

GEOGRAPHIC INFORMATION SYSTEM OF MINERAL RESOURCES OF THE REPUBLIC OF CROATIA. A TOOL FOR A SUSTAINABLE USE AND PROTECTION OF NATURAL RESOURCES

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INTRODUCTION

The main purpose for creation of Geographic Information System of Mineral Resources of the Republic of Croatia (GIS MS) is to give major guidelines for regional and detailed research. Also, it is a base for decision-makers as a tool to make long-term plans for sustainable use of mineral resources, and to reduce the impact of exploration on environment and inhabitants (population).

GIS MS

The GIS MS is based on a relational database with entries for more than 4000 deposit sites and occurrences of metallic and non-metallic mineral resources, and energy resources. The result of GIS MS is a Map of mineral resources of the Republic of Croatia, which exists as a scientific project created with financial support of Ministry of education, science and sports. The data are entered into the database via entry forms. Separate forms are made for general data about sites or occurrences, geological data, data of quantity of exploitable reserves, and documentation (studies of mineral resources, scientific papers, books, maps etc.).

Conceptual and logical model of the database were made according to "Instructions for creation of Cadastre of Occurrences and Deposits of Mineral Resources" using method ESRI ArcGIS. Data-entry forms were primarily made in MS Access (Figure 1). Today, in its final stage, it is transferred into MS SQL Server 2000 relational database. Main feature dataset is called KMS (Karta Mineralnih Sirovina – Map of Mineral Resources). It consists of 4 layers as feature classes and tables (Figure 2). One layer is a point feature class, which is used to display information about deposit sites and mineral occurrences. Each type of mineral resource is given a distinct symbol which is shown on the map. Other data about each point can be shown as a label, or in a table. Other three feature classes are polygons, used to

present mineral potential of metallic, non-metallic and energetic resources.

Spatial data are arranged for display in measures 1:5000 to 1:300000, projection Gauss-Krüger zone 5, Bessel 1841 ellipsoid, using central meridian 15° east of Greenwich.

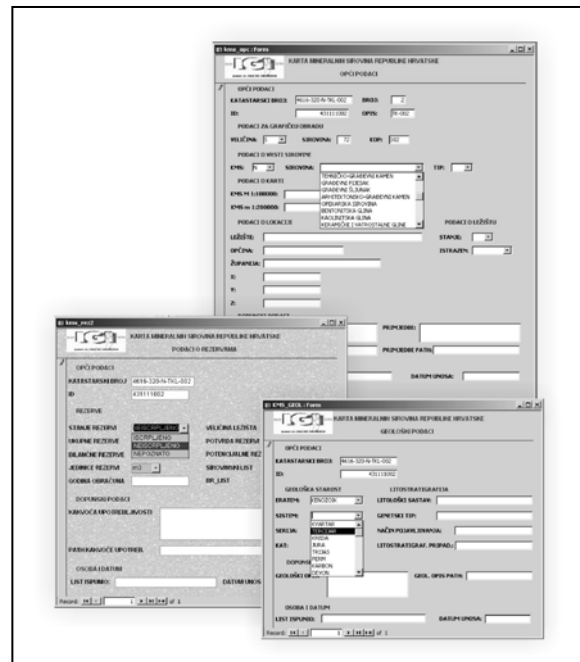


Figure 1 – Various data-entry forms in the database for Map of mineral resources.

A MAP OF MINERAL POTENTIAL

Maps of mineral potential are created as a compilation of data from Map of Mineral Resources combined with lithological and formational geological maps (Figure 3). These maps are used as a basis for management and decision – making for land use, impact on environment (like health or landscape) sustainable management of mineral resources and their protection for future, and creation of strategy for management of mineral resources.

The data of the mineral potential is overlain with other data that represent restrictions, such as cadastral plans, roads, railroads, settlements, rivers, spring sanitary protection zones, national

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parks, nature parks, protected landscapes, areas for current exploitation of minerals, etc. Each restriction has different rules that have to be applied. Final result is a limited area that is favourable for possible exploitation of mineral resource.

Up to the moment such maps (as GIS projects) are finalised for several counties: Dubrovačko-Neretvanska, Međimurska, Splitsko - Dalmatinska, Šibensko - Kninska, Primorsko - Goranska Varaždinska and Zagrebačka County.

MAJOR MINERAL RESOURCES IN CROATIA

Only several mineral resources are currently continuously exploited, having a significant economical value.

Dimension stone is exploited in a relatively large number of quarries in Istria and Dalmatia (predominantly Cretaceous limestones); Building stone is exploited in all regions of Croatia as carbonate, igneous and metamorphic rocks. Production of gravel and sand is located along the alluvial plains of two major rivers, Sava and Drava, in the Pannonian Basin.

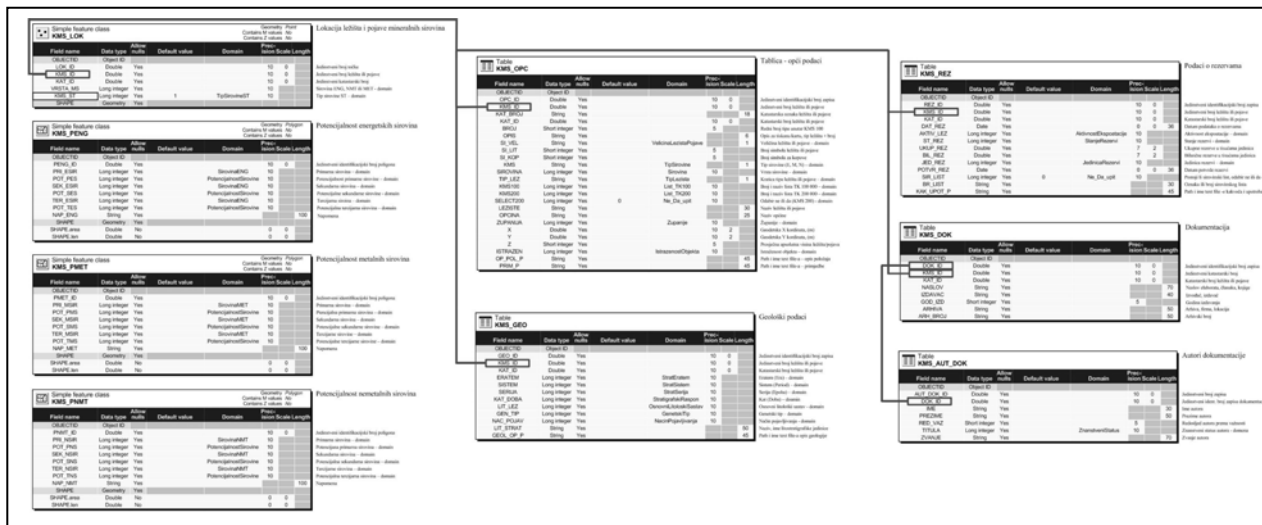


Figure 2 – Simplified diagram of the database model for GIS MS

In the karst area, gravel and sand are produced from deluvial deposits in karst depressions. Deposits of brick clay are mostly situated in Pannonian part of Croatia. They consist of Quaternary loess, loess-like and fluvio-lacustrine sediments. Marl, used for production of cement, is quarried out and used in Slavonia, Istria and Dalmatia. Gypsum can be found in Dalmatia and Lika along the contact with Permian clastic sediment complex. Carbonate ores for industrial processing are quarried in Slavonia, Lika, Dalmatia and Istria. Quartz sand, as the most important resource for glass production, is exploited from Pontian alluvial sediments in Moslavina and Slavonija. Hydrocarbons (oil and gas) are produced in 35 oil-fields and 17 gas and gas condensate fields (approximately 830 boreholes).

The whole oil production and most of the gas production comes from Pannonian basin. The rest of gas production is located in the Adriatic Sea. Over 90% of oil reserves and more than 80% of oil production is located in three greatest oil fields – Molve, Kalinovac and Stari Gradac. Hydrocarbon production covers approximately 50% of energy consumption in Croatia. There is a big potential for use of geothermal energy in Pannonian basin, but is only scarcely used. Five fields have temperature range from 120 to 170 °C, and five more with temperature range from 65 to 100 °C. Only two fields are used as energy source. Geothermal wells with temperatures below 65 °C are used for balneological and recreational purposes in 14 spas and recreational centres.

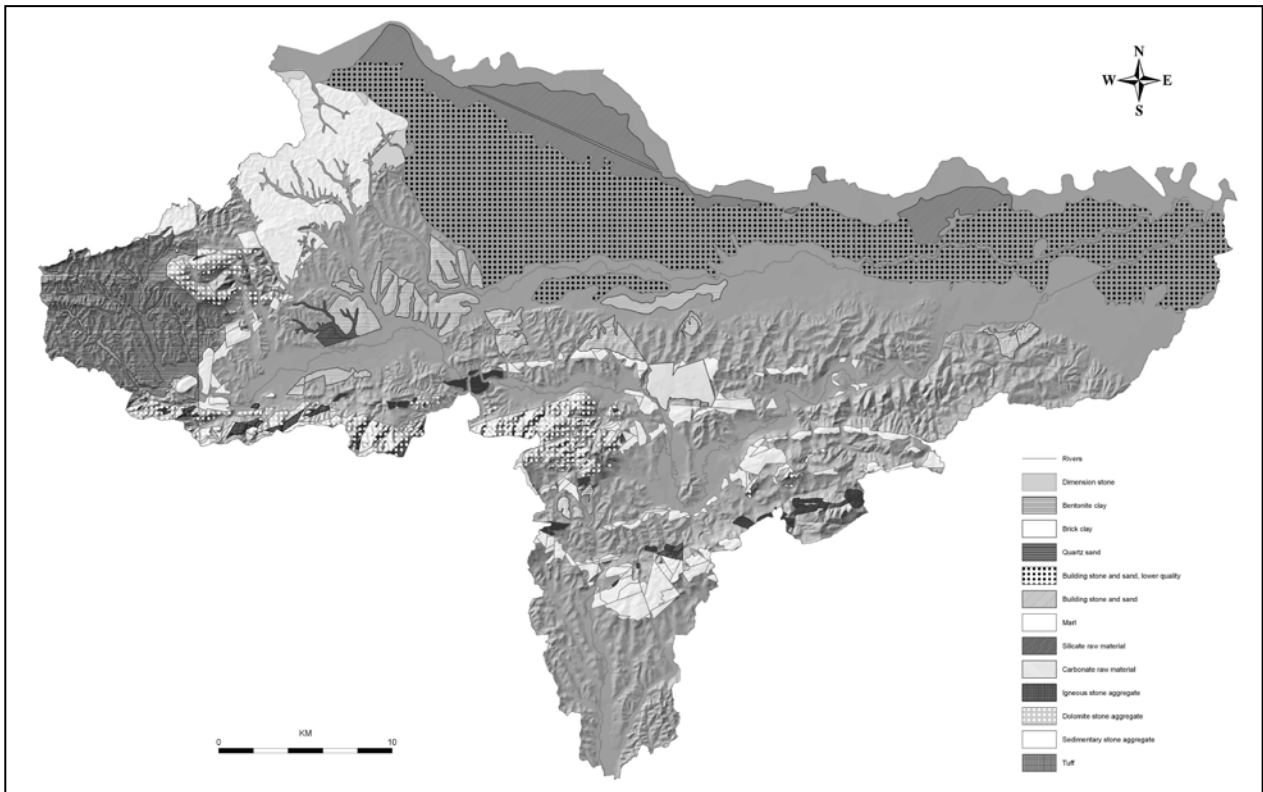


Figure 3 – A map of mineral potential for Varaždinska County based on data for 170 deposit sites and lithostratigraphic map.

OTHER MINERAL RESOURCES

Other mineral resources, which are exploited occasionally, or in small quantities, are ceramic and fire clays (can be found in Pannonian Basin area, Hrvatsko Zagorje, but also in the Kordun and Banovina area); bentonite clays (in Maovice-Štikovo area, Dalmatia, in Upper Jurassic Lemeš beds, and in Hrvatsko Zagorje area in clastic sediments of the Middle Miocene), quartzites (Lemeš beds); in the Pannonian Basin quartzites are located near Velika in the Papuk Mt.); tuffs and tuffites (can be found in Pannonian part of Croatia – Krndija, Papuk, Psunj, Kalnik, Hrvatsko Zagorje and Outer Dinarides – Drniš, Knin, Brušani); the largest tuff deposit in Brušani near Gračac was never researched into details, or exploited), and bauxite (now used in nonmetallic industry).

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