RESEARCH HIGHLIGHTS IN EARTH SYSTEM SCIENCE, Special Volume 1, Chief Editor: O.P. Varma, Editor: T.M. Mahadevan. Published by the Indian Geological Congress on behalf of Earth System Science Division, Department of Science and Technology, New Delhi, 2000, 379p.

The volume under review consists of 28 research papers in three different disciplines, namely: (1) Deep Continental Studies, (2) Glaciology and (3) Atmospheric Sciences.

In his preface, Chief Editor, O.P. Varma draws our attention to the fact that with the passage of time, surface and near surface exploration targets are near exhaustion and therefore deep continental studies assume an important role to understand the genesis of deep seated mineralisation and the processes responsible for them. Atmospheric sciences are extremely important for the agriculture based economy of our country. The lack of precipitation during monsoons of 2002, in spite of a forecast of normal monsoon during 2002, is a prime example of our being yet far away from completely understanding the phenomena of the Indian Monsoon. Glaciology plays a very important role in understanding the availability and management of water resources as well as addressing important issues such as global warming.

In the first paper, K.R. Gupta and T.M. Mahadevan talk about Deep Continental Studies in India and highlight the progress made so far and identify further thrust areas. One of the major achievements over the last decade has been to generate awareness of the need for multi-disciplinary approach to learn more about deep seated structures and processes. For this, high cost instrumental facilities have been provided at a number of research institutes and universities. Efforts have been made to build up necessary state-of-the-art capabilities in various disciplines of geophysics and geochemistry. Among the areas deserving attention, the authors have identified: deep continental structure below the south Indian shield; geochemistry of mantle xenoliths; tectonics, P-T constraints and timing of Indo-Asia collision in North West Himalaya, etc. They have also stressed on the need for generation of a geo-scientific database and application of fractals and mathematical modelling in comprehending geological phenomena. In the next paper, P.R. Reddy et al. deal with deep seismic reflection studies in the Proterozoic Aravalli- Delhi Fold Belt in the northwest Indian shield. They show that various tectonic domains are well demarcated based on reflectivity patterns. Aravalli and Delhi fold belts are found to have evolved due to convergence, collision and suturing of Bundelkhand and Marwar cratons. They demonstrate the use of integrated geological, geophysical and geochemical studies in deciphering the evolution of the region.

In the third paper, Sinha-Roy addresses the plate tectonic evolution of crustal structure in Rajasthan. This paper summarizes several interesting studies conducted in the region. There are three very interesting diagrams. The first one depicts the crustal structure inferred from seismic reflection profile in Central Rajasthan, the second diagram depicts inferred intra-continental underthrusting of cratonic blocks in Rajasthan, while the third diagram depicts plate tectonic development of crustal structures in Central Rajasthan during the last 2.2 Ga. Sinha-Roy demonstrates that the geological attributes of the Rajasthan Craton allow for application of plate tectonic concepts in the evolution of the Archaean basement, the Banded Gneissic Complex and the Proterozoic Aravalli and Delhi foldbelts.

The fourth paper by A.B. Roy is on tectonostratigraphic and petrological studies along DSS profile line between Ajmer and Bundi in Rajasthan. Roy brings a lot of field experience of working in Rajasthan in interpreting the results of seismic profiling, magnetic and gravity mapping of the region. He invokes the re-constitution of the Precambrian Aravalli crust through the Mesozoic-Cenozoic underplating to explain the domal pattern of the seismic reflectors seen along the profile as well as the gravity anomaly patterns observed over the Aravalli mountain.

The next paper is by P.R. Reddy and others which deals with coincident deep seismic reflection and reflection profiling in central India along Mungawani-Kalimati profile across the Central Indian Suture. A five layer velocity structure including two low velocity layers were inferred from forward modelling of the reflection/wide angle reflection data. They also infer the presence of Central Indian Suture.

The sixth paper by Yedekar, Reddy and Divakara Rao on Deep Continental Studies in Central India involves identification of a major East North East - West South West trending ductile mylonite zone from Nagpur northeastswards, traceable for over for 500 km. They call it “Central Indian Suture (CIS)/Shear Zone”. They show that multi-disciplinary data supports a plate tectonic-subduction, collision and suturing model for the evolution of the area.
In the next paper Divakara Rao and others provide a litho-
geochemoical evidence for the tectonic evolution of the 
Central Indian Craton. The eighth paper is by Kewal Sharma 
which addresses the evolution of Archaean -
Palaeoproterozoic Crust of the Bundelkhand Craton in the 
Northern Indian Shield. He infers upwarping of the 
Bundelkhand Craton, rapid uplift and fast erosion, 
development of rift basins and extrusion of rift-
related volcanics into the volcano-sedimentary Gwalior 
and Bijawar sequences due to plume related mantle 
volcanics.

Mita Rajaram, in the next paper, reviews the work 
done by the scientists of the Indian Institute of 
Geomagnetism to study crustal magnetic anomaly of India 
and its contiguous region from the date of Magsat. In the 
ten-th paper, Arora deals with geomagnetic deep sounding 
Studies in India and their tectonic implications. He has 
provided a very useful map showing the locations of 
magnetometer arrays in India along with the orientation of 
Inferred conductors. He pleads for preparing an electrical 
conductance map for the entire Indian sub-continent. The 
next paper on “Magnetotelluric Techniques” by Gokarn 
and Singh outlines the usefulness of magnetotelluric 
techniques in geo-exploration and presents results of 
detailed magnetotelluric studies in different parts of the 
country. The Rohtak region, west of Delhi is found to be 
covered by about 500 m thick alluvial and Tertiary cover. 
Using MT methods, they could infer a deep rooted 
north-south aligned fault zone below the sedimentary cover.

Arora, Chandrasekhar and Campbell have investigated 
upper mantle electrical conductivity distribution beneath 
the Indian Sub-continent, while Bhattacharya and others 
have concentrated on Magnetotelluric Studies over 
Singhbhum Granite. In the next paper, S.S. Rai and others 
have provided the results of seismic tomography in the 
Koyena Region. In an interesting paper, Phadke and others 
have reviewed the development of migration and modelling 
algorithms for imaging crustal structures. The 16th paper 
by Agarwal, Shaw and Das is dedicated to the study 
deep continental studies using gravity data.

Section-2 on ‘Glaciology’ has four papers. In the first 
paper, Vohra has reviewed the development of 
glaciology over the last 25 years. He points out that inventory of 
glaciers has already been completed by the Geological 
Survey of India. He also points out the difficulties in 
glaciological studies and has made a case for increase in 
inputs, both personal and instrumental, for a better 
assessment and monitoring of Indian glaciers. In the 15th 
paper, Hasnain reports on the chemistry of glacial 
meltwaters in Garhwal Himalaya and finds it to be dominated 
by coupled reactions involving sulphide oxidation and 
carbonate dissolution. Pratap Singh, Ramasastri and Naresh 
Kumar have reported results of hydrological studies on 
Dokriani Glacier in the Garhwal Himalaya. Extensive 
studies of this Garhwal Himalaya glacier were initiated in 
1995 by setting up a standard meteorological observatory 
at the base camp near the gauging site. In the next paper 
Hasnain reports the stream flow characteristics of the 
glacierised Dokriani catchment in the Bhagirathi Ganga 
Basin. The total discharge of the 1994 ablation period was 
62.38 x 10^6 m³ of which about 12% was contributed by 
the monsoonal rainfall.

Section-3 of this volume has eight papers on 
‘Atmospheric Sciences’. Sikka in the 21st paper has 
highlighted the R & D support by the Department of 
Science & Technology in Atmospheric Sciences in India. 
He underlines that several of these programmes have 
nucleated research in important branches of meteorology 
including climate variability and its relationship with 
agriculture. Thrust has also been laid to design and 
undertake special process-oriented field programmes. 
He has hoped that Indian atmospheric science community 
would “pursue their research with great vigour and tackle 
the very difficult problem of understanding the monsoon 
and prediction in different spatio-temporal scales”. In the 
22nd paper, Vernekar has described field programmes 
conducted in India to study the tropical atmospheric 
boundary layer. There were two major field programmes 
namely the Monsoon Trough Boundary Layer Experiment 
(MONTBLEX) and the Land Surface Processes Experiment 
(LASPEX). The two programmes have provided critical 
information useful in improving the understanding of 
tropical atmosphere over the Indian region.

In a paper authored by A.P. Mitra and several others, an 
inventory of greenhouse, modelling and global change 
has been addressed. They point out that measurement of 
methane emission during the methane campaign of 1991 
and in subsequent years has contributed significantly 
to the Indian national inventory for IPCC. The increase in 
CO₂, CH₄, CO, N₂O, O₃, H₂O and aerosols measured with 
solar IR Spectrophotometer for the period 1992-97 has 
shown an increasing trend. Very useful information 
related to green house gas inventory has been compiled 
in this interesting paper.

B.N. Goswami, in the 24th paper, has addressed the 
predictability of tropical climate and dynamics of intra- 
seasonal and inter-annual monsoon variability. Major 
findings include first quantitative estimate of limit on 
predictability of the tropical climate, discovery of an 
internal biennial oscillation of the tropical troposphere,
and a broad new scale index for Indian summer monsoon variability. Satyan and others in the 25th paper deal with climate predictability and variability studies using atmospheric general circulation models. Gopala Krishna and Suryachandra Rao have reported that the International Tropical Ocean Global Atmosphere (TOGA) programme has been implemented on a few shipping routes in the Indian Ocean. It is an interesting paper giving a total historical monthly sea surface temperature data. The authors point out that it is necessary to have long-term stationary position data for a better understanding of Rossby Wave characteristics in the Bay of Bengal. The 27th paper by Damle examines the basic concepts of Wind Profiler/RAS system and gives details of indigenous development undertaken in India. He has also outlined the future course of action in this area. The last paper by Dash and others describes the Atmospheric and Oceanic Modelling Studies at IIT, Delhi. It is basically a compilation of the results of six projects sponsored by the Department of Science and Technology.

In a nutshell, this volume provides an up-to-date knowledge of various projects implemented by the Department of Science and Technology, and their results in the three major areas of Deep Continental Studies, Glaciology and Atmospheric Sciences. The papers are precisely written and provide in-depth information. The authors, the editors and the Department of Science and Technology need to be complimented for bringing out a timely publication. I have no hesitation in recommending this volume to all the researchers and libraries.

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RESEARCH HIGHLIGHTS IN EARTH SYSTEM SCIENCE. Special Volume 2, Editor: O.P. Varma. Published by the Indian Geological Congress on behalf of Earth System Science Division, Department of Science and Technology, New Delhi, 2001, 365p.

This is second of the two volume series on research highlights in earth system science brought out by the Earth System Science Division of the Department of Science and Technology in collaboration with the Indian Geological Congress. While the first volume focuses attention on the 'Deep Continental Studies, Glaciology and Atmospheric Sciences (reviewed in this issue, p.607), this second volume under review focuses attention on 'Seismicity' and has been edited by O.P. Varma.

The volume consists of four sections: (1) Seismicity and Seismotectonics, (ii) Neotectonics and Palaeoseismology, (iii) GPS, Geodetic and other Geophysical studies and (iv) Strong Motion and Earthquake Engineering studies. It is a very good attempt to bring together the highlights of the research investigations sponsored by the Department of Science and Technology (DST), Government of India, during the last decade.

In the first section there are eleven research papers on the DST sponsored projects. At the outset, I must say that this section is not quite up to the mark. It looks to me as if the papers were not pre-reviewed. Some papers, however, are well presented and informative, like those by S.N. Bhattacharya et al. on 1997 Jabalpur earthquake; Rastogi on the RIS at Koyna-Warna; Kusala Rajendran's on triggered seismicity at Koyna and S.K. Srivastava et al. on the 1999 Chamoli Earthquake. The information presented is not new as these are published elsewhere, but now collated and available at one place.

Section two is found to be comparatively better presented. It gives a good account of information on the palaeoseismic and neotectonic evidences; two from the Himalayan region, three from the shield area and one from the Gangetic plain. One short note is given by Gupta et al. on the drilling results in the Killari earthquake epicentre area, confirming reactivation of an old fault. The Himalayan palaeoseismic study is interesting, and warrants more research projects and detailed investigations in the Himalaya. The palaeoseismic evidence in the Killari area (by Rajendran and Rajendran) gives a comprehensive account and an interesting case study in the shield area. Such palaeoseismic studies deserve encouragement.

In the third section, GPS, geodetic and other geophysical studies are presented. The first paper by Issar gives a brief status of the geodetic investigations in the Himalaya by the Survey of India. He has also given an account of the GPS and geodetic studies in Peninsular India in the third