

performance and instrument operation. (4) Manufacturers of instrumentation. (5) Analytical quality assurance and reference materials. (6) Sample preparation procedures – liquids, silicates, non-silicates and separation techniques. (7) Applications – Chemostratigraphy and Oil exploration, Zeolites, Archaeological studies and Environmental monitoring. Prof. Walsh with his vast practical experience in ICP developmental activities and special sample preparation techniques over the past 35 years, was the star attraction to clarify day to day practical problems in ICP Spectrometry posed by the participants. Perhaps the best part of the whole programme was the series of informal discussions and sharing of problems as well as knowledge and experiences between the participants and the course instructors.

Guest Speaker Sri L.S. Mumbasawala of IIT Bombay, brought out the salient aspects dealing with routine operation and maintenance of ICP-AES. Drs. Kapil Kuller and Ragesh Acharya of Perkin Elmer assisted by Sri G. Partiban of NIO gave a live demonstration of ICP-AES and also showed the usefulness of the powerful software

for multi-element analyses at very low levels. Participants had a tour of the modern analytical laboratory facilities of NIO, such as geochronology unit, CNS, particle size analyzer, XRD and ICP-MS.

Professor K.V. Subbarao (IIT) and Dr.V.K. Banakar (NIO) together planned and executed the whole programme with the support of Dr. B.P. Radhakrishna, President, Geological Society of India, Eric M. Galimov of IAGC, and Dr. Eric Desa, Director, NIO assisted by Dr. N.H. Hashimi and Dr. A.B. Valsangkar and their colleagues.

On behalf of the Geological Society and IAGC, Prof. P.S. Zacharias, Vice-Chancellor of Goa University and a well known chemist himself, gave away the certificates to all the participants during the valedictory function and highlighted the need for periodically running short courses of this type to update the knowledge and advances in the analytical tools and methodologies for the benefit of the research scholars as well as professionals.

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## GROUP DISCUSSION ON ACTIVE TECTONICS IN WESTERN INDIA

A two-day group discussion on “Active Tectonics in Western India” was held on 20th and 21st March 2003 at the Department of Geology, Faculty of Science, M. S. University of Baroda, Vadodra under the sponsorship of the Seismicity Division, Department of Science and Technology (DST), New Delhi. The deliberations commenced without formal inauguration. Prof. R.V. Karanth, convener, in his introduction outlined the scope of the envisaged discussions.

The discussion took place in four different sessions, with the focus in each on (1) the Kachchh region, (2) the Gujarat Mainland, (3) the Saurashtra region and (4) on sea floor spreading and sea level changes. Experts from various organizations presented their views on the active tectonic aspects of different blocks in western India with special emphasis on Gujarat. The first presentation was by Dr. S. K. Biswas, Visiting Professor, IIT, Mumbai, wherein he talked about various tectono-structural features of western Indian subcontinent in general with an emphasis on Kachchh region. Some light was thrown on the Karakoram thrust and Chaman transcurrent fault and its effect on Kachchh rift basin. He emphasised on the strike-

slip tectonics playing a major role in the structural evolution. His talk was followed by a detailed presentation by R.V. Karanth on exposure scale fault-fold interactions enumerating and supporting the fact that a major structural inversion has taken place in the Kachchh basin. He stressed on the need to reinterpret several tectono-structural aspects in the light of the new data generated by different agencies. The next presentation was by B.K. Rastogi, NGRI, who gave detailed analysis of the 26th January 2001 earthquake and stressed on the causative fault to be blind in nature and not the one which can be related to Kachchh Mainland Fault. P. R. Reddy's (NGRI) talk revolved around the geophysical investigations of western Indian sub-continent.

R. K. Saxena and A. K. Saxena of Geological Survey of India, Jaipur, gave an account of the investigations carried out in Saurashtra and Kachchh after the series of earthquakes that struck the region. R. S. Dattatrayam, IMD, New Delhi dealt with the initiatives taken by the IMD to provide credible data/information about any earthquake taking place in the region. K.S. Rao, IIT, Mumbai gave an account of the usefulness of Synthetic Aperture Radar (SAR)

interferometry in detail. The corroboration of GPS technique with that of SAR was also discussed. M. N. Kulkarni, IIT, Mumbai presented GPS studies in Kachchh region. He gave an account of 17 GPS stations with which the monitoring is being carried out. George Mathew focused on the dating of terrace sediments along the Kachchh Mainland Fault. His conclusions suggest that the Kachchh Mainland ridge is growing laterally eastward. The mechanism, however, remains to be understood.

The first presentation in the second session on Gujarat Mainland was by L. S. Chamyal, M. S. University of Baroda, wherein he focused on the active tectonics in Narmada basin. Several geomorphic features were considered to conclude that the region is undergoing a compressional regime. Anand Kale, ONGC, Vadodara gave a comprehensive presentation on neotectonic aspects of Cambay basin. A lot of information on stratigraphy and structure of Cambay Basin was shared and neotectonic aspects were discussed for different blocks. K. C. Tiwari, M. S. University, Vadodara, gave an account of the neotectonic attributes of Tapi river basin. Several geomorphic, structural and seismic evidences were considered to argue that the region is under the influence of active tectonic activity. He gave an account of the fracture controlled river channels, differential uplift and tilt in trappean rocks along crustal fractures and high heat flow in the region revealed by the presence of numerous hot springs.

The third session on Saurashtra on the morning of 21st March 2003 also had some interesting presentations; the first in line was by D.A. Sant. His presentation was based on the sampling of the three geomorphic sites near Gulf of Cambay. The appreciable grain size data was presented and a very useful question was put forward that if there is no structural or geomorphic representation of the ongoing tectonic activity whether the sediment deposition pattern can provide useful data. Purnachandra Rao, NIO, Goa gave an account of evidences suggesting the neotectonic activity off the Gulf of Kachchh.

Kamlesh Vora, NIO, Goa presented and explained different archaeological sites in Saurashtra, in particular the site of Dwarka. Also the evidences suggesting the shift in the shorelines were presented. C. D. Reddy, IIGM, Mumbai presented the active tectonic study using the GPS techniques in Maharashtra. B. K. Rastogi in his presentation focused on the seismic aspects of Saurashtra region in general. S. N. Bhattacharya, IIT, Kharagpur, gave a detailed seismic picture of whole of the peninsular India stressing upon the occurrence of seismic activity in Saurashtra region. He expressed that a systematic seismotectonic investigation is

required in Saurashtra. P. P. Patel, M. S. University of Baroda, focused on the tectonic aspects of Saurashtra. It was suggested that the data generated at the engineering structural sites might be considered to obtain general perception of the subsurface geology and structure. This in turn may help in the evaluation of the surface faulting potential of a particular region/area.

The fourth session was devoted to the presentations on sea floor spreading and sea level changes. Gopal Rao's (NIO, Goa), presentation was one of the most comprehensive presentations on the tectonic features off the western continental margin of India. Marginal highs off the western continental margin of India with their tectonic significance were discussed in great detail. The total tectonic and structural data was discussed in the present context to delineate the role of these structures on the deformational pattern seen inland. He opined that N-S linear ridges such as Pratap Ridge and Laxmi Ridge are detached parts of western Indian continental shelf.

During this session a detailed discussion on the active tectonic aspects of western India was taken up and following recommendations emerged.

1. Looking to the void in the geophysical data as far as Kachchh region is concerned, there is an urgent need to get 2D seismic survey done for the Kachchh region on both i.e. the E-W and the N-S lines along all the major faults of the region, especially the latter, since the N-S seismic survey could reflect on the nature of regional faults and run across the strike of various geological formations and folded structures such as Bhachau fold nose.
2. There is an urgent need to synthesize the available geophysical and geological data with surface geomorphic/geologic features in Gujarat as a whole. The significance of gravity highs in the region have to be studied in detail.
3. A systematic study on neotectonic aspects for identification of active faults and their traces should be initiated.
4. Seismic vulnerability Shake maps as well as the ground failure maps be prepared on top priority basis by integrating the available geological and geophysical data. A detailed survey is needed especially of the alluvial tracts of western India. There is a need for revision of maps of geological faults whether active or inactive for hazard assessment. There is also a need to evaluate and map the anomalously high velocity zones, as they are the strain accumulators.
5. Based on the newly evolved concepts, a focused study on major fault systems all across Gujarat should be

taken up for studying their geometrical aspects thereby evaluating their surface faulting potential. For this type of study the University departments be recognised and should be provided with requisite help.

6. Geodetic data collection through a network of GPS for strain studies should be intensified to collect real time data on the deformational front through continuous and prolonged monitoring. The study can be supplemented by SAR interferometry.
7. Looking into the perceptible seismic hazard in the state of Gujarat, an institution with interdisciplinary approach of study be constituted. This institute may synthesise the data that comes up from various fields and the data may be exchanged among various interested organizations. A website may be created for

disseminating the new data/work in this region.

8. Coherent efforts should be made to procure the sub-surface data from different organizations during various types of exploration, such as hydrocarbon exploration.
9. The likely return period of earthquake with moderate magnitude in Kachchh is  $45 \pm 5$  years and the return period of earthquake with large magnitude in Kachchh is  $175 \pm 5$  years
10. Such meetings on active tectonics may be held periodically.

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## Geological Society of India

### Annual General Meeting 2003 at Goa

The Annual General Meeting of the Geological Society of India will be held in Goa during 3-5 November 2003 at the invitation of the National Centre for Antarctic and Ocean Research (Department of Ocean Development, Government of India); Goa. A National Seminar on "**Antarctic Geoscience and Palaeoclimatology**" will be held concurrently. The Seminar will cover the following themes:

- Antarctic Geoscience
- Palaeoclimatology, especially the documentation of the Decadal to Millennial-scale climate records of the last 100 kyr.

Scientists/researchers interested in participating in the Seminar are requested to contact Dr. S. Rajan, Project Director (CLCS), National Centre for Antarctic and Ocean Research (Department of Ocean Development, Government of India), Headland Sada, Vasco da Gama, Goa - 403 804. **Phone:** (0832) 2520878; **Fax:** (0832) 2520877; **Email:** rajan@ncaor.org

During the Annual Convention it is customary to hold a session for presentation of highlights of recent and ongoing research. Earth scientists who are desirous of presenting their latest findings are requested to contact S.V. Srikantia, Hon. Secretary, Geological Society of India, P.B. No. 1922, Gavipuram P.O., Bangalore - 560 019. **Phone:** (080) 6522943; **Telefax:** (080) 6613352; **Email:** gsocind@bgl.vsnl.net.in