



# Experimental and field study of fractionation processes of Sr and Mg isotopes in karst aquifer of Ljubljanica River (Slovenia)

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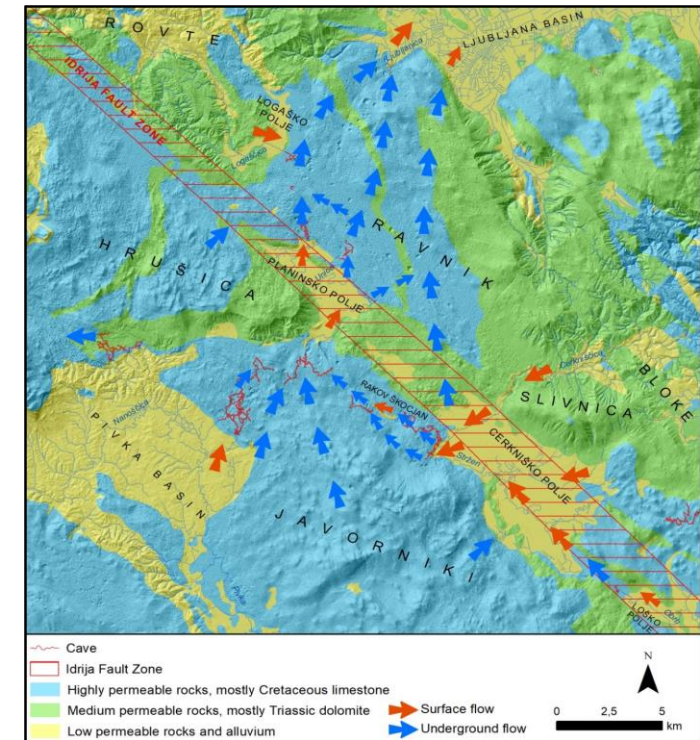
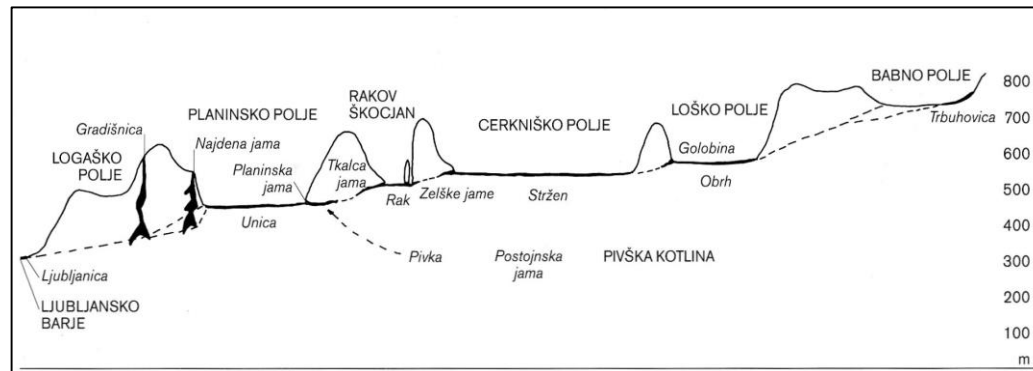
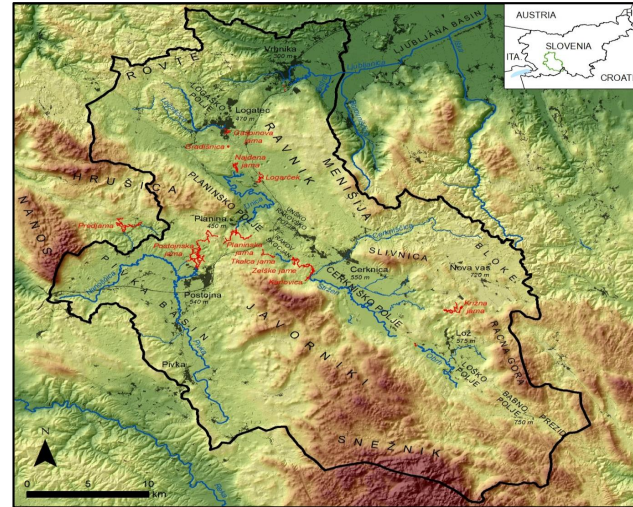
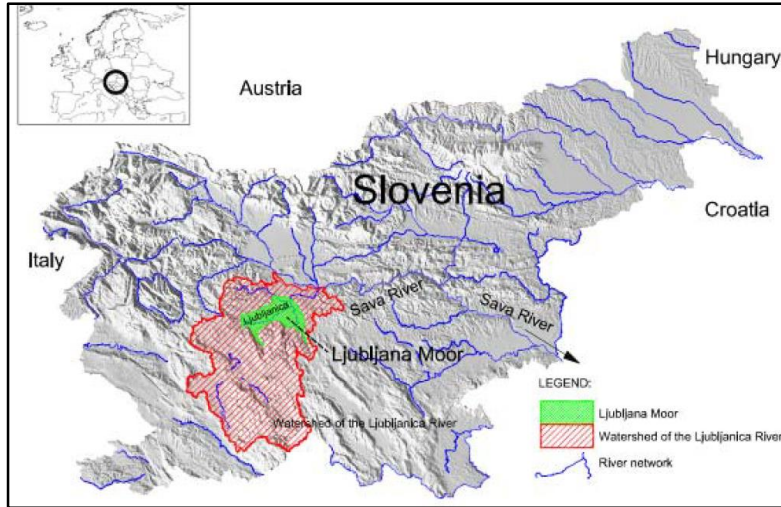
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# Ljubljanica River catchment



Ref: Rusjan et al., Journal of Hydrology, 577, 2019



# Objectives of the study

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Main objective of the project:

**„The use of non-traditional isotopes (Sr, Mg) as identifiers of authigenic carbonate in terrestrial environments.“**

- to obtain basic data on the isotopic composition of Sr and Mg in their potential sources (e.g. soil, bedrock);
- to study the isotope fractionation of Sr and Mg during leaching/dissolution/precipitation of carbonate from source material into water;
- to assess whether and to what extent the CO<sub>2</sub> fixation in the form of authigenous carbonate in the Ljubljana aquifer occurs.

# Study area

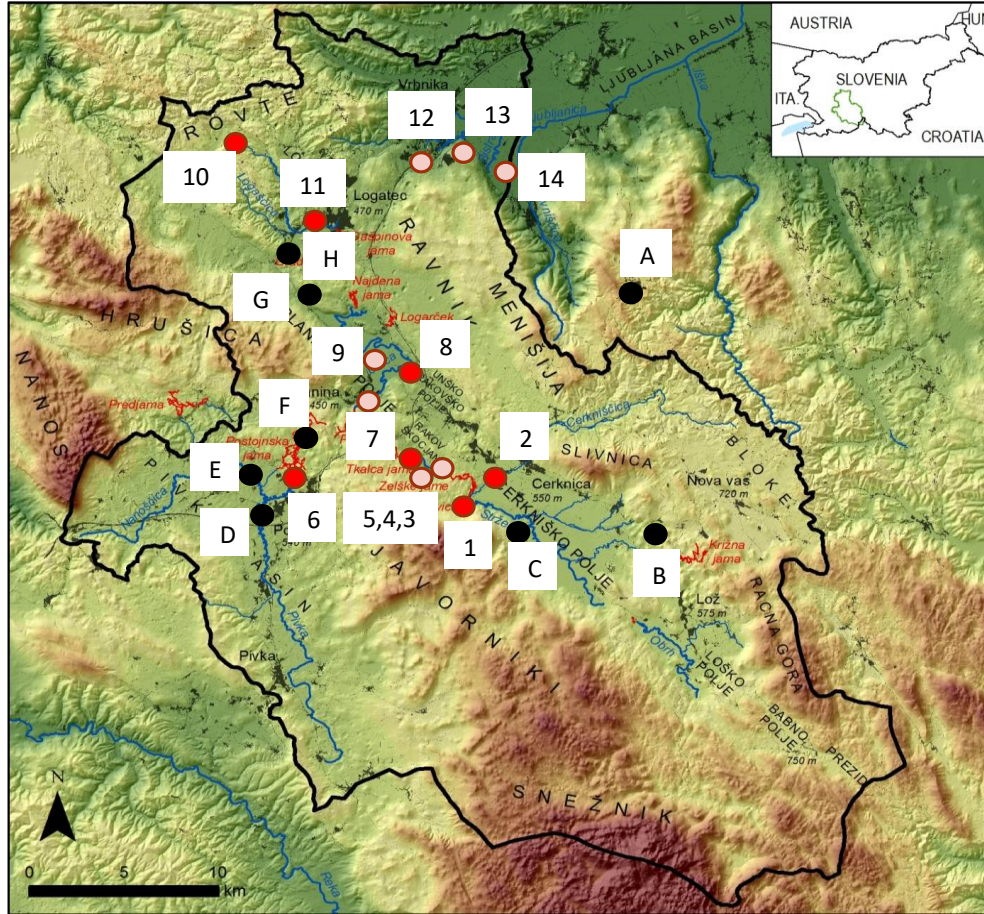
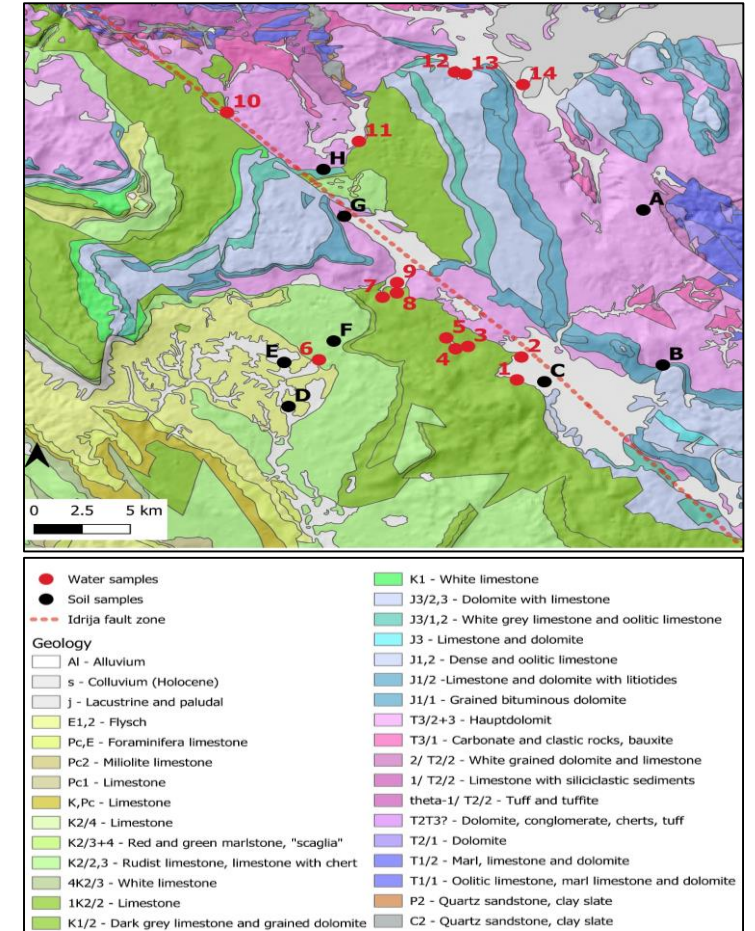


Table 1: Sampling point locations and codes

Location Name	Sample Code
Rakitna	A
Grahovo	B
Pivka	D
Mali Otok	E
Veliki Otok	F
Planinsko Polje	9
Hotedrščica	10
Logaščica	11
Kalce 1	H
Kalce 2	G



Ref: Rovan et al., Water, 12, 2064, 2020

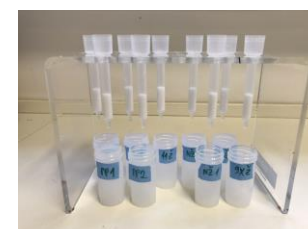
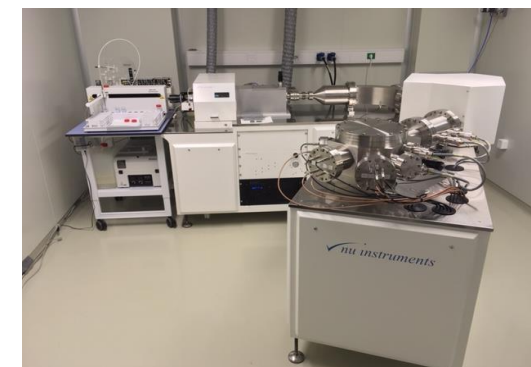
# Methods

## Sample preparation:

- Soil-bulk – MW digestion
- Rocks – dissolution with  $\text{HNO}_3$
- Laboratory experiments – 24/48 h extraction of soil in rain water

## Measurements:

- major and trace elements determination by XRF and ICP-QMS (Agilent 7900x);
- Mg and Sr isotope ratio determination by MC-ICP-MS (Nu II, Nu Instruments, Ametek)
  - Sr: separation on Sr-resin, NIST 987
  - Mg: separation on AG 50W-X12 resin, DSM3

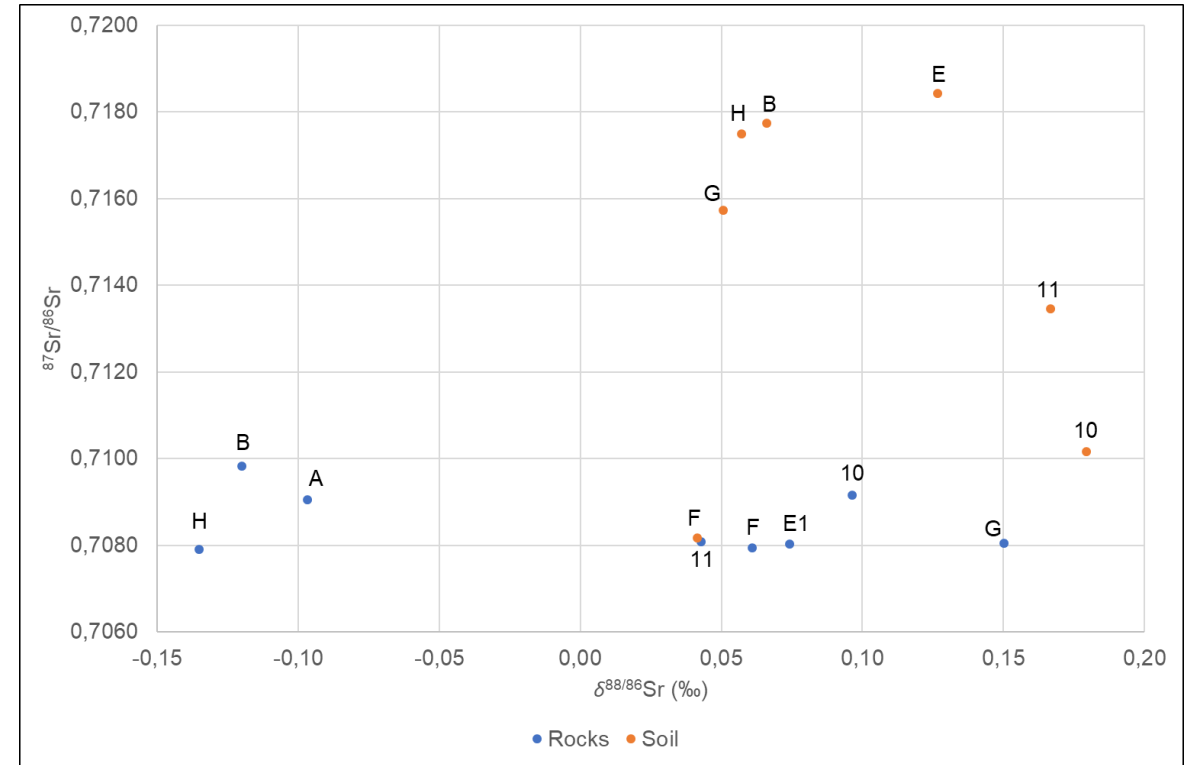
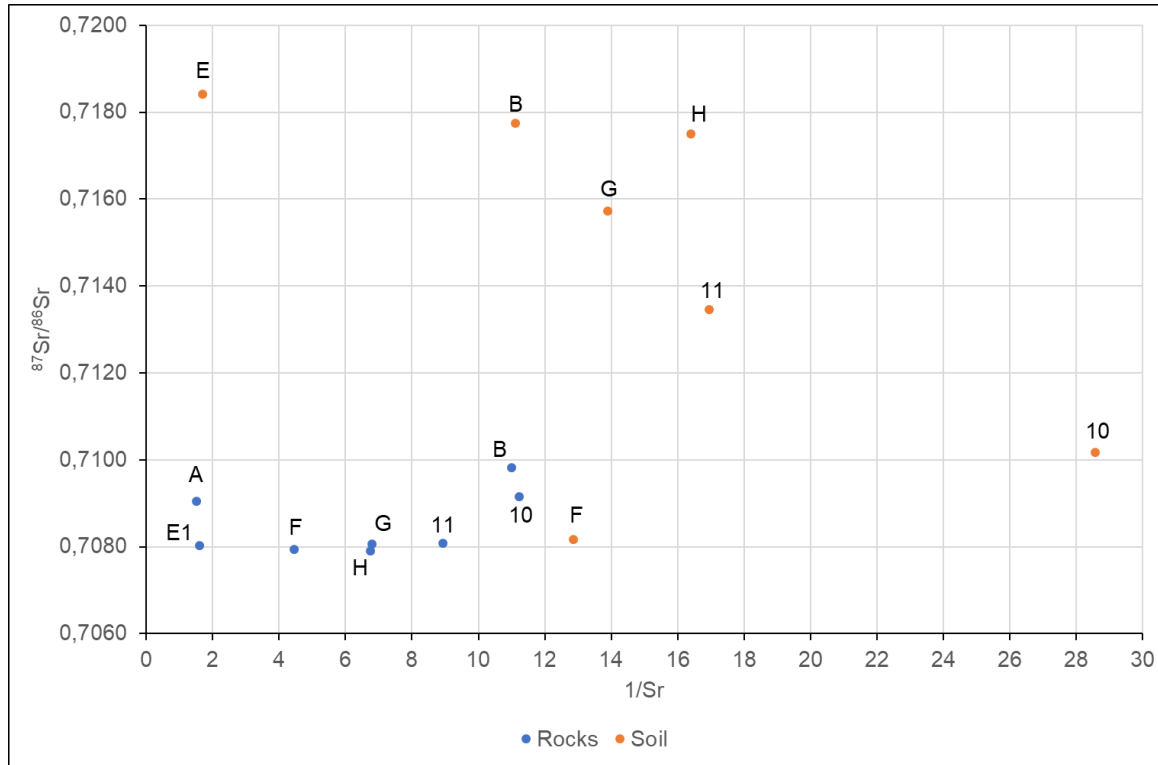




# Results

## Sr isotope composition in the samples from the field

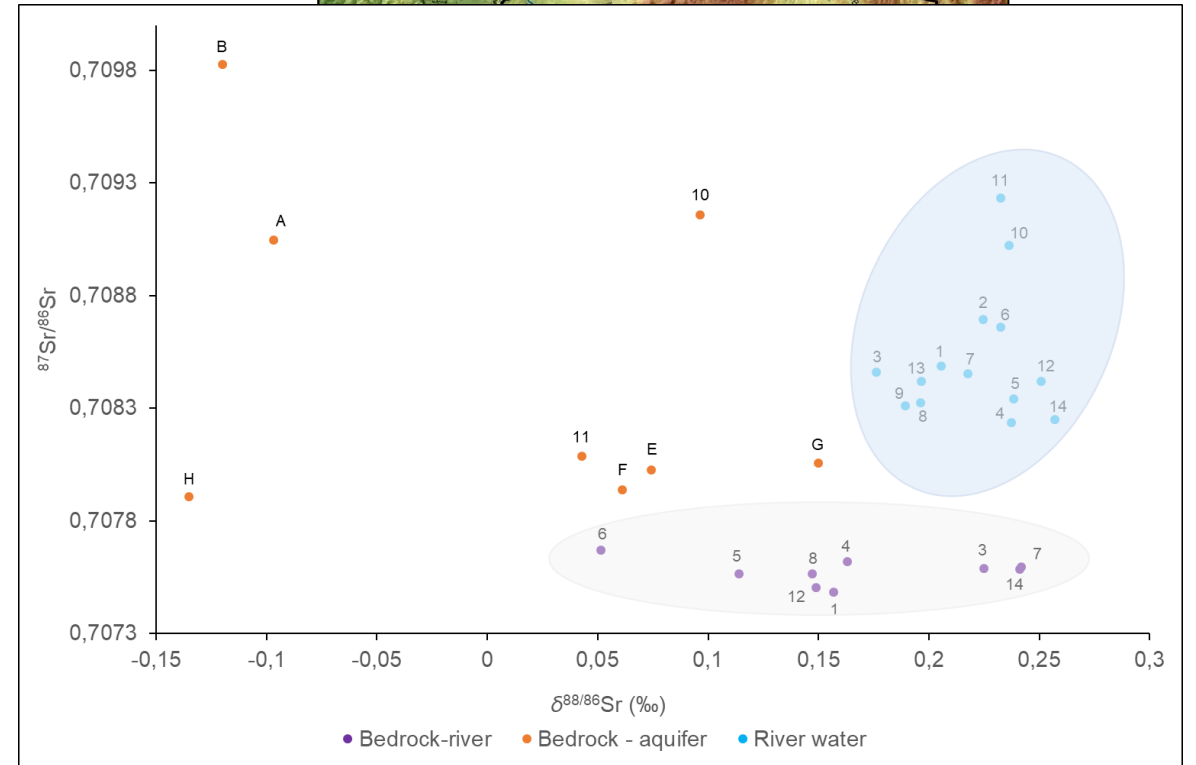
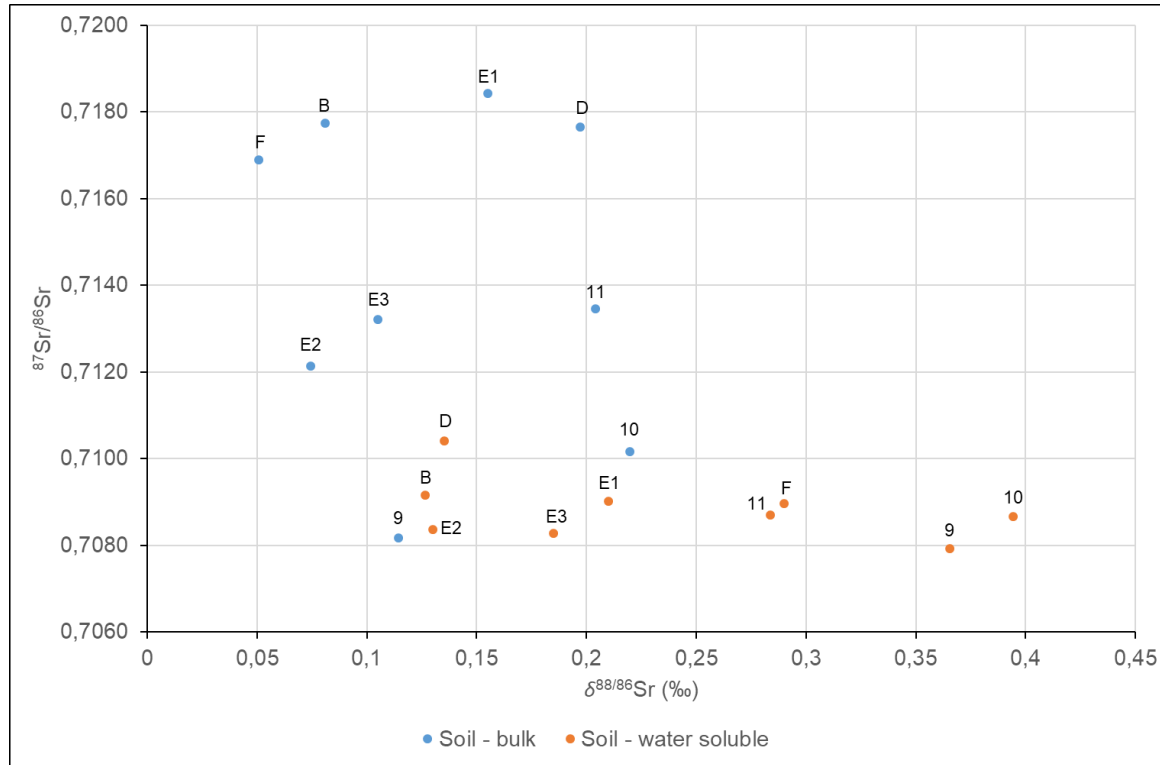
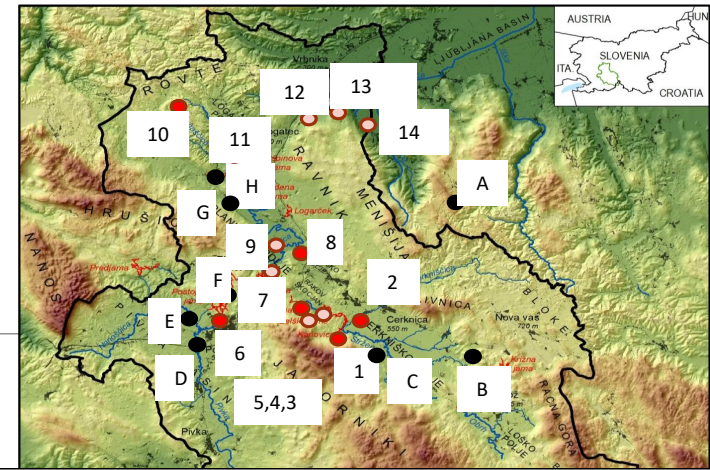
Location Name	Sample Code	Rock type
Rakitna	A	Dolomite
Grahovo	B	Dolomite
Pivka	D	Flysh
Mali Otok	E	Flysh
Mali Otok	E1	Limestone
Veliki Otok	F	Limestone
Hotedrščica	10	Dolomite
Logaščica	11	Dolomite
Kalce 1	H	Dolomite
Kalce 2	G	Limestone





# Results

## Sr isotope composition laboratory vs. field data

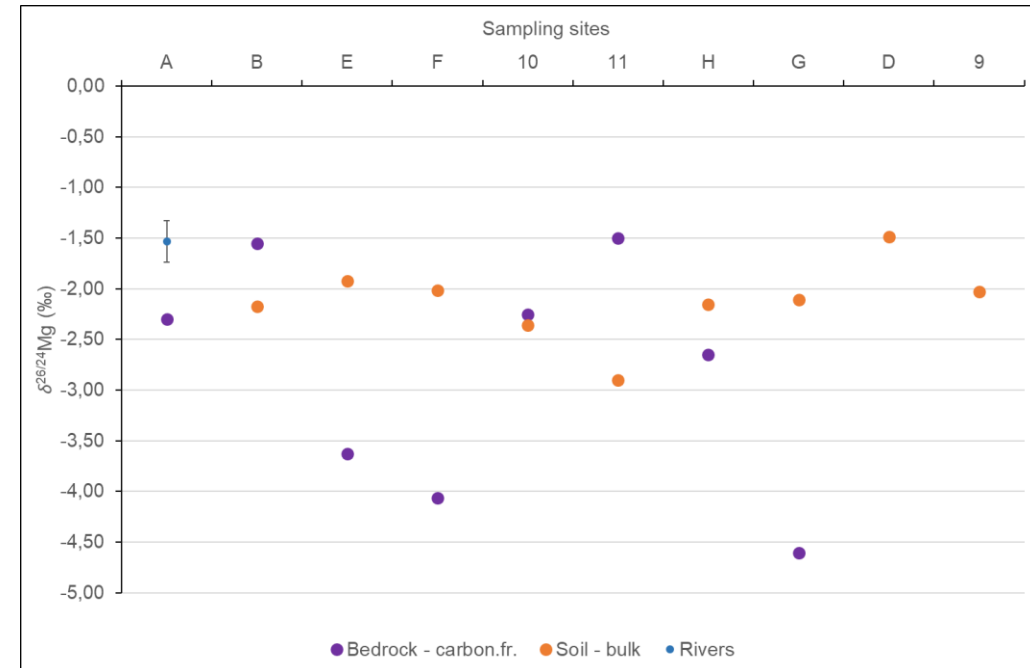
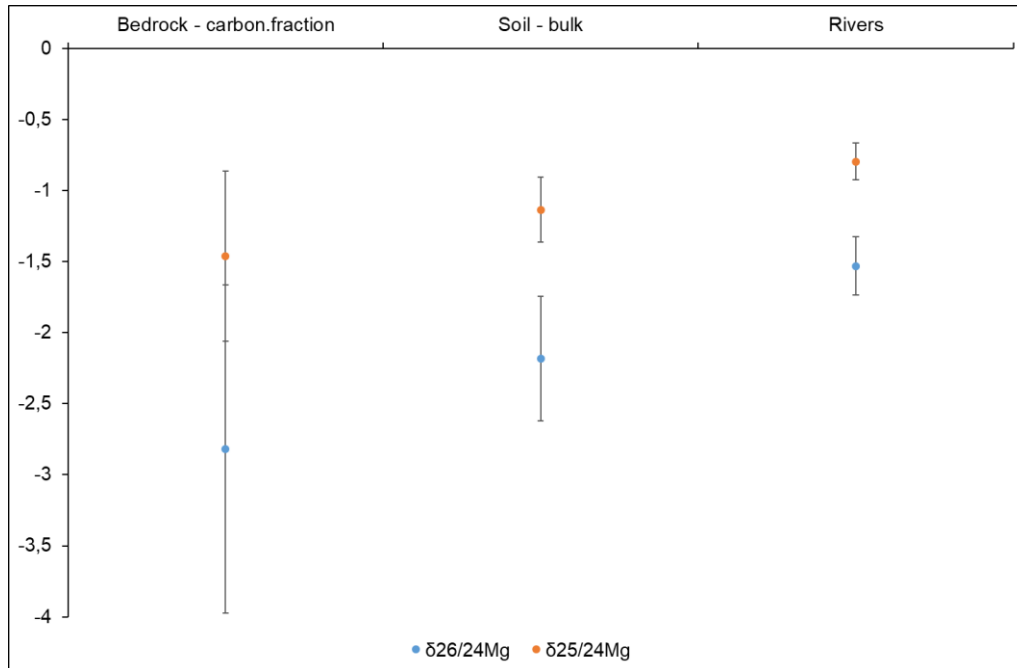




# Results

## Mg isotope composition – field data

Location Name	Sample Code	Rock type
Rakitna	A	Dolomite
Grahovo	B	Dolomite
Pivka	D	Flysh
Mali Otok	E	Flysh
Mali Otok	E1	Limestone
Veliki Otok	F	Limestone
Hotedrščica	10	Dolomite
Logaščica	11	Dolomite
Kalce 1	H	Dolomite
Kalce 2	G	Limestone

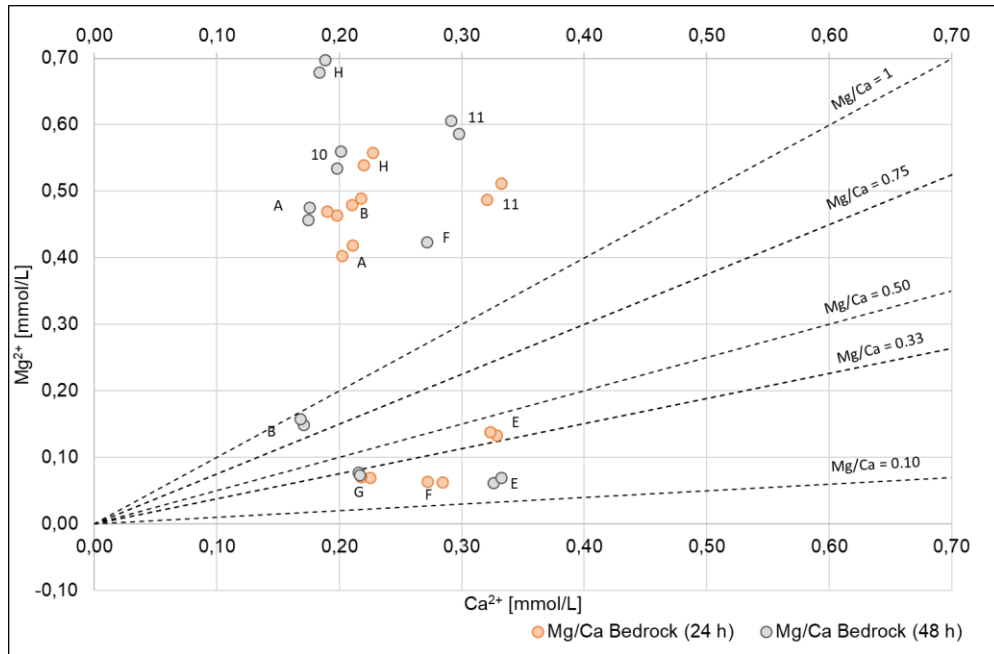






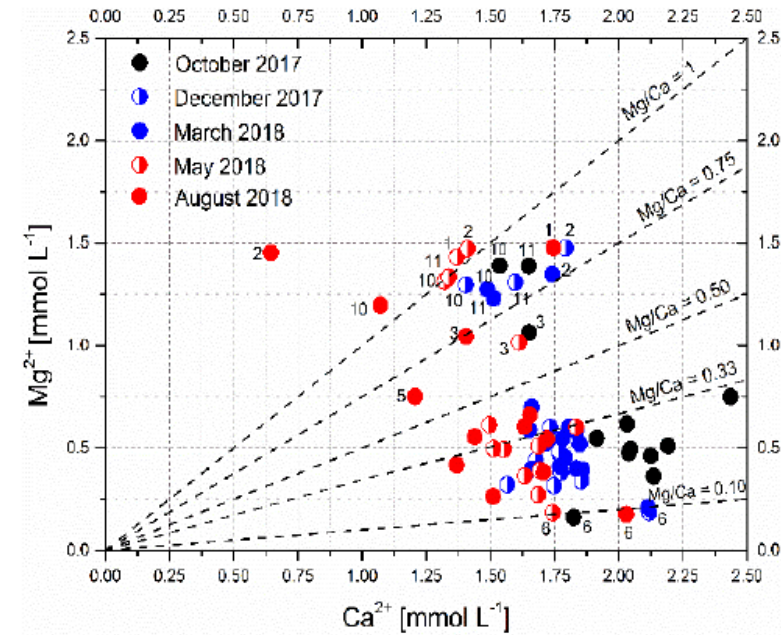
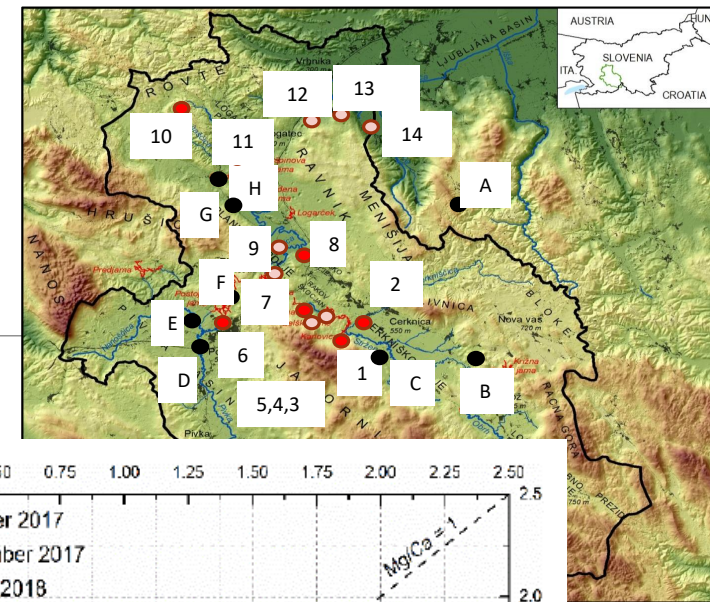
# Results

## Experimental study



Mg<sup>2+</sup> vs. Ca<sup>2+</sup> concentrations of the water-soluble fraction of bedrocks – laboratory experiment

## Field data



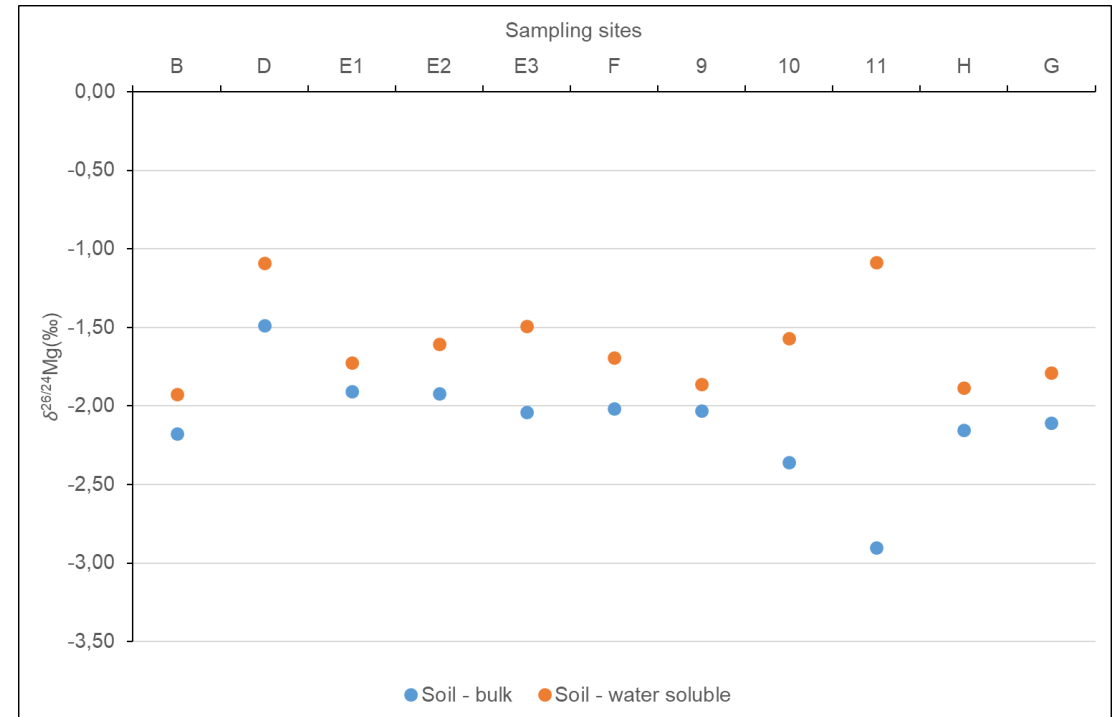
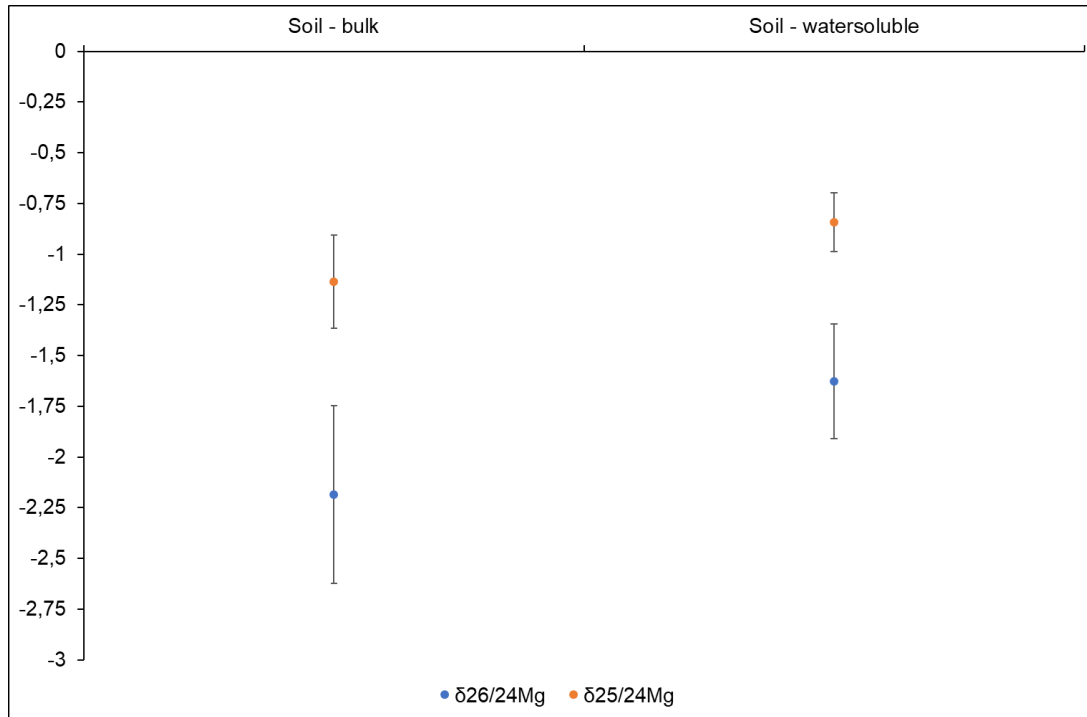
Mg<sup>2+</sup> vs. Ca<sup>2+</sup> concentrations of the Ljubljana River catchment (from: Rován et al., Water, 12, 2064, 2020)



# Results

## Mg isotope composition – experimental data

Location Name	Sample Code	Rock type
Rakitna	A	Dolomite
Grahovo	B	Dolomite
Pivka	D	Flysh
Mali Otok	E	Flysh
Mali Otok	E1	Limestone
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# Conclusions

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- heterogeneous distribution in Sr and Mg isotopes between the potential source materials;
- Rock samples – composed mostly of carbonates – prevailing limestone and dolomite;
- Soil samples – no paedogenic carbonate;
- Field data (bedrock vs. river water) potential dissolution and/or precipitation of carbonate;
- Laboratory data (soil-bulk vs. water soluble) only dissolution;
- many results are inconclusive and need further investigation.