Comprehensive (geo)chemical characterization of the Austrian-Slovenian Mur/Mura River catchment

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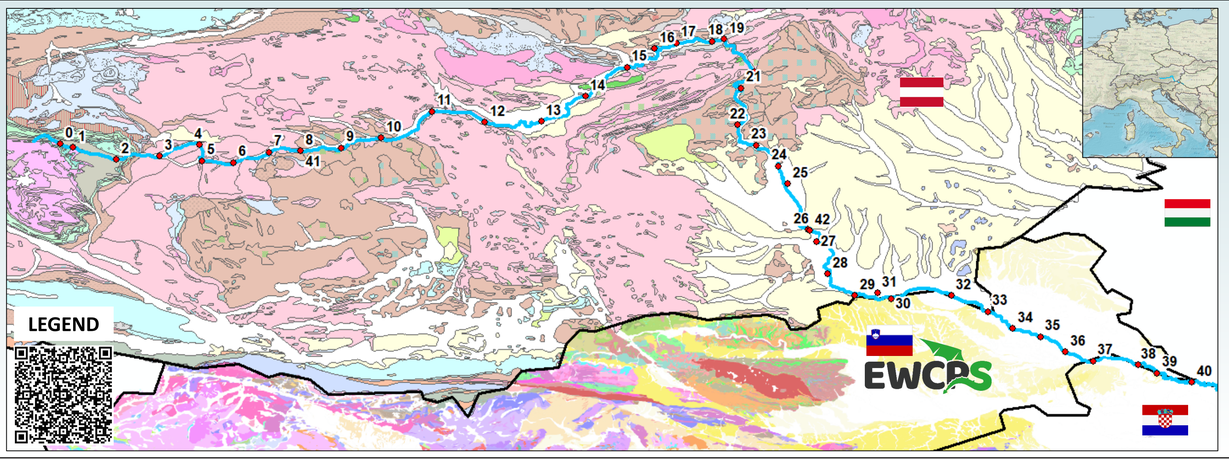
Introduction

The project "**MURmap**" aims to shed light on the spatial and temporal distribution of elemental mass fractions, isotope ratios and nanoparticles in the Mur river by combining multielement and isotope analysis to investigate influences on the river from

(1) natural geochemical background of the catchment area including tributaries
(2) historical and recent anthropogenic sources and
(3) solid/liquid phase interaction of chemical elements.

In three campaigns in May 2022, August 2022 and February 2023
- water samples
- suspended particulate matter, and
- alluvial and stream sediment samples

are taken and processed to comprehensively characterize the Mur catchment area.



Methodology

Sampling in Field

Stream Sediment

- Drainage
- Packaging and wrapping

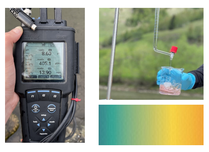
SPM – Suspended Particulate Matter

Filtration with nitrocellulose filter (0.22 µm) (*n*=4)

Acidification (HNO_3 subb.) to pH <2

Water

- Conductivity, pH, RDO and T
- Alkalinity determination



Sample Prep

- Drying at 40°C

- Sieving to <63 µm

- Digestions

- Drying at 40°C
- Digestions

- 0.45 µm filtration
- Acidification to w = 1% HNO_3
- Sr-separation DGA resin 3 mL column

PrepFAST-MC (Elemental Scientific)

Measurement

Multi-Element Analysis by ICP-MS/MS

- External calibration
- Internal normalization (In)
- MS/MS mode using N_2O

NexION 5000, PerkinElmer

Isotope Ratio Analysis by MC-ICP-MS

- Internal-external IIF correction with SSB using NIST SRM 987 + Zr spike

Nu Sapphire and Nu Plasma HR, Nu Instruments

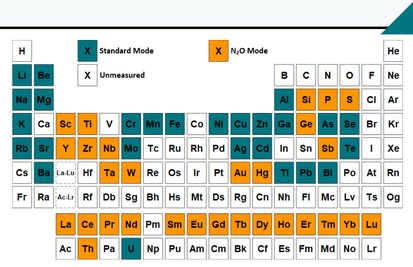
Nanoparticle Analysis

- Pre-screening to identify particulate elements
- Transport efficiencies were determined using a 50 nm Au NP standard (NanoComposix)
- Calibration with ionic standards
- Data analysis was carried using the software SPCal

Agilent 8900, Agilent Technologies

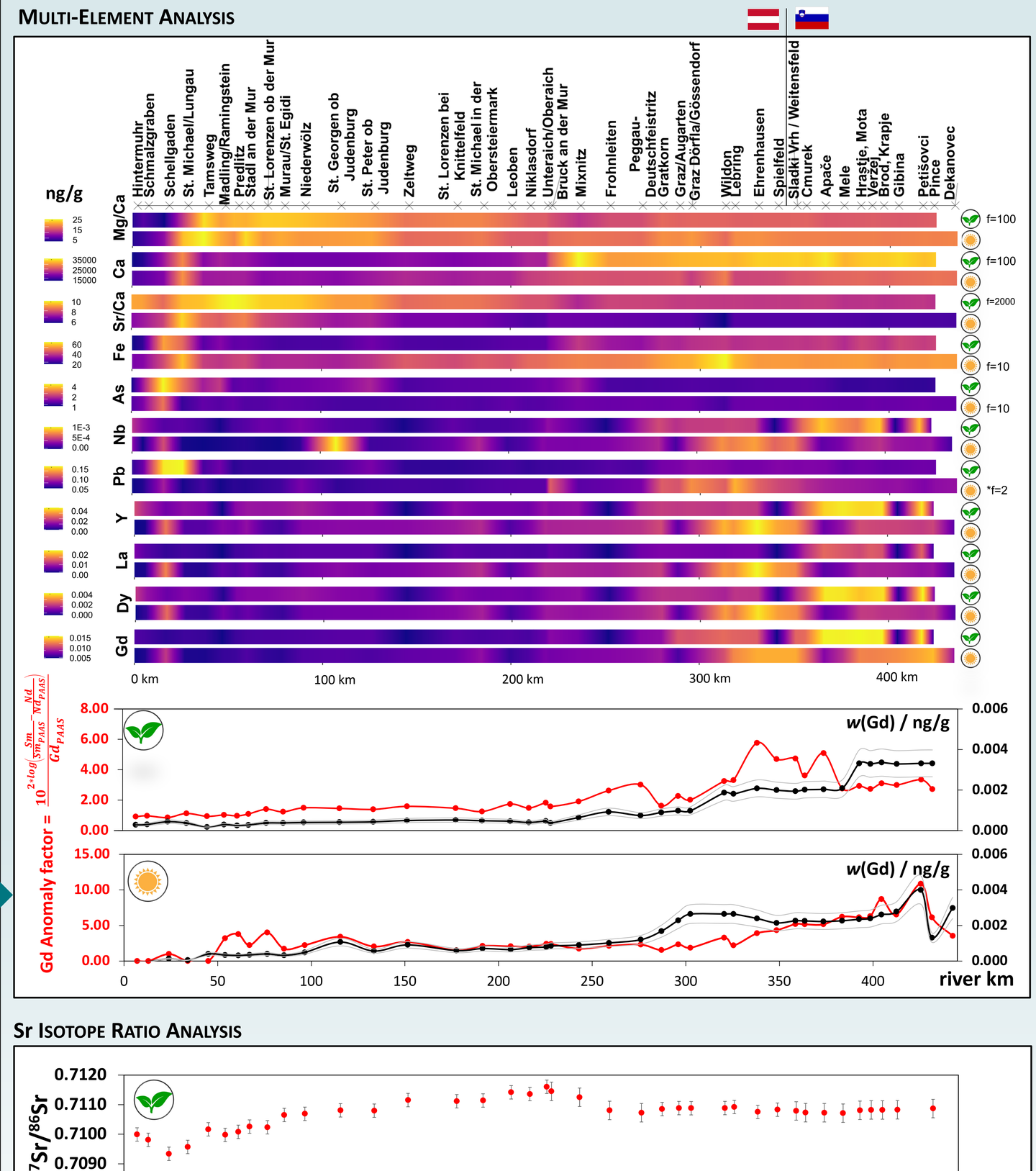
Data Processing & Evaluation

- Full method validation
- External calibration (quantification)
- Use of CRM
  - NRC SLRS-6 (Ebeling et al., 2022)
- Calibration of combined uncertainty budgets according to Eurachem/GUM
- Normalization to PAAS (McLennan, 1989)
- Statistics and GIS-based visualization

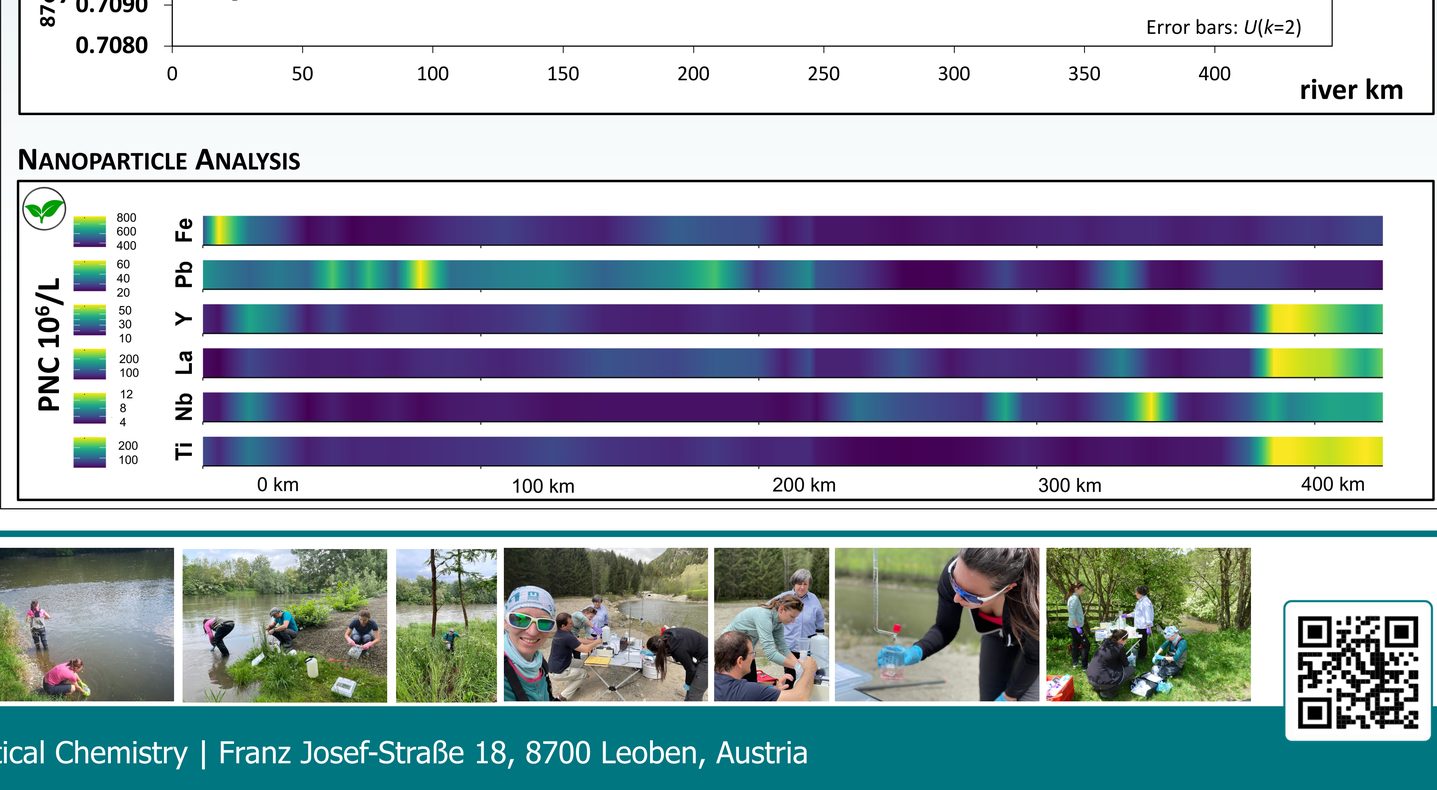


Results

Multi-Element Analysis



Sr Isotope Ratio Analysis



Nanoparticle Analysis

Interpretation

- COMPARISON OF SEASONS
  - Significant differences in water discharge
  - Significant dilution effect in high water regime
  - Dilution of mass fractions of e.g. Fe, As, Pb likely reduced leaching effect from solid matter due to less discharge
- Gd-ANOMALIES
  - Contribution of 40-90% of total Gd originating from anthropogenic input
  - Clear Gd peaks in larger cities
- $^{87}Sr/^{86}Sr$ isotope ratios reflect the underlying geology of the catchment
- Nanoparticle pattern correlate with elemental mass fractions along the river

Outlook

- SAMPLING of low water regime in winter (February 2023)
- Sampling and analyses of tributaries
- Collection of alluvial sediment and sequential leaching experiments with river bed sediment
- Analysis of B and Pb isotope ratios in water
- Isotope ratio analysis of SPM and stream sediments (e.g. Pb, Nd, B)
- Speciation of Gd

- Comprehensive data compilation of all data with geological maps and information about contaminated sites and deposits

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