GEOLOGICAL SURVEY OF INDIA

TRAINING INSTITUTE, HYDERABAD

PHOTOGEOLOGY AND REMOTE SENSING DIVISION

COURSE REPORT ON THE SIXTH COURSE ON APPLICATION OF REMOTE SENSING AND GIS FOR MINERAL EXPLORATION

(GSI TI-ISRO COLLABORATIVE PROGRAMME UNDER NNRMS)

(22nd January to 5th april,2007)

The GSI-ISRO collaboration programme under NNRMS aimed at generating trained man power in the field of application of Remote sensing and GIS for mineral exploration was reviewed at the 4th NNRMS meeting, held at Bangalore on 3rd March,2006. ISRO agreed to go for another 5 years cycle of this course and a memorandum of understanding for the fourth 5th cycle was signed between the ISRO and the GSI TI on 18.1.2007.

The present course-the first of the fourth cycle-was conducted from 22.01.2007 to 05.04.2007. A total of 18 participants sponsored by the different central and state government organization and universities as given under successfully completed the course.

The core faculty with the programme includes

J.V.Reddy, Director PGRS,GSITI,Hyderabad-Course coordinator

S.S.Nayak,Geologist(sr.),PGRS Division, GSITI, Hyderabad

D.K.Choudhury, Geologist (Sr), PGRS Division, GSI, SR, Hyderabad

V.Ravi Kumar, Director, CGMT, GSITI, Hyderabad

Dr. N.R.S.Reddy, Geologist(Sr), CGMT, GSITI, Hyderabad

S.Ramamurthy,Geologist(Sr),CGMT, GSITI, Hyderabad

Dr.L.P.Singh,Geologist(jr),CGMT,GSITI,Hyderabad

B.K.Sahu, Geologist(Sr), CGMT, GSITI, Hyderabad

Apart from the above core faculty, a number of eminent geoscientists from GSI and other organizations delivered guest lectures on specific specialized topics including case studies on mineral targeting.

In the inaugural session on 22.1.2007, after a brief self introduction by the participants, Sir I.V.Reddy, course Director, gave a brief account of the course curriculum. Sri.P.K.Sinha, Dy.Director General GSI Ti and Chairman of the session advised the participants to interact with the faculty and guest faculty to extract maximum benefit during the training programme. Professor I.V.Murali Krishna, JNTU, Hyderabad, the Chief guest gave and account of how the NNRMS course was taken up by the GSI TI and briefly described the growth of technology in satellite remote sensing from Landsat to Cartosat and stressed the need of development of the trained manpower in the state of art technology for harnessing the natural resources.

The course was conducted in four modules as under:

1.Photogeology and remote sensing 22.01.2007 to 11.02.2007

2.Digital image processing and Digital photogrammetry 12.02.2007 to 26.02.2007

3.Geographic information system 27.02.2007 to 13.03.2007

4.Block interpretation and field checks 14.03.2007 to 03.04.2007

5.Group discussion, evaluation test and valediction 04.04.2207 to 05.04.2007

Module1: Photogeology and Remote sensing

In this module training was imparted covering various topics such as areal photography, photogrammetry physics of remote sensing, sensors and platforms, various remote sensing data types, formats and remote

sensing in visible, thermal and microwave regions of electromagnetic spectrum. Techniques of interpretation of areal photos and satellite imageries, discrimination of igneous, sedimentary and metamorphic rocks and structural elements using photo recognition elements were taught. Besides, at the end of the course Dr.J.Krishna Murthy, ISRO gave a glimpse of the ISRO's space programme and Chandrayan mission through two lectures.

Practical exercise included appreciation of photo recognition elements such as tone, colour, texture, pattern, association, landforms, mosaicking and annotation, interpretation of areal photograph and satellite imagery for lithological discrimination and identification of structural features.

In this module, various case histories where remote sensing studies were successfully applied in targeting mineral prospects were also included for the benefit of participants. The case studies of application of remote sensing in exploration for gold, diamond, atomic minerals, ground water, surface deposits etc were dealt with by highly experienced resource persons mentioned as under.

1.Remote sensing for surface deposits: Sri P.F. Augustine Director, TC Division, GSI, Hyderabad.

2. A case study on bedded barite deposit at Mangampet, Cuddapah Dist, AP. : I.V. Reddy, Director, PGRS Division, GSITI, Hyderabad

3. Application of remote sensing in gold exploration with case studies: Dr. T.V. Ramachandran, Director (Retd.) , GSI, Bangalore.

4. Diamond Exploration: Sri S.V. Satyanarayana, Director, TC Division, GSI, SR, Hyderabad.

5. Application of remote sensing in diamond exploration: Sri S.S. Nayak, Geologist (Sr), PGRS Division, GSI TI, Hyderabad.

6. Remote sensing for atomic minerals: Dr. A.K. Chaturvedi, AMD.

7 Integrated approach in mineral targeting: Sri S.S. Ameta, Director, Zawar Centre, GSI TI

8. Case study of integrated surveys on Ramagiri and Atmakuru blocks, Anantpur Dist, Andhra Pradesh: V. Hanumantha Rao, Director, TC, GSI TI, Hyderabad.

9. Hyperspectral remote sensing: Dr. K. Vinod Kumar, Scientist, NRSA, Hyderabad.

10. Application of remote sensing and GIS for coal bed methane in Raniganj Coal fields: T.R. Martha, scientist, NRSA, Hyderabad.

Module 2: Digital Image Processing and Digital Photogrammetry

After gaining sufficient exposure to the visual interpretation of aerial photographs and satellite imagery the trainees were introduced to the digital techniques of image processing. This module was conducted in two parts – viz ; Digital Image processing and Digital Photogrammetry. Under the digital image processing part, after a brief introduction to ERDAS Imagine 9.0, the software used during training programme, the trainees were introduced to Digital Image Processing through lectures, demonstration and hands on practice on the various aspects like:

1. Different digital image formats
2. Loading of different satellite images and subsetting
3. Geometric rectification of spatial data
4. Statistical analysis of digital data
5. Various enhancement(Radiometric, Spectral, Spatial) techniques
6. Multi band enhancement techniques-including band ratioing, principle component analysis, RGB-HIS transformation, resolution merge, image fusion
7. Image classification(Supervised and unsupervised) techniques
8. Mosaicing and map composition

The trainees were given the digital data of one of the blocks (The Ramgiri Block) of their project work to enable them for applying digital processing techniques and appreciate the results.

The sigital photogrammetry part included lecture and demo on Ortho-Rectification, generation of digital elevation model(DEM), 3D

visualization and feature extraction of DEM using both areal phots (Stereo-pair) and satellite data.

Module3:Geographic Information System

In this module conducted at the CGMT Laboratory the following topics were covered through lectures demo and hands on practice:

1. General concept of spatial data models
2. Introduction to Arc GIS
3. Spatial data capture techniques
4. Georeferencing on screen digitization
5. Automatic and semi-automatic vectorization using ArcScan
6. Spatial data editing
7. Concept of GPS and mobile mapping
8. Spatial adjustment
9. GIS analysis and Modeling tecniques
10. Cartographic principles and Map layout

The trainees were given a project work on prognostication of kimberlite pipes in Narayanapet area using GIS. They were also introduced to vector and raster GIS using free and open source software(FOSS).

Module4 Project work- Block interpretation and field checks

After retaining a fair degree of confidence in photo interpretation techniques, the trainees were given two for preparation of geological maps based on aerial photo on satellite imagery interpretation and subsequent field checks.

The first block – the Kurnool- Veldurti- Kalva Block falling in toposheets 57I/1,2,6, 57E/14 in Kurnool Dist.- were selected for interpretation of the sedimentary rocks together with the basement- the Ramagiri Block falling in toposheet 57F/7 and 11 in Anantpur district- was choosen for the interpretation of igneous and metamorphic lithologies belonging to the Ramagiri schist belt and Peninsular Gneissic complex.

The trainees were grouped in to four batches. Each batch pre-field aerial photo and imagery interpreted geological maps of both the blocks. Aerial photographs on 1:50,000 Scale, Geocoded sheets (FCCs) of IRS-1C and IRS-1D were used for prepairing pre-field interpreted maps. This was followed by field checks for nine days, along selected selections- two in the Kurnool-Veldurti- Kalva block and one in the Ramgiri block. The two traverses along which the field checks were carried out in the Kurnool-Veldurti- Kalva Block were 1. Kurnool- Narnur-Somayajulapalli- Nandyal section and 2. Kurnool-Veldurti- Ramallakota-Kalva section. These two sections exposed the lower Cuddapah sediments and the entire sequence of Kurnool sediments. Various aspects of geomorphic expression and field deposition of the lithounits vis-à-vis their mutual field relationship of the different lithounits, primary and secondary structres preserved in them were studied. The trainees were made to appreciate the lack of tonal contrast between some of the lithounits a probable reason for missing such lithounits during pre-field interpretation. Deposition of lithounits breaks in the structural deposition of the lithounits along the major ENE-WSW trending Gani-Kalva fault, the fault geometry and mineralization like steatite, ironore, uranium along this fault and the secondary diamond in conglomerate were studied. In the ramagiri block the field checks were carried out along one traverse across the general trend of the lithounits from Kuntimaddi to West of Ramgiri making the trainees to understand the reasons for missing some of the mafic dykes during the preparation of the pre-field interpreted map.

After returning from the field the observations were incorporated and the pre-field maps were modified by the participants and project reports were submitted by each of the batch. In the end the trainees enthusiastically participated in group discussions and presented their observations during the project work both in the digital image processing and block interpretation. And evaluation test was also conducted in this all the trainees were performed well.

Feedback:

1. All the participant agreed that the course is relevant to the objective of the course and expressed their satisfaction with the course content.

2. They also appreciated the systematic approach in handling the theory and practical exercise and hands on practice
3. Most of the participants have given a word of appreciation for the director and the faculty members of their approach in teaching, Untiring involvement at every stage, cooperation and encouragement extended during the course.
4. However some of the participants have expressed that some of the guest lectures need improvement
5. Many of the participants have felt that more time should be allotted for the GIS
6. Some of them suggested that internet facility should be provided for the participants.
7. Block interpretation and field checks should be immediately after the remote sensing module.