Sedimentological and geochemical analyses of the Krka River and its tributaries

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KICK-OFF MEETING

Integrated evaluation of aquatic organism responses to metal exposure: gene expression, bioavailability, toxicity and biomarker responses (BIOTOXMET)

Zagreb, 11th October 2021

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BIOTOXMET

Geological setting

Grain size analysis

Multielement composition

Geological setting

Following the Würm period of deglaciation in the Pleistocene, which caused **the sea level rise**, submerged today's Adriatic coast - **the estuary of the Krka River was formed**

The present day appearance of the Krka River canyon - **result of tectonic movements and surface karst-building processes** in the carbonate layers.

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Geological setting

Formation of the travertine layers formed the **the waterfalls along the river's course** - causing the formation of Visovac Lake and the remaining water accumulations in the canyon part.

The only man-made accumulation is Brljan Lake, which was created as a reservoir for the Miljacka hydroelectric plant.

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Geological setting

Suspension - fine material such as clay and sediment is carried by the river.

LOW

Solution - disolved minerals are carried by the river.

HIGH

Traction - large boulders and pebbles are rolled along the river bed.

Saltation - small stones, pebble and silt bounces along the river bed.

CARBONATES

River bed

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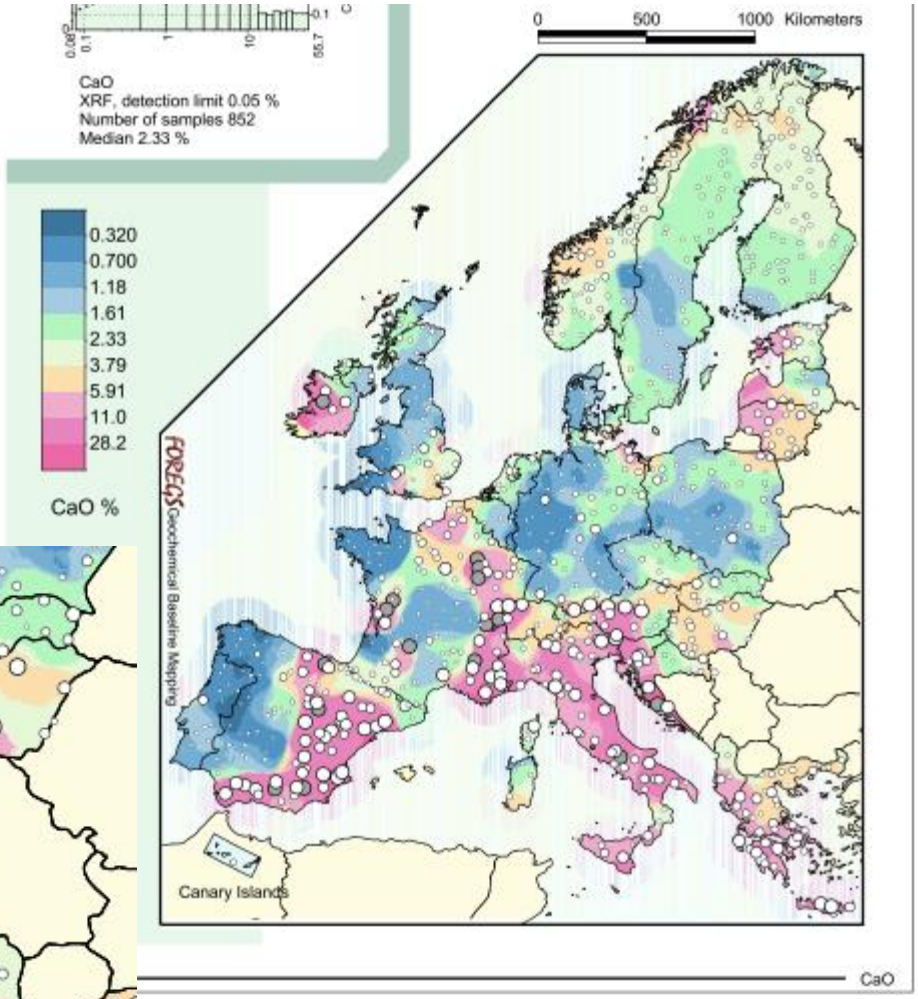
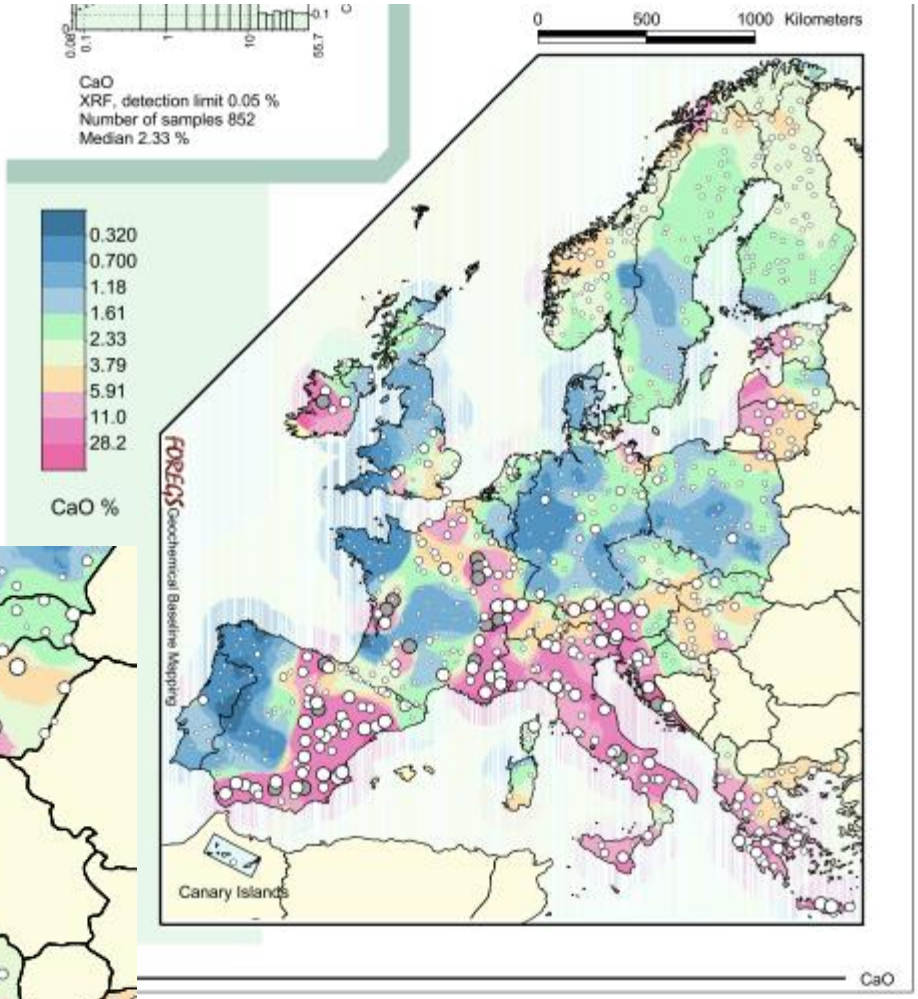
Geological setting

Geochemical Atlas of Europe



Geological setting

Geochemical Atlas of Europe



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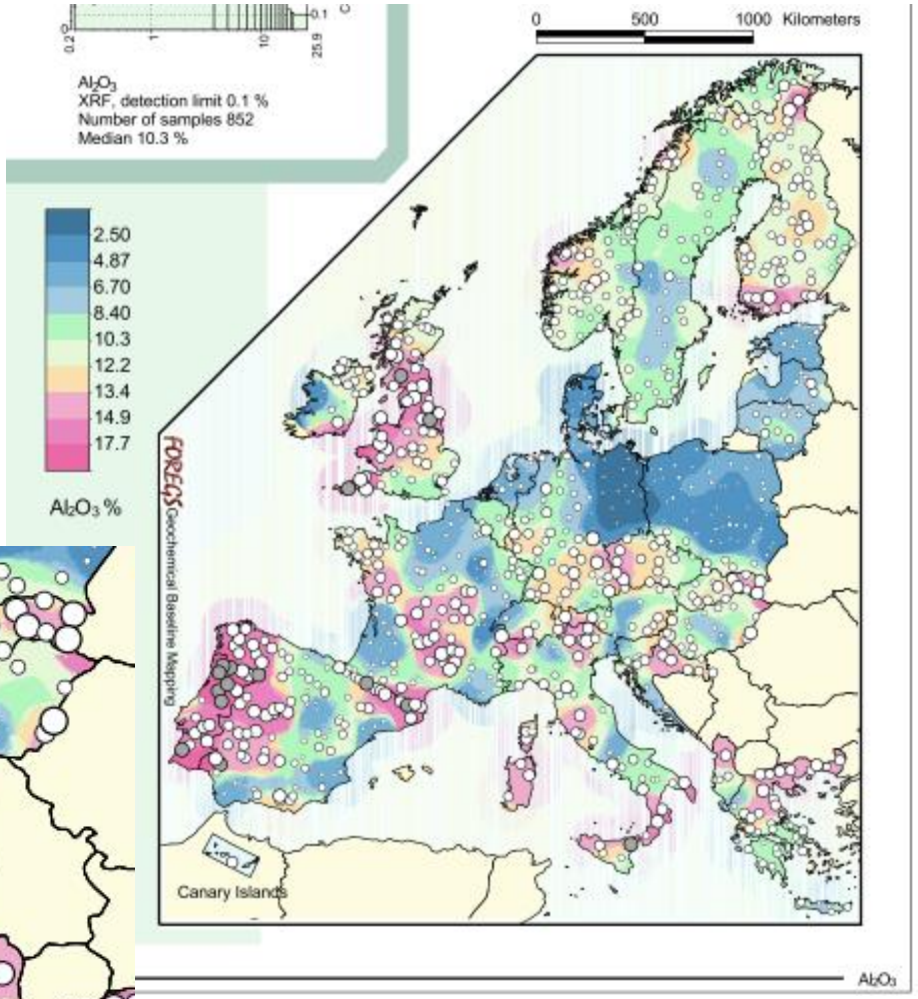
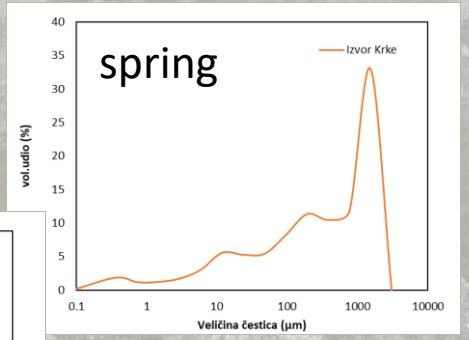


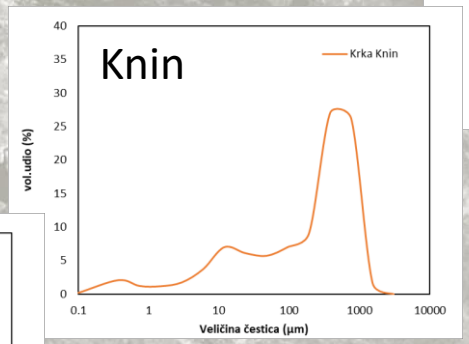
Grain size analysis

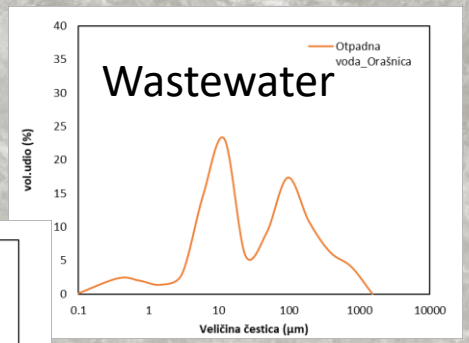
Methodology: Laser Diffraction Particle Size Analyzer

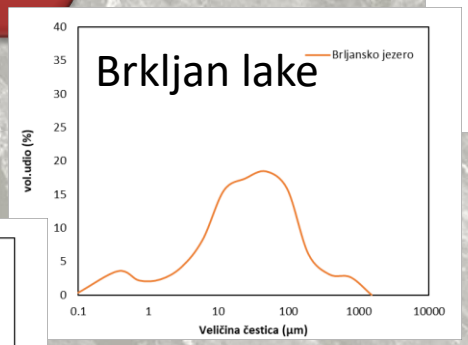
- wet sieved < 2mm
- data analysis by GRADISTAT v.7

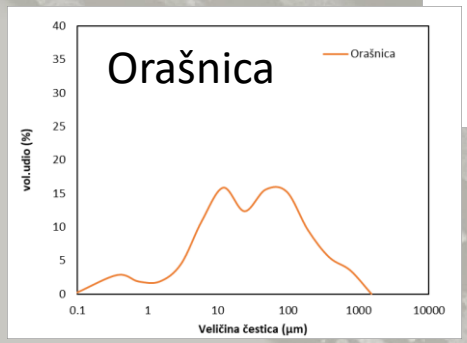
Grain size analysis

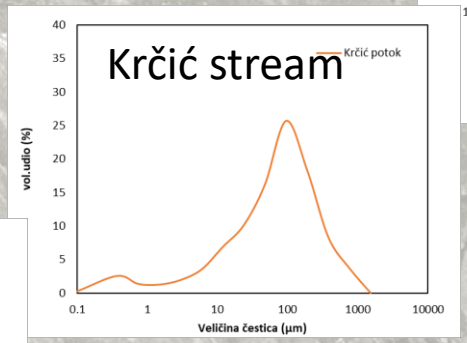


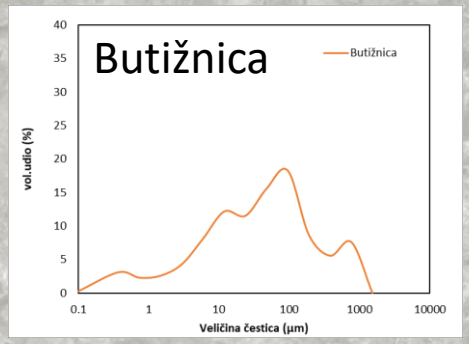


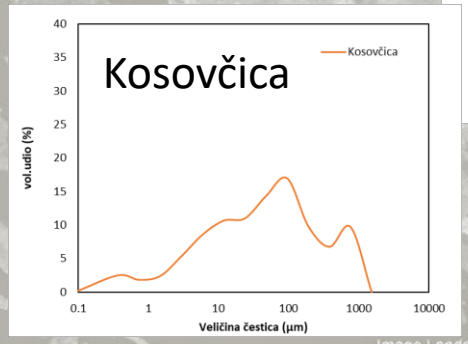












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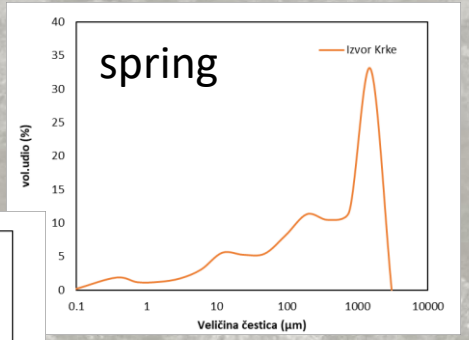
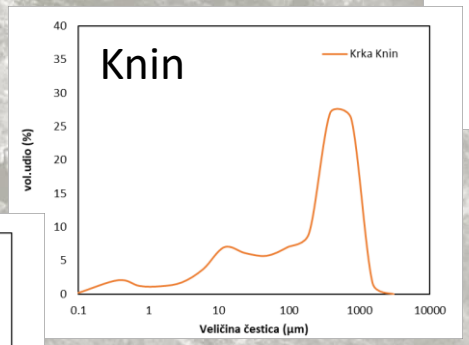
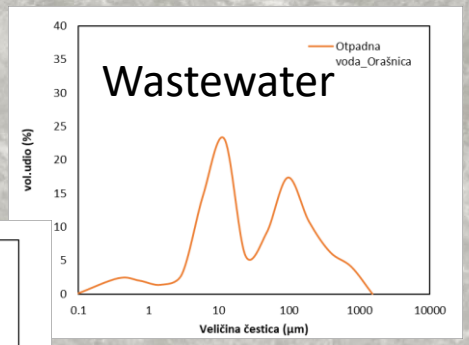
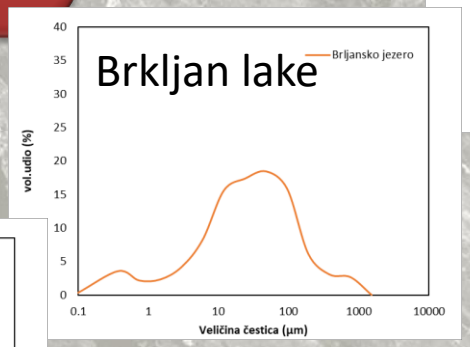
Grain size analysis

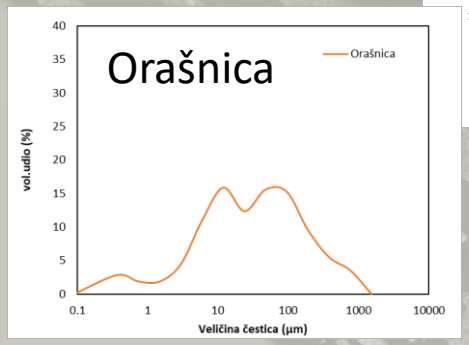
% clay
% silt
% sand

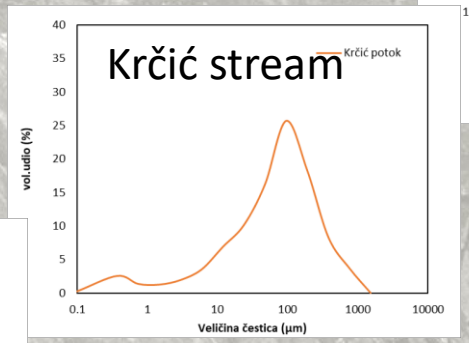


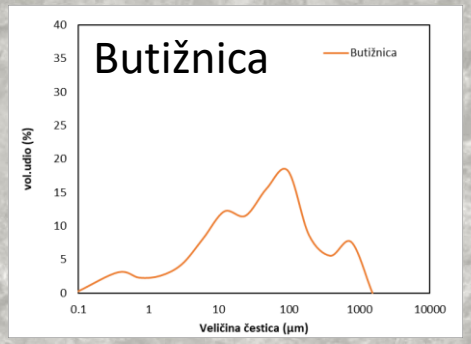


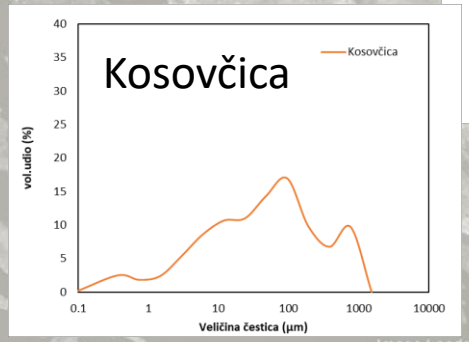












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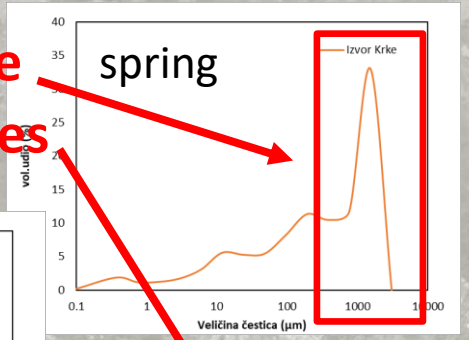
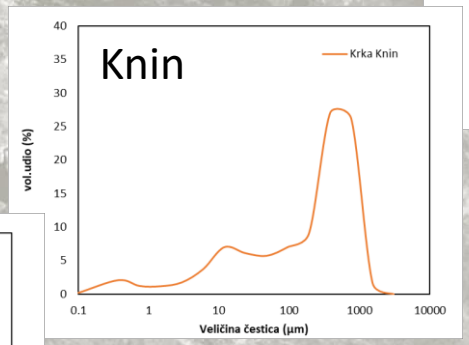
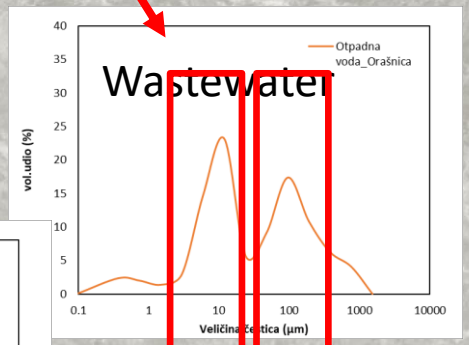
Grain size analysis

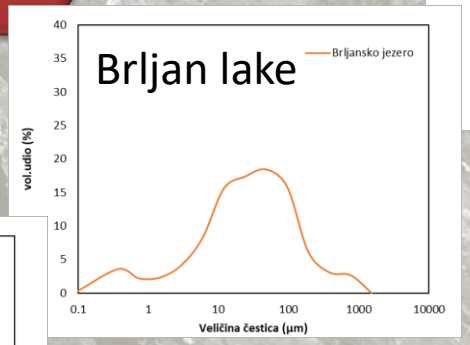
one dominant source

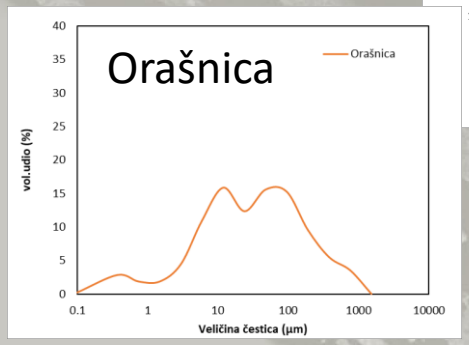
two dominant sources

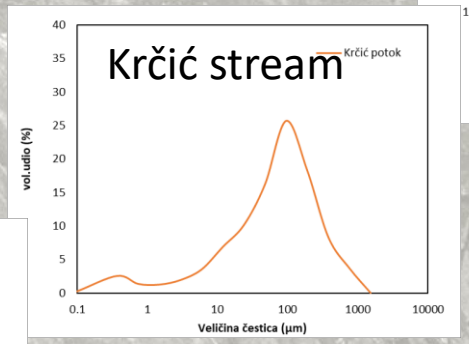


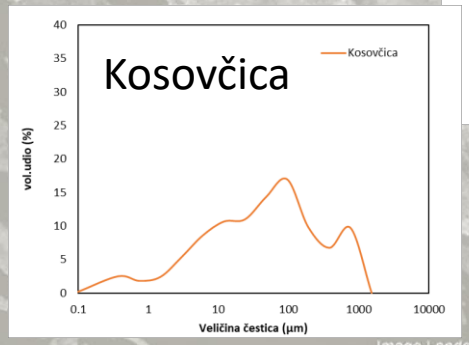


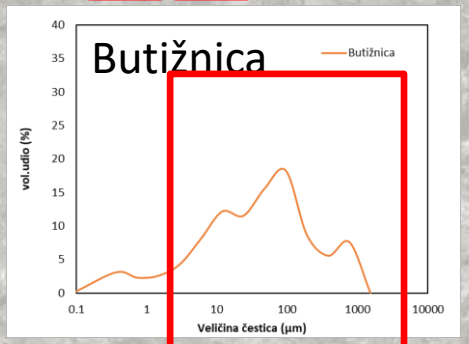












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Multielement composition

Geochemical data

- sediment from all sampling sites
  - wet digestion (MW)
  - methodology: HR-ICP-MS
    - total concentrations of 30+ elements

Multielement composition

Trace and macro elements in sediments of the Krka River

- Compared to Geochemical Atlas of Europe (FOREGS)
- Enrichment factors

$$EF = (M/N)_{sediment}/(M/N)_{background}$$

- Geoaccumulation index

$$I_{geo} = \ln M_{sediment} /1.5*M_{background}$$

M – element concentration
N – reference element concentration

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Multielement composition

Al – geogenic element

HIGH level of Al – high % of clay fraction

LOW level of Al – low % of clay fraction

Trace and macro elements in sediments of the Krka River

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Multielement composition

Al – geogenic element

Metal carrier!

HIGH level of Al – high % of clay fraction

LOW level of Al – low % of clay fraction

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Multielement composition

EF < 2 insufficient to minimal enrichment
EF = 2 – 5 moderate enrichment,
EF = 5 – 20 considerable enrichment
EF = 20 – 40 very high enrichment
EF > 40 extremely high enrichment

Trace and macro elements in sediments of the Krka River

- **Compared to Geochemical Atlas of Europe (FOREGS)**
- **Enrichment factors**

$$EF = (Fe/Al)_{sediment}/(Fe/Al)_{background}$$

- **Geoaccumulation index**

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