

debated session. The presentations were by Abhinaba Roy, K. Shivkumar, A. P. Dhurandhar, J. N. Solanki, D. V. Subba Rao and H. Thomas. Third technical session was short and four presentations were made in this session under the theme 'Sedimentology'. Chairpersons were Dr. P. M. Tapaswi and Dr. Uppal Chakraborti and rapporteurs were J. N. Solanki and Gargi Bhattacharya. The presenters were Prof. H. J. Hansen from Denmark, S. Jeevankur, Saumen Paul and Yamuna Singh. Fourth technical session on 'Mineralisation and Exploration' was a marathon session in which 18 presentations were made. Chairpersons for this session were Dr. Anupendu Gupta and Mr. K. G. Bhoskar with M. Sashidharan and Anindya Bhattacharya as rapporteurs. The presentations were by S. K. Acharyya, K. G. Bhoskar, M. K. Devrajan, V. K. Khadse, Biswajit Ghosh, D. R. Kanungo, V. C. Srivastava, M. L. Yadav, G. N. Dwivedi, R. D. Mehrotra, M. A. Khan, V. J. Katti, Kamlesh Kumar, A. S. Sachan, M. Agarwal, Anindya Roy and V. Balaram. Fifth technical session on 'Life' was chaired by Prof. H. J. Hansen and Dr. P. P. Kundal with S. N. Meshram and P. Raja as rapporteurs. Papers were presented by Vibhuti Rai, A. K. Moitra, Sumant Gupta and Kantimati Kulkarni. The last technical session on 'Mineral Policy' was chaired by Dr. K. S. Raju and Dr. A. G. Bhusari with A. K. Saha and K. R. Nagaraj as rapporteurs. The papers were presented by Anupendu Gupta, R. L. Bhatia and C. Chakravarti.

Concluding Session

Two days hectic deliberations were followed by a concluding session. This session provided a platform to take stock of things and to chart out the course for future endeavours. Dr. S. K. Acharyya was the chairman and K. R. Randive was rapporteur for this session. Prof.

D. Mukhopadhyay, Prof. H. J. Hansen, Dr. R. N. Padhi, Dr. Anupendu Gupta, Dr. P. M. Tapaswi, Dr. K. S. Raju, Dr. V. D. Borkar and Dr. M. P. Chawade presented their views and suggestions.

Seminar Volume

At the time of symposium a special volume of the Gondwana Geological Society (No.7), entitled "Advances in Precambrians of Central India" containing papers accepted for presentation at the symposium was released. The volume was edited by Dr. Abhinaba Roy and Dr. D. M. Mohabey with other members of the editorial committee that included K. R. Randive, K. Shivkumar, A. K. Chatterjee, Utpal Chakraborti, K. Sashidharan and K. R. Nagaraj. There are 41 full papers (including a keynote address by Prof. D. Mukhopadhyay) and 18 abstracts. The volume is available for sale @Rs.650/- at the office of the Gondwana Geological Society, C/o Department of Geology, Nagpur University, Nagpur - 440 001 and has been reviewed in this issue of the journal.

Field Trip

Post-Symposium excursion was arranged to the Sausar fold belt on 19th October, 2003. This field trip received an overwhelming response from the participants and more than 50 people joined the excursion. Around 13 crucial spots were shown and the geology explained. The excursion guide was Dr. A. S. Khan under the overall charge of Dr. Abhinaba Roy. Facilities en route were arranged by Dr. D. B. Malpe and Mr. Radhakrishnan.

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ROUNDTABLE DISCUSSION ON NATURAL RESOURCES MANAGEMENT, GEOSCIENCE INSTRUCTION AND JOBS

On the inaugural day of the Refresher Course for earth science teachers held at JNTU, Hyderabad on 3 November, 2003, a roundtable discussion on the above topic was conducted and the consensus that emerged from the discussion is summarised below.

The Roundtable Discussion was moderated by Prof. Arun Nigavekar, Chairman, University Grants Commission, New Delhi. There were presentations from Professors U. Aswathanarayana (Mahadevan Centre; Course Coordinator),

K. V. Subbarao (IIT, Mumbai), and V. S. Kale (Poona Univ.), R. Shankar (Mangalore Univ.), B. L. Deekshatulu (Univ. of Hyderabad), Y. Anjaneyulu (JNTU), C. Srikantappa (Mysore Univ.), etc. The Discussion was based on the *Quo vadis* note, and the list of issues of concern, which were circulated to the discussants in advance. Prof. S. K. Tandon (Delhi Univ.) who was unable to attend, communicated his concurrence with the ethos of the *Quo vadis* note. While accepting the need for the reorientation of geoscience

instruction, the Chairman observed that the exploration of new paradigms for the purpose should come from within the system. Hence this note.

Economic development in India has to be knowledge-driven and job-led. A practical way to make geoscience instruction employment-generating, relevant to the needs of the country, modern, flexible, affordable and of good quality, is to make it end-use oriented (rather than subject discipline oriented), and broad-based. The end-use orientation can be achieved by designing course ensembles built around potential job clusters. The broad-basing has a number of dimensions, such as, inputs in fundamentals of physics, chemistry, mathematics and life sciences, integration of geology, geophysics, geochemistry and geobiology, and linkage with cognate subjects, such as pedology, meteorology, land-use, oceanography, etc. The key words are *synergy* and *flexibility*.

The assistance of UGC is sought to sponsor the following activities for implementing the proposed paradigm shift:

1. *Identify broad-spectrum geoscience jobs* (say, 30 - 50) based on the existing and emerging technologies, social, environmental and industrial requirements (e.g. drinking water, Integrated wasteland management, beneficial use of mine tailings and effluents, soil health), and also those that are needed to maintain India's global position in cutting-edge sciences and technologies (e.g. Space science, exploration for hydrocarbons on the seabed, geotechniques). Experience shows that the candidates who have skills in Remote Sensing, GIS and GPS, and computers have the least difficulty to get jobs. Hence all geoscience instruction should include these skills in their framework, as there is a demand for them.
2. *Design about 100 course ensembles* (several of which may be multi-disciplinary and may have to be given by more than one teacher; they may be PC based and linked to Internet) for the above jobs. Some courses may be planned at two levels - undergraduate and post-graduate. Preparation of course instruction materials, student grading and examination procedures in tune with the new approaches.
3. *Design possible curricular structures* (say, a four-year Resource engineering course, a two-year M.Sc. course in Natural Resources Management, Certificate / short term courses to impart special skills such as Remote Sensing and GIS, Evening courses and Distance education, etc.). Synergy is promoted through the linking of geoscience with other cognate subjects. Thus, the School of Earth and Space Sciences (which incidentally will have access to Rs. 22 crore Super-computing facility) that the University of Hyderabad is instituting is a most welcome step. Based on the same criteria, UGC is urged to include earth sciences in the proposed National Institute of Sciences in Chennai, Bhubaneswar, Allahabad and Pune - the courses offered in the new institutions could take advantage of the synergy approach. That the recently instituted M.Sc. course in Natural Resources Management, offered by the Mysore University, succeeded in attracting a significant number of students, is an indication of the viability of the proposed approach. Participatory learning of science at the high school level is best facilitated based on local environments (waters, soils, minerals and biota). This may not be formally called geology, but there is little doubt that geology graduates would be most suitable to teach such a subject. Also, short-term courses may be designed to acquaint the administrators with ecologically sustainable, economically viable and people-participatory ways of management of natural resources (e.g. drinking water, soil moisture and irrigation management, etc.) to enable them to take informed decisions. There should be institutional mechanisms for creating new courses or modifying the already existing courses, depending upon the market demands and societal needs.
4. From the "smorgasbord" of courses, a geoscience department may choose appropriate course ensembles and specializations, and course structures (subject to satisfying the prescribed total course credits) to suit their academic and financial resources, and biophysical and socio-economic situations. It is envisaged that there would be at least three kinds of course clusters (IITs and some well-equipped universities; medium universities; smaller departments which could still survive by specialising in some key areas, such as coastal resources, or agricultural geology). Those undergraduate departments of geology, which have only one or two teachers and are sub-viable, should be either merged to constitute viable units capable of offering instruction in employable knowledge and skills, or abolished as their continuance serves no useful purpose.
5. It has been found that even though some universities have departments of geology, geophysics, meteorology, etc., the coordination among them leaves much to be desired. UGC may design a mechanism (such as, advising the university concerned to appoint a

Coordinator for these departments) to facilitate the offering of the multi-disciplinary courses by the departments jointly.

6. The need for the geoscience courses to have strong linkages with industry cannot be overstated. Experts from the industry should be persuaded to give short-term courses in the universities, which could be made use of a number of universities in a region. The central and state ministries of Water Resources, Environment, Agriculture, Mines and Geology, etc. as well as industries, should sponsor carefully-selected candidates to study short-term courses or M.Sc. in Natural Resources Management, with ear-marked specializations in selected universities. This way the sponsoring organizations could assure themselves of the steady supply of well-qualified candidates from among whom they could make their choice. The

syllabus for all competitive examinations involving geosciences (e.g. CSIR/UGC fellowships, Geologists' Examination, UPSC and PSCs tests, etc.) should reflect the proposed orientation.

It would take a lot of planning and hard work during the next 3 - 5 years to bring about the envisaged paradigm shift. It is not a question of whether we could afford to do this, but whether we can afford not to do this.

Many distinguished geoscientists have warmly endorsed the strategy and follow-up actions recommended in the consensus document, which is very heartening.

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[Editor's Note: The above consensus document may be read in conjunction with the note published in the Journal on "An Action Plan to make Geoscience Education in India Employment Oriented and Relevant" (Jour. Geol. Soc. India, v.62, no.4, pp.503-506) by the same author. Comments, suggestions and other alternatives on this note may be communicated directly to the author by email: uaswathanarayana@yahoo.com]

A NEW MODEL FOR THE ORIGIN OF BEDDED BARYTE DEPOSITS

Attention of the readers is drawn to a paper that has appeared in the Journal – *Geology* (October 2003, v.31, no.10, pp. 899-900) by Marta E. Torres and others, on a new mechanism for the genesis of ancient bedded baryte deposits. This is based on the analogy of modern baryte deposits at cold methane seeps on continental margins. The ancient deposits are supposed to reflect remobilization of baryte in sulfate-depleted, methane-rich sediments and transport of methane- and barium-enriched fluids by hydrotectonic processes. This new model explains the intertwined biogenic and hydrothermal scenarios satisfactorily and provides a consistent model for reconstructing the tectonic, hydrothermal and oceanographic conditions in the Palaeozoic. The implication of this model

is that the palaeozoic bedded barytes deposits represent not only large-scale venting of barium but also of methane affecting the then carbon cycle as well as the ancient climate.

The Mangampet Baryte Deposit in the Cuddapah District of A.P., in the volcano-sedimentary Pullampet Formation of the Nallamalai Group (middle to upper Proterozoic Cuddapah Supergroup), is one of the largest bedded baryte accumulations/deposits of the world. It would be of great interest to examine the genesis of this deposit in the context of the new model proposed by Marta E. Torres and co-workers.

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