How to increase future mineral supply from EU sources

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Europe's insufficient mineral production and increasing industrial demands are reflected in high dependency on imported raw materials. Although exploration and exploitation of Europe's mineral raw materials are essential activities, the land available for extraction is constantly diminishing. To improve the sustained mineral supply from European deposits, access to mineral deposits needs to be ensured and they need to be protected from potential sterilisation. Mineral deposits need to be properly evaluated, taking into account the geological setting and the viability of exploitation in accordance with other land-user and environmental requirements. Their incorporation into spatial plans will be of key importance. In the near future, each Member State needs to identify and protect the access to its selected significant mineral deposits within its national legislation framework. This paper presents a list of mineral deposits in Slovenia that should be protected and discusses criteria for their selection.

La production minière européenne, insuffisante, et les demandes croissantes de l'Industrie sont le reflet du haut niveau de dépendance des matières premières importées. Bien que l'exploration et l'exploitation des matières premières minérales en Europe représentent une activité essentielle, le terrain disponible pour l'extraction minérale se réduit de façon constante. Pour améliorer l'approvisionnement durable en matières minérales à partir de gisements européens, l'accès à ces ressources doit être garanti et il est nécessaire de les protéger d'une disparition potentielle. Les gisements miniers doivent faire l'objet d'une évaluation soigneuse, prenant en compte les conditions géologiques et la viabilité des conditions d'exploitation en accord avec les exigences des autres utilisateurs du terrain et les lois environnementales. Les incorporer aux cartes et plans d'exploitation aura une importance cruciale. Dans un proche futur, chaque pays membre doit identifier et protéger ses accès aux gisements miniers choisis comme significatifs, au sein de son cadre législatif national. Cet article présente la liste de gisements miniers en Slovénie qui méritent d'être protégés et débat des critères qui ont mené à leur sélection.

La producción insuficiente de minerales en Europa y la demanda industrial creciente se reflejan en una gran dependencia de las materias primas importadas. Aunque la exploración y explotación de las materias primas minerales en Europa son actividades esenciales, la superficie de terreno disponible para la extracción disminuye constantemente. Para mejorar el suministro sostenible de minerales en Europa, se debe garantizar el acceso a los depósitos minerales, los cuales deben protegerse de la esterilización potencial. Los depósitos minerales deben evaluarse de manera adecuada, teniendo en cuenta el entorno geológico y la viabilidad de la explotación de acuerdo con otros requisitos de gestion territorial y ambientales. Su incorporación en los planes espaciales será muy importante. En un futuro cercano, cada Estado miembro deberá identificar y proteger el acceso a los depósitos minerales importantes seleccionados dentro de su marco de legislación nacional. Este documento presenta una lista de depósitos minerales en Eslovenia que deberían protegerse y analiza los criterios para su selección.

In recent decades, the increasing global demand for mineral raw materials has been driven by the growth of emerging economies and their mineral consumption. Insufficient production within the EU causes increases in imports of raw materials from third countries. This manifests itself as mineral supply dependency. While the mineral consumption is increasing, available areas for potential mineral extraction are running short and therefore domestic supply is put at risk. Mineral deposits are often neglected in land-use planning, while some land uses, e.g. nature preservation, infrastructure building, water resources protection, and others receive preferential treatment.

In November 2008, the European Commission (EC) launched the "Raw Materials Initiative — meeting our critical needs for growth and jobs in Europe" (RMI). The RMI (European Commission, 2008) is based on three pillars: (1) Ensuring the fair and sustainable supply of raw materials from international markets, promoting international co-operation with developed and developing countries; (2) Fostering sustainable supply of raw materials from European sources; and (3) Reducing consumption of primary raw materials by increasing resource efficiency and promoting recycling. By identifying mineral deposits for safeguarding and securing access to them, the second pillar is supported.

The RMI and the European Innovation Partnership's (EIP) Strategic Implementation Plan (SIP) (European Commission, 2013) highlight access to mineral deposits as a common challenge to be targeted by Member States. Therefore, national geological surveys endeavouring to designate mineral deposits for safeguarding reflect the above-mentioned initiatives' aims. The work and activities of geological survey experts contribute to better communication between the minerals sector and land-use planners. Current land-use planning fails to address potential mineral resources areas. Temporary land-use for mineral extraction is neglected as well (e.g. surface extraction of clays). Constructive dialogue between the different land-use interests and planners needs to be strengthened.

Recent EU statistics show that every newborn infant will need a lifetime supply of 300 kg of lead, 280 kg of zinc, 560 kg of copper, 1,350 kg of aluminium, 12,200 kg of iron, 9,950 kg of clay, 1,500 kg of salt and 448,000 kg of stone, sand, gravel, and cement.[1] Therefore, the sustainable exploitation of minerals in Europe is an indispensable activity and must ensure that the present and future needs of the European society can be met. This requires free access

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1 Euromines: Sustainable Development Issues (***http://www.euromines.org/what-we-do/sustainable-development-issues***).

to mineral deposits. Also potential mineral deposits (also taking into account abandoned mines and historical mining sites) should be considered with respect to and in balance with other land uses, such as agriculture, forestry, natural preservation, building, and infrastructure.

Mineral supply depends on advanced land-use planning that respects environmental and socio-economic criteria. Some deposits of metals, industrial minerals, and construction materials should be considered of 'public importance' (energy minerals are already adequately treated in Europe). 'Public importance' is a term used when information demonstrates that sustainable exploitation could provide economic, social, or other benefits to the EU or the Member States or a specific region/municipality.[2]

In parallel with geological definitions, a harmonised European regulatory framework for sustainable access and mineral supply will need to be developed. It should include the 'sustainability principle' for exploration and mineral extraction (Shields & Šolar, 2004). The concept of mineral safeguarding will need to be incorporated into the broader policy-making.

Slovenian case-study

Slovenia lies in the narrow area between the Adriatic Sea, the Alps and the Pannonian Basin. Compared to other EU countries, Slovenia has the largest relative proportion (~37%) of Natura 2000 sites, not counting other protected areas (13.29%).[3] However, in the country's small territory some considerable deposits of mineral raw materials are to be found. Although the extraction of metallic mineral raw materials became non-profitable, the extraction of aggregates and non-metals is still quite active. In 2016 there were 144 exploitation right holders operating 189 pits and quarries. They target 26 different mineral commodities. Slovenia has around 200 sites of metallic mineral deposits and occurrences, and several dozen closed or abandoned metal mines. Today, after a long period of mining all metal mines are closed; however, ore reserves that could be exploited in the future remain. The extraction of mineral resources concentrates on aggregates for the construction industry and a few industrial minerals whose annual production is around 12.6 million tons (aggregates, dimension stone, clays, chert, quartz sand, etc.), not taking into account energy minerals (lignite and hydrocarbons) (GeoZS, 2017).

Mineral safeguarding in Slovenia is partly regulated by the Mining Act[4], in which strategic mineral resources are considered to be of public interest. Extraction areas with a mining concession are incorporated into spatial plans. Moves towards the protection of access to mineral deposits have been active for some time but are still waiting for implementation.

Methodology description

The second pillar of the 'Raw Materials Initiative' promotes the intention of safeguarding mineral deposits from sterilisation. Each Member State should identify and protect access to their selected significant mineral deposits in accordance with its national legislation.

Slovenia currently exploits only non-metal and energy resources. Energy resources are already of strategic importance and are adequately treated; therefore, this survey was focused on non-energy minerals (industrial minerals and aggregates). A list of areas suggested for safeguarding of mineral deposits has been created for Slovenia along with a relevant map (Rokavec & Mezga, 2017) with the view of protecting the access to deposits and ensuring sustained mineral supply in the future. The deposits were selected due to their uniqueness, rareness or importance for existing industries and traditional housing.

Considering the entire relevant legislation and legal entities on all levels is crucial for the preparation of such list and the eventual implementation of a protection policy for such areas. A short review of the existing minerals policy in Slovenia is given in the following.

In cooperation with the ministry responsible for mining/minerals management (currently the Ministry for Infrastructure) the Geological Survey of Slovenia (GeoZS)

2 MINATURA2020 Project (***http://minatura2020.eu/***)

3 ARSO (Ministry of the Environment and Spatial Planning, Slovenian Environment Agency), 2017. Nature conservation. (***http://www.arso.gov.si/narava/zavarovana%20obmo%C4%8Dja/***)

4 Official Gazette of the Republic of Slovenia, No. 14/14 (***https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/116414***)

Table 1: List of designated safeguarding areas for mineral deposits – summary data by country (SI-Slovenia, IT-Italy, PT-Portugal, HU-Hungary, SE-Sweden, UK-United Kingdom and PL-Poland) (Rokavec & Mezga, 2017).

Country	Province	No. of potential areas of safeguarded mineral deposits	Level	Type of mineral endowment		
				metals	non-metals	aggregates
SI	entire state territory	30	national		X	
		max 50	local/regional			X
IT	Emilia Romagna Region	11	regional			X
PT	north and north-eastern regions of Portugal	38	national	X		
	Rio Maior municipality	1	local		X	
HU	Borsod-Abaúj-Zemplén, Hajdú-Bihar, Heves, Szabolcs-Szatmár-Bereg Counties	402	regional		X	X
SE	Norrbotten County	24	national	X	X	
UK	South West England & South Wales (on shore)	40	regional	X	X	X
	South West England & South Wales (off-shore in Celtic and Irish seas)	10	regional	X		X
PL	Lower Silesia	142	regional	X	X	X

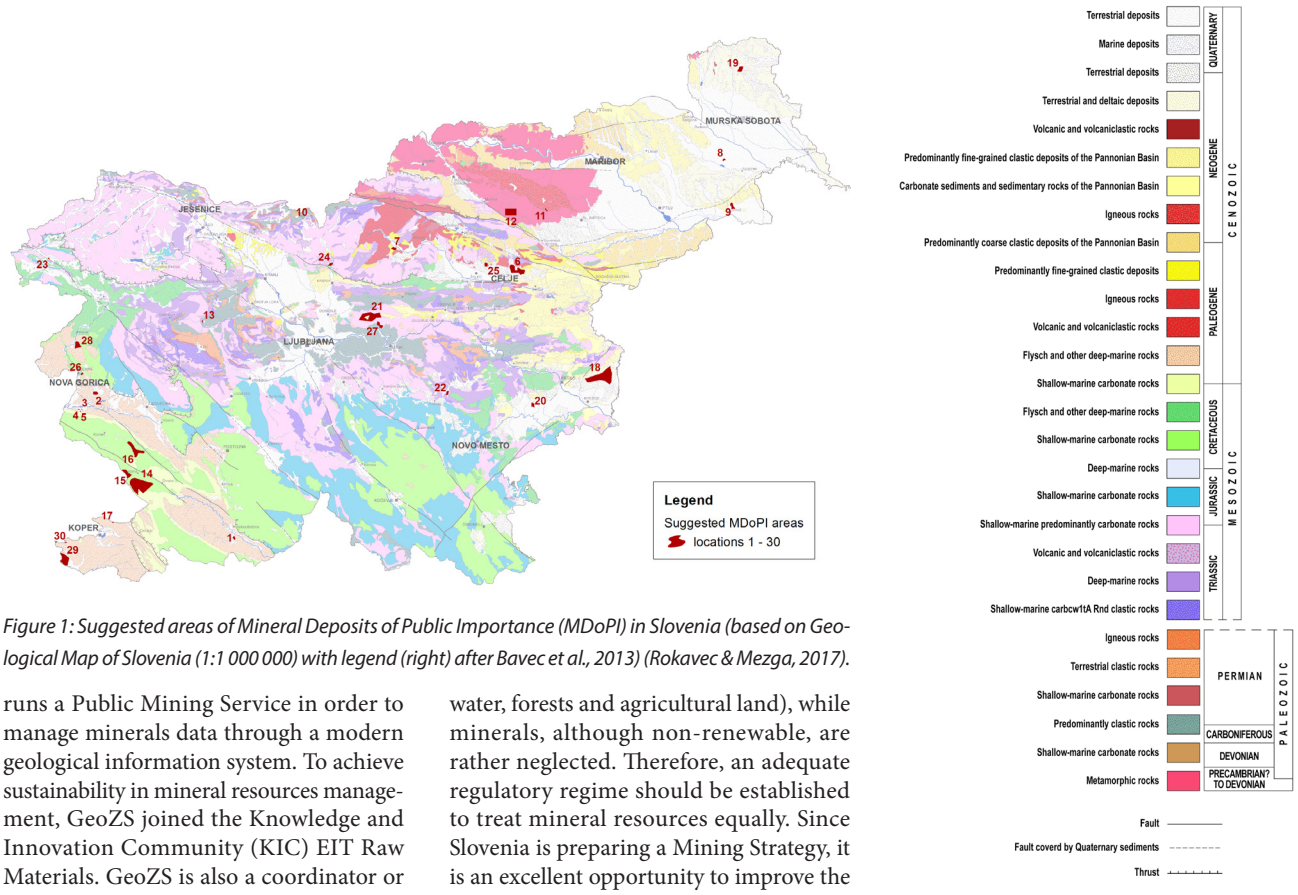

Figure 1: Suggested areas of Mineral Deposits of Public Importance (MDoPI) in Slovenia (based on Geological Map of Slovenia (1:1 000 000) with legend (right) after Bavec et al., 2013) (Rokavec & Mezga, 2017).

runs a Public Mining Service in order to manage minerals data through a modern geological information system. To achieve sustainability in mineral resources management, GeoZS joined the Knowledge and Innovation Community (KIC) EIT Raw Materials. GeoZS is also a coordinator or partner in several EU- financed projects dealing with sustainable mineral supply (e.g. MINATURA2020, MineService and others).

Slovenia is in the process of adopting a National Mining Strategy. Until then, the National Mineral Resource Management Programme – the General Plan is in force (Government of the Republic of Slovenia, 2009). Its goals include enabling access to resources for future generations and minimising negative environmental impacts. It ensures a sustainable minerals supply for Slovenia.

Results

Slovenia applies a safeguarding regulative concept in which mineral deposits are included in land-use plans only through a licencing process, meaning that only areas with mining rights are automatically safeguarded. There is no open door for 'potential deposits' that do not have mining rights yet. However, according to the Slovenian Mining Act, exploration and exploitation of minerals are in the public interest if their deposits are in areas where the exploitation could encourage economic and social development, reduce transport costs, and stabilise the minerals market.

In Slovenian practice, certain natural resources are properly safeguarded (e.g. water, forests and agricultural land), while minerals, although non-renewable, are rather neglected. Therefore, an adequate regulatory regime should be established to treat mineral resources equally. Since Slovenia is preparing a Mining Strategy, it is an excellent opportunity to improve the current minerals status in terms of safeguarding minerals and their deposits on a national level.

In the scope of such aspirations, a list of and a respective map of suggested mineral areas in Slovenia were prepared (***Fig. 1***; Rokavec & Mezga, 2017). The total surface of suggested safeguarding areas for mineral deposits in Slovenia is approximately 95 km^2, which is less than 0.5% of the State's territory. Aggregates are not included, but would also need to be safeguarded. In land-use plans, they often overlap forest, agricultural, or built-up areas. Some of the mineral areas even extend into protected areas (e.g. Natura 2000, ecologically important areas, valuable natural features, landscape parks, etc.).

At national level, 30 areas of non-metal deposits (industrial minerals) were designated, containing clays (brick and ball clay), dimension stone (limestone, travertine, tonalite, and cizlakite, a flysch sandstone), quartz sand, chert, chalk, calcite, bentonite, tuff, and raw materials for the lime and cement industry. Due to their geological settings, these deposits should be designated in land-use plans.

At the local/regional level, fewer locations of aggregate supply centres per statistical region were considered. For all 12 Slovenian regions, up to 50 extraction sites were suggested as aggregates supply centres, which are quarries for crushed stones (mostly limestone and dolomite) and sand and gravel pits.

The list of safeguarded mineral deposits and the borders of mineral deposits under evaluation are not final; rather, they are dynamic and should be adapted, reflecting new geological knowledge and future social needs. The mineral deposits should be incorporated into spatial plans and thus safeguarded for the needs of future generations. Mineral deposits are bound to a specific area, while most human activities can be moved (e.g. industrial facilities and housing). Even the Natura 2000 Directive (Habitats Directive 92/43/EEC) does not exclude or even prohibit mineral exploration and extraction, but sets certain limits and requirements (European Commission, 2010).

The Horizon 2020 project "Developing a concept for a European minerals deposit framework" (MINATURA2020, ***www.minatura2020.eu***) offers the opportunity to develop a concept for safeguarding certain mineral deposits from sterilisation. Seven case-study countries, i.e. the United Kingdom, Italy, Slovenia, Sweden, Portugal, Hungary and Poland, were selected, considering differences in the territorial size, types of mineral endowment, and national mineral policies. All case-study countries

have designated potential areas of mineral deposits for safeguarding within at least one province or a region, while Slovenia has prepared such a list of the entire national territory (***Tab. 1***).

Conclusions

In order to ensure sustainable mineral supplies within the EU for future generations, it is of great importance to properly safeguard mineral deposits and foster sustainable mineral supply from European sources.

For the existence and development of the European economy and the achievements of its civilisations, the safeguarding of European mineral deposits is a key requirement. Access to mineral deposits should be secured in order to permit mineral exploration and exploitation, if viable. It is of great importance that current mineral extraction does not endanger the supply of future generations. The mineral deposits should be properly evaluated, considering geological knowledge, the technical and economic dimensions, competing land uses, and the societal dimension. Delineation of mining areas in co-ordination with other land uses is challenging, but necessary to avoid conflicts and meet societal needs.

The EU is preparing the fundamental concept for defining and subsequently safeguarding mineral deposits of public importance. Current spatial planning treats certain other land uses preferentially, e.g. nature preservation, infrastructure building, water resources protection, etc., while mineral deposits are often neglected. Relevant mineral deposits need to be identified and properly designated on the national and local levels to facilitate their incorporation into spatial plans. In this context, a list and a map of proposed safeguarding areas for mineral deposits in Slovenia have been prepared. At a national level, 30 mineral deposits of non-metals have been designated as well as up to 50 aggregate supply centres at the local/regional level. Less than 0.5% of the national territory might be dedicated to future mineral safeguarding. The list is not final but dynamic, and will be updated according to new geological research results and knowledge of deep geological structures, as well as market conditions and societal needs. Even some abandoned and closed mines could be of significance in the future.

Slovenia is in the process of adopting a new National Mining Strategy, which provides an opportunity to improve the current mineral status in terms of safeguarding mineral deposits at a national level.

The views and opinions expressed in this paper are those of the authors and do not necessarily reflect the view of any institution.

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