aperture radar and laser altimetry for monitoring landslide movement nationwide, incorporating state of the art technologies such as microseismicity and rainfall and pore-pressure monitoring with hydrologically based models of slope stability and Global Positioning Systems (GPS) and monitoring capabilities with the National Weather Service Radar Systems.

4. Loss assessment – compiling and evaluating information regarding the economic impacts of landslide hazards including extent of losses to public and private property, infrastructure, natural and cultural resources.
5. Information collection, interpretation and dissemination – Establishing an effective system for information transfer.
6. Guidelines and training – Developing guidelines and training for scientists, engineers and decision makers in the use of landslide hazard maps, assessments, and other technical information for planning, preparedness and mitigation.
7. Public awareness and education – Developing information and education for the user community, organizations, universities and professional societies and associations. Achieving widespread public awareness of landslide hazards will enable communities and individuals to make decisions on where to live, purchase property or locate a business. Local decision makers will know where to permit construction of residences, business and critical facilities to reduce potential damage from landslide hazards.
8. Implementation of loss reduction measures – Encouraging mitigation action.
9. Emergency preparedness, response and recovery – Building resilient communities and rapid response capability and emergency deployment of technology for mitigation.

The US Geological Survey has collated all available information on the landslide history affecting the nation and arrived at the above important aspects for mitigation. Many case studies of the important disasters are highlighted in the book and the remedial measures adopted are also quoted. The book in conclusion stresses the importance of a coordinated role of various governmental organizations, local bodies, public associations and communities for a rapid information dissemination regarding the forecast of possible occurrence of the hazards and also speedy remedial measures of mitigation using the state of art technology and scientific information. The book serves as a useful guide for adoption of such strategy in other parts of the world where no such systematic efforts have been mounted.

(The book is available free on application to U.S. Geological Survey Information Services Box 25286, Federal Center, Denver, CO 80225. A copy is available for reference in the Library of the Geological Society of India, Bangalore)

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HIMALAYAN GEOLOGY, v.26, no.1, 2005, 307p.; SPECIAL ISSUE DEVOTED TO "RECENT ADVANCES IN EARTH SCIENCES IN INDIA" B.R. Arora and A.K. Dubey (Eds.), Published by Wadia Institute of Himalayan Geology, Dehra Dun. Price: Individual Rs.100; US$ 25 (Foreign); Institutional: Rs.750/-; US$50 (Foreign)

The *Himalayan Geology* is published since 1971, with an objective to disseminate the geological data generated from the study of Alpine-Himalayan mountain belt. The present issue of the journal deals mainly with the deep continental studies in Himalayas and South Indian Shield. The initial 11 papers deal with the studies done in Himalayan Collision Zone; the next 5 papers present the data from the Peninsular Shield; the following 10 papers deal with the new experimental and numerical techniques and the remaining 6 papers dwell on the future perspectives.

Jain et al. have dealt comprehensively with the tectonic evolution of the Himalayan collision zone. They have proposed a two-stage model for the deformation and exhumation processes in combined ductile shear and channel flow mode. The metamorphic inversion, wherein the lower grade metamorphics occur in the basal parts and the highest grades are disposed towards top of the channel is well explained. The colour photographs and illustrations exhibiting sense of movement for shear/thrust zones provide excellent support to the arguments. The newer

geochronological data and tectonic modeling has increased the quality content of this contribution. The paper of Ram Sharma also deals briefly on the metamorphic inversion associated with Himalayan orogeny, while proposing a geodynamic model linking the twin problem of southern convexity and inversion of metamorphic isograds.

Sachan et al. have brought out the evidences of cold subduction of Indian plate from Tso-Murari region of Ladakh with eclogites preserved as boudins within para and orthogneisses. The process of deep burial of Indian continental crust indicated by gt-cpx-carbonate association and isothermal rapid decompression resulting in exhumation of UHP eclogite assemblages is presented coherently. Passing reference to the Blue schist and ophiolitic melanges does not justify the importance of these from the high-pressure (39 kb) zones of subduction.

The presentation by Ahmed et al. on geochemical data set of the lithological assemblages from the Indus and Shyok suture zones brings out their contrasting nature convincingly. This effort may help in pacifying the critics of unrelated nature of the two suture zones. The short paper of Hakim Rai describes a complete ophiolite sequence with characteristic features of a melange in the eastern Ladakh and occurrence of large fragment of oceanic crust from south of Nidar and flyschoid units in Indus suture zone for the first time, while expressing hope that this could help future workers in reconstructing the precise plate tectonic models.

Islam et al. have attempted to synthesize the field aspects, petrographic, geochemical and geochronological data of the various granitoids of Proterozoic[2200- 1800 & 1400- 1200 Ma], early Paleozoic or late Pan African [550- 450Ma], Trans Himalayan Plutonic Complex[103-40Ma] and collision related Tertiary leuco-granites of northwestern Himalayas to understand the crustal evolution processes in the Himalayas. The compiled isotopic age data of the large variety of granitoids contained in this paper is of great value. The following paper on geochronological review of Himalayan collision belt by Sandeep Singh has constrained the age of emplacement, cooling and exhumation histories, which range from palaeo-proterozoic to late Miocene. He emphasises the need to generate more and more precise age data, particularly the high resolution U-Pb data together with CL imaging of zircon.

Rajesh Sharma has presented the results of his fluid inclusion micro-thermometry studies of representative sulphides associated with sedimentary succession of lesser Himalayas. He has attempted to quantify the genetic parameters through the entrapment processes involved in sulphide and carbonate mineralization with excellent photographs of sulphidic ore and fluid inclusions. Prasad et al. assign an early to middle Miocene age to Ladhak Molasse in northwestern Himalayas on the basis of discovery of a fragmentary rodent tooth with excellent stratigraphic coloumn, systematic palaeontology, SEM photographs etc. Nanda and Sehgal have brought out the time trangressive nature of various lithological boundaries of Siwalik Group and the enclosed mammalian fauna indicating different ages. This is demonstrated well by presenting a chert showing the range of ages between Tatrot and Pinjar species with a transitional zone near Chandigarh. They contend that the magneto-stratigraphic studies also support the trangressive nature of Siwalik Group of rocks. Rajkumar et al. have attempted to measure the palaeo-latitudes for Kakara and basal Sabathu Formation in Dogadda area using palaeo-magnetic methods. Based on their work, they report palaeo-latitude of 36.4 for the Kakara formation and 12.70 for the latter in the study area.

In second section, Gupta and Rai have applied the different models of continental crustal evolution to the South Indian crust by the parameters of crustal thickness (Poisson's average composition and the variation in S velocity analysing the telesiesmic ratio) and wave forms recorded between 1999 and 2002. The results indicate that the Eastern Dharwar craton and Deccan volcanic province have a relatively thinner (33-38 km) crust, whereas the crust beneath Western Dharwar craton (WDC) is 42-54 km thick. This is a possible evidence of crustal shortening during early Archaeans. Similarly the study has brought out the contrast in average crustal thickness between the deformed Archaean terrain of WDC and Proterozoic southern granulite terrain.

Prasad and Rao have emphasised that the near-vertical reflection method of seismic imaging provides the highest resolution images of the crust and sub-crustal lithosphere including signatures of palaeo-subduction, collision and suture zones. It is a significant attempt to understand the complex geodynamic processes responsible for the evolution of the important tectonic blocks of the Indian shield. They have concluded that both the horizontal and vertical tectonics is responsible for the crustal evolution and moulding the crustal architecture of the Indian shield. Naqvi in his inimitable style has described various orogens and presented his exclusive views about the processes of gold mineralisation through the subduction, accretion and mantle plumes - the model currently in vouge. Mahadevan has speculated that the Proterozoic high grade domain depicts a greater buoyancy, compared to Archaean Dharwar craton which is endowed with a lighter sub-crustal lithospheric mantle, has possibly evolved during the Archaean-Proterozoic period; through the processes of depletion of

basaltic component and mantle metasomatism.

Since mafic dykes constitute best repositories of palaeomagnetism and could also provide thermal demagnetization history through ages, Radhakrishna and Joseph have utilised the data available on the dykes of south India to assess the thermal influence on the region and observed that the thermal influence and related heat flow corresponding to the Deccan trap or other Cretaceous activity have no significant effects in the south Indian shield. Their analysis could decipher a clear late Neoproterozoic thermal influence in the dykes from the Dharmapuri, Thiruvannamali, Agali, Coimbatore granulite belt in the close vicinity of Bhavani shear zone, and the 1 Ga thermal event suggested earlier might not have a major influence in Dharwar craton or the granulite region. Based on the palaeo directions, earlier considered to be 1 Ga ,possibly correspond to Palaeo-Proterozoic intrusions. Radhakrisna and Joseph conclude that the terrain has undergone large thermal events due to late Palaeo Proterozoic dyke magmatism at 1.65 Ga.

In section three, short paper of Dimri illustrates the application of fractal theory on acquisition, processing and preliminary interpretation of potential field data through the interpretation of two major transects across western and central India. Since an understanding of the structure of lithosphere is necessary for earthquake mechanics and geodynamic studies, Manglik has summarised the work on modeling of rheological structure of the Indian continental lithosphere and its implication on the deep crustal seismicity. He has briefly touched upon the flexural studies of the Himalayas and Indian shield. Mamtani and Arora have discussed application of technique of anisotropy of magnetic susceptibility in the study of deformed rocks; presenting examples from Aravalli Mountain belt and the BIF of eastern India. The versatility of the AMS studies in locating weak deformation planes and deciphering mechanism of granite emplacement and folding deformation, beside the strain/ stress analyses related to neo-tectonic movements is discussed systematically. Sukhija and Harsh Gupta have predicted that the recurrence period of major earthquakes in Shillong plateau would be 400-600 years, based on extensive palaeo-seismic measurements from 10 trenches and carbon dating of 25 organic samples. Among the two papers on GPS, the first by Mukul examines the revolutionary role and pros and cons of using GPS technology in the study of continental deformation from different angles; whereas the second paper by Dubey emphasizes the need to fix the study point (GPS) outside the deforming body undergoing translation, particularly in active orogenic belts like Himalayas.

A new method of analyses of fold shapes and their classification is evolved using Bezier curves by Ghatak et al. The necessity of generating more and more data sets on isotope hydrology, which could provide a system-wise understanding of the hydrological cycle of Indian sub-continent is discussed by Gupta and Deshpande. The paper by Sinha et al. reviews the present state of knowledge of quaternary geology and alluvial stratigraphy of the Ganga basin and presents a study of surface geomorphology, near surface stratigraphy and drill cores from shallow boreholes coupled with sedimentological and geochronological analyses to understand the tectonic framework and geological evolution of Ganga basin. All the photographs, cliff sections , stratigraphic and drill core logs are excellent and systematically presented. Chamyal and Juyal have discussed the possible linkage between climatic events in southern Thar Desert margin and Higher Central Himalaya during the last glacial stage. This is a significant study, since the Himalayan glaciers influence the southwestern monsoon in western India.

In section four dealing with future perspectives, Raval has reviewed the three major geo-transects providing wealth of information and urges for many more geo-transects across the other interesting terrains; whereas Avasthi has discussed the data generated by 32 geo-transects in different geological terrains. Since the objective of the geo-transects is to understand the configuration of sub-crustal lithosphere and suture zones, it is imperative that a multidisciplinary approach is adopted. A special branch of science, the Nannoscience is all set to revolutionize the understanding of geo-materials. It has definitely opened a wide spectrum of possibilities for application in almost all fields of geology and the efforts of Anand Mohan to draw attention of Earth Scientists towards the immense potential of Nannoscience is timely and laudable. Raina has reviewed the status of glacier studies in India, since the depleting resources of fresh water and the negative effects of global warming has made the scientists all over the world to monitor the glaciers. Saraswati has emphasized the need for interdisciplinary approach in paleontology and quantification of interpretations made. Shah has described some recent advances in understanding stratigraphy of Himalayas including his views about future challenges and opines that the study of Phanerozoic sequence cannot be undertaken in isolation since it is intimately linked with transgressive and regressive phases affecting the Indian sub continent as a whole and suggests a holistic approach .

A major omission of the special issue is absence of any paper on the northwestern Himalayas, the large northeastern Himalayan tract and the belt of Schuppen. A comprehensive paper each on northwest and northeast Himalaya and Arakan

Yoma belt could have made the issue particularly valuable. Contributions related to ophiolite generation, development of melange zones, and relevance olistostromal limestones, blue-schists, C-type eclogites, mantle derived mafic segregations and oceanic plagiogranites are sadly missing from the volume. It could be true that the issue has been brought out in a hurry, since umpteen spelling mistakes have escaped the attention of proof readers. It appears that there is confusion about the special publications of Geological Society of India, which are repeatedly referred to as 'Memories' rather than 'Memoir' (see pages 149, 159-160, 173, 191, 220, 222, 280 and 293). Careful proof reading before printing is essential for any standard publication. Despite these, the issue in its present form itself is an excellent addition to the knowledge of Himalayan and Peninsular terrrains. The advanced modeling to explain the crustal evolution, experimental and numerical techniques and the newer approaches for research in future contained in the volume are sure to spur many a scientist to take-up comprehensive studies. With all the maps, photographs, sketches, diagrams, text content printed nicely with an excellent cover photo showing the deep sounding crustal images of the Narmada-Son lineament of Central India, this special issue on Himalayan Geology qualifies to adore the shelves of all prominent Earth Science libraries as valuable reference volume.

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K.T. VIDYADHARAN
SALEEM KHAN

ANNOUNCEMENTS

DST SUPPORT FOR THE SECOND AOGS CONFERENCE AT SINGAPORE

Department of Science and Technology invites applications from interested Indian Earth and Atmospheric Scientists who are either organizing sessions or have a letter of acceptance for presentation of a paper in the 2nd Conference of the Asia Oceania Geoscientific Society (AOGS) scheduled to be held in Singapore from 20-24 June 2005. For details please logon to AOGS website: www.asiaoceania.org. DST will be extending support to a limited number of candidates for participating in the meet. The application should contain the following details: (1) Name and affiliation with full address including email and other contact information; (2) Brief details of participation (Title and Abstract of the paper being presented); (3) Brief write up on the relevance of your research/paper to Indian science; (4) Details of International Conference attended in the last three years; (5) Requirement of fund including details of applications submitted elsewhere (6) Passport details (number, validity, place of issue etc.). Airfare by the shortest excursion/economy class.

Applications need to be routed through proper channel and may be sent to Dr. M. Prithviraj, Scientist F, ESS Division, Department of Science and Technology, Technology Bhavan, New Mehrauli Road, New Delhi – 110 016 by 15 April, 2005. **Email:** prithvi@nic.in

XX INDIAN COLLOQUIUM ON MICROPALAEONTOLOGY AND STRATIGRAHY

The Department of Geology, Andhra University is organising the above colloquium at Visakhapatnam to be held during 24-26 October, 2005. The colloquium will focus on various aspects of micropaleontological studies which include Phanerozoic biostratigraphy, evolution, diversity, ecology and palaeoecology, culture experiments on foraminifera, palaeopalynology, microvertebrate fossils; Applications of microfossils in environmental studies, hydrocarbon exploration, oceanography, palaeoceanography and palaeoclimate. Special emphasis will be placed on the micropalaeontological studies of deltas of India and the Indian Ocean. For further details, please contact: T. Yeruku Naidu, Convener, Department of Geology, Andhra University, Visakhapatnam - 530 003, Andhra Pradesh. **Phone**: 0891-2844720 (O); 0891-2538134 (R). **Email:** yntalari@yahoo.com.