participants. The internal resource persons included faculty members from the departments of Civil Engineering, Applied Mechanics and Hydraulics, Mining Engineering, Computer Engineering and Nodal Centre of the NITK.

Latest trends in engineering geology, geothermal energy exploration and exploitation, quality assessment techniques of dimensional stone deposits, assessment of active landslides and control measures were some of the topics covered under engineering geology. Lateritic soils, geosynthetics of slopes, liquefaction of soils were some of the topics related to the geotechnical part. Subsurface and submarine exploration, dredging and underwater blasting, rock fragmentation engineering are few from the subjects covered with respect to exploration and mining. Ocean waves, coastal erosion, offshore structures, tectonics and eustatic changes along Indian coast, planning of ports etc. were the subjects covered under coastal engineering. Groundwater related topics such as groundwater development, rainwater harvesting, surface and ground-water relationship, groundwater problem in Civil Engineering etc. were dealt with. In the construction domain the role of structural controls, planning of multi-storied buildings, investigation for bridges and failure of dams were discussed. Remote sensing, GIS and GPS, along with computer application in Civil Engineering, I.T. role in engineering projects were also covered in the training programme. Waste management, environmental magnetism, management information system, role and development of marine resources by GSI marine wing were some topics of general interest, which made the course more attractive to the participants. All the sessions were followed by group discussions in which the resource persons and the participants actively discussed the problems and proposed solutions.

The subject oriented field visits made the course more useful to the participants. To see the coastal erosion sites and the preventive measures taken to tackle the condition, the group visited Sasihithlu and Ullal areas of D.K. District. Another Field visit was to see the dredging activity by New Mangalore Port Trust. One more field visit took the participants to a bridge construction site near Bantwal. It also included a visit to the water treatment plant, Thumbe, which supplies water to Mangalore Corporation; and a visit to the Kethikal landslide area. The participants were accompanied by the resource persons, which made the visit useful one because of the field discussion.

During the valedictory function participants presented their views about the training programme. They expressed satisfaction on the course-content and its management in a smooth fashion by the course coordinator - Dr. D. Vcnkat Reddy. The two-week training programme, it is hoped, will bring about a new awareness about Engineering Geology and Geotechnology in this part of the country.

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WORKSHOP ON X-RAY DIFFRACTION OF CLAYS AND INAUGURATION OF XRD-LABORATORY

To intensify teaching and research in Marine Geology and Geophysics, the Department of Ocean Development (DOD), Government of India has established the Ocean Science & Technology Cell (OSTC) at Mangalore University and has been extending financial support for setting up laboratories and human resource development. As a continued part of this activity, a D8 Advanced X-ray Diffractometer has been installed. Inauguration of the XRD-laboratory and one-day workshop on X-ray diffraction studies on clays were organized by the OSTC in Marine Geology & Geophysics, Mangalore University on 14th January 2003. About seventy participants (including teachers, professionals, research scholars and post-graduate students) from Research/Academic Institutions and Officers of State and Central Government Departments from south India attended the workshop.

The workshop was inaugurated by Dr. Harsh K. Gupta, Secretary, Department of Ocean Development (DOD). Dr. P.C. Pandey, Vice-Chairman, Management Board, OSTC and Director, National Centre for Antarctic and Ocean Research (NCAOR), Vasco-da-Gama released the workshop volume. Prof. B. Hanumaiah, Chairman, Management Board, OSTC and Vice-Chancellor, Mangalore University presided over the inaugural function. In his address

Dr. Harsh K. Gupta stressed the importance of intensifying oceanographic research to gather information on marine resources, ocean-atmospheric interaction studies similar to Global Ocean Observation System (GOOS), tapping the thermal energy resource using ocean thermal energy conversion technique etc. In order to predict environmental changes including monsoon, he strongly advocated the necessity of obtaining information from ocean surface also, in addition to the land surface. Dr. P.C. Pandey emphasized that studies on marine sciences should be given more importance and students as well as research scholars of marine sciences should fully utilise the new XRD facility. In his presidential remarks, Prof. Hanumaiah expressed his satisfaction about the progress of the Cell and suggested to utilize the XRD machine to the maximum extent. He promised that all the necessary facilities including space will be given to the OSTC for its future developmental activities. He also expressed his desire to see that the OSTC becomes a centre of excellence. Prof. K.R. Subrahmanya, Research Coordinator, OSTC and Chairman, Dept. of Marine Geology, Mangalore University welcomed the gathering and explained the purpose of organising the workshop. Dr. K. Pandarinath, Research Scientist, OSTC, Mangalore University proposed a vote of thanks.

The various aspects covered in the workshop included: (1) Elements of X-ray crystallography by Prof. Jayagopal Uchil; (2) Sample preparation and X-ray diffraction techniques for mineralogical studies by Dr. K. Pandarinath; (3) Technical presentation on D8 advanced X-ray diffractometer by Mr. A.K. Choudhary,and (4) Identification and quantification of clay and other minerals by Dr. Pandarinath. The workshop included visit to the XRD laboratory where the salient features of the equipment and its operation were explained by Dr. Pandarinath. The informal valedictory function was held at the fag end of the day when participants gave their appreciative feedback and desire to see more such courses organised by the centre. Dr. S. Rajan, Head - Planning and Evaluation Division, NCAOR and Dr. P.C. Pandey, Director, NCAOR, Vasco-da-Gama distributed certificates to all the participants.

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CONTROLLED BLASTING FOR UNDERGROUND EXCAVATION OF ROCKS*

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EXTENDED ABSTRACT

The National Institute of Rock Mechanics (NIRM) has been providing blasting services to several underground excavation projects, mostly in hydroelectric projects. The objectives were to control overbreak, increase pull and reduce blasting to the surrounding rock mass. The presentation highlighted the practical problems faced at Sardar Sarovar Project and Nathpa Jhakri Project and explained how these problems were solved.

STUDIES AT SARDAR SAROVAR PROJECT (SSP)

The major contributions of NIRM for this project include removal of ramp, removal concrete plugs in draft tube tunnels and excavation of turbine pits.

Removal of Ramp

During excavation of the power house cavern at SSP, distress problem was encountered due to the limited amount of cover and the presence of shear zones. After cracks were observed on the cavern walls, further excavation was suspended and additional treatments to the walls was provided. A construction ramp on the downstream wall was to be excavated by drilling and blasting without causing further damage.

^*Lecture delivered at the monthly meeting of the Geological Society of India at Bangalore on 29 January 2003.*