



CESS-ONGC tie up to give fillip to oil exploration

India is largely dependent on fossil fuel imports to meet its energy demands. By 2030, India's dependence on energy imports is expected to exceed 53% of the country's total energy consumption. In 2009-10, the country imported 159.26 million tonnes of crude oil which amounts to 80% of its domestic crude oil consumption and 31% of the country's total imports are oil imports. India stood fourth in petroleum consumption after United States, China and Japan with 3292×1000 billion barrel/ day (United States Energy Information Administration Report 2012). Statistics points to the urgent need for technology addition and intensification in our national oil exploration and production scenario to bridge the gap between imports and domestic demand. There exists a demand at national level to harness and upgrade at least a few petroleum exploration technologies in the coming years.

Oil and Natural Gas Corporation Limited (ONGC) one of the "Navaratna" companies of India, is also the largest Asia-based oil and gas exploration and production company. It produces around 72% of India's crude oil (equivalent to around 30% of the country's total demand) and around 48% of its natural gas. The Oil and Natural Gas Commission (ONGC) has entered into collaboration with the Centre for Earth Science Studies (CESS) for developing the Fluid Inclusion Techniques (FITs) that would eventually help to locate and tap the immense hydrocarbon reserves in the petroleiferous basins of India. The collaborative effort in the project mode is funded by the Ministry of Earth Sciences (MoES), Government of India. It involves the use of hi-tech equipments to verify and compare the resource potential of the offshore sedimentary formations of the Mumbai Offshore and Kerala Offshore basins. Being a technology demonstrator pilot study, the CESS – ONGC combine intends to extend the programme to all petroliferous basins of India in the coming years.

Fluid inclusion techniques have great diversity



Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Government of India releasing the abstract volume of the National Conference organized during the 34th meet of Institute of Indian Geographers at the Centre for Earth Science Studies on 13th December 2012, by giving a copy of the volume to Prof. A C Mohapatra, President, IIG. Prof. V N Rajasekharan Pillai, Executive Vice-President, KSCSTE and Dr. N P Kurian, Director, CESS are also seen

of applications in oil exploration and are invaluable tools in the reconstruction of fluid flow histories in reservoir rocks (David Middleton et al., 2001). They can yield information about the temperature, salinity, and composition of fluids that have migrated through the basin in the geological past. Fluid inclusions therefore provide us with samples of reservoir fluids at certain points through geological time. In recent years, fluid inclusion work has become a significantly important tool in oil exploration and development in the developed countries like the United States. Fluid inclusions figured prominently in understanding the diagenetic controls on porosity evolution and thermal history. In recent years, attempts have been made to interpret the Pressure- Volume- Temperature relationships of oil in fluid inclusions to better evaluate temperature and pressure of entrapment. Most diagenetic studies rely on a combination of petrography and trace element analysis of diagenetic minerals. Of these tech-

niques, the petrography typically provides the most unequivocal constraints on diagenetic history. Most diagenetic systems are defined by the temperature and salinity of the fluids active in them. For that reason, fluid inclusions are one of the best techniques for constraining the diagenetic history of sedimentary rocks.

Various essential elements that are widely recognised as important geological aspects of hydrocarbon production are source rock, maturity, migration, trap and reservoir. These essential elements and processes must occur in time and space so that organic matter in a source rock can be converted to hydrocarbons. The most prominent agent involved in the transformation of *Kerogen* (complex waxy mixture of hydrocarbon compounds which are the precursory material of oil) in the sedimentary rock formations to oil is *temperature*. The formation of oil from sedimentary organic matter was

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Director Speaks



I am very pleased to present this issue of CESS News for the period from July to December 2012. During this period CESS continued its research and development activities at a hectic pace focusing on the themes of Crustal Evolution and Geodynamics, Natural Hazards, Coastal Processes and Management, Atmospheric Processes, and Natural Resources and Environmental Management. The highlight of the period was the successful completion of 5 externally funded projects

and 9 projects that were funded internally.

Under the theme of Crustal Evolution and Geodynamics, three projects viz. “Metasedimentary rocks of the Kerala khondalite belt, southern India: petrology and geodynamics of their formation”, “Tectonothermal history of Kerala khondalite belt” and “Quaternary geology and geomorphic evolution of the coastal lands of Kollam district, SW India” were completed. The projects completed under the theme of Environmental Impact Assessment and Management included “Environmental degradation of Muvattupuzha river basin”, “Monitoring the impact of environmental changes in corals of Lakshadweep Archipelago by fluorescence imaging”, “Monitoring of soil moisture under bare cropped conditions of tapioca and pineapple in the midlands-highlands of western ghat areas of Kerala” and “Sunlight-induced multi-spectral fluorescence imaging system for vegetation assessment.”

The projects completed under the theme on Natural Resources Management were “Study of urbanization between Kochi and Thrissur”, “Digital resource atlas of Kerala and environmental atlas”, “Assessment and monitoring of land quality for sustainable agriculture: a GIS based approach coupled with technology implementation”, “Climatological features of Kerala- a ready reckoner” and “Agro-ecological atlas of Kerala”.

In addition, we continued to provide consultancy services to several public and private sector undertakings, and agencies from different parts of the country. Due thrust was given to the development of infrastructural facilities. The establishment of the National Facility for Fluid Inclusion Research crossed another major milestone with the release of purchase order for the Micro Laser Raman Spectrometer.

The 11th Professor C. Karunakaran Endowment Lecture by Professor V. K. Gaur of the Indian Institute of Astrophysics, Bangalore, on 10th August, 2012, and the 34th meet of the Institute of Indian Geographers (IIG) and the National Conference on NRM and Decentralised Planning during 13-15 December, 2012 were a few of the important events during the period.

Our academic activities continued to be vibrant and energized. Ms. V. Dhanya, Project Fellow, won the Green Talent Competition 2012 for “High Potentials in Sustainable Development” constituted by the Federal Ministry of Education and Research, Germany.

The period was also notable for the progress achieved on the proceedings with respect to the take-over of CESS by the Ministry of Earth Sciences (MoES), Government of India. The Expert Committee appointed by the MoES to examine the various aspects related to the take-over submitted its report. The formal Order approving the take over and the Memorandum of Understanding to be signed between the MoES, Dept. of Science & Technology, Govt. of Kerala and Kerala State Council for Science, Technology & Environment (KSCSTE) was issued by Govt. of Kerala during December 2012. We hope that our dream of becoming a National Institute will soon be fulfilled with the anticipated issue of the formal order by the Govt. of India.

I gratefully acknowledge the guidance and support that we have received in all our endeavours from the KSCSTE, Research Council, and Management Committee, as well as the unrelenting cooperation from the scientists and staff of CESS

Dr. N. P. Kurian

brought about by thermal, strongly temperature dependent process and has to be non- biological. It is pointed out that there is a range of temperature at which the generation of oil can take place and is known as “liquid window” (North, 1985). It therefore implied that temperatures below and above *liquid window* would not yield the desired product. Thus the data on temperature generated in space and time using Fluid Inclusion studies in the lithologies of the sedimentary basins would exhaustively examine the ‘presence’ of liquid window at any point in time.

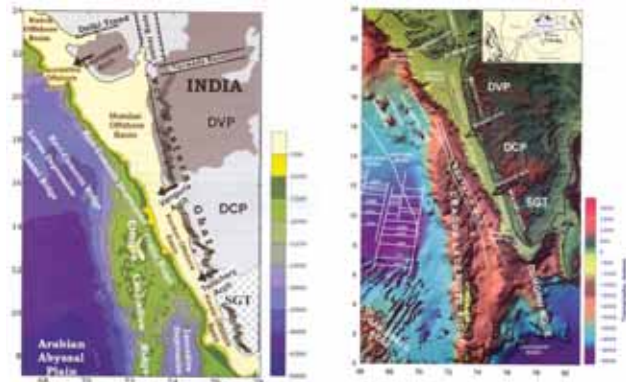


Fig. 1 Western continental margin of India

The CESS- ONGC joint research initiative on the ‘*Palaeo Fluids in the Petroliferous Basins of Western Offshore, India*’ is a micro-scale fluid inclusion study to verify and compare the hydrocarbon generation potential of the offshore sedimentary formations, especially the Mumbai Offshore and the Kerala Offshore Basins (Fig. 1). According to ONGC estimates, the hydrocarbon potential of the Kerala- Konkan offshore basin extending from Goa in the North to Cape Comorin in the South, is of the order of 660 million metric tonnes. But 15 exploratory wells drilled in the Kerala- Konkan basin so far have not yielded oil. Core samples, both clastic as well as carbonate that are available with ONGC from the various lithologies/ formations in the Mumbai Offshore Basin are studied in detail for characterising the fluids sealed in as fluid inclusions in the India’s pride oil fields. Further, this helps CESS to standardize the sophisticated laboratory equipments and to ascertain its full utility for its deployment in non proven as well as challenging fields like Kerala Basin from the 3rd year of study onwards.

CESS has recently established two state-of- the- art laboratories for the purpose viz. Geo Fluids Research Laboratory (GFRL) using CESS plan funds and the National Facility for Fluid Inclusion Research (NFFIR) housing an automated Laser Raman Micro Spectrometer with three lasers using MoES funding. The facilities are mainly focusing on analysing the fluid inclusions within the drill core samples obtained from the different petroliferous basins. Studies that have been carried out so far in the GFRL laboratory have yielded encouraging results. CESS was able to practically put to test the sophisticated equipments procured for the purpose, set protocols for analysing the core samples, locate fluid inclusions in the sandstone reservoirs including Hydrocarbon Fluid Inclusions (HCFIs). The fluid

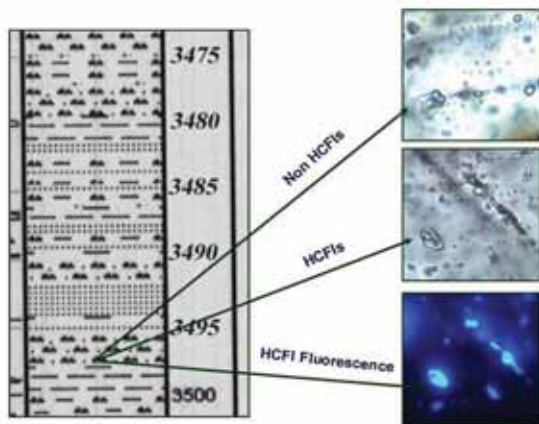


Fig.2: The litho log showing the composition of the horizon (sandstone - siltstone rocks) and the nature of observed fluid inclusions

inclusions observed in a sample from Panna Formation off shore to Ratnagiri were primary as well as secondary inclusions (Figs. 2 & 3). The primary and secondary inclusions include both mono-phase and bi-phase inclusions. Hy-

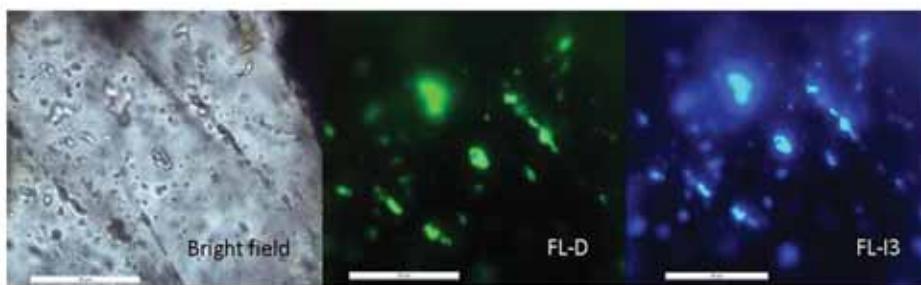


Fig.3 Hydrocarbon inclusions in bright field (BF) and fluorescent light (FL) using D and I3 filter cubes

drocarbon inclusions showing good fluorescence were observed. Secondary fluid inclusion trails which are of hydrocarbon nature were observed. Microthermometric studies were performed on both the non- HCFIs as well as HCFIs. Studies confirmed the presence of the carbonic inclusions, aqueous inclusions as well as hydrocarbon inclusions.

Homogenization temperature T_H of aqueous inclusions ranges between 120 and 140°C. The salinity value of the aqueous inclusions varies from 2 to 22. The observed homogenisation temperature range of 80-160°C range observed for the criss-crossing secondary trails for the

fluid inclusions in some sample indicate that there were several episodes of thermal cracking conducive for oil and gas generation (Fig-4).

Micro-thermometric observations corroborates with the petrographic observations. Microscopically we are observing the presence of oil and gas inclusions and micro-thermometrically we are proving the existence of a palaeo-environment conducive for oil and gas generation in the geological past. The homogenization temperature of the HCFI, with the available data, indicates that a high level of maturity has been achieved in oils and the bluish white fluorescence colour also is indicative of commercially most viable lighter oils in the Panna Reservoir horizons. The technologies that are em-

ployed in the course of the project period and those vital technologies and deliverables emerging out of the proposed work are expected to impart India a cutting edge in its future oil exploration activities utilizing indigenous expertise. Sri.H. Upadhyay, GM (Geology), KDMIPE, ONGC Headquarters, Dehra Dun is the Co-ordinator of the project from ONGC side.

over view on its environmental effects. Bonfring Int. J. Industrial and Management, Vol.2, special issue, pp.36-40.

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Sreela Reghu, Reji Srinivas, Girish Gopinath and Kurian Sajan (2012) Spatial and temporal variations of groundwater quality of phreatic aquifers in Central Kerala river basin, India. J.Ecology, Environment and Conservation, Vol. 18 (3), pp 579-584.

Srikumar Chattopadhyay (2012) Natural Resource Management. National Geographical J., India, BHU, Varanasi. Vol.58. pt.1, pp 1-8.

Vishnu R, Varikodan H, Anil Kumar V, Muralidas S, Mohankumar G, and Subi Symon V N (2012) Abnormal modulation of atmospheric parameters during the Tsunami of 2004, Current Science, Vol.102, pp.11

Santhosh V, Padmalal D, Sobha, V and Baiju R S (2012) Mining of Tile and Brick Clays from the Coastal Lands of Chalakudy and Periyar Rivers, Kerala, SW India, published in the book "Earth Resources and Environment" published by Research publishing, Singapore. pp. 328-334.

Vishnu Mohan S, Padmalal D, Sreebha S and Maya K (2012) Environmental Effects of Sand mining from Kallada River, Kollam District, Kerala State, published in the book "Earth Resources and Environment" published by Research publishing, Singapore. pp.353-362.

Dr. V. Nandakumar
Principal Project Co-ordinator & Principal Investigator, Palaeo Fluids in Petroliferous Basins Project

Publications

Research Papers

Baburaj B, Remya S. I, Padmalal D, Maya K and Lekshmi I (2012) DIN, DIP, DIC and SO_4 fluxes from the Neyyar River (Kerala) into the receiving coastal waters. Bonfring Int. J. Industrial and Management, Vol.2, special issue, pp.1-7.

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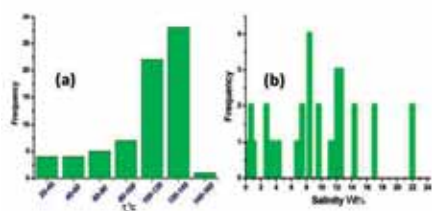


Fig. 4 Variation of Homogenisation temperature T_h (a) and salinity of fluid inclusions (b).

Padmalal D, Maya K, Narendra Babu K, Baiju R S and Baburaj B (2012) Hydrochemical characterization and water quality assessment of the coastal springs of Southern Kerala, India. National Seminar on Recent Advances and future challenges in Geochemistry and Geophysics: the Indian Scenario. Vol.14. No.4 (2012) pp. 466-481.

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Book

Transactions: Journal of the Institute of Indian Geographers, Special Issue on Philosophy and Research Methodology of Geography (Guest Editors: Srikumar Chattopadhyay and Mahamaya Chattopadhyay), December, 2012. 118p.

Papers Presented in Conferences

Ratheesh Kumar M, Shibu.R, Sudhanandh V S, Vishnu S Raj, Faisal A K, Vimexen V, Ajmal K, Aneesh K S, Sooraj Krishna R, Baiju R S and

Anoop Krishnan K, 'An investigation on Phytoplankton community structure and species diversity along south west coast of India', 2nd Indian Biodiversity Congress (IBC 2012) during 9-12, December 2012 at IISc, Bangalore.

Shibu R, Sudhanandh V S, Vishnu S Raj, Ratheesh Kumar M, Faisal A K, Ajmal K, Vimexen V, Aneesh K S, Baiju R S, Sooraj Krishna R and Anoop Krishnan K, 'Biodiversity of benthic species in Kavaratti lagoon -A case study from 2010-2012', 2nd Indian Biodiversity Congress (IBC 2012) during 9-12, December 2012 at IISc, Bangalore.

Vishnu S Raj, Sudhanandh V S, Shibu R, Ratheesh Kumar M, Faisal A K, Ajmal K, Vimexen V, Aneesh K S, Baiju R S, Benno Pereira F G and Anoop Krishnan K, 'Effect of TTP Effluents on the Biological Productivity with emphasis on Biodiversity at Veli coast, Trivandrum', 2nd Indian Biodiversity Congress (IBC 2012) during 9-12, December 2012 at IISc, Bangalore.

Prasad R and Nair L S, 'Numerical Modelling of shallow water wave characteristics of a monsoon dominated coast', HYDRO 2012 Conference held at IIT Bombay during 7-8, December 2012.

Nair L S and Kurian N P, 'Southern Indian Ocean swells and its impact along the Kerala coast – a case study' HYDRO 2012 Conference held at IIT Bombay during 7-8, December 2012.

Padmalal D, 'Late Quaternary evolution of coastal wetlands of Kerala, SW India', National Seminar on Sediments and sedimentary rocks: Resource potential, depositional processes, implication to ecosystem and environmental changes and the 29th Convention of Indian Association of Sedimentologists, in Pondicherry University, during 20-22, December 2012.

Krishnakumar A, 'Textural and Heavy metal accumulation studies of Karamana River, South Kerala, India', National Seminar on Sediments and sedimentary rocks: Resource potential, depositional processes, implication to ecosystem and environmental changes and the 29th Convention of Indian Association of Sedimentologists, Pondicherry University, during 20-22, December 2012.

Invited Talks

Dr. Anoop Krishnan K delivered a talk on 'Ocean Acidification : Chemistry and Impacts' in the National workshop on 'Ocean Acidification Research (OAR) 2012' held at Department of Marine and Coastal Studies, Madurai Kamaraj University, Madurai on 12th December 2012.

Dr. N. P. Kurian delivered a talk entitled 'Impact of beach sand mining on beach-nearshore system: a case study' in the HYDRO 2012 Conference held at IIT, Mumbai during December, 6-7, 2012.

Dr.N.Subash has attended the DAE-BRNS Symposium on Atomic, Molecular and Optical Physics 2012 during December 14-17, 2012 and delivered an invited talk on "Diffuse reflectance spectroscopy for detection of peridontal inflammation

Membership in Committees

Dr. N. P. Kurian

Member, Project Appraisal and Monitoring Committee on Ocean Sciences and Resources of the Ministry of Earth Sciences, Government of India.

Member, Project Management Board, Coastal Engineering Division, National Institute of Ocean Technology, Ministry of Earth Sciences, Government of India.

Member, Board of Studies in Physical Oceanography and member of the Faculty of Marine Sciences, Cochin University of Science and Technology, Cochin.

Member, Kerala Coastal Zone Management Authority by Ministry of Environment & Forests, Government of India.

Member, Kerala Dam Safety Authority by Water Resources (Inter State Water Cell) Department, Government of Kerala.

Member, Kerala Protection of River Banks of Regulation of Removal of Sand Rules 2002-State High Level Committee for River Management Fund by Revenue (P) Department, Government of Kerala.

Vice-Chairperson (Research) Hazard Vulnerability and Risk Assessment Cell, ILDM, Thiruvananthapuram.

Dr. N Subhash

Guest Editor of a Special issue on Fluorescence in Natural Systems being brought out by the International Journal of Spectroscopy (Hindawi Publishing Corporation, USA).

Member of the Governing Council of STIC (Sophisticated Test & Instrumentation Centre), Cochin.

Dr. K. V. Thomas

Member, KCZMA subcommittees to look into various CRZ issue implementation, policies, violations and reports.

Member Lakshadweep Coastal Zone Management Authority

Member, Project Advisory Committee of the ICZMP project of Odhisa

Dr. Srikumar Chattopadhyay

Editor of the ANNALS, National Association of Geographers, India

Dr. Ajaykumar Varma

Chairman of the Committee constituted for assessing the damages to the properties of local people due to the blasting operations in a 7 km long tunnel of Sengulam Augmentation Scheme.

Expert Member in the Assessment Committee of C-DIT.

Member, Committee for preparing Project Report for modernization of the Department of Mining and Geology, Government of Kerala

Dr. C N Mohanan

Member, Technical Committee of Karumpukonam Community Ecosystem Management Committee constituted by Dept. of Environment & Climate Change.

Member State Expert Appraisal Committee, Government of Kerala, under the State Level Environment Impact Assessment Authority (SEIAA) Kerala

Sri. John Mathai

Member State Expert Appraisal Committee, Government of Kerala, under the State Level Environment Impact Assessment Authority (SEIAA) Kerala

Dr. C M Harish

Member of the Board of Studies in Environmental Studies at CUSAT

Ph.D. Awarded



Dr. R Vishnu has been awarded Ph.D degree for his thesis work on 'Investigations on formation and characteristics of thunder clouds in a region of high lightning incidence' under the Faculty of Science,

University of Kerala on August, 2012. Dr. Vishnu has worked under the supervision of Dr. S Muralidas, Scientist (retired), CESS.

Dr. V S Sudhananth has been awarded Ph.D degree under the Faculty of Science, University of Kerala for his thesis 'Studies on Pathogenic enteric bacteria and their seasonal distribution with special reference to public health along the selected Southern Kerala coast' under the guidance of Dr. P P Ouseph, Scientist (retired), CESS on September 2012.



New Arrivals in CESS Library

Machiwal, Deepesh and Madhan Kumar Jha. Hydrologic Time Series Analysis: Theory and Practice. Capital Publishing Company, New Delhi, 2012.

Philpotts, Anthony and Ague, Jay. Principles of Igneous and Metamorphic Petrology. 2nd Ed. Cambridge University Press, Cambridge, 2009.

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Roelvink, Dano and Reniers, Ad. A Guide to modeling coastal morphology. Advances in Coastal Engineering Series, Vol.12. World Scientific, Singapore, 2011.

Sahoo, R.K. Atlas of oxide ores of India and their textures. SSDN Publishers, New Delhi, 2011

Leng Melanie J(Ed). Isotopes in Paleoenvironmental Research. Springer, Dordrecht, 2006.

Gautam N C. Atlas on methodology for land information system (LIS) or cadastral survey & mapping. Centre For Land Use Management, Hyderabad, 2011.

Heintzenberg, Jost, Charlson, Robert J. (Eds) Clouds in the perturbed climate system : their relationship to energy balance, atmospheric dynamics, and precipitation. MIT Press, Cambridge, 2009.

Mallia, Rupananda, Subhash Narayanan. Photodiagnosis of oral malignancy : basic, translational and clinical. LAP LAMBERT Academic Publishing, Germany, 2010.

Lorenzo, Jorge Ripoll . Principles of diffuse light propagation : light propagation in tissues with applications in biology and medicine. World Scientific, Singapore, 2012.

Tracking climate history and geological evolution from peat deposits

Dr K.P.N. Kumaran, CSIR Emeritus Scientist at Agharkar Research Institute, and Dr. D. Padmalal, Scientist, CESS hope that peat deposits unearthed from coastal wetlands in South Kerala could emerge as a powerful tool to track climate history and geological evolution back over thousands of years. Scientific analysis of the fossil woods found in the sub surface deposits would trace their existence to the Holocene period, 6,000 to 10,000 years back in time.

This study is based on the hypothesis that the heavy South West monsoon, reported to be approximately three times more than the present rate of rainfall, could have triggered floods, causing massive destruction of the coastal forests. The trees were likely to have been buried under the continuous influx of sediments brought in by flood waters. The rising sea level could also have contributed to the inundation. The sea possibly withdrew in phases, leaving behind lagoons and wetlands.

The scientists are analysing the growth rings and the cellular and anatomical details preserved in the fossil logs to reconstruct the environmental conditions and assess the pattern of climate change over the past few thousand years of geological history. They expect the study to throw light on the geological evolution of the coastal regions and wetland systems as well as the changes in sea level over thousands of years.

Institute of Indian Geographers' 34th Meet and National Conference on 'Natural Resources Management and Decentralised Planning'



Prof. A C Mohapatra, President, IIG, delivering the special lecture on 'Political economy of Natural Resources and Geography' on 13th December 2012 at CESS during the inauguration of the National Conference on Natural Resource Management and Decentralised Planning

Centre for Earth Science Studies (CESS) hosted the 34th Institute of Indian Geographers' Meet and organized the National Conference on Natural Resources Management and Decentralised Planning during 13-15 December 2012. A pre-conference symposium, held on 12th December, mainly focused on 'Teaching and Research in Geography, in India'. The focal theme of the main conference was 'Natural Resources Management and Decentralised Planning'. The inaugural session of the three day conference was presided over by Dr. Rajasekharan Pillai, Executive Vice President, KSCSTE and the keynote address was delivered by Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Government of India & Chairman, Research Council, CESS. Dr. Nayak emphasized the role of the local panchayats to ensure water and ecological security by maintaining forest cover, air and water quality, and practicing scientific land use. A special lecture on 'Political economy of Natural Resources and Geography' was delivered by Prof. A C Mohapatra, President, IIG. The conference deliberated on 172 papers including 29 presentations included under invited/special lecture categories. The annual meet of geographers was attended by 272 delegates from the 17 Indian States and one each from Germany and Australia. Ms. Mahima Chantranta of Himachal Pradesh University, Shimla, the author of the research paper entitled 'Frontal recession of Gangotri glacier (1891-2010) using remote

sensing' and Mr. Prasenjit Acharya of CSRD, Jawaharlal Nehru University, New Delhi, the author of the paper entitled 'Seasonal variation of aerosol optical depth and its effect on surface radiative forcing' were declared joint winners of 'Young Scholar Award'.

A career guidance session was also held and Dr. P V S P Prasad Raju of ADRIN, Hyderabad, Prof. Prem Chhetri from Australia and Mr. G Renoy from Geo Spatial Delhi Ltd gave expert opinions. During the valedictory function the IIG secretariat officials felicitated Dr. Kurian, Director Centre for Earth Science Studies. Dr. Srikumar Chattopadhyay, Covener and Dr. Mahamaya Chattopadhyay, Co-convenor of the event

Urban/Rural Cooling Rates in Thiruvananthapuram, Kerala

Urbanization leads to micro-climate changes, particularly with regard to the thermal structure of the location. Most documented among such changes is the Urban Heat Island (UHI), which has received increasing attention during recent decades. Factors leading to the excess heat of towns are changes in the thermal characteristics of the surface, modification of the air flow patterns, reduction in evaporative cooling and heat generated by human activities. High specific heat capacity of building materials and their emissivity changes in comparison to the natural surroundings, impervious engineered surfaces like roads and paved spaces, change in surface roughness, blockage of wind due to buildings, reduction in sky view factor and associated blockage of outgoing long wave radiation from surfaces, reduction in vegetation and associated reduction in cooling through evapotranspiration, etc., are the major factors contributing to UHI.

An Urban Heat Island (UHI) develops when urban cooling rates are lower than what would have been without urbanization. Cooling peaks around 3 to 5 hours after sunset. As night advances the cooling rates in the urban and rural sites become similar and attain steady state by midnight and then remain nearly constant until sunrise. The growth and intensity of heat island depends upon the cooling rates of urban and rural environments.

The inhomogeneous cooling rates in the urban centre and adjoining suburban area and its effect on the Urban Heat Island (UHI) in Thiruvananthapuram city in peninsular South India was investigated by Dr. E J Zachariah. Air temperature variations across the study area were

Green Talent Award

Dhanya V, Project Fellow, Resources Analysis Division, CESS has won the Green Talent

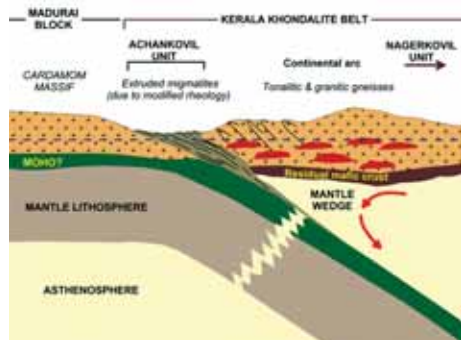


Competition 2012 for High Potentials in Sustainable Development constituted by the Federal Ministry of Education and Research, Germany. She has attended the Green Talents International Forum for High Potentials in Sustainable Development in Germany during October 9-24, 2012 and received the 'Green Talent' award from Prof. Dr. Annette Schavan, Federal Minister of Education, Germany.

recorded by mobile traverse method. Cooling and warming rates in the urban centre and sub-urban area were derived from stationary air temperature recorders installed at these locations. The UHI intensity at this location was 2.4°C. Significant difference in the urban and rural cooling rates was observed. The maximum cooling rate in the city centre was 1.5°C/hr and 3.4°C/hr in the rural area.

Arc-related Magmatism in Kerala: Implications for Supercontinent Reconstruction

The changes in global configuration of continents and oceans throughout the Earth's history suggest that they are in continuous motion with respect to each other. The research on the history of evolution and dispersion of supercontinents is essential in identifying mineral and energy resources that we utilize today and in understanding the atmospheric composition, the global climatic conditions, and the evolution of life through geological time. The new research findings of Sreejith and Ravindra Kumar, published in Journal of Geodynamics,



constraining the petrogenesis of high-K metagranites in the Kerala Khondalite Belt (KKB), turn out to be very significant in this context.

The Indian subcontinent, with its longest voyage of all drifting continents, takes up greater significance in reconstructing supercontinents. The popular models regarding supercontinent assembly assume that India, Sri Lanka, Madagascar, Australia, and Antarctica were together up to the dispersal of Gondwana. However, starting from the early studies, the fit of Palaeoproterozoic configuration including India, Sri Lanka, and Madagascar were always been problematic. The major shortcoming in the reconstruction of pre-Neoproterozoic juxtaposition is the lack of petrogenetically and geodynamically relevant geochronological data set from all these terranes. The study of Sreejith and Ravindra Kumar records a major magmatic

Prof. C. Karunakaran Endowment Lecture



Prof. Vinod K Gaur, Distinguished Professor, Indian Institute of Astrophysics, Bangalore delivering the 11th Professor Karunakaran Endowment Lecture on 10th August 2012

Prof. C. Karunakaran Endowment Lecture, the eleventh lecture in memory of the founder Director of Centre for Earth Science Studies, was delivered by Prof. Vinod K Gaur, Distinguished Professor, Indian Institute of Astrophysics, Bangalore on 10th August 2012. Prof. Gaur talked on 'Earthquake Hazard in India: Knowledge and Response' A galaxy of Scientists from various R & D Centres in the State and officials of the Disaster Management Department attended the lecture. Prof. V. N. Rajasekharan Pillai, Executive Vice President, KSCSTE and Principal Secretary, Department of Science & Technology, Government of Kerala, presided over the function. Dr. R. S. Nair, Dy. Director General (Rtd), Geological Survey of India paid tributes to Prof. C. Karunakaran and Dr. Krishnamurthy, Director, SPL, VSSC, introduced the speaker. Dr. N. P. Kurian, Director, CESS welcomed the gathering and Dr. D.S. Suresh Babu, Scientist, CESS proposed the vote of thanks

crust forming event that can be correlated to accretionary tectonics, for the first time, from this terrain. The study, using vast geochemical data in corroboration with available isotope data, convincingly show subduction-related origin for high-K granites within the KKB, most probably by partial melting of igneous rock in a continental margin arc environment. Thus, it forms a foundation for a new geochemical comparison of the KKB orthogneisses with similar rocks of Sri Lankan Highland Complex and

Meso- to Neoproterozoic plutons occurring in south central Madagascar, which are now interpreted as products of a continental magmatic-arc system. This new contribution offers an insight into the crustal growth in Palaeoproterozoic supercontinent event and strong evidence for an improved fit to the once contiguous fragments of Gondwana, thereby, providing a lead towards more robust comparisons between the supercontinent cycles and processes.

Diffuse Reflectance spectroscopy – an emerging technique for non-invasive tissue classification

Recent clinical trials conducted by CESS in collaboration with the Regional Cancer Center, Trivandrum has shown that diffuse reflection spectroscopy (DRS) could turn out to be a highly sensitive tool to classify oral cavity tissues especially those of the tongue and lip that have poor classification sensitivities with laser-induced autofluorescence (LIAF). In this technique the DR ratio of oxygenated hemoglobin absorption intensity at 545 and 575 nm is used to detect early tissue transformations associated with oral cavity cancer. This non-invasive diagnostic modality can go a long way in reducing the number of biopsies required to diagnose the grade of cancer correctly and in detecting oral pre-cancers thereby enhancing chances of cure and in improving the quality of life of patients.

Laser Raman Micro Spectrometer National Facility for Fluid Inclusion Research at CESS

What can be analysed?

Any solid, natural or synthetic material can be characterized by Raman scattering with the Laser Raman Micro-System. Fluid inclusions in minerals can be characterized by Micro Raman Spectrometry for which doubly polished wafers used for fluid inclusion micro-thermometry are suitable. Spectra can be obtained on compact polycrystalline aggregates mounted on glass/aluminum slides or embedded in a mould with the top surface polished. Powders can also be used on glass slides. Liquid samples must be sealed in a curette or covered with cover glass.

Analytical briefs

Micro Raman Spectrometry is done with 785 nm (fixed wavelength) NIR Laser with 300mW output. With the use of motorized neutral density filters, one can work with 16 different power levels from 0.00005 to 100 percent of the actual Laser power. The spectral range of the



Renishaw- InVia Reflex Raman Micro-System in NFFIR

equipment is from 50 cm^{-1} to 4000 cm^{-1} shift from the Laser line, accomplished with an edge filter. The Raman scattered light is dispersed with a grating and our equipment is having dual grating 1200 l/mm and 2400 l/mm . The detection is done by a Peltier cooled CCD detector with 576 x 384 pixels, with spectral resolution of 1 cm^{-1} . The Raman system is fitted with XYZ mapping stage as well as confocal arrangement enabling imaging studies with a spatial and depth resolutions

of 1 and 2 mm respectively. The Renishaw Raman system has the flexibility for performing photoluminescence (PL) studies at two laser wavelengths, 495 and 325 nm. The system is fully automated and self validating with auto aligning and optimization of input laser power. The operation of the equipment is fully software controlled.

Output

Results of micro spectrometry are distributed either as hard copy of the spectral traces or as soft copy of the spectral data (Intensity vs Raman Shift at 0.25 cm^{-1} interval) in CD



Dr. P V S S K Vinayak
Scientist-F, Atmospheric Sciences Division retired on 31st August 2012.

Dr.C.M.Harish Scientist-F, Head Central Geomatics Lab retired on 30th September 2012.



Smt. Ahalya Sukumar
Scientist-E2, Resources Analysis Division retired on 31st August 2012.

Shri. K. J. Mathew Scientist-E2 Atmospheric Sciences Division retired on 31st December 2012.



Glimpses of Onam Celebrations organized by the CESS Recreation Club