MINERAL RESOURCES IN CENTRAL CROATIA: GEOLOGICAL POTENTIALITY AND STRATEGIC IMPORTANCE

Nikola Gizdavec[1]*, Željko Dedić[1], Boris Kruk[1], Ljiljana Kruk[1], Erli Kovačević Galović[1], Slobodan Miko[1], Nikolina Ilijanić[1]

[1]Croatian Geological Survey, Sachsova 2, 10 000 Zagreb, Croatia
*corresponding author: ngizdavec@hgi-cgs.hr

Introduction

Mineral resource mapping is used as a tool for delimiting areas with high and low geological potential, all with the purpose of determining the strategic importance of certain mineral resources in a particular area. Utilizing a Geographic Information System (GIS) allows an expert user to rapidly evaluate all mineral raw material data. The goal is to identify exploration and exploatation opportunities of certain mineral raw materials.

Research covered central part of Croatia, respectively the area of so called Internal Dinarides, which is generally built from Quaternary sediments of Pannonian basin (95 %) and a smaller part of magmatic and metamorphic rocks (5%). Precisely, the area in the administrative boundaries of Koprivnica-Križevci, Bjelovar-Bilogora and Sisak-Moslavina County is observed.

This area is selected to demonstrate the usefulness of determining geological potential in the area where exploration for exploitation of mineral resources is common, and predictions of the occurrence of a particular lithologic member are necessary.

Within lithological members of the observed area and taking into account all kinds of mineral resources which appear in the area, crushed stone, sand and gravel, brick clay and quartz (silica) sand were singled out as valuable mineral raw materials.

Such research is currently being carried out in the legislative framework of Mining and Geology Studies. Their goal is, using modelled potentiality, to steer and facilitate explorations works, as well as the future exploitation of mineral raw materials in any given area.

Methodology

The initial search for the optimal location for a mineral extraction site is a complex process, involving identification of existence and quality of a mineral resource, location and degree of constraints imposed by a wide range of environmental designations, distance to the market and access to transport infrastructure. As minerals can only be extracted from where they occur, it follows that the location and quality of a resource is the primary factor to consider.

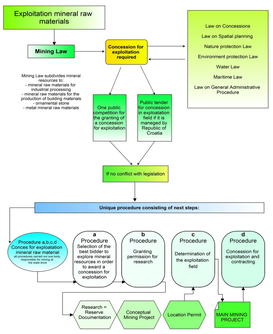


Fig.3. Complex process for granting research permission and concession for exploitation.

Fig.4. Crushed stone exploitation field.

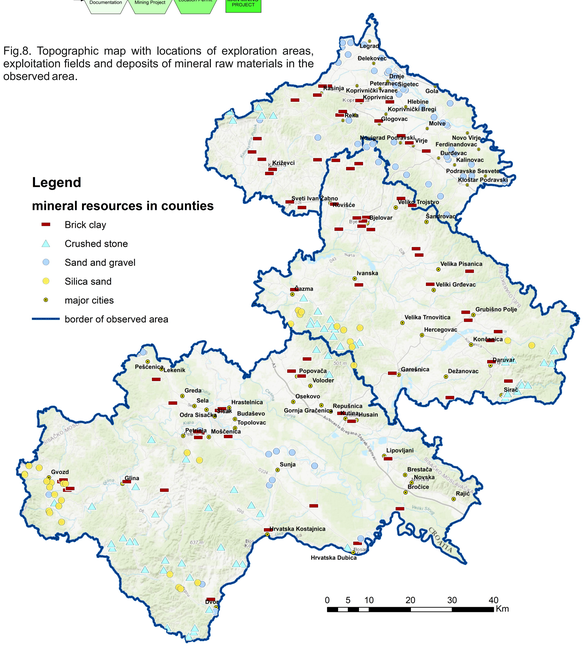


Fig.8. Topographic map with locations of exploration areas, exploitation fields and deposits of mineral raw materials in the observed area.

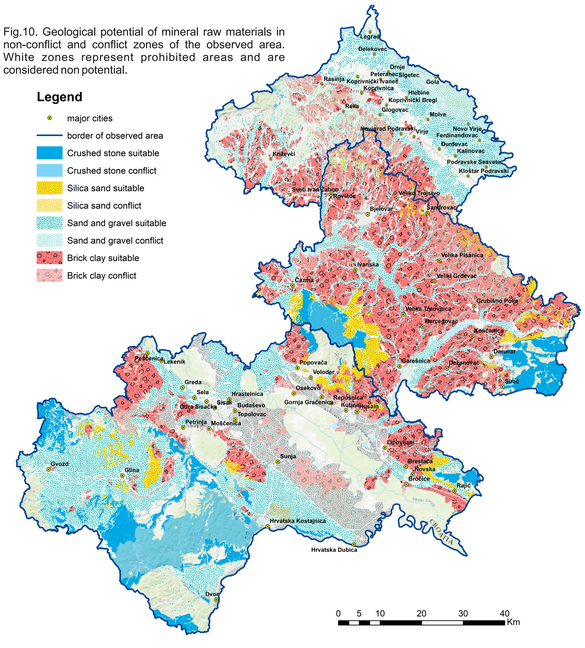
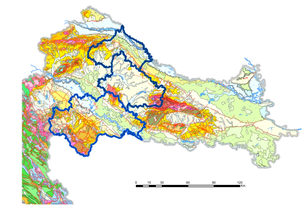
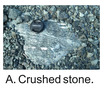


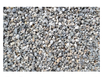
Fig.10. Geological potential of mineral raw materials in non-conflict and conflict zones of the observed area. White zones represent prohibited areas and are considered non potential.





A. Crushed stone.

C. Brick clay.



B. Sand and gravel.

D. Quartz (silica) sand.

Fig.1. Geology of Croatia: The three counties of the observed area in central Croatia are borderd in blue.

Fig.2. Mineral raw materials investigated in selected counties (A÷D).

At first, all exploration areas and exploitation fields of mineral raw materials, locations of deposits and abandoned dumps with their occurrence frequencies of mineral raw materials are displayed on a background of topographic maps. The topographic maps of the State Geodetic Administration were used.

Next, specifically for this purpose, a geological map of the wider area was developed (DEDIĆ et al., 2018, 2019; KRUK et al., 2015) by modifying the Basic Geological Map of Republic of Croatia.

By combining these two maps, a map of geological potential of mineral raw materials, which shows the natural propagation of certain types of mineral raw materials was created.

The map of geological potential of mineral raw materials is then combined with a map of the county's spatial plan. The potential market for mineral resources was evaluated using population density, proximity to urban areas, housing targets and priorities for highway improvements. Distances to main roads were also examined. All these aspects were weighted using expert opinions.

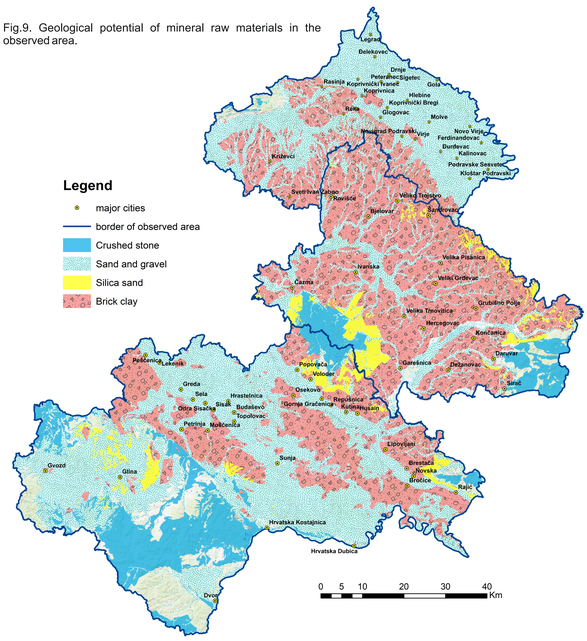
The degree of constraint imposed by various environmental designations was assessed and mapped. The final product is the map of geological potential which includes potentiality in non-conflict and conflict zones but diferentiates between the two. Prohibited areas are considered non potential.

Fig.5. Sand and gravel exploitation field.

Fig.6. Brick clay exploitation field.

Fig.7. Quartz (silica) exploitation field.

Fig.9. Geological potential of mineral raw materials in the observed area.



Conclusion

The aim of this research project was identifying the main factors that should be included in a GIS-based decision support tool and developing a suitable method of incorporating all factors into a map showing the potential for an area to be suitable for aggregates extraction.

In this research, a geographical information system (GIS) was used to combine all of these aspects and to map the potential for mineral resources extraction. It moves beyond simple mapping of the extent of mineral resources to examine the potential of an area to be suitable for mineral extraction.

It is necessary to note data variability with regard to the type of mineral raw material, the method of exploration and exploitation of mineral raw materials, as well as the dynamics of area change in the ten-year (medium-term) spatial plan.

Such maps represent a useful decision-making tool for Mineral Planning Authorities and quarry operators.

Although the paper focussed on mineral resources extraction in the central Croatia, the methodology developed could be used for any other region, and geological potential determined for any raw materials.

Keywords: mineral resource, geological potential, central Croatia, spatial planning, GIS.

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