Coordinating and integRating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East and Balkans and Developing Links with GEO related intiatives toward GEOSS

GEO-CRADLE pre-Kick-Off Meeting
Friday, 18th of February, 2016

Dr Marianthi Stefouli

Institute of Geology and Mineral Exploration

IONIC Centre, 11 Lysiou Street
Athens, Greece

HORIZON 2020

RAW MATERIALS & EARTH OBSERVATION – PAST EXPERIENCE...

The " **GeoNickel**“ Project

GeoNickel is an achronym of EU-supported BriteEuram Project No: BE-1117 entitled
"Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits".

The project was realized 1996-1998 and reported early 1999

IONIC Centre, 11 Lysiou Street
Athens, Greece

Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits : RAW MATERIALS & EO

GeoNickel

The following corporations participated in the project: Coordinator: Outokumpu Mining Oy, Finland; Partners: LARCO, General Mining and Metallurgical Co, SA, Greece; SOFTECO SISMAT S.p.A, Software Development Company, Italy; IRIS Instruments S.A, France; GTK, Geological Survey of Finland; Associated contractors: BRGM, France; IGME, Institute of Geology and Mineral Exploration, Greece; NCSR "Demokritos", Institute of Informatics & Telecommunication, Greece; Subcontractors: University of Turku, Department of Geology, Finland; Athens University, Department of Geology, Greece.

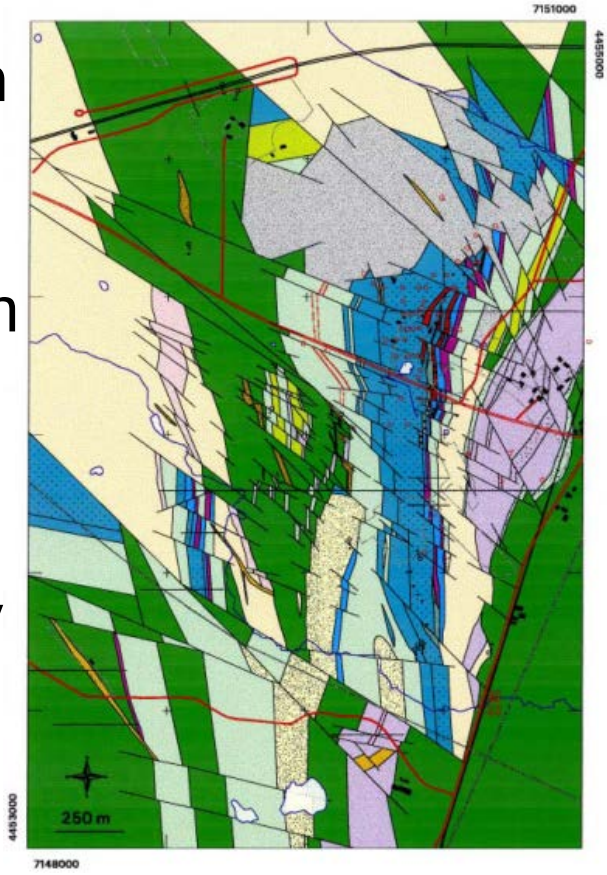
Two Mining companies, two SMEs, three Geological Surveys, One Research Institute and two Universities Four countries...

Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: : RAW MATERIALS & EO

The overall objectives of GeoNickel were set to enhance the geological and geophysical knowledge on nickel ore deposits, and to develop novel**, integrated nickel exploration methods and tools**.

To meet the overall objectives, **three key areas** of methodology in nickel ore exploration were selected for research and development work:

1. **Modelling of nickel deposits**
2. **Development of geophysical technology**
3. **Development of a Geo-scientific Information System (GEOSIS)**



Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: : RAW MATERIALS & EO

It was realized in six work packages:

WP1 Mineralogy and modelling of Ni ore deposits

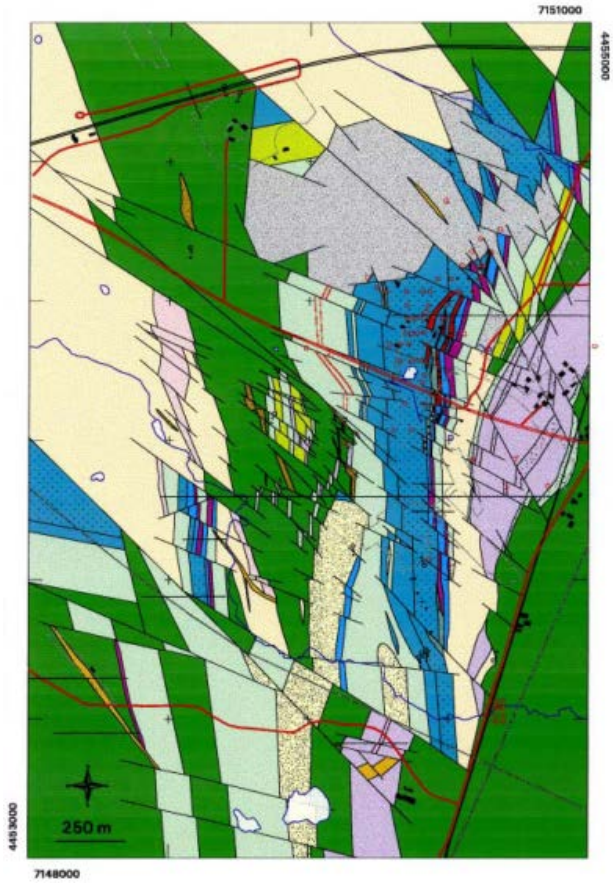
WP2 Development of geophysical technology

WP3 Image processing/pattern recognition

WP4 GEOSIS design and GIS tools development

WP5 Knowledge Based System

WP6 Final integration and testing



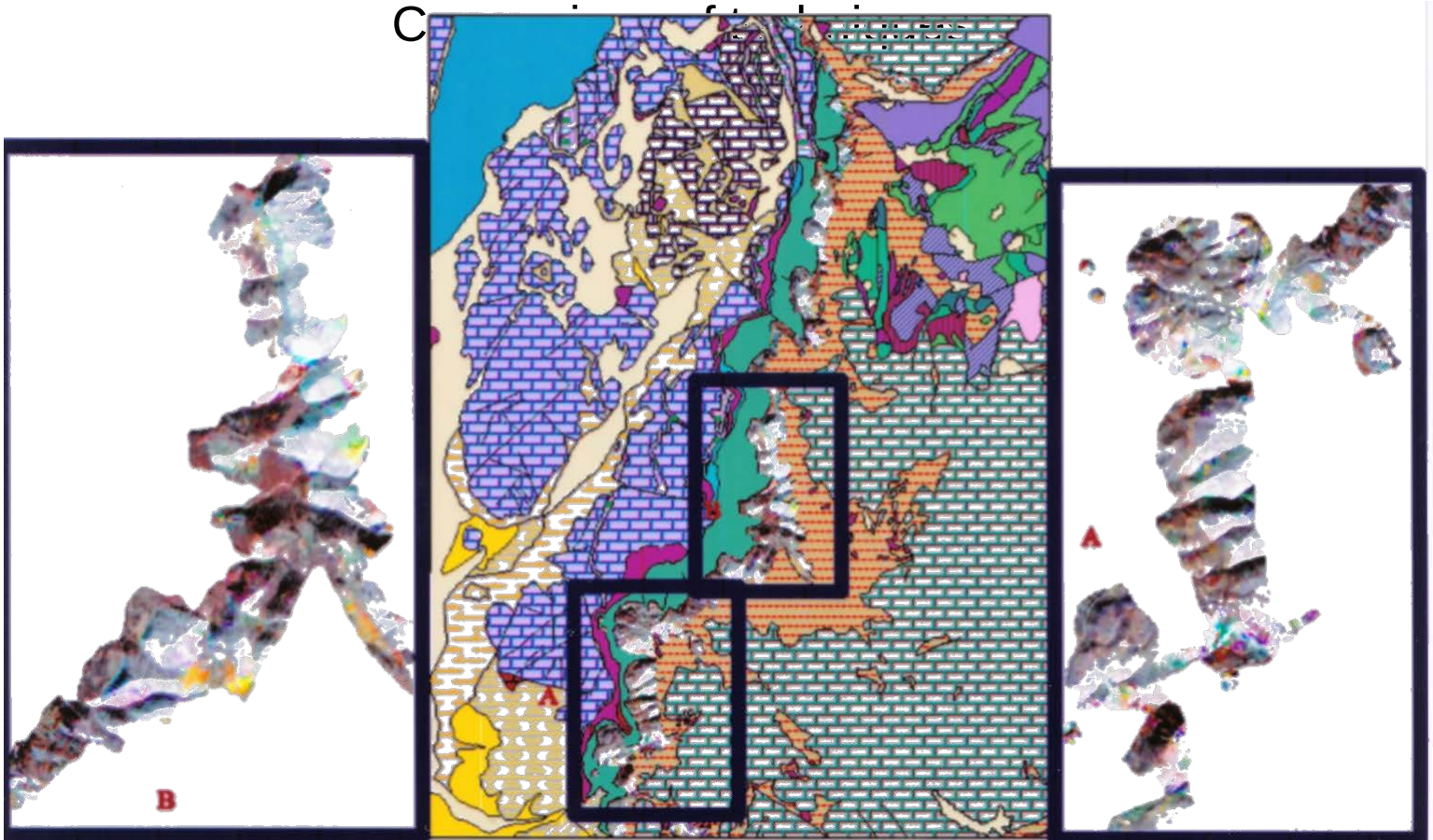
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits

WP3 **was devoted to analysis of Earth Observation data and it included:**

Data acquisition, quality evaluation / Image processing/pattern recognition

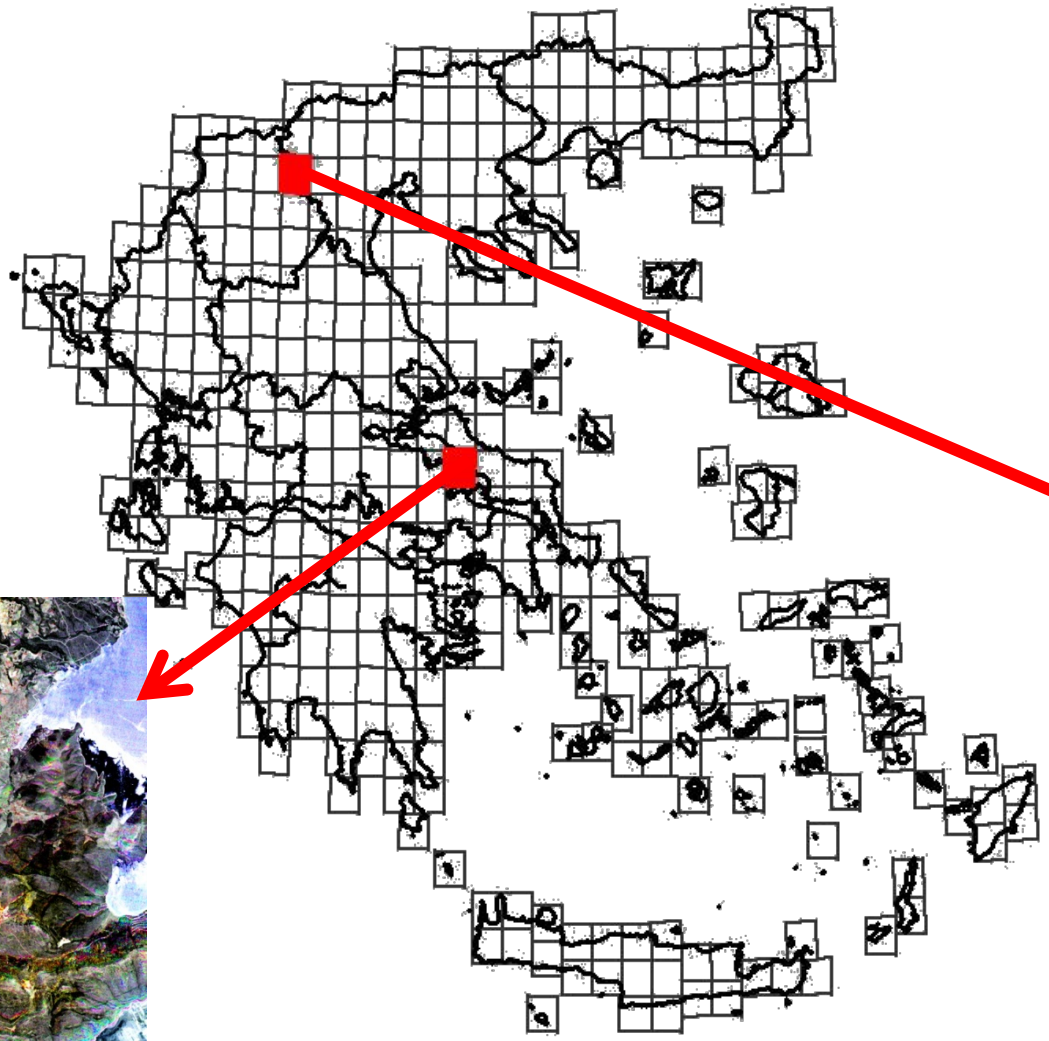
Classification of lithology and alterations / Delineation of lineaments using Advanced Neural Network techniques - ANN

C

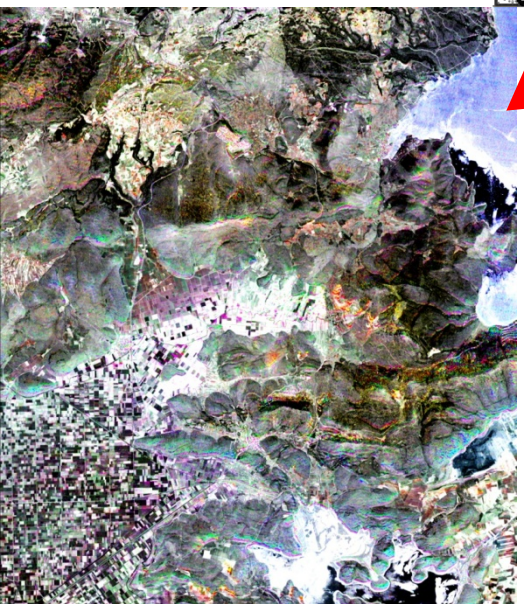


Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO

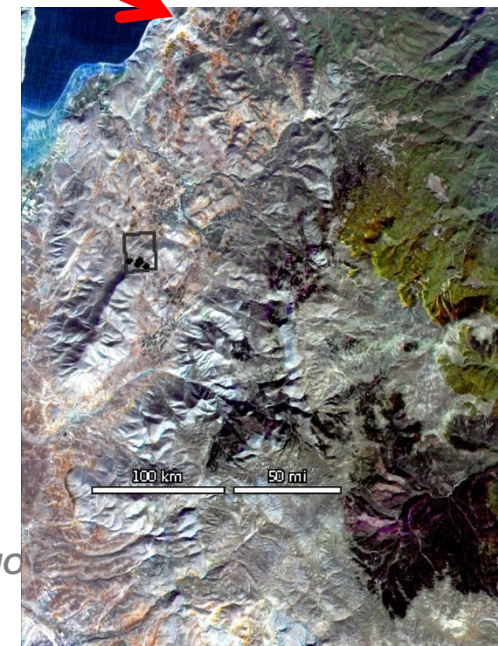
Two Pilot areas for laterite nickel deposits



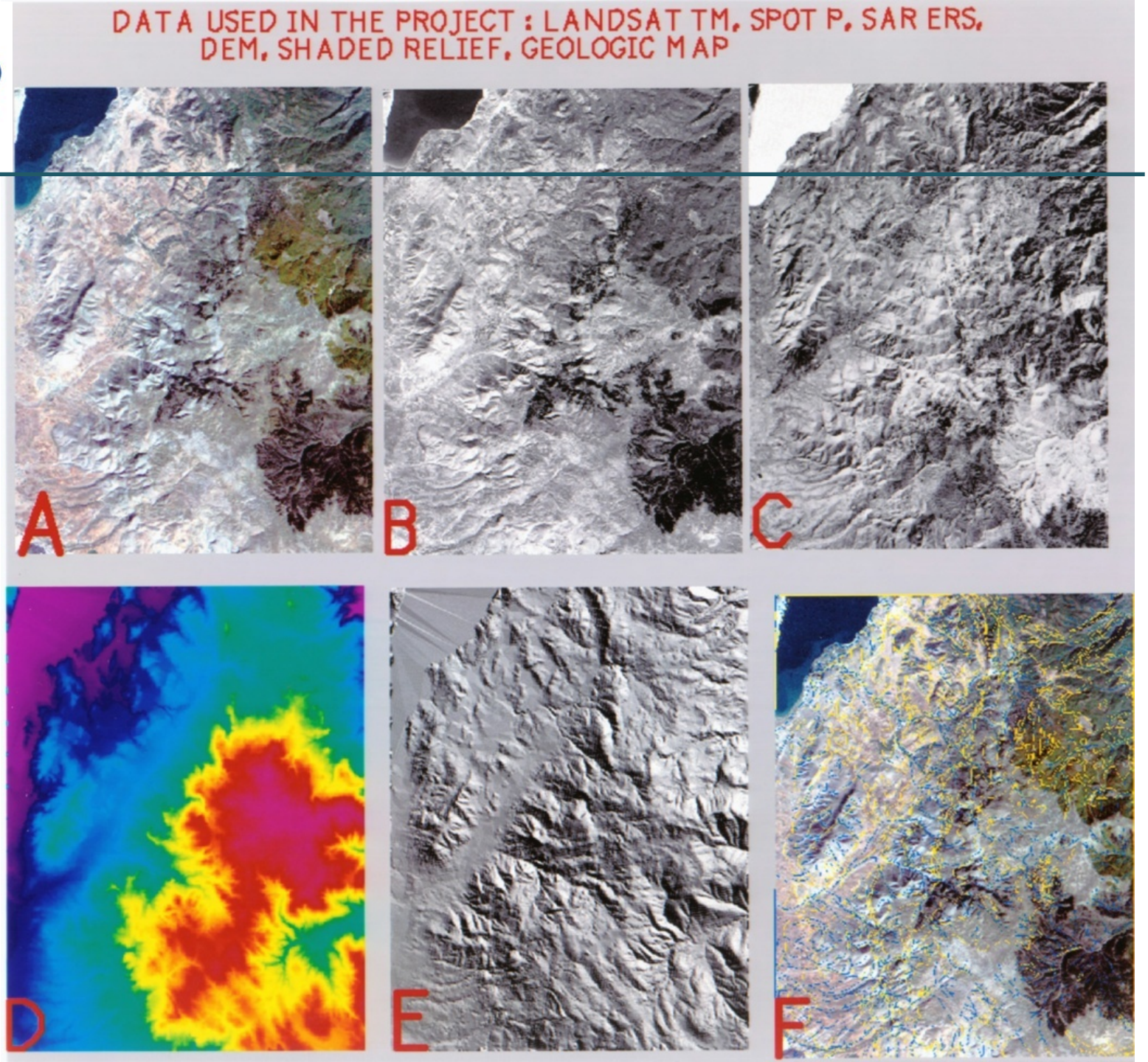
Pirgoi area…



Larymna area….

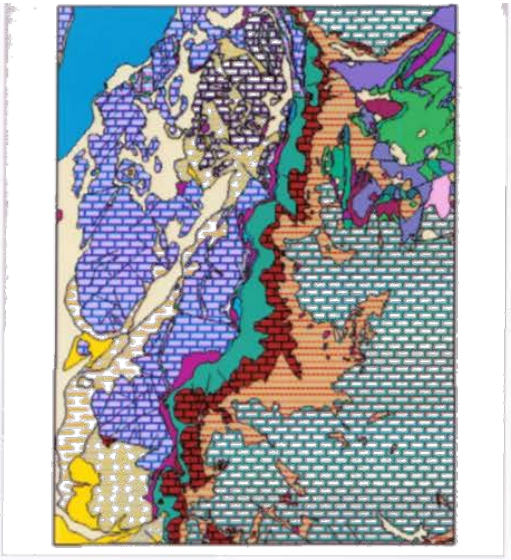


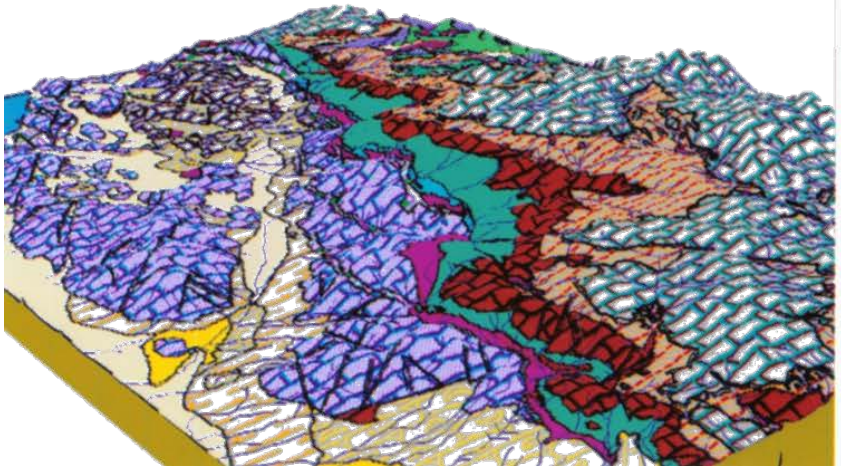
- **Data used**

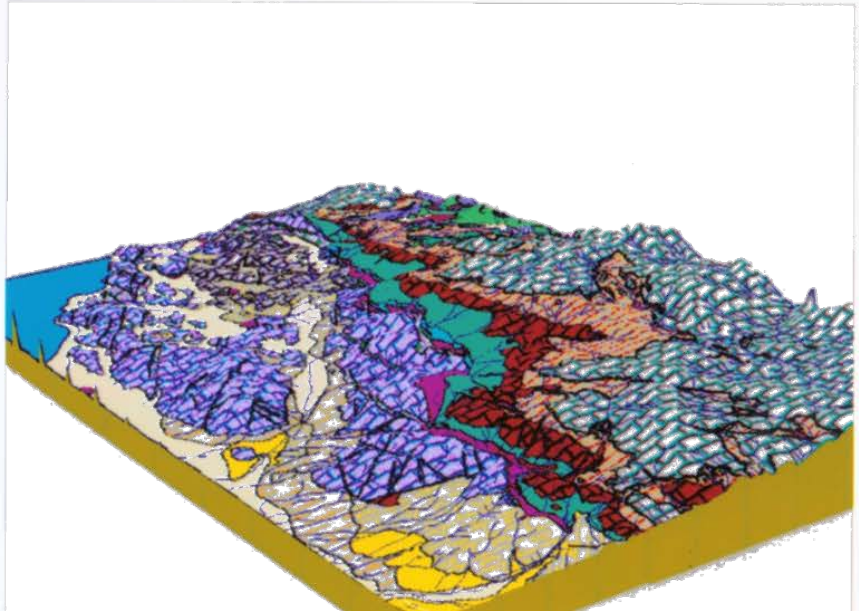

DATA USED IN THE PROJECT : LANDSAT TM, SPOT P, SAR ERS,
DEM, SHADED RELIEF, GEOLOGIC MAP
A
B
C
D
E
F

Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO

Processing of Non Earth Observation Data:
Geological Maps
&
DEM

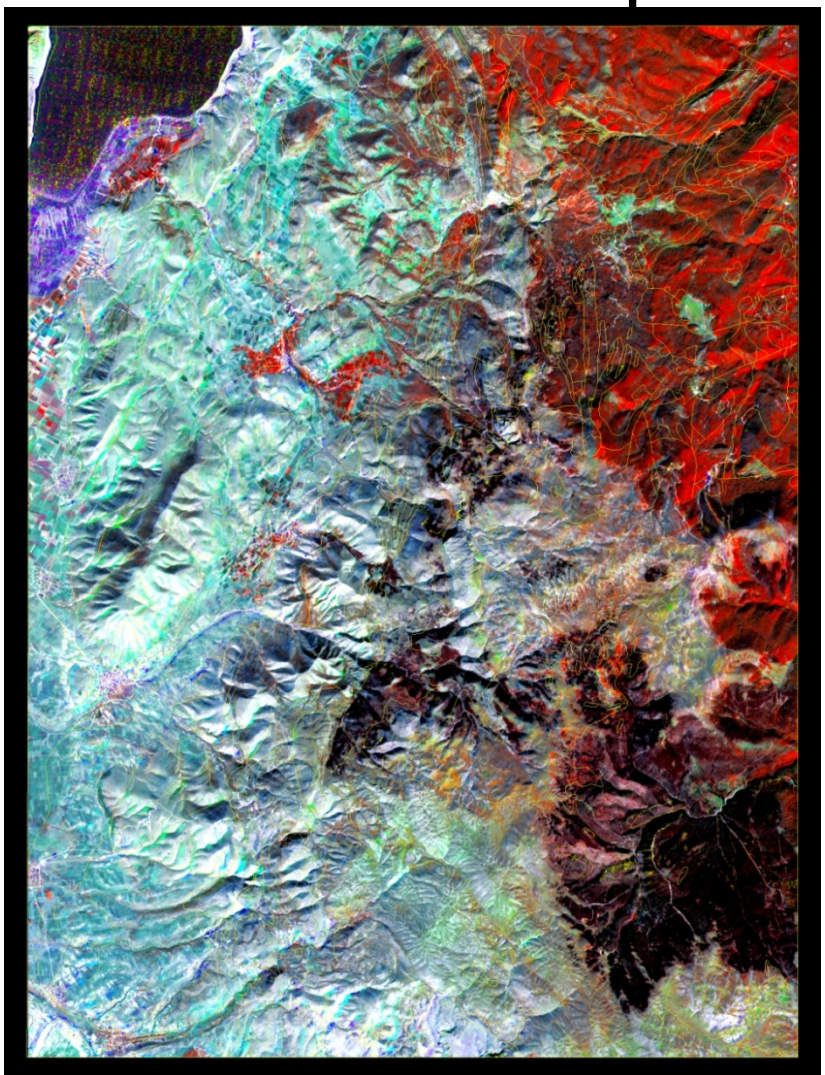






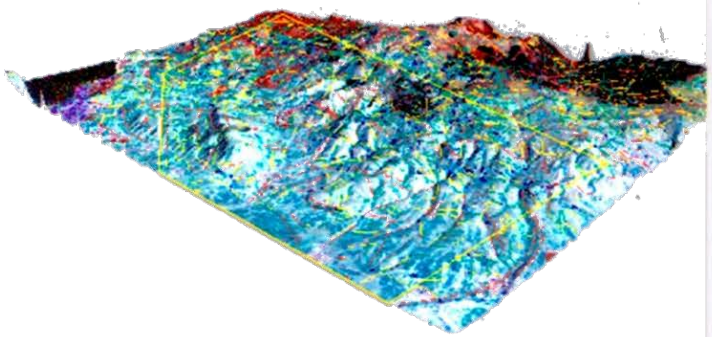
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO

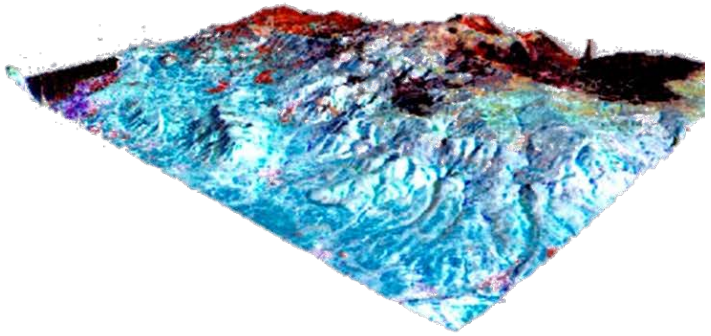
Image processing: Preprocessing, Image Enhancement, Spectral processing, interpretation

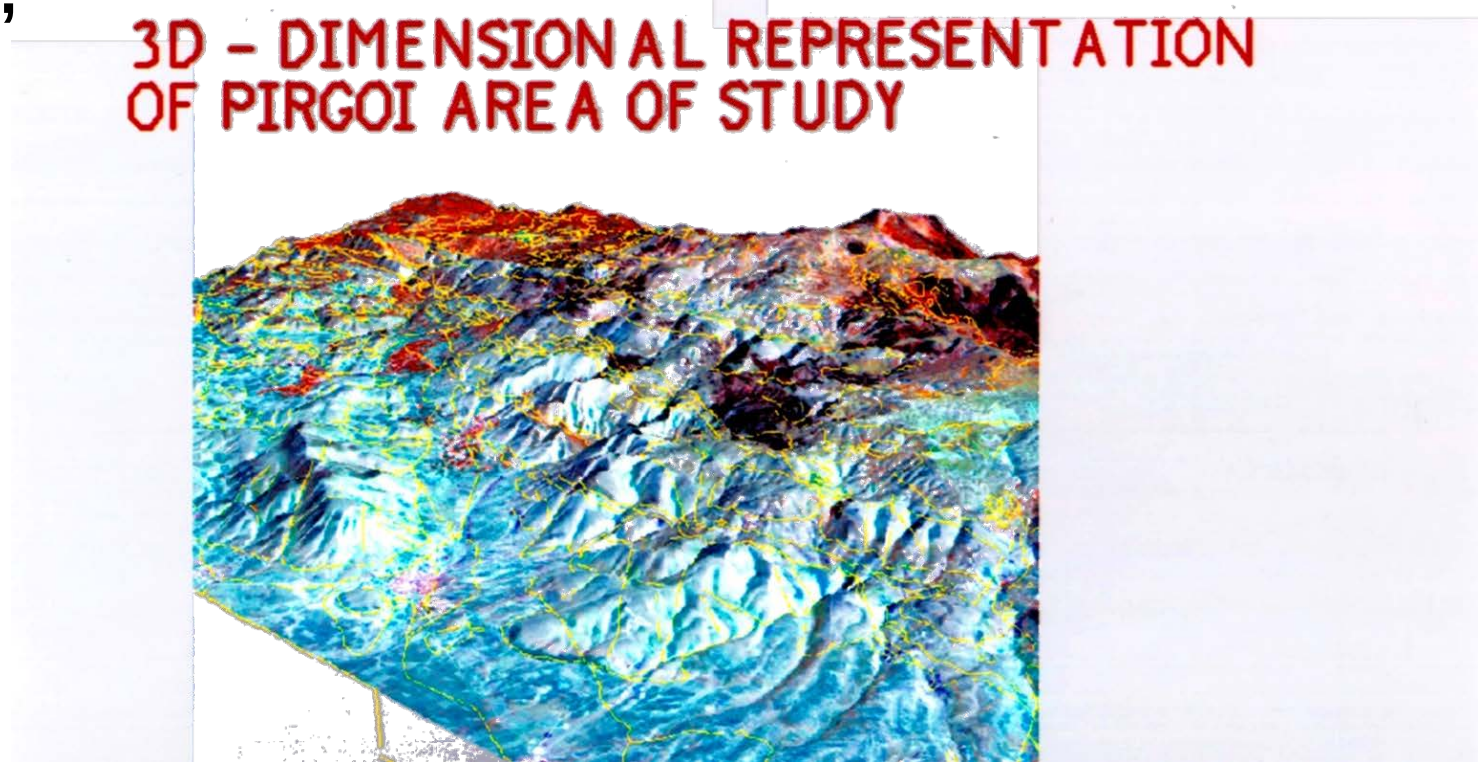


Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits : RAW MATERIALS & EO

Data fusion of satellite images of different resolution, i.e. SPOT & Landsat TM images

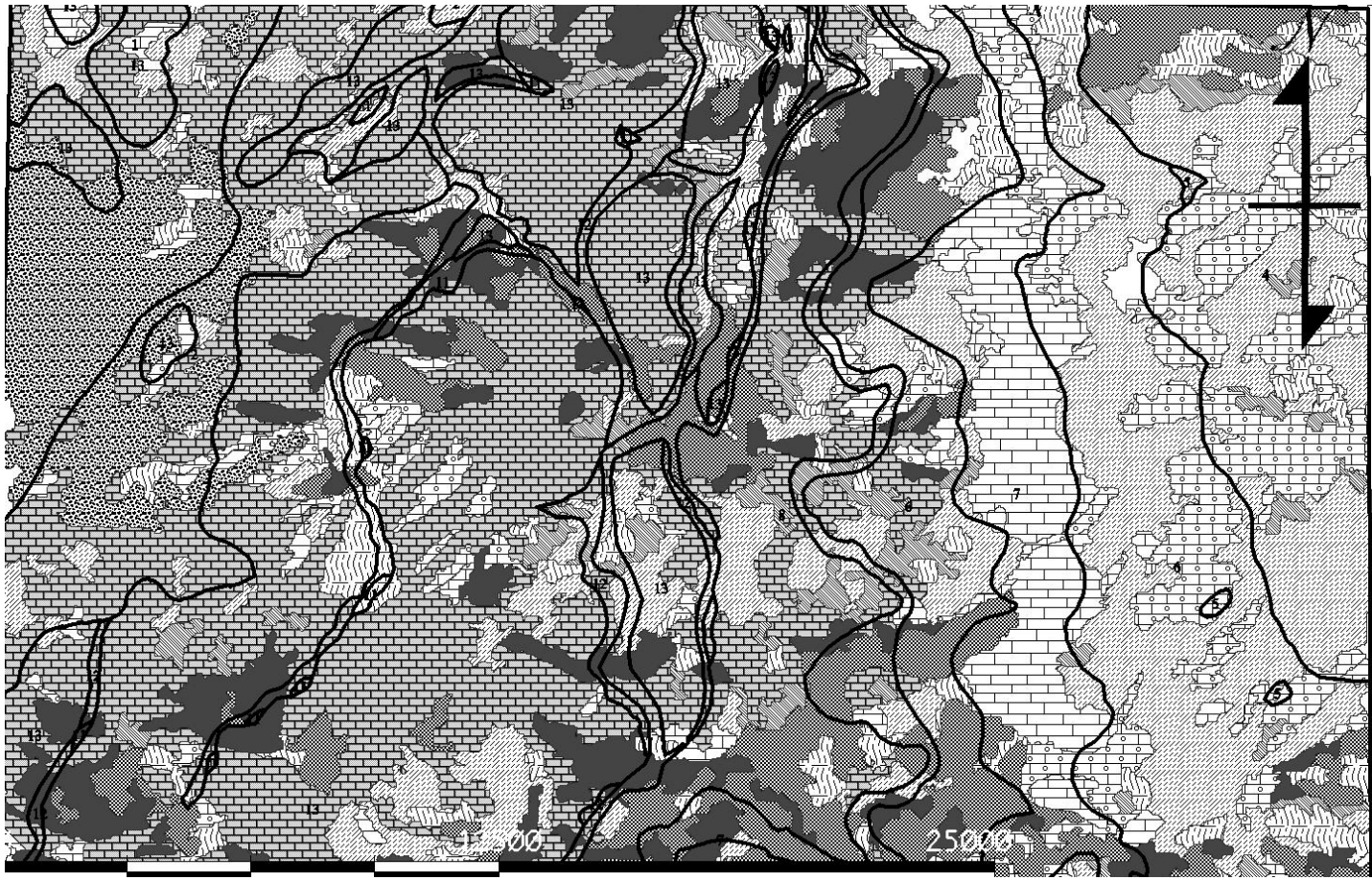






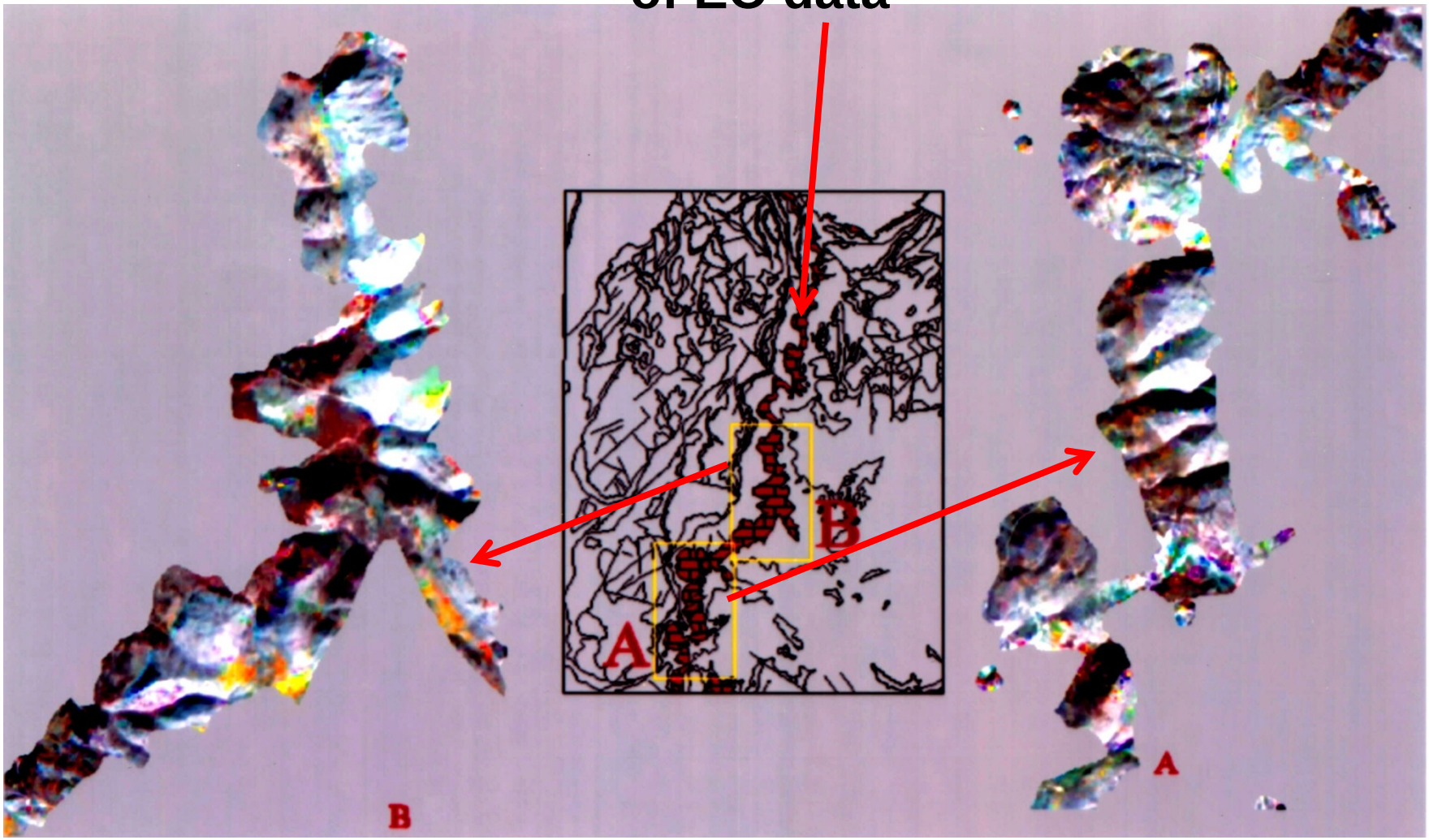
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits : RAW MATERIALS & EO

Geologic maps could be updated when using Earth Observation data

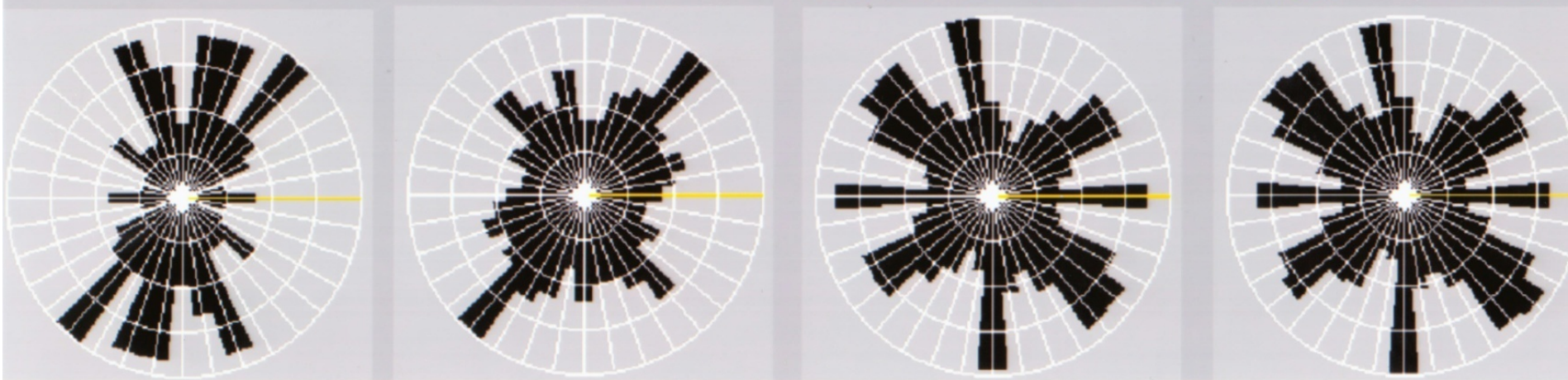


Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO

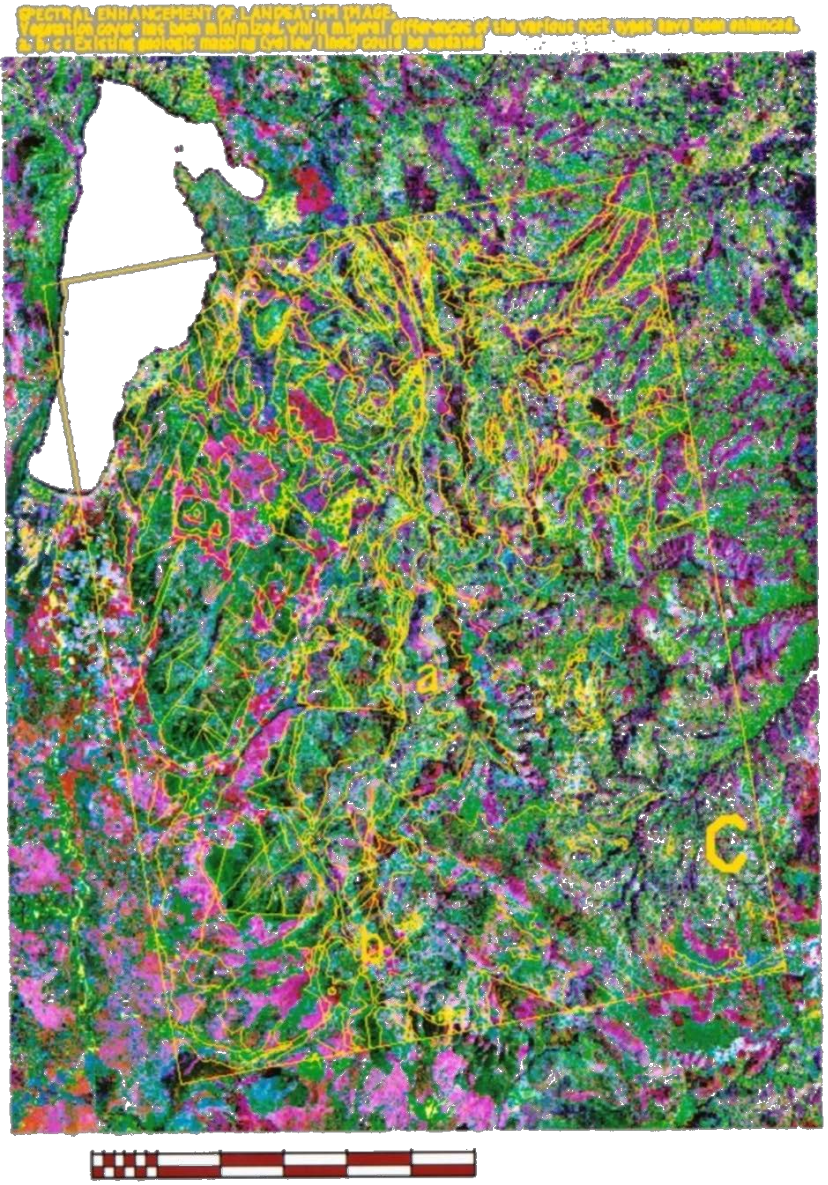
Variable information can be obtained after the processing of EO data



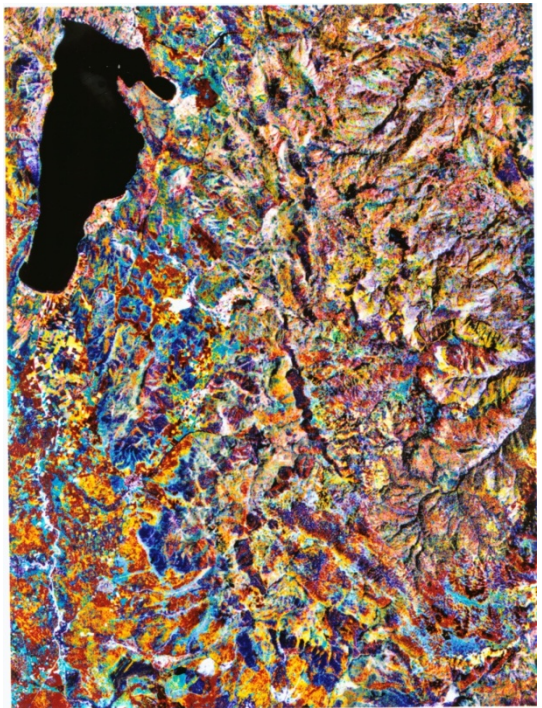
The mapping of structural and statigraphic features can be made quickly and quite accurately for comparatively large areas.



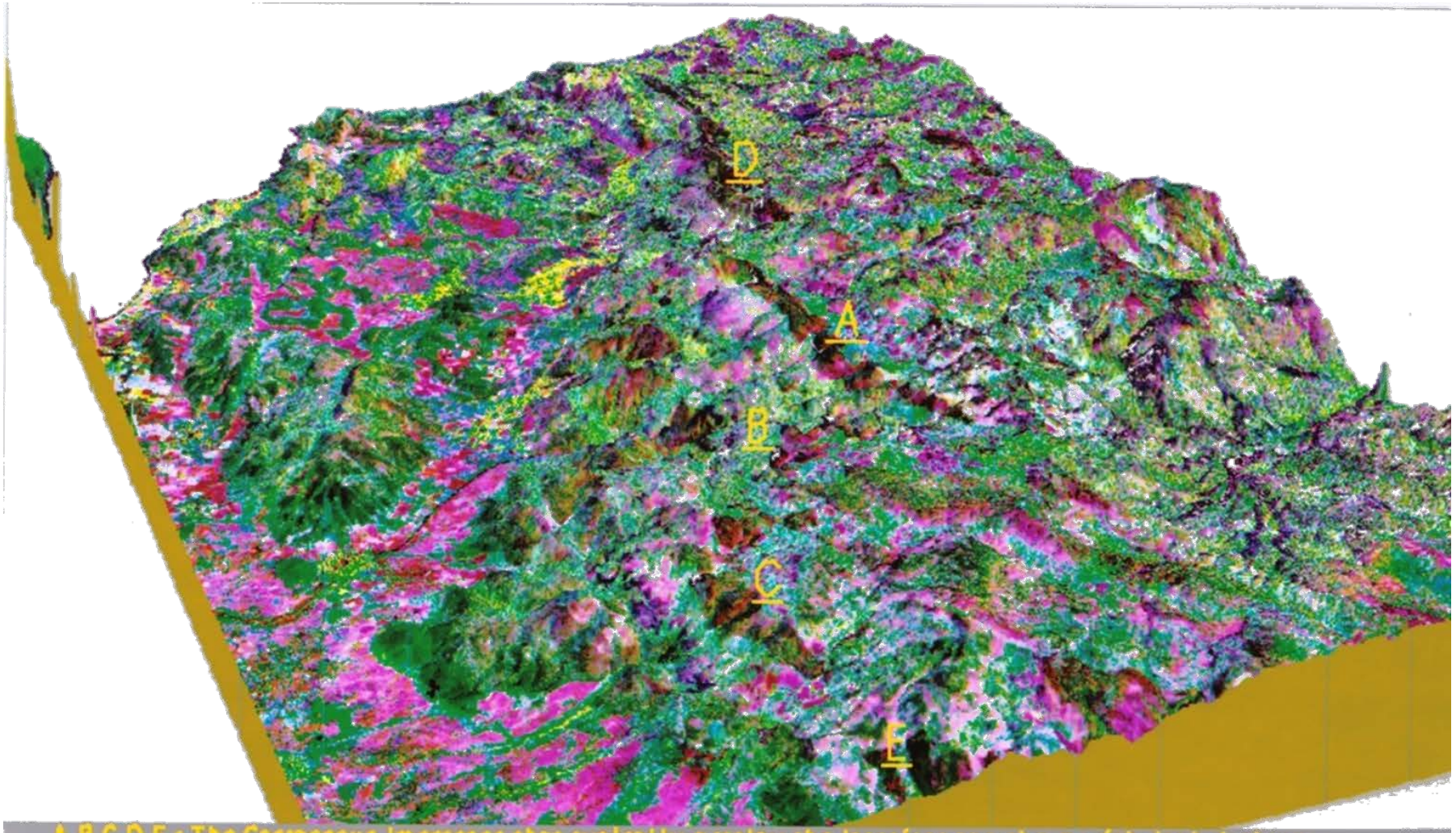
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits : RAW MATERIALS & EO



Features related to Ni lateritic occurrences have been interpreted on the satellite images. They are not shown on general purpose geologic maps ,a,b,c

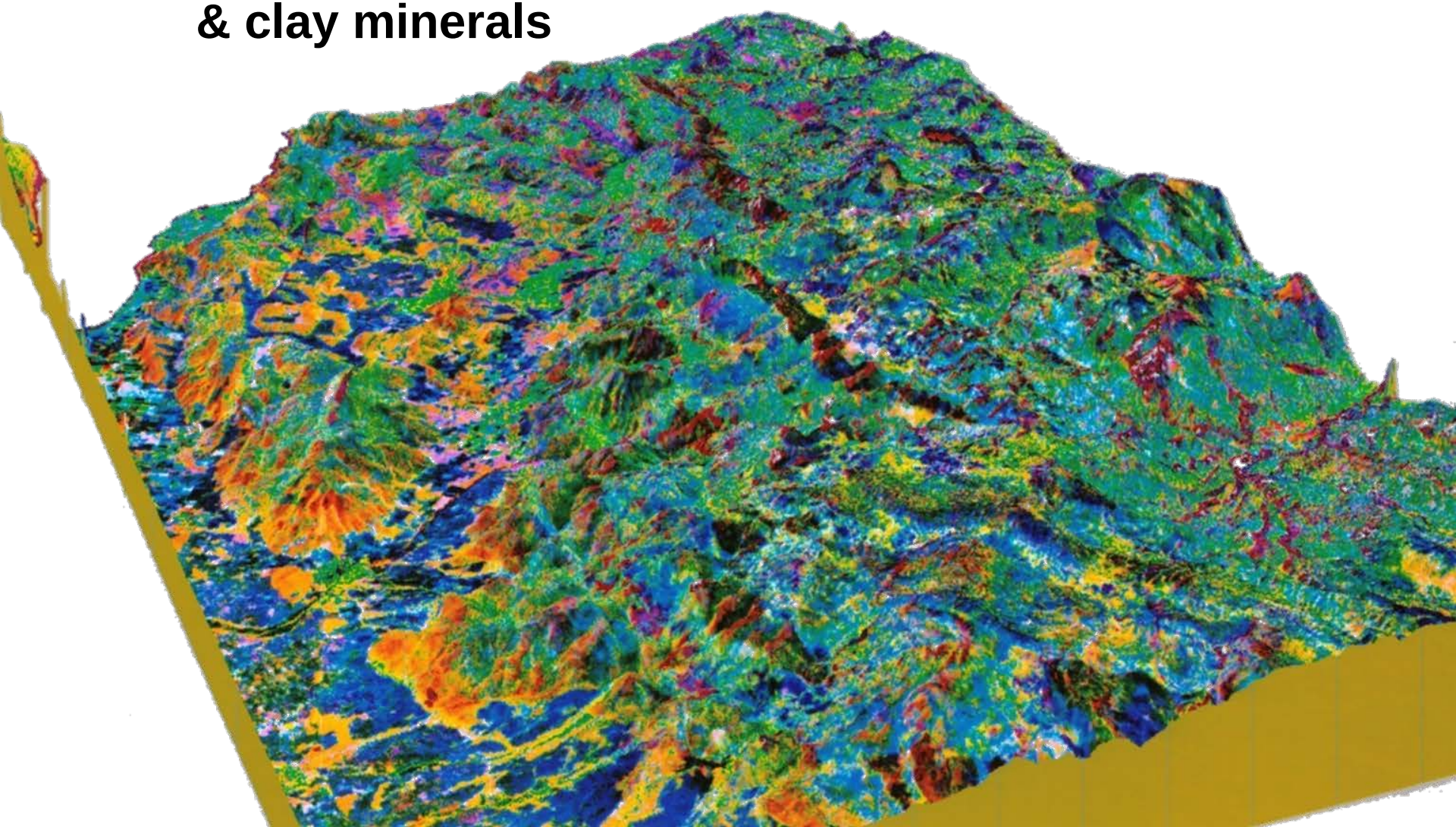


A,B,C,D,E: Features related to Ni laterites

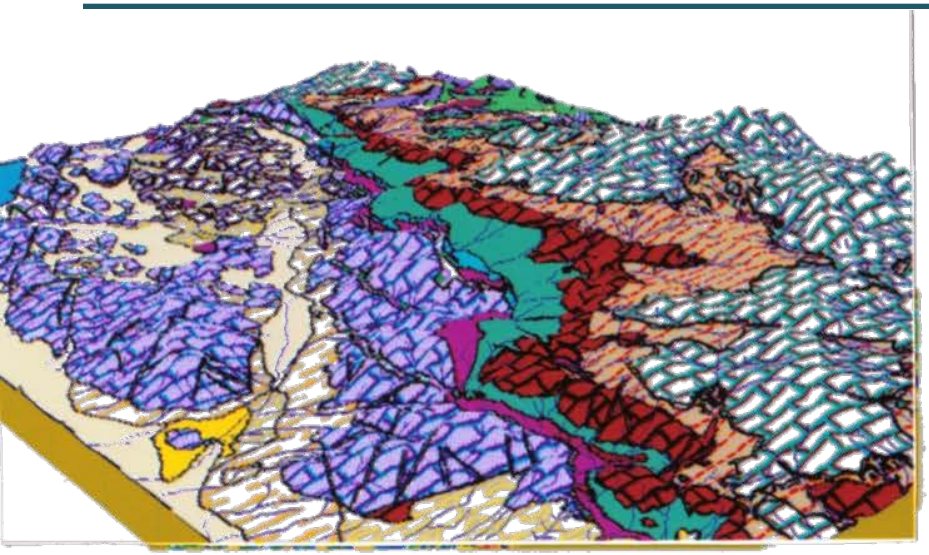


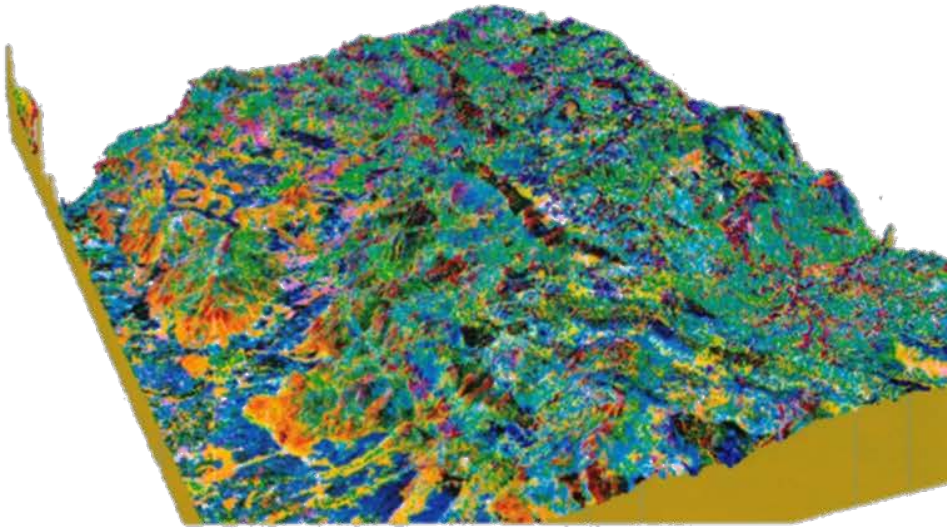
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO

Enhancement of iron oxides & clay minerals

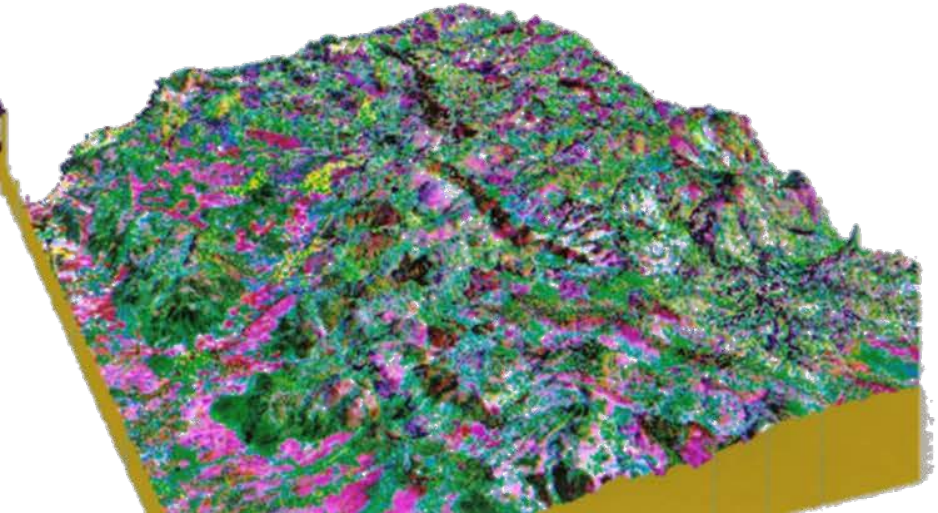


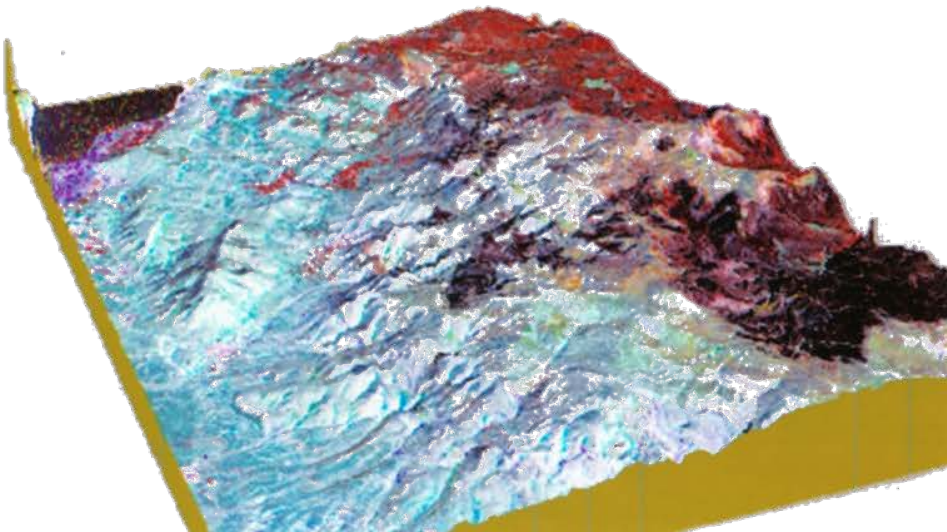
Integrated Technologies for Minerals Exploration, Pilot Project for Nickel Ore Deposits: RAW MATERIALS & EO





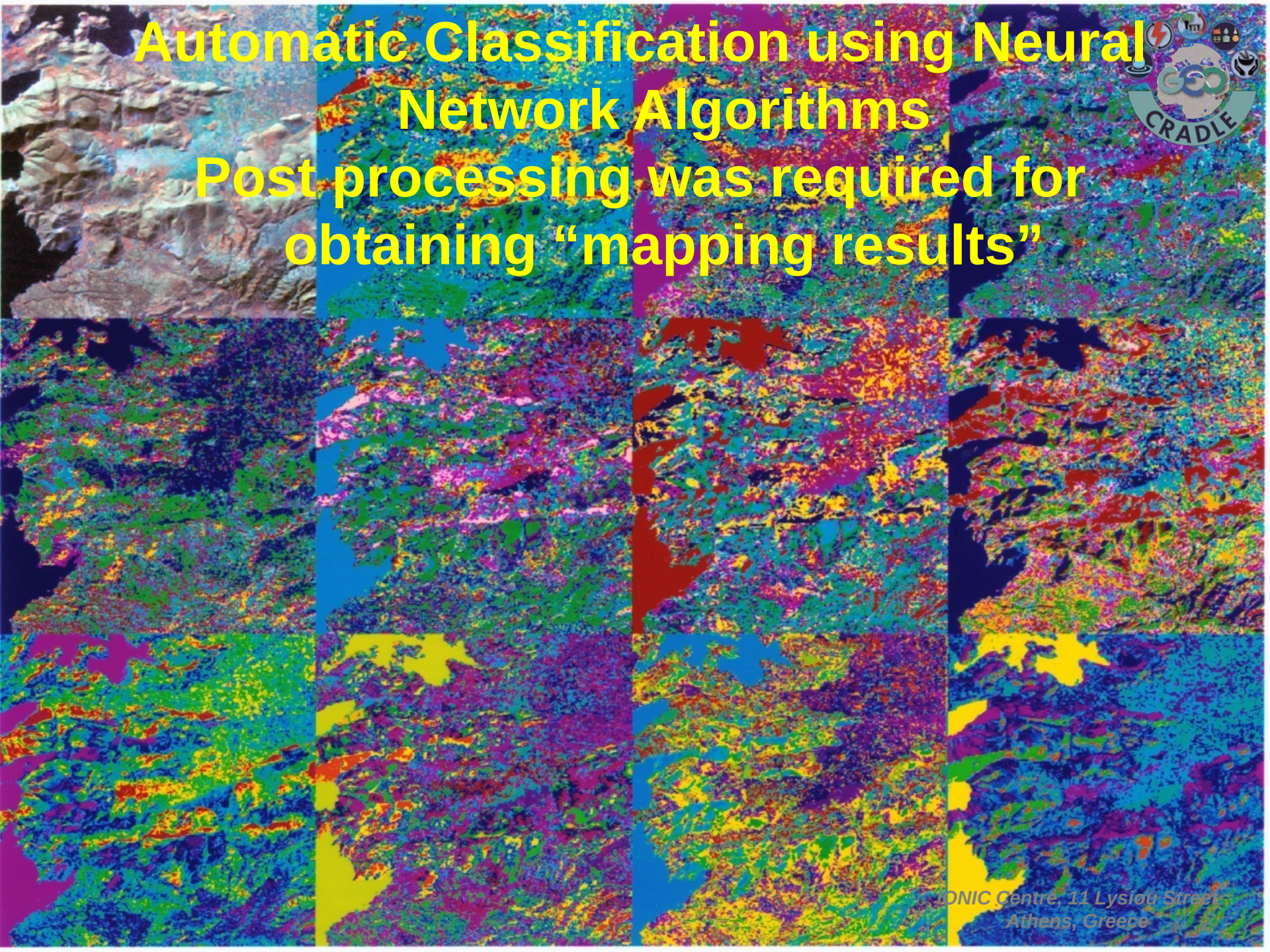
Acquisition of GIS related information





Automatic Classification using Neural Network Algorithms

Post processing was required for obtaining “mapping results”



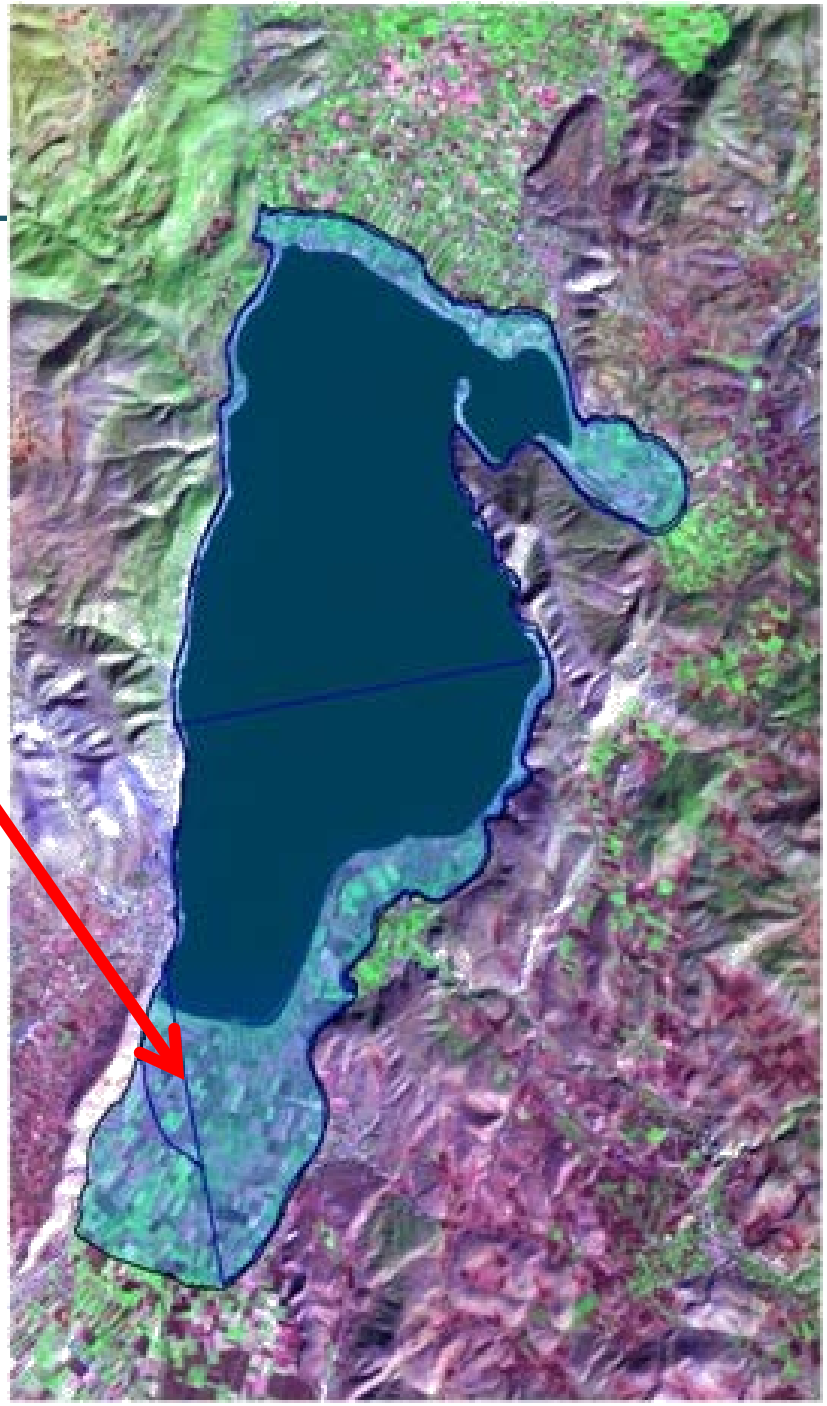
LAND COVER & EO

Additional information is available related to land cover

Geological map update of lake boundary...

The time to delineate the general structure of the area and to support geologic mapping is minimum...

The information of satellite images can contribute to geologic mapping to scales up to 1:25,000



Discussion

Spectral characteristics of Landsat satellite TM do not always cover the needs for a "mineral exploration" project…

Integration with the SPOT Panchromatic image improved the spatial resolution of the images…

<u>Does other satellite systems like those of the Copernicus ESA system (Sentinel) could contribute to mineral Exploration projects?</u>

This is a question that should be answered after the implementation on pilot project areas and on various types of "raw materials"

Discussion

Development of a Knowledge Based System (GEOES) was based on the modelling of nickel deposits, as well as on geological, geophysical, and other data stored in geographic information system (GIS) database and on **remote sensing data which were** processed with innovative image processing/pattern recognition techniques

Integration of developed software tools – classification using neural networks, automatic recognition of lineaments, expert system – into the GEOSIS system, was not fully accomplished …

An integrated software system has to be used so as to act as a focal point for the active co-operation between explorers with different backgrounds!

Every success to GEO-GRADEL works!

GeoNickel

Helsinki Meeting, August 1996

The *GeoNickel* Consortium against the wall.
Outside one of the best restaurants I have ever been.