

Magnetic Anomaly

The magnetic anomalies are obtained by deducting the standard values for the ideal earth at the geoid level from the actual magnetic values observed on the surface of the earth. Thus, Magnetic anomaly,

$$VM = M_{obs} - M_{TH} = (M_{obs} - IGRF)/h$$

Where M_{obs} is the magnetic field observed on the surface of the earth at a height h above msl and IGRF indicates the theoretical magnetic field at mean sea level. This is applicable to all the components of the magnetic field. Similar to the gravity anomaly this also indicates the proportional vertical gradient of magnetic field (VM) and indicates a numerical observation point revealing the magnetization. As in the case of gravity, lateral variations of magnetization are brought out. Integrating VM with h indicates the magnetic field at station level. In this case, the inverse or negative of the VM indicates SM, called here Simple magnetic field.

$$\text{Thus, } SM = -VM = M_{Th} - M_{obs}$$

The theoretical gravity and IGRF calculated at geoid/spheroid level help in removing the variation of normal gravity and magnetic field with latitude from equator to poles besides indicating the density/magnetization variations. In the case of VG, SG and VM, SM the station level data can easily be transferred from uneven datum surface on to geoid/spheroid level without applying elevation related corrections.

So, Bouguer and magnetic anomalies with incorporated corrections, which are proportional to vertical gradient of gravity and magnetic fields, only indicate the variations in density and magnetization but not the mass distribution.

*Geological Survey of India
Bandlaguda,
Hyderabad-500 068
Email:manikesava@rediffmail.com*

M. KESAVAMANI
C. RAMACHANDRAN
M.V.R. KRISHNA RAO
R.M.C. PRASAD
M. VENKATESWARLU

DISCUSSION MEET ON MAGNETOSTRATIGRAPHY AND PALAEOMAGNETISM

Palaeomagnetism, although not a new science, lacks in concerted effort in an integrated and focused manner in the Indian scenario. Significance of the subject as an independent scientific database, and as a problem-solving tool is well recognized. Efforts are needed to create scientific manpower and facilities to properly apply this tool to find answers to vexed issues in Indian geology. It is in this context that a two-day discussion meet was held in Mizoram University, Aizawl on 12th and 13th April, 2005 to discuss applications of magnetostratigraphic and palaeomagnetic techniques to burning problems in Indian Geology with a focus on the northeastern sector. The meeting sponsored by Department of Science & Technology (DST), New Delhi was attended by twenty-three earth scientists from various national organizations, universities and State Departments.

The meet was inaugurated by Prof. Arvind K. Sharma, Vice-Chancellor, Mizoram University and chaired and co-chaired by Dr. D.N. Awasthi, DST, New Delhi, Prof. Ashok Sahni, Punjab University Chandigarh, Prof. Tlanglawrna, Pro-Vice Chancellor, Mizoram University and Dr. Ch. Sivaji, DST, Delhi. In his keynote address, Prof. Ashok Sahni highlighted the utility of the palaeomagnetism to stratigraphic reconstructions. He cited the example of the Rajmahal Trap and associated sedimentation and biota.

He also summarized the developments in magnetostratigraphic studies in India and emphasized the need for teamwork by biostratigraphers, sedimentologists, geochemists, magnetostratigraphers and palaeomagnetists in this country. Dr. D.N. Awasthi in his talk focused upon the intricacies of evolution of the eastern margin of the Indian plate, its interaction with Shan Craton of Myanmar and adjoining region, and the formation of the schuppen zone. He described the relevance of magnetostratigraphy and palaeomagnetism in palinspatic reconstruction of the northeastern geodynamic processes. Dr. Sivaji indicated the willingness of the DST to support the magnetostratigraphic and palaeomagnetic studies in the country and to create infrastructures for such studies in an integrated and focused manner. He also stressed on the need for training young researchers in this field by expert groups. Prof. R.P. Tiwari, while welcoming the participants, highlighted the inadequacy of magnetostratigraphic and palaeomagnetic data pertaining to Cenozoic sedimentary basin of Northeast India thus limiting the scope of stratigraphic classification and correlation of isolated sections, particularly in the Neogene basinal sediments.

The two-day meet was conducted in three technical sessions comprising over 15 presentations by individual scientists and working groups. Dr. G.V.S Poornachandra Rao

of NGRI chaired the first technical session. Four presentations were made in this session. Dr S K Patil (IIG, Mumbai) reviewed the palaeomagnetic and rock magnetic work carried out so far in the Deccan Traps and associated dykes. He emphasized upon further attempts specifically on the dykes intruded in the eastern and northern margins of the Deccan Volcanic Province. He also emphasized on the remagnetization aspects related to Deccan volcanism. Dr S K Biswas (Mumbai) gave an overview of the tectonic and geodynamic evolution of the northeastern India. Although he did not deal directly with any magnetostratigraphic aspects, his presentation initiated discussion on several geological problems that may be tackled by palaeomagnetic studies. Dr T Radhakrishna (CESS, Trivandrum) presented an overview of the palaeomagnetic and magnetostratigraphic studies in the Purana basins and indicated the current inadequacy of magnetostratigraphic data. He advocated an interdisciplinary approach involving geochemistry and palaeomagnetism. He also explained how magnetostratigraphy could help solve the correlation aspects of the Tertiary sequences of Kerala coast. Dr S K Lahiri described the sequence stratigraphic approach for hydrocarbon habitat in the Upper Assam valley. He was requested to identify a master magnetostratigraphic section in his study area with magnetic susceptibility profiling and extend the susceptibility correlation to the available well logs.

Second session was chaired by Dr T Radhakrishna of CESS, Trivandrum in which six presentations were made. Dr K Venkata Rao, GSI, Nagpur presented the palaeomagnetic and magnetostratigraphic investigations carried out so far by GSI in Central India. He explained the magnetic polarities in terms of tectonics of Central India along the Satpura region and emphasized the need for detailed tectonic and geomorphic studies to re-evaluate the palaeomagnetism of Deccan Traps. He also proposed a more detailed work in the Satpura-Gondwana belt. Dr D R Nandy, Kolkata presented several interesting features of geodynamic evolution of the northeastern India and correlated these with the seismicity of the region. He strongly advocated intensive palaeomagnetic and magnetostratigraphic studies in resolving geological issues of the region, and appreciated DST's efforts in this direction. Mr Malsawma and Dr R P Tiwari of Mizoram University presented the detailed magnetostratigraphic results of a 570 m thick succession of Bhuban sediments (Surma Group) of Mizoram based upon analysis made at Palaeomagnetic Laboratory of Wadia Institute of Himalayan Geology, Dehradun. They delineated seven magnetozones in this section and also estimated the rate of sedimentation.

Dr Devesh Walia of NEHU, Shillong proposed to undertake geochemical and palaeomagnetic investigations of carbonatites from Sung valley, Shillong Plateau. Dr K P Sarma of Gauhati University proposed to take up study concerning petrography, petrochemistry and palaeomagnetism of Khasi Greenstones (Meta-dolerite) of Shillong basin of Meghalaya. Dr A K Jauhari and Dr R P Tiwari proposed to take up biostratigraphic and palaeomagnetic studies in the Cenozoic sedimentary sequences in Meghalaya and Mizoram in order to correlate the faunal changes with the climatic and sea level changes, and to develop precise chronostratigraphic framework for fossiliferous sequences.

Dr V Raiverman of Kolkata chaired the third session. This session also witnessed six presentations. Dr S J Sangode of Wadia Institute of Himalayan Geology delivered two lectures to demonstrate the strength and versatility of the palaeomagnetic and rock magnetic techniques. In his first lecture, he overviewed the magnetostratigraphic work in the Himalayan foreland basin by indicating the versatility of the technique to derive quantified information on deformational and depositional processes, paleoclimate and paleohydrodynamic reconstructions in the Himalayan orogenic belt. In his second presentation, he demonstrated two new approaches, one each for neotectonic block movements and for paleo seismicity using palaeomagnetic and rock magnetic methods. Finally he suggested a mobile laboratory concept to promote the studies in wider horizons of geological community in India. Dr S K Biswas, Mumbai, summarized magnetostratigraphic observations along Hari River section in Northeast and made cautionary remarks on magnetostratigraphic studies of similar depositional and tectonic settings. Dr G V S Poornachandra Rao reviewed magnetostratigraphic and palaeomagnetic investigations in Vindhyan basin describing the drift history, magnetic polarity changes and possibility of hydrocarbon deposits in this basin. Dr G T Thong and Prof R P Kachhara of Nagaland University proposed to take up sedimentological and magnetostratigraphic studies in the Neogene succession of Nagaland. Sri V Raiverman of Kolkata, while recognizing the utility of magnetostratigraphy and palaeomagnetism in solving several vexed issues of Indian stratigraphy, highlighted their limitations also and suggested ways to overcome these.

A group of experts amongst the participants was formed for identification of geological corridors and working groups to take up extensive and intensive magnetostratigraphic and palaeomagnetic studies. This group comprised Sh D N Awasthi, Dr Ch Sivaji, Prof Ashok Sahni, Dr S K Biswas, Sri D R Nandy, Sri V Raiverman, Dr Poomachandra Rao,

Dr K Venkat Rao, Dr T Radhakrishna, Dr R P Kachhara, Dr A K Jauhari, Dr S K Patil, Dr S J Sangode and Dr R P Tiwari

Following geological corridors were identified to initiate palaeomagnetic and magnetostratigraphic studies

- I Deccan Trap Magnetostratigraphy and its remagnetization aspects in the Vindhya and Kachchh basins
- II Magnetostratigraphy and paleointensity studies in the Rajmahal and Sylhet Traps
- III Tripura-Mizoram Accretionary belt Magnetostratigraphy, Palaeomagnetism, Biostratigraphy, Sedimentology and Geochemistry
- IV Satpura-Gondwana belt Magnetostratigraphy and Geochemistry
- V Malabar Coast Tertiary sequences Magnetostratigraphy, Geochemistry, Biostratigraphy
- VI Cauvery basin Magnetostratigraphy and Biostratigraphy
- VII Shillong Basin, Shuppen zone and Ophiolite belts Magnetostratigraphy, Structure and Tectonics, Biostratigraphy, Sedimentology and Geochemistry

Key issues to be focused in these corridors were formulated and working groups for the corridors were identified. The expert group also gave the following general recommendations

- 1 Facilities for sample preparation (coring and cutting) and magnetic susceptibility measurements need to be provided with each working group
- 2 Each working group also needs to be equipped with

certain instruments for petro-physical properties

- 3 A central facility with full sets of palaeomagnetic and magnetostratigraphic instrumentation needs to be established in Mizoram University
- 4 Identification, logging and documentation of each section should be made on careful priority to build up a database and reference sections
- 5 Training programs for young research scholars and faculty members may be frequently organized, at least at the interval of one year in well-established laboratories
- 6 The coordinators of the working groups may invite proposals in DST format from other group members and formulate an integrated proposal to be submitted to DST for funding

*Department of Geology,
Mizoram University,
Aizawl - 796 012, Mizoram*

R P TIWARI

*Wadia Institute of Himalayan
Geology, Dehra Dun - 248 001,
Uttaranchal*

S J SANGODE

*Indian Institute of Geomagnetism,
Magnetic Observatory, Alibagh
Raigarh*

S K PATIL

*ESS Division,
Dept of Science & Technology,
New Delhi*

CH SIVAJI

SECOND MEETING OF THE NORTH INDIAN CHAPTER (DELHI) OF THE GEOLOGICAL SOCIETY OF INDIA

The above meeting was held on 15 July, 2005 at the Department of Geology, Delhi University, Delhi. Prof. P. K. Verma, Head, Geology Department, Delhi University welcomed the Fellows and other participants. The meeting was chaired by Prof. S. K. Tandon. The main focus of the discussion/meeting was on **"Challenges for Hydrocarbon Prospecting in India – the next decade"**.

Although while addressing the gathering, Prof. Tandon lamented on the lack of interest shown by the younger generation in the pursuit of studies and research in Earth Sciences, there was a substantial presence of young scientists in the audience, which appeared to be keen on hearing about the status of new habitats of petroleum and natural gas in

the country and the worldwide researches being carried out to find appropriate substitutes for the depleting reserves of hydrocarbons.

The first invited lecture of the day was by Shri Ch. Ratnam, former Chairman and Managing Director of Oil India Ltd., on "Global and Indian Petroleum and Natural Gas Scenario".

In his presentation, Dr. C. Ratnam, former CMD of Oil India, spoke of considerable scope of finding more oil in the NE region of the country. He said that while the proved ultimate recoverable reserves of hydrocarbons in the NE region were estimated at 700 MMT, the prognosticated additional reserves were 300 MMT. As about 250 MMT of