

APPLICATIONS OF ICP-MS IN EARTH SYSTEM SCIENCES

A five-day training course on "Applications of ICP-MS in Earth System Sciences" sponsored by the Department of Science and Technology (DST), New Delhi was organized by the National Geophysical Research Institute, Hyderabad from 26th to 30th June 2006, with the objective to impart theoretical and practical training on geochemical analysis of major, minor, trace and ultra-trace elements including rare earth elements (REE) and precious metals for studies in Earth, Ocean and Atmospheric Sciences. Seventy-three participants from various universities and R&D organizations across the country attended this training programme, which was inaugurated by Dr P.M. Tejale, Director General, Geological Survey of India (GSI). In his inaugural address, he stressed on the importance of ICP-MS in the analysis of trace, REEs and PGEs in geological samples, with applications in different fields, notably geological, environmental, industrial, food, medicine, biological and nuclear fields.

The course was designed in such a way that lectures and practical training were given equal weightage and conducted during morning and afternoon sessions respectively. The first day session began with a lecture by Dr CRM Rao (GSI, Hyderabad) on the 'Role of ICP-MS and other techniques in Geochemical Mapping' in which he gave details of ICP-MS analysis of geological samples and the unified data quality monitoring procedures adopted in International Geochemical Mapping Project. He cited examples of analytical schemes currently followed in mapping projects undertaken by GSI. Dr MRP Reddy (C-MET, Hyderabad) delivered a talk on 'Analysis of Geological samples by ICP-AES' in which he discussed the problems and intricacies involved in the analysis of geological samples. Dr VVS Gurnadha Rao (NGRI) delivered two lectures entitled 'Use of information and communication technology for Earth System Sciences' and 'Speciation studies of trace elements in the sediments of Hussain Sagar Lake, Hyderabad' in which he vividly discussed the computation/modelling in hydrosociences, data presentation and interpretation giving site specific examples. Mr Kapil Kumar (Perkin Elmer India Ltd, Mumbai) gave a talk on some aspects of 'Dynamic Reaction Cell (DRC) for reducing interferences using chemical resolutions in ICP-MS' and described its advantages and analytical potential.

The second day began with a lecture by Dr R. Gopalakrishnan (GSI, Bangalore) on 'Platinum Group of Elements (PGE) in layered complexes' in which he explained the nature, occurrence and distribution of PGE bearing rocks

in different parts of India and abroad. Prof V. Rajamani (JNU, New Delhi) delivered a series of lectures on the 'Theoretical basis of geochemical data interpretation for igneous systems' and dealt in detail about the fundamental aspects of geochemistry, solution behaviour, factors governing mineral formation, classification of elements etc. Dr T. Prasada Rao (RRL, Trivandrum) gave a talk on 'Applications of preconcentration and hyphenated techniques in geochemical analysis' and explained the importance for such techniques in precisely estimating trace and ultra-trace elements, which are problematic and difficult to be determined by normal methods.

On the third day, the session began with the lecture by Dr ML Patil (Hutti Gold Mines Ltd, Hutti) on the 'Nature and mineralisation of Hutti gold deposits' in which he discussed the occurrence and distribution of gold in Hutti, various procedures and protocols involved in retrieving the bullion gold right from the exploration stage. Dr PK Mukherjee (Wadia Institute of Himalayan Geology, Dehra Dun) gave an overview of the 'Application of X-Ray Fluorescence (XRF) spectrometric technique' to the regional and global geochemical baseline studies after explaining the principles, concepts, instrumentation, methods and developments of XRF spectrometry. Dr AK Agrawal (NPL, New Delhi) delivered a lecture on 'Quality assurance and quality control in chemical analysis' and dealt on SI units, traceability, certified reference materials (CRMs), Indian programme on preparation and dissemination of CRMs. Dr EVSSK Babu (NGRI) gave a talk 'Electron probe microanalysis (EPMA) Overview of concepts, instrumentation, methodologies and petrological applications' and explicitly dealt with the fundamental aspects of EPMA. Dr Masood Ahmed (NGRI) delivered a lecture on the 'Importance of isotopic and trace elemental studies in marine sediments for understanding past global and regional climate events' and discussed evidences of past global changes, application of stable and radiogenic (Sr, Nd) isotopes and some new isotopic/trace elemental proxies in palaeoclimatic studies.

On the fourth day, the first lecture was delivered by Prof DK Paul (Presidency College, Kolkata) on 'PGE geochemistry of mafic rocks with emphasis on the Deccan basalts. Implications for mineralization and petrogenesis' in which he discussed the nature, occurrence, distribution of PGE bearing minerals in mafic-ultramafic rocks. Dr V. Balaram (NGRI) gave a lecture on 'Recent advances in instrumentation and applications of ICP-MS' and

explained the fundamental aspects of ICP-MS analysis and recent advances in the field of geochemical analysis by ICPs. Dr K Chandrasekhar (DMRL, Hyderabad) delivered a talk on 'Applications of nanomaterials in environmental management' in which he gave a detailed account on the basic aspects of nanotechnology and its application in pollution prevention, remediation and treatment, citing several examples. Dr MV Subba Rao (NGRI) gave a lecture on 'Trace element and REE data interpretation in geochemical sciences' giving details on the method and mode of geochemical data presentation and interpretation. Dr YJ Bhaskar Rao (NGRI) talked about 'Multi collector (magnetic sector) ICP-MS and its applications to earth system sciences' in which he compared the salient features of TIMS and MC-ICP-MS particularly useful in the field of geochronology. Mr Prasenjit Kar (M/s Varian India Ltd, Kolkata) gave a talk on 'New innovations in atomic spectroscopy from VARIAN' and dealt on the latest features that have been incorporated in manufacturing ICP-MS systems.

On the last and fifth day, the session began with a lecture by Prof Mihir Deb (Delhi University) on 'Petrographic evaluation - An essential pre-requisite for any geochemical studies' in which he brought out the importance of petrographic studies citing several studies carried out before and after obtaining geochemical data prior to thin section studies. Prof N Someswara Rao (Andhra University) gave a lecture on 'Applications of ICP-MS and AAS in different fields of research' and explained the importance of chemical

analysis with selected case studies on analysis in surface and groundwater, indoor air pollution, drugs, edible oils, ambient air quality, seawater and marine sediments. Dr M M Sarin (PRL, Ahmedabad) delivered a talk on 'Reducing interferences in ICP-MS using DRC or Collision Cell Technology (CCT)' and explained some important aspects of spectrochemical analysis pertaining to physical structure of plasma, atomization/excitation processes, types of nebulizer and principles governing DRC or CCT in mass spectrometry. On all the five days, participants were given extensive practical training in batches on different instruments such as ICP-MS, AAS, GF-AAS, XRF, EPMA, MC-ICP-MS, GC-MS and ICP-AES. Enough care was taken to ensure that all the participants obtained hands-on training and a feel of these equipments within the training period.

Dr Ch Sivaji, DST, New Delhi, presented an overview of the DST initiatives in Earth System Sciences during the closing ceremony, and distributed certificates to all the participants. Dr VP Dimri, Director, NGRI, who was present during the closing ceremony, said that NGRI will continue to hold such Training Programmes periodically in emerging technologies which are highly beneficial to the young and budding researchers of our country.

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DEEP OFFSHORE TECTONICS OF THE MEDITERRANEAN (DOTMED)

The Geological Society of France (Societe Geologique De France) has brought out a 64 page memoir on DOTMED A Synthesis of deep marine data in the eastern Mediterranean. Chamot-Rooke, N, Rangin, C, Le Pichon, X and DOTMED working group (2005) Mem Geol Soc France, n s, no 177 64p 9 plates +CD, containing nine excellent detailed Eastern Mediterranean maps on the (1) Kinematic framework, (2) Seismicity and crustal motion, (3) Cruise tracks location, (4) Magnetic and Bouguer anomaly map (5) Heat flow map, (6) Structural map of Eastern Mediterranean, (7) Structural map of Central Mediterranean, (8) Morphostructural map of the Central Mediterranean (9) Cross-sections map.

The publication attempts to synthesize deep marine data in the Eastern Mediterranean. The project evolved out of the growing interest in oil exploration in deep waters during the last two decades with the academic and scientific interest in new geological and geophysical studies in deep offshore tectonics. All the new information was compiled into a GIS base from which several maps were produced adding valuable inputs to the global geodynamic database.

The publication is available for reference in the library of the Geological Society of India at Bangalore.

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