PAST MINING AND PRESENT QUARRYING IMPACTS ON THE DALMATIAN KARST ENVIRONMENT, CROATIA

Erli Kovačević(1) Slobodan Miko(1) Željko Dedić(1) Ozren Hasan(1) Boris Lukšić(1) Zoran Peh (1)

(1) Croatian Geological Survey; Sachsova 2, Zagreb 10000, Croatia

15th Meeting of the Association of European Geological Societies
Content

- Geography and geology of Croatia
- Mineral resources of Croatia and Dalmatia
- Consequences of bauxite mining and impact on soils
- Topsoil geochemical mapping
- Impacts of quarrying on landscape
- GIS modelling
- Future prospects
Geography of Croatia

- Area: 58,540 km²
- Population: 4.8 million
Geology of Croatia

1) North and NE Croatia - Inner Dinaride Belt
   - 90% thick unconsolidated Quarternary sedimentary deposits
   - 10% igneous and metamorphic rocks

2) South Croatia - Outer (karstic) Dinarides
   - carbonate rock (limestone and dolomite – carbonate platform environments)
Geology of Croatia

Dalmatian karst
Geology of Croatia

Dalmatian karst

Terra rossa
Mineral resources of Croatia

Mineral commodity:
- crushed stone aggregate: 253 sites
- dimension stone: 103 sites
- sand and gravel: 82 sites
- clay: 49 sites
- bauxite: 15 sites
- gypsum: 9 sites
- other non metal deposits
- coal in the past

TOTAL NUMBER OF EXPLOITATION SITES IN CROATIA: 626 (378 km²)
Quarrying in Dalmatia

- 72 active crushed stone aggregate quarries or 25% in Dalmatia
- 83 active dimension stone quarries or 80% in Dalmatia

Total number of active exploitation sites: 195
Bauxites in Dalmatia

More than 1000 deposits were mined in the 20th century

Two types of environmental impacts:
1) over 800 open pits left today, many of them used as illegal waste disposal sites
Bauxites in Dalmatia

Bauxite pits
Bauxites in Dalmatia

Bauxite pit
Bauxites in Dalmatia

Bauxite pit

2) dispersion of bauxite dust by wind and water, and changing the topsoil chemistry
Geochemical mapping

The geochemical mapping of karst topsoil is performed within the project “The basic geochemical map of the Republic of Croatia”

- 1700 sampling sites
- analysis for 35 elements
- single element maps
- GIS-database
Karst topsoil database
Soils from Istrian and Dalmatian region: 30 – 50% higher concentrations of Cr, V, As, Cd, Ni and Pb

Areas of highest concentrations correspond with locations of bauxite mines.
Soils and bauxite

Consequence of bauxite mining or natural geogene influence of bauxite dust in Pleistocene?
Soils and bauxite

Cr+V+Ni/Sc in bauxites and soils
Soils and bauxite

Zr/Sc in bauxites and soils
Soils and bauxite

Cr/V in bauxites and soils
Soils and bauxite

Cr/V distribution in a soil profile
Soils and bauxite

Cr/V distribution in a soil profile
Soils and bauxite

Zr/Sc distribution in a soil profile
Quarrying in Dalmatia

Visual impact
Illegal waste disposal
GIS – bauxite deposits in Sibenik county
GIS - topography
GIS – digital geological map
GIS – geological mineral potential
GIS – population density distribution
GIS – protected areas, seacoast, towns, roads
GIS – areas of mineral exploitation restrictions

Based on distance from seacoast, towns, roads, protected areas, sports and tourist centres and agricultural areas
GIS – resultant geological mineral potential
GIS – geological potential for crushed aggregates
Future prospects

To rise awareness of various mining problems and impacts on karst, to help manage better the use of mineral resources in Dalmatia, based on identification of more suitable areas for stone production by taking in account both environmental and marketplace restrictions and to help local environmental policy makers to correctly manage the fragile karst environment and to preserve the natural landscape.
Thank you!