of Industrial Research in advancing the economic prosperity of this country, will favourably consider these modest proposals and extend their financial support....

The National Research Laboratories have a great part to play in the future development of the natural resources of this country. We have every hope that the proposals of the Council of Scientific and Industrial Research to establish the six National Research Laboratories will be actively supported by the Government of India.