

The miniRUEDI: what is it, and why?

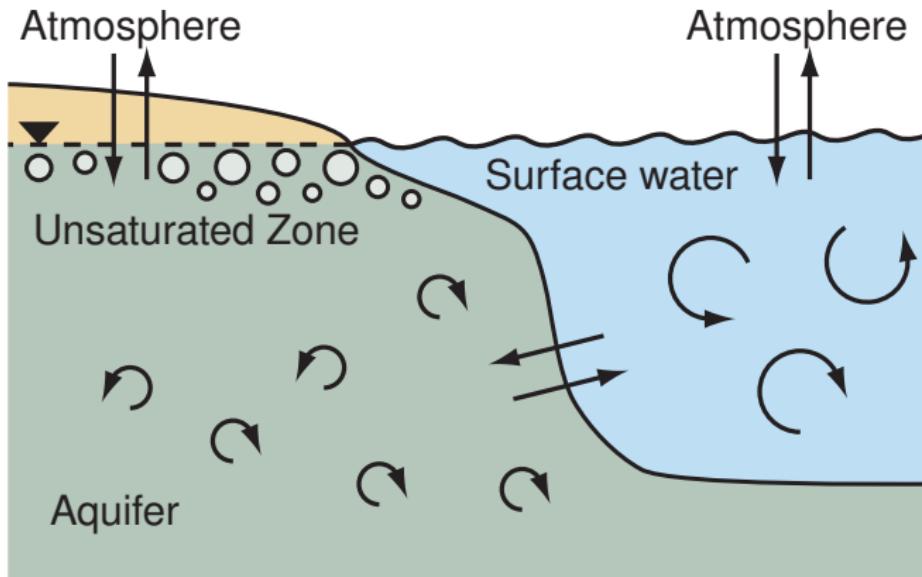
(It's a portable mass spectrometer for efficient on-site quantification of dissolved gases in aquatic systems)

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(Eawag)

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Noble gases as environmental tracers



Internal transport and mixing

Exchange of fluids and solutes

Turnover of reactive species

Analysis of noble gases (conventional)

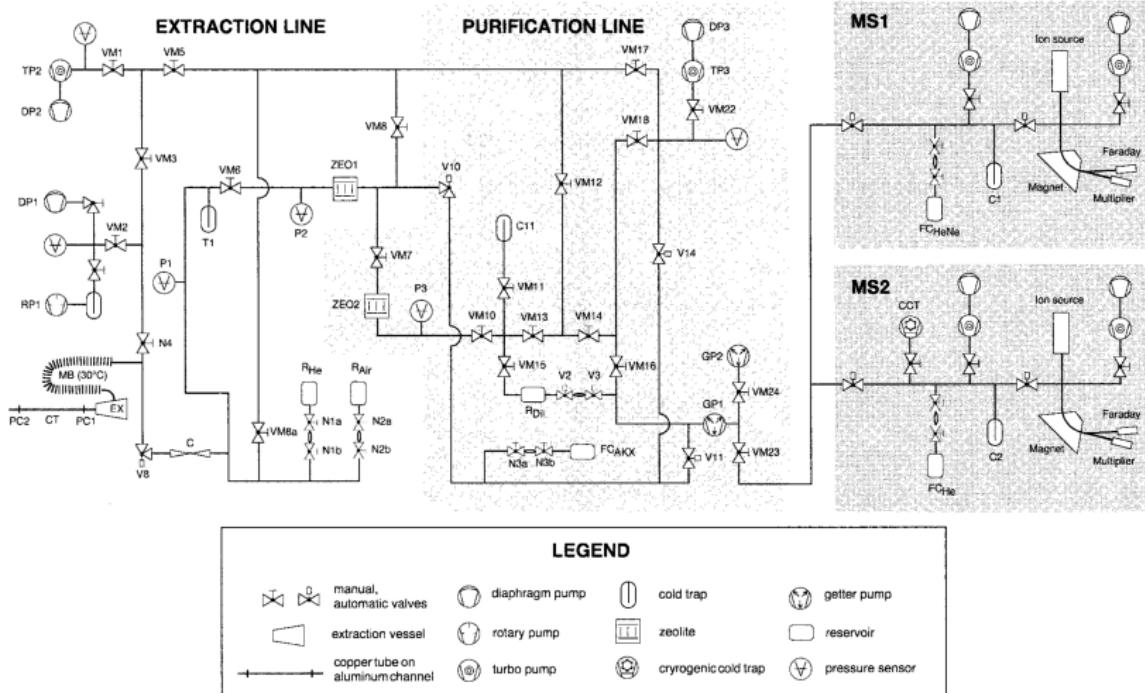
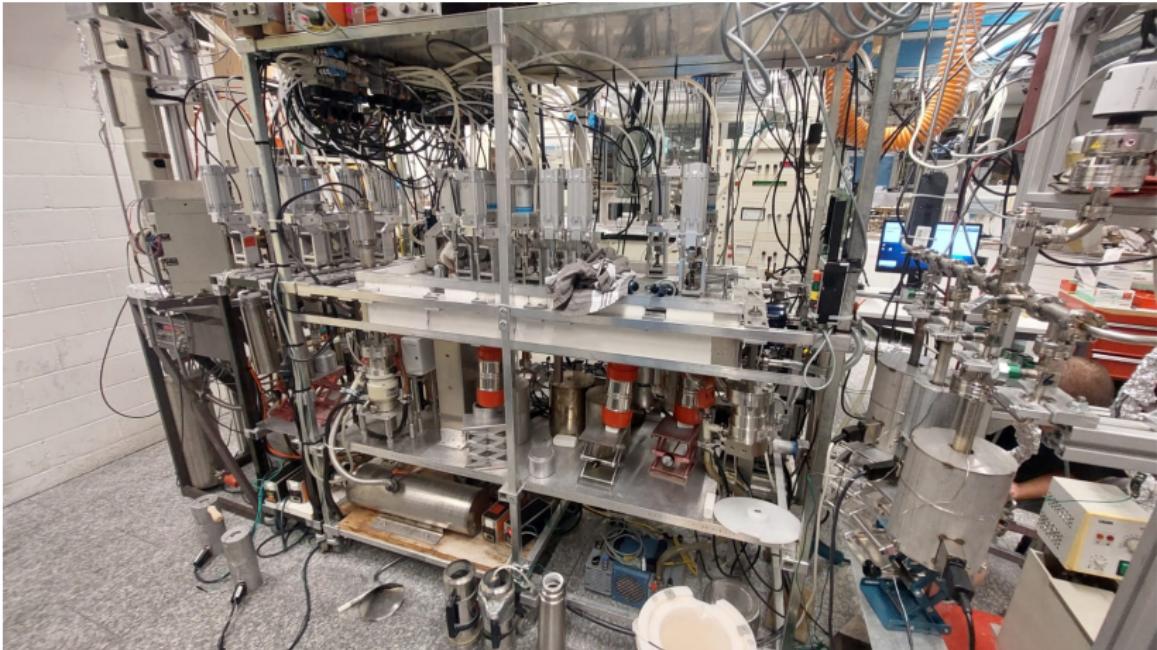


Diagram of Zurich noble gas isotope analysis

Analysis of noble gases (conventional)



Sensitive and high-quality analysis of noble gases
Low sample throughput, resource intensive
Only few and specialized labs worldwide
Limited accessibility to NG analytics

miniRUEDI portable trace-gas analyzer



Diagram of miniRUEDI gas analyzer for analysis of

He, (Ne), Ar, Kr, (Xe), N₂, O₂, CO₂, CH₄, H₂, etc.

Combined tracers for physics and biogeochemical processes

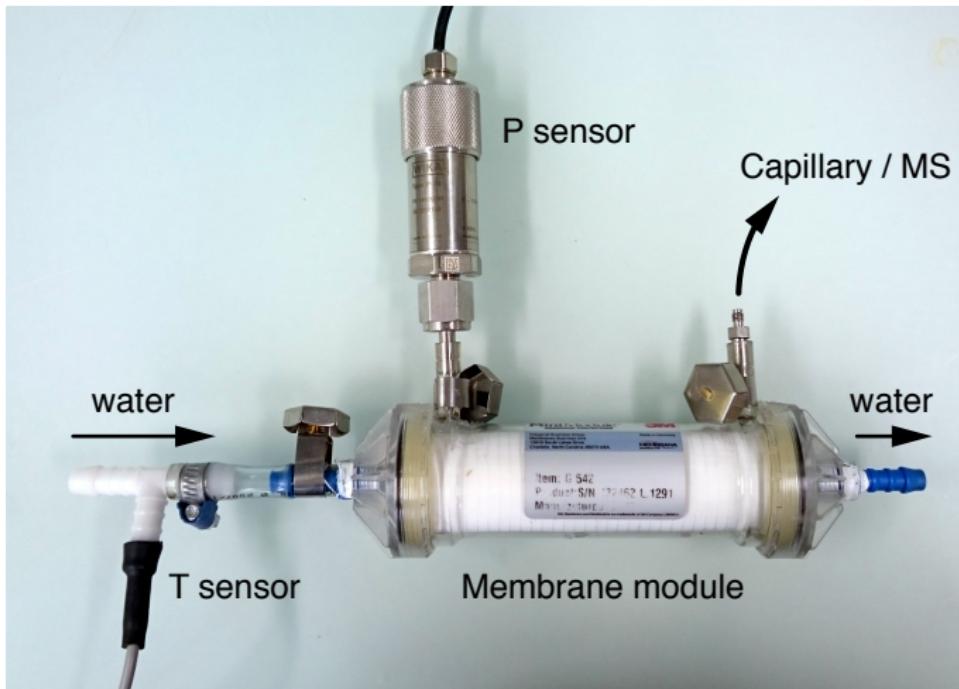
miniRUEDI portable trace-gas analyzer



Simple, self-contained instrument for on-site gas analysis

Mächler et al. 2012 ES&T, Brennwald et al. 2016 ES&T

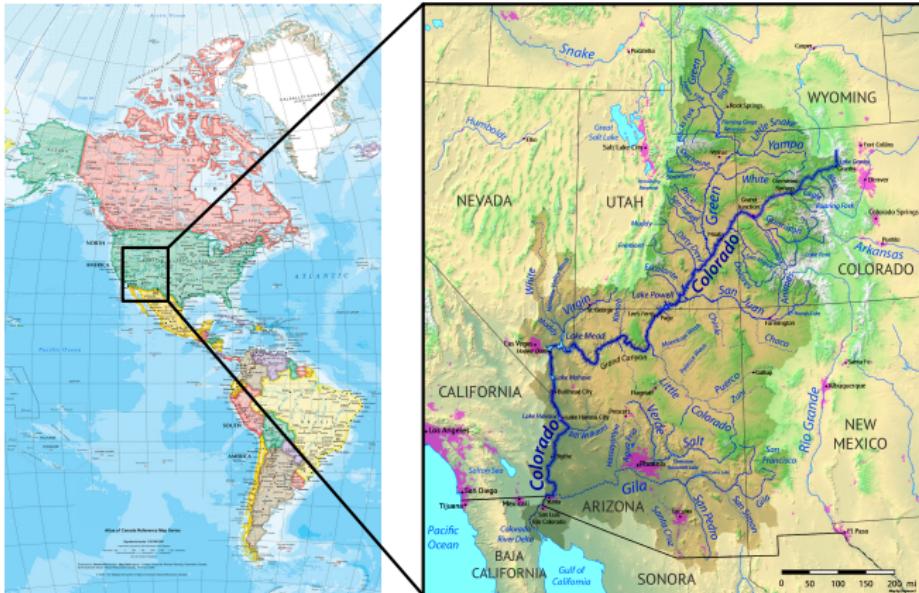
miniRUEDI portable trace-gas analyzer



Membrane system for dissolved-gas quantification in water

Patent EP4109092A1

Salinity Pollution of Colorado Water Resources



Saline geothermal systems are major sources of solutes
Negative effect on downstream water use

Salinity Pollution of Colorado Water Resources



Salinity Pollution of Colorado Water Resources



Salinity Pollution of Colorado Water Resources

Hidden discharges in the river:

Where? How much? Water quality?

Salinity Pollution of Colorado Water Resources

Hidden discharges in the river:

Where? How much? Water quality?

Natural tracer tools:

Temperature, salinity

Salinity Pollution of Colorado Water Resources

Hidden discharges in the river:

Where? How much? Water quality?

Natural tracer tools:

Temperature, salinity

Dissolved helium!

Salinity Pollution of Colorado Water Resources



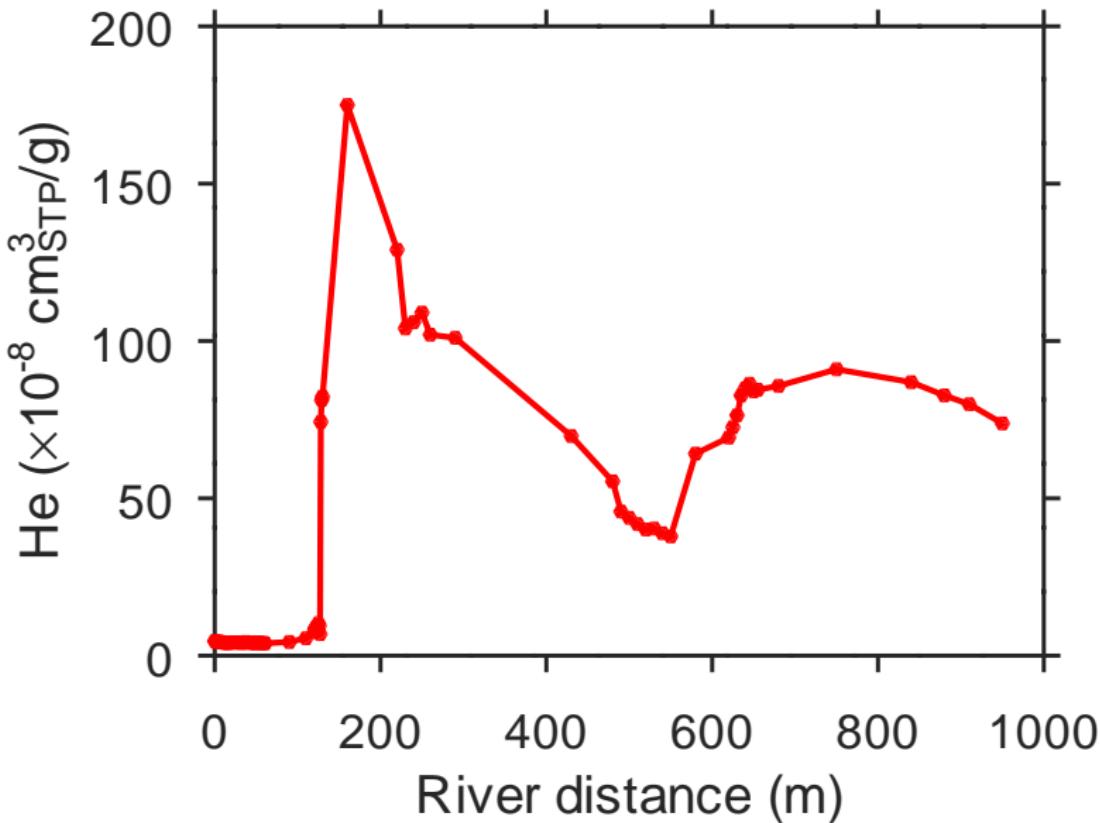
C.P. Newman et al., J. Hydrology, 2024

Helium analysis along the Virgin River

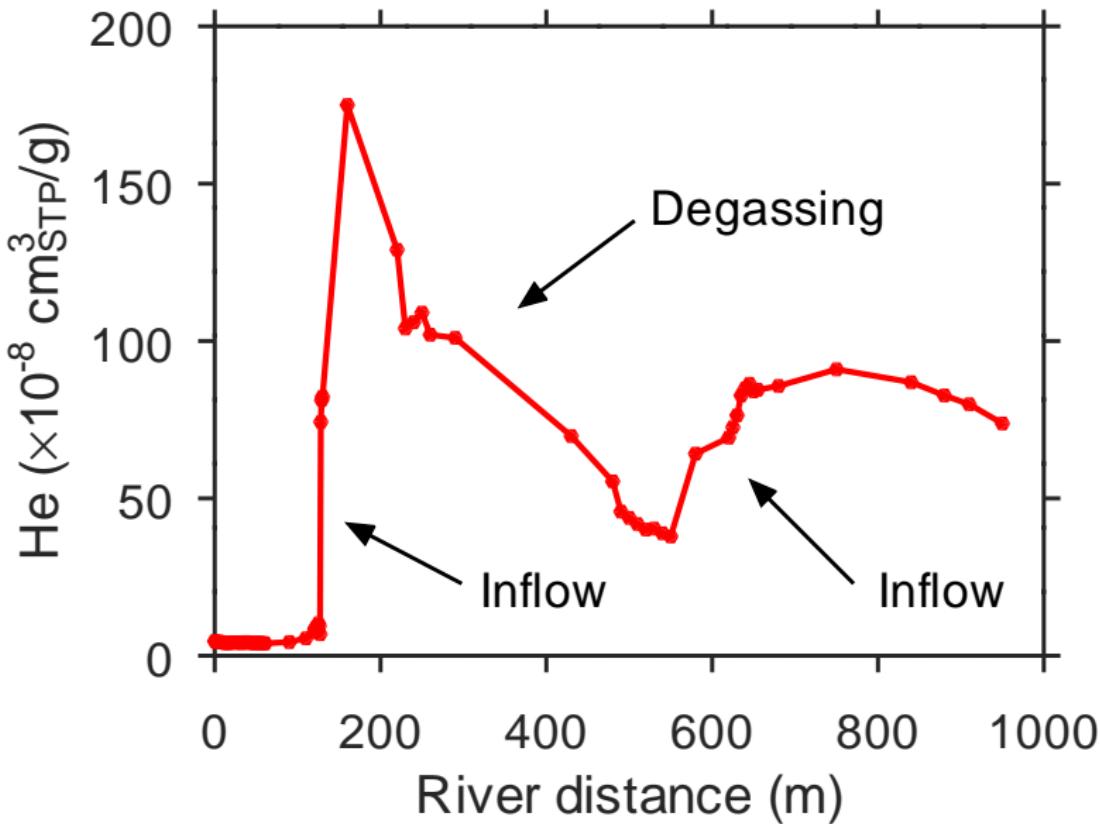


3 days on the river, 181 gas measurements

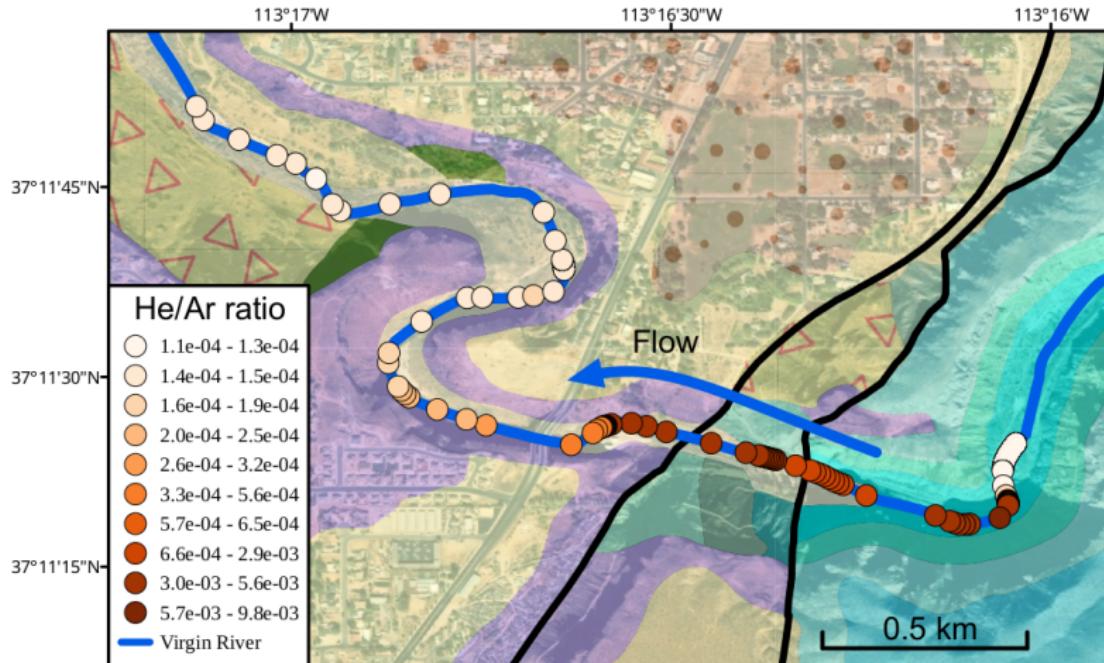
Helium analysis along the Virgin River



Helium analysis along the Virgin River



Helium analysis along the Virgin River

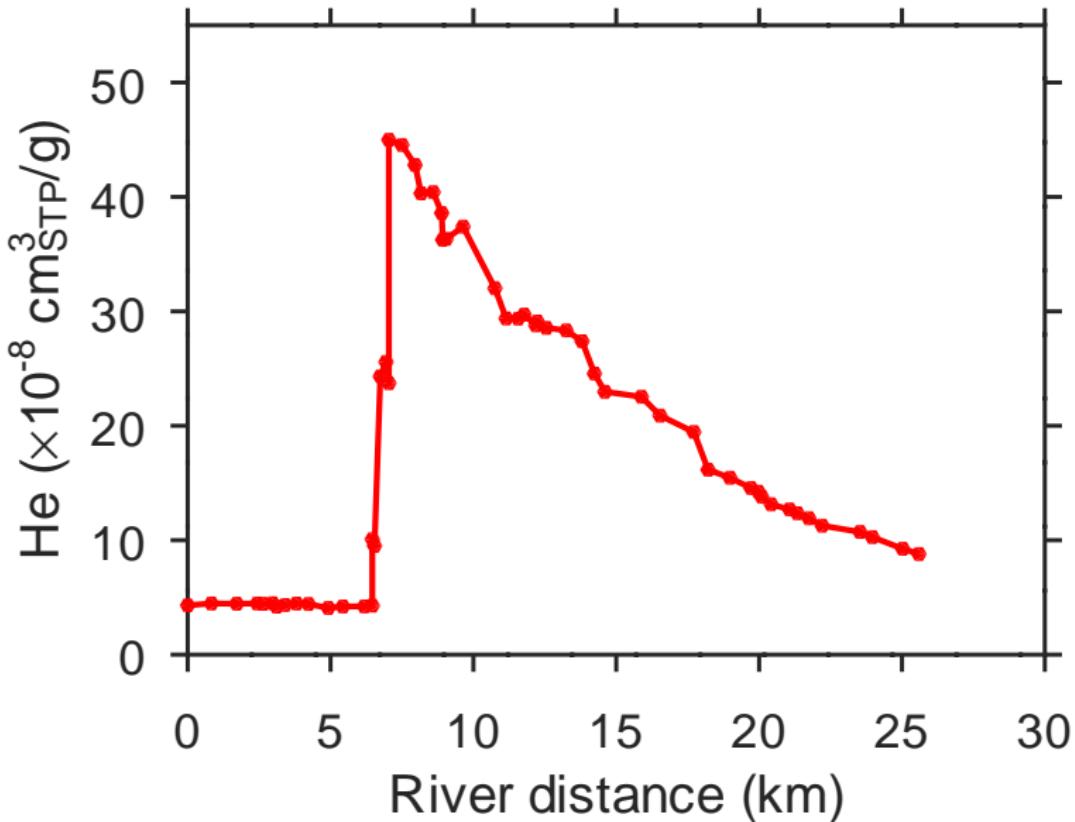


Helium analysis along the Colorado River



2 days on the river, 187 gas measurements

Helium analysis along the Colorado River



Eawag miniRUEDI applications around the world



miniRUEDI is an efficient tool for environmental gas analysis

He, (Ne), Ar, Kr, (Xe), N₂, O₂, CO₂, CH₄, H₂,...

50+ instruments, range of uses (not only) in aquatic systems