

The ever increasing demand for exploration of new mineral resources from the earth's subsurface has brought tremendous pressure on exploration geologists all over the world. The growing global energy need, rapid infrastructure development, and environmental concerns have renewed the focus on better utilisation and responsible exploration of

natural resources especially for exhaustible mineral resources.

Discovering hidden mineral deposits requires novel understanding coupled with innovative technologies. This has led to an increased adoption of advanced tools and technologies such as Remote Sensing (GIS), advanced geophysical surveys, geochemical sampling/analysis, geological modelling etc. for exploration of mineral assets.

**Making proper use/utilisation of data from different studies/techniques is the most challenging part of an exploration geologist's work, requiring theoretical knowledge, practical understanding and a degree of flair and imagination.**

### **An integrated approach**

Exploration of Earth's subsurface for mineral sources requires a collaborative, integrated approach and methodologies that combine all 4Gs – Geospatial, Geology, Geophysics and Geochemistry – to meet the exploration challenges. This makes exploration cost-effective, efficient and more accurate.

Such a multi-disciplinary approach is a prerequisite

Integration and interpretation of 4G data through a systematic approach and in a time and cost effective manner is the key to a successful mineral exploration program. Moreover, due to the multidimensional approach, the results derived in such process are considered to be more authentic

# Going 4G for mineral exploration





requiring theoretical knowledge, practical understanding and a degree of flair and imagination. A logically designed exploration program progresses through a number of stages, from regional reconnaissance to semi-detailed follow up and then to detailed evaluation.

Geospatial application is the initial step of regional reconnaissance study, which gives an overview/visualisation/acquisition of the geological information of a wide area at a small or large scale. This application uses the remotely sensed imagery which has become increasingly important to worldwide geological and mineral mapping, and gives a base/direction to go ahead for further exploration in a cost effective manner and in a short turnaround time.

Geological Mapping is the science and study of the solid Earth which cannot be completed without surveying the earth surface features in field with geological instruments like GPS, clinometers, hammers, lens etc by expert geologists with a good knowledge of the subject. Collecting structural data (dip/strike) and identification of lithological units and their contact zones are some of the major activities to be observed in the field. Basically, the quality of a geologic map depends upon the accuracy and the precision of the field investigations.

Based on the integration of geospatial and geological studies of an area it is crucial to assess a correct and proper geophysical method (viz. magnetic, gravity, resistivity etc) for every individual mineral. Lithological and structural units associated with any particular mineral in an area play a major role in identifying the geophysical method that is to

**Exploration of Earth's subsurface for mineral sources requires a collaborative, integrated approach and methodologies that combine all 4Gs – Geospatial, Geology, Geophysics and Geochemistry to meet the exploration challenges.**

in today's highly focused exploration environment. Instead of using a single approach for mineral exploration, a systematic integrated approach of different technologies complements/supplements each other in finding the target area in a short turnaround time with a greater level of confidence.

The integrated approach demonstrates the end-to-end process adopted by many experts, viz. geologists, geophysicists, geochemists, geospatial experts etc. This process includes verifying historical data from different origins, geospatial application using satellite imageries,

geological mapping, geophysical surveys, geochemical sampling/analysis, processing of the data, analysing results, integrating results and finally, developing integrated geological interpretations on which follow-up drilling and mining exploration can be planned. Mineral exploration methods vary at different stages of the process depending on the size of the area under exploration, as well as the type and intensity of required information.

Making proper use/utilisation of data from different studies/techniques is the most challenging part of an exploration geologist's work,

### Project Facts

- Discovering hidden mineral deposits requires use of advanced technologies and this has led to an increased adoption of Remote Sensing, GIS, advanced geophysical surveys, geochemical sampling/analysis, geological modelling.
- Combined use of geospatial, geology, geophysics and geochemistry makes exploration cost-effective, efficient and more accurate.
- The end-to end exploration process includes verifying historical data from different origins, geological mapping, geophysical surveys, geochemical sampling/analysis, data processing, analysing and integrating results, and finally, developing integrated geological interpretations on which follow-up drilling and mining exploration can be planned.

be applied. It is also critical to integrate geochemical studies with geological and geophysical data for better confirmation of mineral resources. The intensity of geochemical survey (viz. random/systematic surface sampling or sampling through pitting/trenching) depends on the geological status of the area.

Finally, integration of all the acquired and processed geospatial, geological, geophysical and geochemical data/results helps in prioritisation of target areas for follow-up exploration.

**Conclusion**

Integration of 4G data and its interpretation is the most crucial and decisive part in mineral

exploration for prioritisation exploration targets. Such an integrated approach has a major contribution in substantial reduction of upfront investments (In terms of drilling expenses) and associated risks. All subsequent stages of exploration get guided by the findings of such integration and interpretation. Hence, it is crucial to select the right combination of technologies and expertise.

**Author's Profile**

**Dr. Bijay K Mishra** is a Geologist working as an Asst General Manager with the Mineral Exploration Group of RMSI Private Limited. He holds a Doctorate degree from Birla Institute of Technology, Mesra. He has more than 15 years of extensive experience in the field of Geological/Geophysical

**Integration of 4G data and its interpretation is the most crucial and decisive part in mineral exploration for prioritisation of exploration targets.**

exploration and Geospatial technology.

**Dr. N Sulekha Rao** is a Geologist presently working as a Team Lead in the Mineral Exploration Group of RMSI Private Limited. She has received her Doctoral Degree from Indian Institute of Technology, Kharagpur and has more than 6 years of experience in the field of geological and geophysical exploration.

**About RMSI**

RMSI is a geological and resource consulting company. With a project footprint across six continents viz. North/South America, Europe, Australia, Asia and more than 15 African countries. RMSI offers due diligence, mineral asset evaluation, geological/geophysical surveys, geological modeling, resource/reserve estimation based on JORC/SAMREC standards, and IT/GIS services for mining/exploration industry.

**India's 1st Conference & Exhibition on Survey and Mapping**

**SURVEY INDIA 2014**

**16-17 April, New Delhi**

ASSOCIATE SPONSOR

GOVERNMENT PARTNER

INSTITUTIONAL PARTNER

MEDIA PARTNER



- Surveying Best Practices - Technology & Techniques
- Data Processing and Visualization
- Ecosystem
- Survey of India: Partnership and Practices

[www.directionsmag.in/surveyindia](http://www.directionsmag.in/surveyindia)

For more details, please contact:

Sonal Bahuguna E [sonal.bahuguna@directionsmag.in](mailto:sonal.bahuguna@directionsmag.in)

M +91 9013068056/ +91 8527179791

[www.directionsmag.in/surveyindia](http://www.directionsmag.in/surveyindia)