



Raw Materials Week 2018

12th November 2018, Le Plaza Hotel, Boulevard Adolphe Max 118-126, 1000 Brussels

Copernicus for Raw Materials: making the potential fully operational

1. Nature of the meeting

This full day meeting was part of the Raw Materials Week, which included representatives from academia, business, NGOs and governments. It was to bring together the raw materials and the Copernicus communities and to discuss how the potential of satellite-based technology can be fully exploited to the benefit of the exploration and extraction of raw materials that will be needed for tomorrow's products in Europe and globally – and may even facilitate the societal acceptance of mining activities.

2. Welcome and objectives of the meeting

The EC welcomed the attendees to the meeting and outlined the objectives, primarily to discuss the application of Copernicus to the raw materials industry, particularly within mining activity. The EC highlighted the potential of Copernicus in combination with ground sensors to deliver free, easily accessible data towards all phases of the mining process. Mineral composition of areas may be obtained, creating a geological map that can be followed throughout exploration, exploitation and mine closure. Use of this data could also help combat against illegal mining while monitoring safety and environmental impact of current mining activities, through mineral depletion and mine subsidence.

Overall Copernicus programme is projected to generate a €67-131bn benefit to the EU by 2035, with 85% of this benefit outside of the space industries.

3. Session I: Copernicus for Raw Materials: an overview

The Earth observation (EO) Working Group from EuroGeoSurveys presented its work in combination with on how different types of EO data can be combined to assess mineral resources and mining impacts. The findings included the use of hyperspectral techniques not only as a means of assessing mineral presence but also the anthropogenic hazards as a result of mining activity; stress caused on vegetation, acid mine drainage amongst others. A free toolbox, QUANTools, has been developed facilitating simple processing of hyperspectral data without the need for prior collection of validation samples.

GAF AG summarised the 4 key stages of the mining life cycle: exploration, development, production and closure. Combination of the hyperspectral data obtained from Copernicus with ancillary data from ground surveys can lead to a new range of services available from the data. Currently - in combination with Sentinel-2 data - geological mapping is possible; however, better standardisation of Copernicus and land monitoring data could lead to applications in areas such as soil and forest monitoring, atmospheric detection and agriculture.

The Raw Materials Copernicus (RawMatCop) programme summarised some of the current results from the project. Key successes in the application of Copernicus data services have included: mapping geological rock units; ability to monitor mining sites and map dust dispersion patterns around existing mines; mapping iron oxides; assessing ground deformation around mining operations; environmental impact monitoring of water quality; vegetation impact; and ground movements. A summary of new Cohort 2 projects was also given. It was emphasised the importance to develop skills and critical mass in this area.

The EC summarised the key outcomes of the session: Satellite data cannot solely be used, it must be combined with different sources into cloud-based data for easy access/processing. Copernicus

alone cannot reach the end user; it provides the raw data for an intermediate layer of research groups to process for use in the private sector. Skills and education need to be promoted through programmes such as RawMatCop for widespread uptake of Copernicus and its benefits.

4. Session II: Copernicus for Raw Materials: applications and benefits

GeoERA summarised its 4 projects aimed at helping to create a sustainable supply of raw materials in Europe:

- EUROLITHOS – Creating a directory of European ornamental stone resources.
- FRAME – Forecasting Europe’s raw materials needs.
- MINDeSEA – Focus on strategic raw materials of the sea bed.
- Mintell4EU – Data compilation of critical raw materials.

The results of these projects hope to improve monitoring of both the surface and subsurface during exploration, mining and post-mining activity. Combination of this data with Copernicus will improve both quality and transparency of data to build trust in the industry.

The Federal Institute for Geosciences and Natural Resources (BGR) presented the results of its recent work on hyperspectral imaging as a means of describing the mineralogical environment of deposits. This was successfully achieved for select major lithological units in Northern Cape, South Africa, and verified with ground truth data. Future work was highlighted, focussing on deriving the fraction of main mineral components of focus sites, as well as using the techniques for vegetational monitoring.

Cornish Lithium Ltd presented the potential for identification and subsequent extraction of lithium from geothermal brines in Cornwall. Lithium is fast becoming a critical metal as a result of the lithium-ion battery and the push for electrification of vehicles. Project Lithium combined EO data with ground survey data from British Geological Survey to explore potential lithium deposits in Cornwall; however, duration was short and no seasonal variation could be taken. Cornish Lithium stressed the importance of using geophysics and satellite EO data to re-evaluate old mining areas for the presence of battery metals.

5. Sessions III & IV: Copernicus for Raw Materials: applications and benefits II & III

The ‘SAGRES’ project is looking at the integration of earth observation geophysical data with other, conventionally sourced data, into one platform for assessing mineral wealth in the oceans. Significant gains are expected against both the cost and the time of conventional deep-sea exploration. The focus is iron-manganese crusts in an 18 million square kilometres area in the North Atlantic. An accuracy of some 80% is being achieved, with further improvements being targeted. Future focus will be on more close-to-market mineral resources and the enhancement of the system capabilities.

The rest of the session focussed on land applications for EO technology. The Sentinel-2 platform, using multi-spectral sensors providing high spatial resolution, monitors mineral assets, both for the responsible owner to provide greater accuracy for informed decision making, and for the enforcement authorities to identify illegal and irresponsible mining and quarrying activities. Reduced exploration costs and enhanced site safety are key benefits. One speaker asked how EO technology can support responsible mining and lead to greater acceptance of exploration and extraction activities by affected communities. If ‘images never lie’, EO data non-invasively provide accurate maps and models of land surface composition and condition at all stages of the resource development cycle from exploration/discovery to mine closure and post-closure surveillance. Questions arose about how this data can be commercialised, with the mining companies and/or the insurance sector as potential users.

Deformation of surface structures using satellite based Interferometric Synthetic Aperture Radar (INSAR) and SAR technology can be quantified to an order of metres. Two- and three-dimensional data are being used to assess the health of assets, from urban structures to land surfaces. Examples presented included a mine, an underground natural gas storage site, and gas storage silos, with applications ranging from daily operations management to safety considerations. Specifically, the

systems can predict potentially catastrophic collapse of structures, mining slopes, dams, etc. A further speaker presented an element of the ‘GeoCradle’ project which is developing a methodology for accessing raw materials using multi-temporal satellite data for the long-term mapping, monitoring and management of mineral resources.

One speaker considered how the potential of EO technology could be more fully exploited. He argued that, whilst the current 6-day return time of Sentinel-1 is sufficient for closure and post-closure observations, exploitation applications would be enhanced by greater return frequencies. More observations in larger wavelengths might be the solution.

The ‘UAVIA’ project is looking at the integration of EO data with those from unmanned aerial vehicles (UAVs) and ground sensors. UAVs can be equipped with a wide range of sensor types and capabilities. Their targeted use can improve data quality and increase data robustness, whilst significantly reducing exploration costs. One drawback is the often protracted process of gaining flight plan permission for UAV sorties.

The final speaker discussed how ‘geo-tuned’ spaceborne sensors are being calibrated for many differing applications in regolith-dominated terrains in Australia, from national crop production mapping to mineral exploration opportunities. The technology can uncover bedrock alterations through surface imagery, using electromagnetic sensors that detect the fingerprint of the physico-chemistry of the vector minerals. That the mining companies lack awareness of the data’s availability was an issue, but dissemination workshops have led to a number of key mineral discoveries.

6. Discussion panel “How to unlock the full potential ... of Copernicus for raw materials”

Delegates stressed the requirement for improvements in the EU mining industry to reduce our reliance on imported raw materials. Primary extraction must be accompanied by circular economy principles;. There is a need for transparency, where data is easily available and easy to process; it is hoped that data from Copernicus will become as easy to handle as Google Maps, for example. This transparency is hoped to improve public trust in the mining industry and the impact that is being felt, and to build confidence within the sector for future investment. The limitations of Copernicus sensors were highlighted by one delegate, particularly in terms of the vegetation coverage in some EU Member States making data harder to interpret, and hyperspectral EO tools are required.

Delegates agreed that combination with land-based sensors was required to better prove the reliability of the data and enable Copernicus’ services to grow. It was discussed whether legislation was required to increase uptake of Copernicus services and enable the sector to grow. Legislation can be restrictive of the uptake of certain technologies, especially in terms of data use. Increasing investment for R&D as well as industrial symbiosis to give market encouragement might be more effective.

The main barriers to be addressed in terms of the use of Copernicus to promote sustainable mining were discussed. Continuity of the system was mentioned as the key minimum objective, as well as generating social acceptance surrounding its use. Integration of different data sources – both from satellite-based and land-based sensors was also cited as a key challenge to further the technology. Delegates also agreed that the collaboration with researchers, start-ups and educational institutions will further develop the ‘ecosystem’ around Copernicus.

7. Conclusions

Although definite progress has been made since the 2016 workshop, many questions remain on the widespread use of Copernicus as a tool to tackle the challenges of the next decades. The EC took note of the suggestions made for building trust in terms of public acceptance and availability of data, as well as the need for education to further Copernicus’ development. The EC plans to run further events surrounding exploration and extraction within the mining industry. It will announce the date and agenda of these events in due course.

Annex: Agenda of the meeting

Raw Materials Week

12-16 November 2018



Copernicus for Raw Materials: making the potential fully operational **12th November 2018**

Le Plaza Hotel (Boulevard Adolphe Max 118-126, 1000 Bruxelles)

09:30-10:45 Welcome and introduction by **Ms Dinka Dinkova**, Deputy Head of Unit, Space Data for Societal Challenges, DG GROW, European Commission

Session I: Copernicus for Raw Materials: an overview – Chaired by **Mr Manuel Gomez Herrero**, DG GROW, European Commission

Earth Observation in support of sustainable mining by the Geological Surveys of Europe – **Ms Veronika Kopačková**, Earth Observation and Geohazards Expert Group from EuroGeoSurveys

EO Services and Products for the mine life cycle – **Mr Bernd Schulte**, GAF AG

RawMatCop programme – **Mr Wesley Crock**, EIT Raw Materials

11:15 – 12:30 Session II: Copernicus for Raw Materials: Applications and Benefits I -Chaired by **Mr Zoltan Bartalis**, Applications and Climate Department, European Space Agency

GeoERA's interest in Earth Observation data – **Ms Antje Wittenberg**, GeoERA Raw Materials Consortium

NIR-SWIR and LWIR Hyperspectral Flight Campaign in South Africa for Exploration – **Mr Martin Schodlok**, Federal Institute for Geosciences and Natural Resources

Cornish Lithium: Exploration for a new metal in an old mining region – **Mr Jeremy Wrathall**, Cornish Lithium Ltd

14:00 – 15:30 Session III: Copernicus for Raw Materials: Applications and Benefits II – Chaired by **Mr Dimitrios Biliouris**, EASME, European Commission

Advanced deep-sea mining exploration from space: the SAGRES project – **Mr João Carvalho**, ISQ

Copernicus Sentinel-2 for monitoring assets of raw materials: from outcrops in New Caledonia to illegal mining in Colombia – **Ms Elsy Ibrahim**, Université de Liège

Would Copernicus help in gaining awareness, acceptance and trust in mining? – **Mr Stephane Chevrel**, MinPol

Use of satellite INSAR analysis and SAR derived products for mining site monitoring – **Ms Elena Francioni**, e-GEOS spa

Assessment of the Added-Value of Sentinel data for supporting mapping and monitoring of mining area: The GeoCradle project – **Ms Marianthi Stefouli**, Institute of Geology and Mineral Exploration

16:00 – 18:20 Session IV: Copernicus for Raw Materials – Applications and Benefits III – Chaired by **Mr Peter Zeil**, Spatial Services Ltd

Satellite based stability and deformation monitoring of mine closure and post-closure processes – **Mr Péter Farkas**, Geo-Sentinel Ltd

Copernicus data integration with UAV and ground sensors for commercial applications in mining – **Mr Roco Lagioia**, ITRB Group

The potential of multi- and hyperspectral satellite imagery for mineral exploration in regolith-dominated terranes – **Mr Carsten Laukamp**, CSIRO Mineral Resources, Australia

Discussion panel – How can we unlock the full potential and increase the benefits of Copernicus?

Moderated by **Mr Peter Zeil**, Spatial Services Ltd

Ms Malwina Nowakowska, Deputy Head of Unit, Resource Efficiency and Raw Materials, DG GROW, European Commission

Mr Wesley Crock, Head of RawMaterials Academy, EIT Raw Materials

Mr Bernd Schulte, GAF AG

Ms Verokina Kopačková, Earth Observation and Geohazards Expert Group from EuroGeoSurveys

Mr Carsten Laukamp, Mineral Systems Science Group Leader, CSIRO Mineral Resources (Australia)

Mr Andor Lips, VP Government Relations Europe, Eldorado Gold

Ms Eibhlín Doyle, Exploration and Mining Division, Department of Communications, Climate Action and Environment Ireland

18:20 – 18:30 Closing remarks by **Ms Malwina Nowakowska**, Deputy Head of Unit, Resource Efficiency and Raw Materials, DG GROW, European Commission
