Stephane Chevrel, Reinhard Belocky, Klemens Grösel

MINEO (***Monitoring and assessing the environmental impact of mining in Europe using advanced Earth Observation Techniques***) is a shared cost action project partially funded by the IST Programme of the 5th Research Framework RTD Programme of the European Commission. MINEO was kicked off on January 2000 to run to December 2002.

Europe has a great history of mining activity that dates back to prehistoric times. Whole **regions are affected and in some cases devastated** by the results of these activities, and also by the more recent industrialised phase of mine development. **Finding solutions** to monitor and assess environmental pollution problems like acid mine drainage caused by waste products of mining activity and collecting data for the restoration of mining areas mining **eleven European companies** work together. MINEO brings together seven European Geological Surveys, members of EuroGeoSurveys, the association of the geological surveys from the European Union, mining companies, an environmental institute and Joint Research Centre of EC.

MINEO **aims** at developing advanced methods for the extraction of information and knowledge from Earth Observation data, which will be required in the future in order to provide EC and users (industry, decision-makers) with new and regularly updated thematic layers for environmental database related to mining areas. MINEO intends to develop operational tools for preparing and updating these layers.
The ***methodological developements*** over six different test areas in various environmental context are aiming at

- A spectral identification of contaminated areas (reference spectral libraries)
- Developing specific image processing for discrimination of contaminated areas (hyperspectral image processing algorithms)
- A GIS modelling of pollutant dissimination, impact assessments and environmental monitoring (models)

The ***Developement of generic tools*** at European scale comprehend

- Generic hyperspectral image processing models for mining environments in diverse European contexts
- Generic models of pollution migration and risk mapping, based on Earth observation and integration into GIS
- the simulation of future hyperspectral satellite data

The development of the key components of the decision making tools and methods to exploit these data will later facilitate their use in **sustainable information systems**. These will be used to locate and monitor environmental risks related to mining sites and aid the decision processes.

Such tools will give a sound basis for **effective environmental management** through a dialogue between industrialists and decision-makers. This will promote sustainable development of the mineral industry, which faces increasing environmental pressure and regulatory controls. Environmental Impact Assessments (EIA) and Environmental Management Plans (EMP) need regularly updated environmental database layers related to mining environments.
Innovative Earth Observation techniques like new ***Hyperspectral sensors*** can meet this demand. Hyperspectral imaging sensors produce data that can characterise the chemical and/or mineralogical composition of the imaged ground surface. The primary advantages of this future space-borne imaging technique are the reduction in hazardous, time-consuming and expensive field sampling methods and their capability to gather repeat data and so monitor mining pollution.

To undertake the envisaged methodological developments, six mining areas have been selected as **test sites** for investigation, to reflect European climatic, geographic and socio-economic environment diversity: 5 within Europe (Finland, Austria, Germany, United Kingdom and Portugal) and one in Greenland.
This six test sites have been flown at an altitude of 2000-2500m above ground level using the HyMap airborne hyperspectral imaging spectroradiometer operated by HyVista Corporation (126 bands in the 450 - 2500 nanometers range) during summer 2000. Simultaneous ground radiometric measurements have been carried out for further calibration of the airborne data as well as for generation of European-scale spectral libraries of contaminated areas. Supplementary many relevant environmental data have been acquired during summer 2000 over the six test sites.

MINEO participants have carried out methodological developments in image processing to map contamination related to mining over the individual test sites.

Interpreting first project results it can be determined that high advanced earth observation technologies are a capable, encouraging and forward-looking methode to monitor and assess environmental impact in mining areas.