



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 initiatives
toward GEOSS

GEO-CRADLE Project Meeting 2
Thursday, 17th November, 2016



The Geological Surveys of Europe

T4.3
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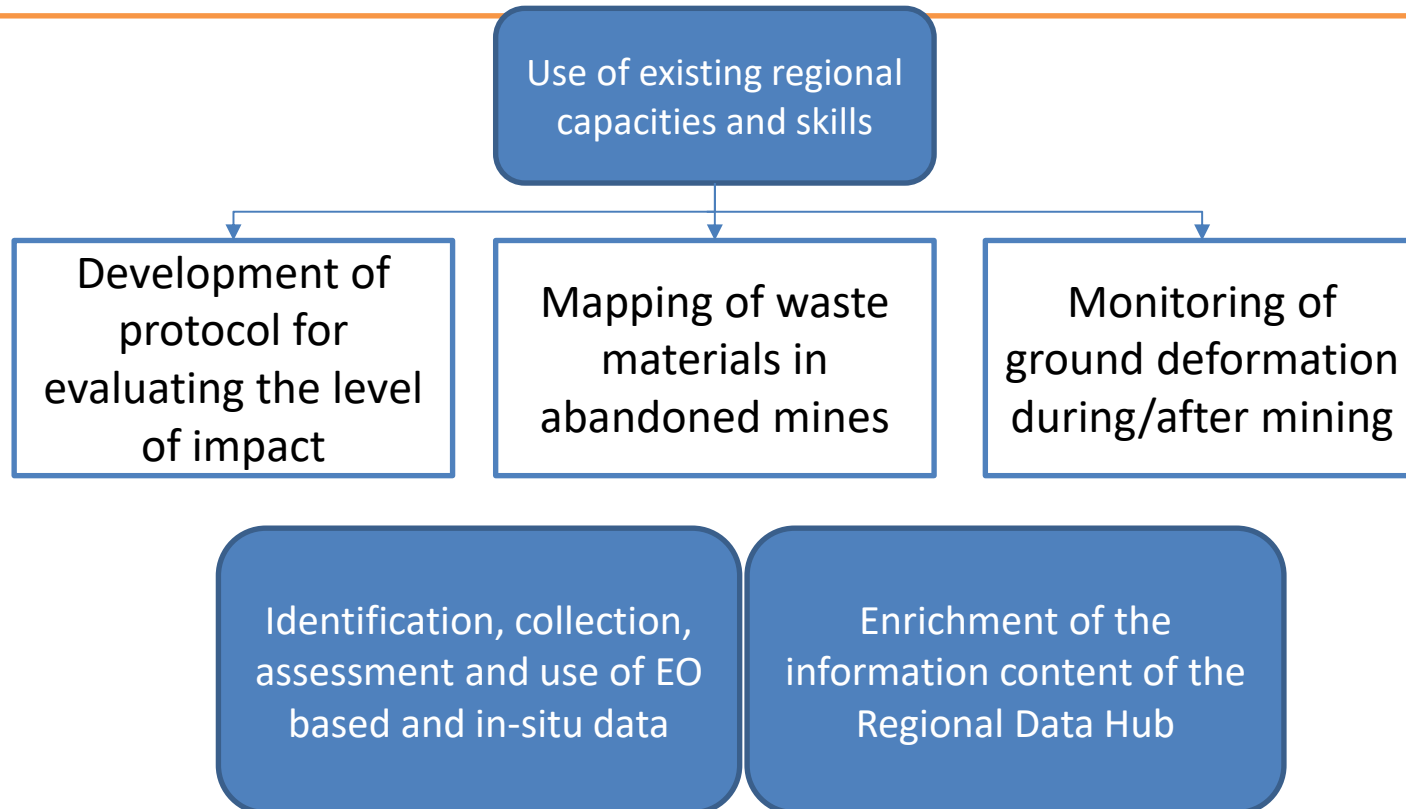
Eratosthenes Research Centre
Limassol, Cyprus



The GEO-CRADLE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690133.



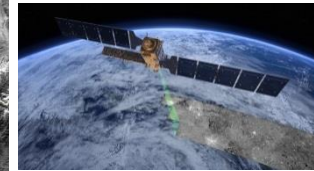
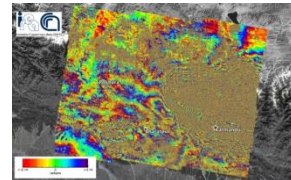
Establishing a roadmap for long-term monitoring, mapping, and management of mineral deposits in a severely under-explored ROI.



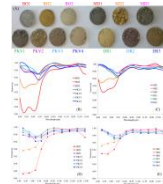


1. Selection of the regional mining study areas based on the local characteristic and mining exploitation history and activity (e.g. 2 locations)

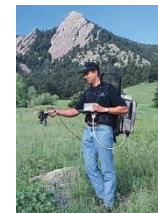
2. Realization of the pilot study, description of the existing EO data and methods, applicable for raw materials:



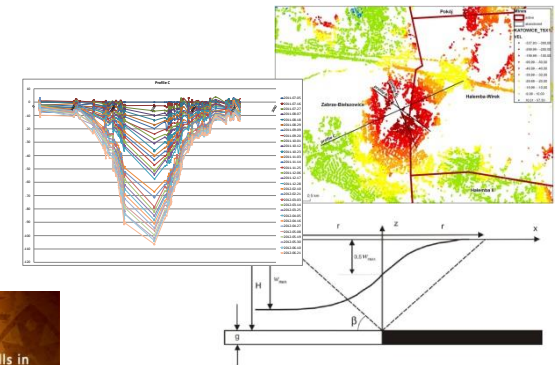
2a. Space-borne.



2b. Airborne.



2c. In-situ.



2d. Models.



2e. Identify existing data and metadata information from projects: Minerals4EU, PanAfGeo, GEIXS, SARMa, SNAP-SEE, etc.

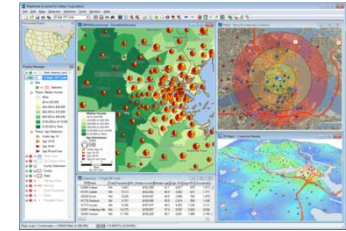
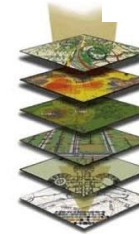


Pictures from:
<http://fas.org>
<https://earth.esa.int>

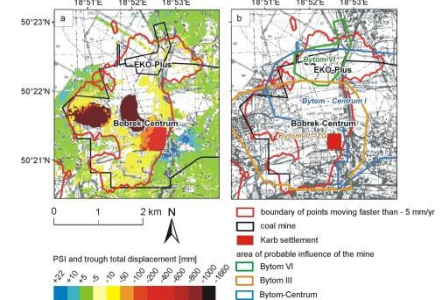
Remote Sensing 2014, 6(8), 7005-7025; doi:[10.3390/rs6087005](https://doi.org/10.3390/rs6087005)



3. Comprehensive analysis of the gathered data



4. Assessment of the EO methods for ground changes and site degradation related to mineral exploitation for each study area.



5. Elaboration of the roadmap for each study area of monitoring, mapping and management of mineral deposits.





WP 2 output

- 42 institutions operating in Raw Material thematic area completed the GEO-CRADLE online survey, which represented 17 countries.
- Most of the institutions declared activities also in other areas (Climate change – 13, Food security – 17, Energy – 17, Other – 14).
- In terms of the role of organisation in the value chain 25 institutions is raw data provider, 24 – value added, 22 – mapping service, 16 – end user with capabilities, 9 – end user.





WP 3 output

- Five proposals on raw materials pilot projects were submitted from Greece (two) and Cyprus (three).
- Selected examples of the pilot studies sites (Greece and Cyprus) present most interesting mining and post-mining areas which are going to be analysed from the point of view applicability of the EO methods.
- The elaborated methodologies will be the main goal of the pilot. The elaborated EO methodologies will be useful for better management of the mining and post-mining areas and reduce their impact on the surrounding areas.
- It is expected that the methodologies elaborated on the examples pilot site will have a universal character and could be applied for other RoI.



Greece

Pilot 1

Monitoring of Illegal Quarrying

Illegal Quarrying is related almost exclusively with:

1. Quarrying of raw materials for the production of primary crushed rock aggregates;
2. Quarrying of river sands for the production of other primary aggregates;
3. Quarrying of clays for the production of construction items (tiles, bricks);
4. “Illegal activities” related to extractive waste from other activities – abandoned quarries (i.e. marble extraction) for the production of aggregates.

Marble extractive waste – N. Greece



Marble extractive waste - N. Greece





Greece

Pilot 1

Existing EO and geological/mining data

IGME is using Earth Observation data since the 80s for supporting geological mapping / mineral exploration activities

However no Earth Observation data have been used for supporting “Mining activities” in the suggested pilot project areas.

A GIS OPEN Database of the legal quarries

http://www.latomet.gr/lp_adranon/

is operated by the Ministry of Environment and Energy.

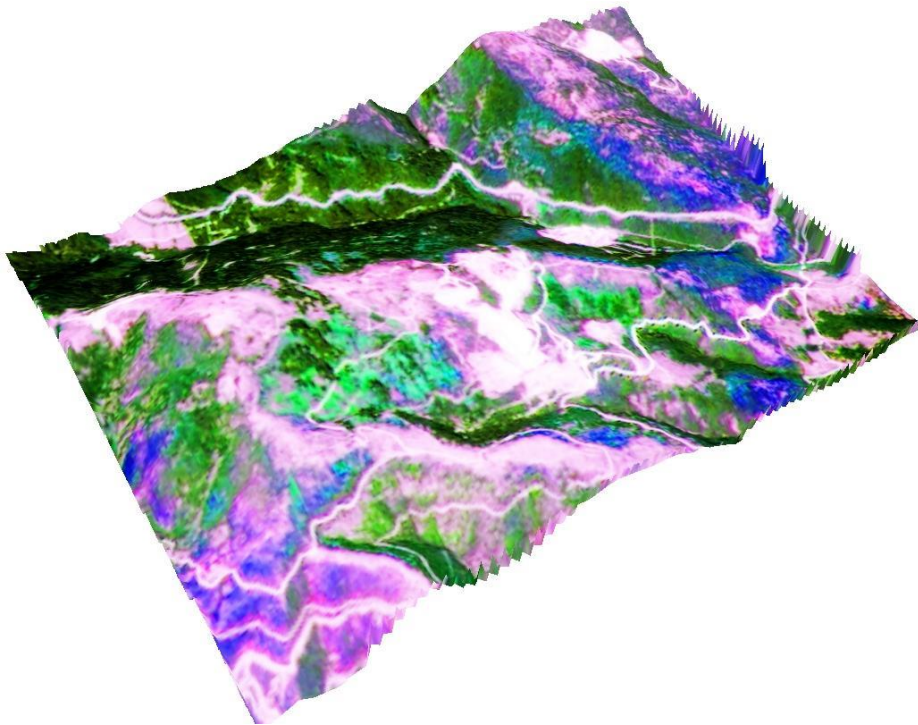




Greece

Pilot 1

Objectives



Future use of Earth Observation data & techniques for mapping and monitoring “Quarries”:

- Selection of suitable sites for quarrying;*
- Monitoring reforestation;*
- Support land Use planning;*
- Monitoring Land cover;*
- Monitoring illegal quarrying;*
- assess “waste”;*
- assess possible instabilities;*
- support restoration actions.*

*Sentinel 2: Velvendos Quarrying Areas Date: 23/7/2016
Area: 12.7 km²*



Greece

Pilot 2

Environmental Monitoring of Ayios Filippos Abandoned Public Mine of Mixed Sulphide Ores – Kirki Village (North Greece)

Site Information: Ayios Filippos sulphide Pb-Zn deposit

Objectives

Creation of a database to include satellite data and other thematic, physical, environmental, geomorphic, geologic, socio-economic information pertaining to factors that affect post-mining restoration activities.





Greece

Pilot 2

Objectives

- monitoring and visualizing the mine site within its setting,
- compiling detailed database of the land-use in the area of the proposed mine, including the surrounding areas and
- developing quantitative measures of land productivity such as vegetation indices in order to be compared with similar data after restoration.
- monitoring ground stability – slope failure on dump sites.

This methodology is to be used to assess the environmental impact at local and regional scale and to serve as a baseline for assessment of post mining restoration. Deliverables are to be used by the End Users for the improvement in the environmental rehabilitation works.





Cyprus

- Cyprus has 33 mines and 32 of them are abandoned.
- For the purpose of this study and the proposition of possible sites for pilot projects we recommend **three mines** with different characteristics which can be used either as a group or individual sites and can fulfill the targets of the project.
- The three mines are located on the **Troodos Ophiolite** and they are:
 - Abestos mine** (abandoned – under restoration)
 - Skourriotissa** (operating - massive sulfides)
 - Kokkinopezoula** (abandoned -massive sulfides)



Abestos



Skourriotissa



Kokkinopezoula

Objectives

- Mapping of waste materials and low grade ores left over in abandoned mines that could potentially re-open by exploiting both primary and secondary mineral resources with parallel environmental restoration.
- Long term monitoring of ground deformation /stability during or after mining activities in order to handle environmental pollution and possible subsidence / landslides.
- The evaluation of the environmental impact, together with feasibility assessment for the potential of the extractive or mining waste to become exploitable as secondary resources.
- Take mitigation measures to handle environmental pollution in abandoned mines in order to fulfil certain obligations derived from the EU Water Framework Directive 2000/60/EC.

Objectives

- Use Space born data to **assess possible instabilities in waste dumps** in order to take the proper remedial measures.
- Use Space born data to **map the waste dumps of abandoned mines** in order to select locations for borehole drilling for the assessment of the waste dumps for secondary mineral resources.
- Use Space born data to assess the **stability of reprofiled waste dumps** in under restoration mines and take the necessary measures if needed.
- Use Space born data to **record the behavior of the leaching heaps** of the operating mine in Skourriotissa and look for instabilities and possible environmental pollution.

Geographic and geological characteristics of the site (Asbestos Mine)



- It is located in the central part of Troodos Ophiolite and it is an outcrop of serpentine.
- The Asbestos Mine operated between 1904 and 1988
- It is estimated that 130 million tones of rock have been excavated
- One (1) million tones of asbestos fibers (chrysotile) were produced

Consequences

- adverse effects on the environment
- the enormous open pit
- the extensive waste tips
- pollution of the soil/water
- stability of the waste tips
- the barren nature of the tips





Cyprus

Geographic and geological characteristics of the site (Skourriotissa Mine)



- It is located in the northern part of Troodos Ophiolite on an outcrop upper and lower pillow lavas.
- It is a historic mine with 4000 years history and it is still operating today.
- In the modern times, the Foukasa deposit (Skourriotissa) was explored in 1914, with estimated reserves of six million tones of massive sulphides and an average grade of 2,5% Cu.
- Its exploitation commenced in 1920 by the Cyprus Mines Corporation and since 1996 by Hellenic Copper Mines.
- The mine since 1996 is producing metallic copper with the application of bioleaching and hydrometallurgy.



Cyprus

Geographic and geological characteristics of the Kokkinopezoula site



- It is located in the northern part of Troodos Ophiolite on an outcrop upper and lower pillow lavas.
- It is an abandoned mine that operated during the 20th century.
- It is a massive sulphide mine and it was an Au bearing deposit.
- It has the potential to be mapped for possible exploitation for both primary and secondary mineral resources with parallel environmental restoration.
- There are not any Earth Observation data for the Kokkinopezoula mine.



Summary

The aim of the feasibility study for the selected pilot test sites is to establishing a roadmap for long-term monitoring, mapping, and management of mineral deposits in a severely under-explored ROI.





Key dates

Deliverables

D4.3 : Refined pilot scope ARM [10]

D4.7 : Pilot activity report ARM [24]

Milestones

MS4 : Lunch of Pilots [10]

MS5 : Mid Term Reports [15]

MS6 : Mid Term Pilots Review [18]

MS7 : End of Pilots [24]

MS9: Final Mark [30]





Open Discussion



Are there any questions



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