

scientific collaboration with the scientists devoted to problems of the environmental pollution.

The vote of thanks was proposed by the President of the event Professor Johann Hohenegger.

The event also included a post congress three-day excursion to Trieste, Italy to study some Alpine lakes; Padericiano Section, which documents the palaeo-environment from the Cretaceous/Tertiary Boundary to the early Eocene; Rosandra Valley, Belvedere to study Eocene rocks for nummulitids, alveolinids and orbitolites; the Gulf of Trieste for a boat excursion; and the tidal flats at Staranzano.

The fourth congress is planned to be held in 2004 in Turkey.

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SHORT TERM PREDICTION OF EARTHQUAKES

Short term earthquake prediction is highly desirable in view of the human and economic devastation due to earthquakes. It is a well-known fact that faulting and fracturing cause observable changes in the characteristics of electromagnetic emissions (EME) through subsurface, atmosphere and magnetosphere in very low frequency (VLF) and ultra low frequency (ULF) domains. In near future, it may be possible to measure electromagnetic signals and short-term prediction of earthquakes may be possible. The method needs careful planning, deployment of a set of ground based receivers and continuous monitoring of activity.

Tokai University Earthquake Prediction Research Centre in Japan used telephonic wires as antennae and spotted anomalous changes in electromagnetic waves in Japan's Izu island in March 2000. The VLF waves grew steadily for three months followed by an earthquake measuring 6.4 on Richter scale on 1st July 2000. The VLF electromagnetic waves died out after the earthquake.

A number of examples based on EME and quoted below have been taken from the papers presented in International Workshop on "Seismo-Electromagnetics and Space Science" held from 19th to 21st December 2000 at Agra. The workshop was sponsored by DST, UGC and CSIR, New Delhi.

Borehole and terrestrial antennae were employed during March-April 1999 to study very low frequency electrical field in Chamoli. The monitoring was done at Agra station. The main shock occurred on 29th March, 1999. The "noise bursts" were observed in borehole antenna 16 days prior to earthquake (Singh et al. 2000).

There are many other examples to confirm the utility of VLF and ULF emissions to predict earthquakes. Positive ULF signatures (in the frequency range of 0.01 Hz to 10 Hz) were recorded during the earthquakes of Kyushu (1997), Biak (1996) and Taiwan (1999) (Akinaga et al. 2000).

Anomalous very high frequency (VHF) emissions recorded in ionosphere can be predictors of earthquakes. Electron content (IEC) in ionosphere is measured from VHF radio beacon (RB).

Strong sporadic E-ionisation was observed at Japanese ionospheric stations for a few days before M 7.2 Hyogoken-Nanbu earthquake of January 17, 1995 and M 7.7 earthquakes east of the Ishigaki island on May 4, 1998 (Ondoh and Hayakawa, 2000).

The electromagnetic emissions may increase due to earths' geomagnetic field, lightning and thunderstorms, effect of solar rays on ionosphere, volcanoes and tsunamis. The impact of these should also be taken into consideration.

Electromagnetic VLF and ULF emissions as short-term precursors of earthquakes seem possible in near future. Scientists particularly in Japan and Russia have been working on these lines and the results so far have been encouraging. It is heartening to see that some work on these lines has started in our country also. But is just the beginning. It is hoped that more researchers will take up this promising line of work in earthquake prediction.

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REPORT ON THE 4TH INTERNATIONAL CONFERENCE ON GAS HYDRATES

The fourth International Conference on Gas Hydrates was recently held at Yokohama, Japan, between 19-23 May 2002 following the earlier conferences held in USA (1993,1996,1999). The main objective of the conference was to bring together the International gas-hydrate workers and to facilitate research. This conference, the first of its kind held in Asia had attracted delegates from all over the world.

The conference was organized under the chairmanship of Prof. Dr. Y.H. Mori, Keio University, Yokohama, Japan, under the guidance of International Scientific Committee consisting of Drs. T. Austvik (Norway), P. Englezos (Canada), R. Matsumoto (Japan), J-P. Monfort (France), C.K. Paull (USA), J. Ripmeester (Canada) and D. Sloan Jr. (USA).

The conference was divided into several thematic sessions. The first session was devoted to the topic – exploration, resources and environment (oral presentations of 8 papers and posters of 47 papers). The posters were subgrouped into environmental issues, fluid migration and seep, marine hydrates, technology, permafrost and lake hydrates, and lastly CO₂ hydrates.

The key note lecture by Prof. R. Matsumoto on “Comparisons of marine and permafrost gas hydrates: examples from the Nankai and Mackenzie Delta” and on the topic of exploration, resources and environment by E. Jones, Lars Zuelsdorf, Fredrick Colwell and Mathew Davie, C.K. Paull, S.R. Dallimore, Y. Masuda and T.S. Collett, were very interesting and thought provoking. Excellent posters were displayed on Nankai Trough, using DTAG seismic survey in Nankai Trough (Shimizu), migration velocity analyses (Hato), distribution of BSR and possible fluid migration in Nankai Trough (Morita), high resolution 2D and 3D seismic surveys for methane hydrate exploration in eastern Nankai (Morita), velocity structure of double Gas hydrates related BSR within the eastern

Nankai accretionary prism, Japan.

A poster by Dr. Ussler’s on gas hydrates was quite interesting for our future work in India on gas hydrates, wherein the process of estimating *in situ* sediment gas concentration in ODP holes by continuously monitoring temperature during core recovery was lucidly presented.

A session was devoted to topics on fundamentals: Thermodynamic aspects and kinetics (oral 8 papers and posters of 46 papers of which 25 on thermodynamic aspects and 21 on kinetics). Dr. Sloan’s work on next generation of hydrates was quite interesting and informative. Similarly other posters by Dr. Ripmeester on the application of MRM (Magnetic Resonance Microimaging) to monitor the formation of gas hydrates. Dr. H. Kono gave a talk on the modelling of gas hydrate formation process by controlling interfacial boundary surfaces.

In the evening at a banquet talk, Dr. Raj Bishnoi, an eminent researcher from Canada, stressed the need of multidisciplinary research on gas hydrates. Following additional topics – Fundamentals covering structural studies and physical properties, multiphase mechanics and heat/mass transfer (oral 11 papers and poster 46 papers of which structural studies 12, physical properties 16, multiphase mechanics and heat/mass transfer 18) were also presented.

In the morning session, we were able to listen to more about the fundamentals; structural and physical properties, multiphase mechanics and heat/mass transfer aspects on gas hydrates. Important speakers of this session were Drs. Sloan, Ajay Mehta, and Markov.

Later Dr. Kuznetsov gave a talk on CODATA project activities which is purely on the information system on gas hydrates. Later Dr. Moon talked on computer modeling of gas hydrate formations, while Dr. L. Stern presented new insights into the phenomena of anomalous or self-preservation of gas hydrates.