

Do hydrothermal systems at the Mid-Atlantic Ridge affect the distribution of dissolved rubidium, uranium und vanadium?

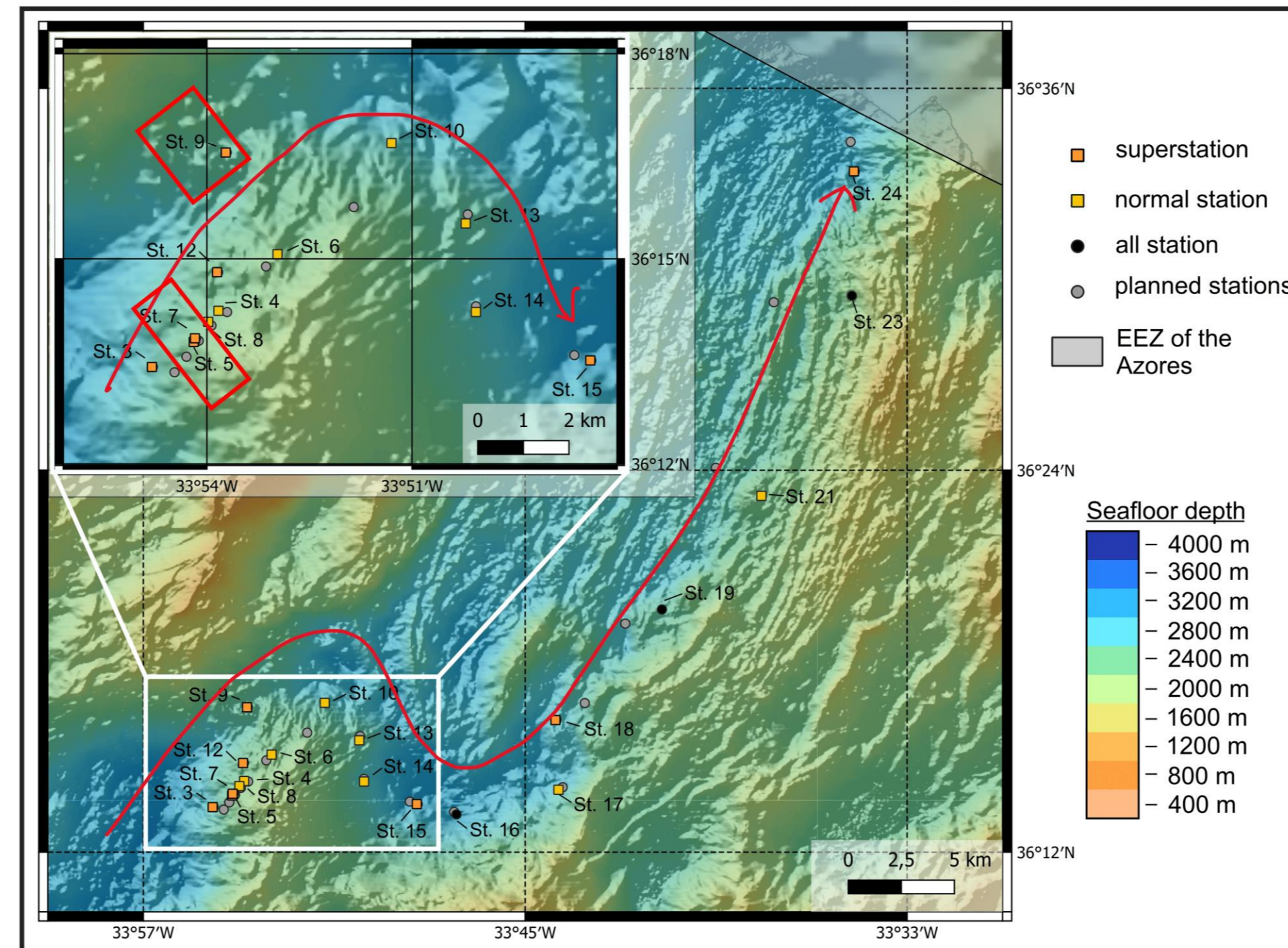
Cruise M176/2 – RainbowPlume

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Introduction

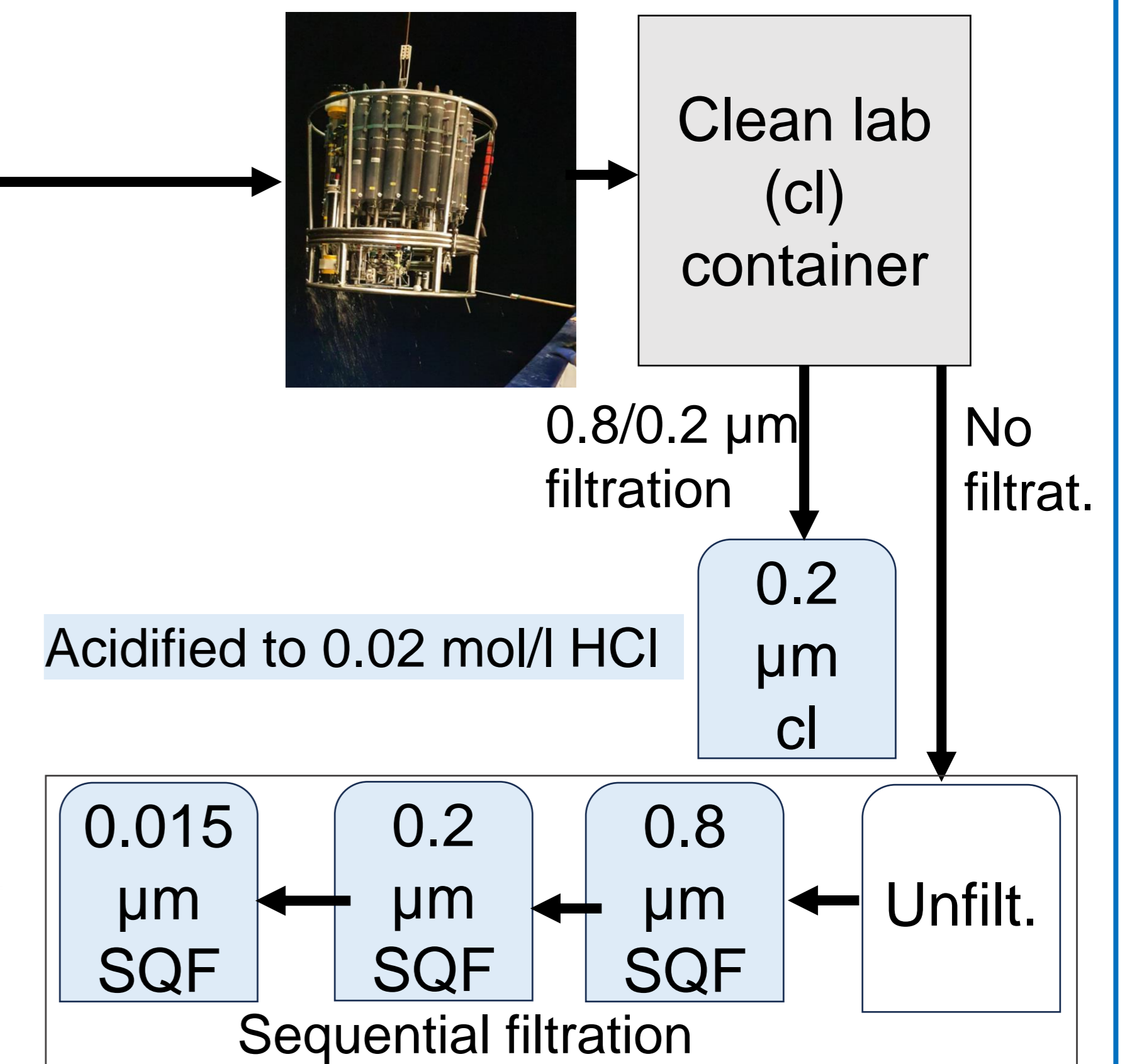
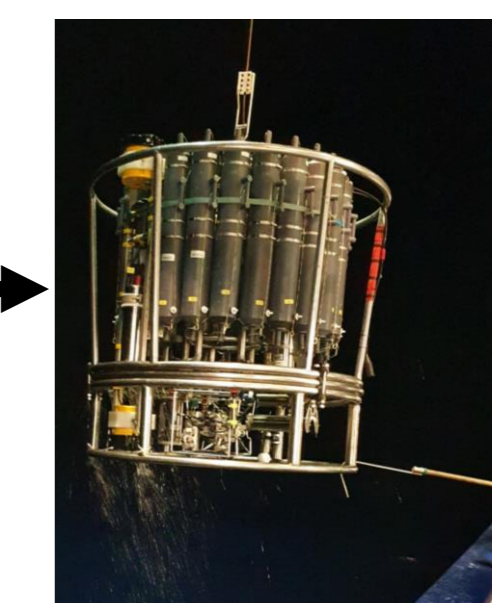
- Rainbow plume known to be enriched in transition metals (e.g. Fe, Mn, and Cu; Findlay et al., 2015)
 - **Rb (rubidium)**: representative for conservative mixing in marine water column, data from hydrothermally active sites not published
 - **U (uranium)**: enrichment observed in some sediments at MAR associated with microbial mediation (Mills et al., 1994)
 - **V (vanadium)**: in suspended particulate matter in plume enriched compared to above-plume waters (Haalboom et al., 2020) V enrichment in sediments under Rainbow plume (Cave et al., 2002)
- Which affect does the Rainbow hydrothermal plume have on Rb, U, and V – is it a sink or a source?

Sampling area and sample pretreatment



- Rainbow vent site (M176/2, Sept. 2021)
- Tracing plume dispersion with tow-yo CTD, perpendicular to expected plume direction

Ti rosette frame, equipped with sensors for e.g. turbidity, oxygen

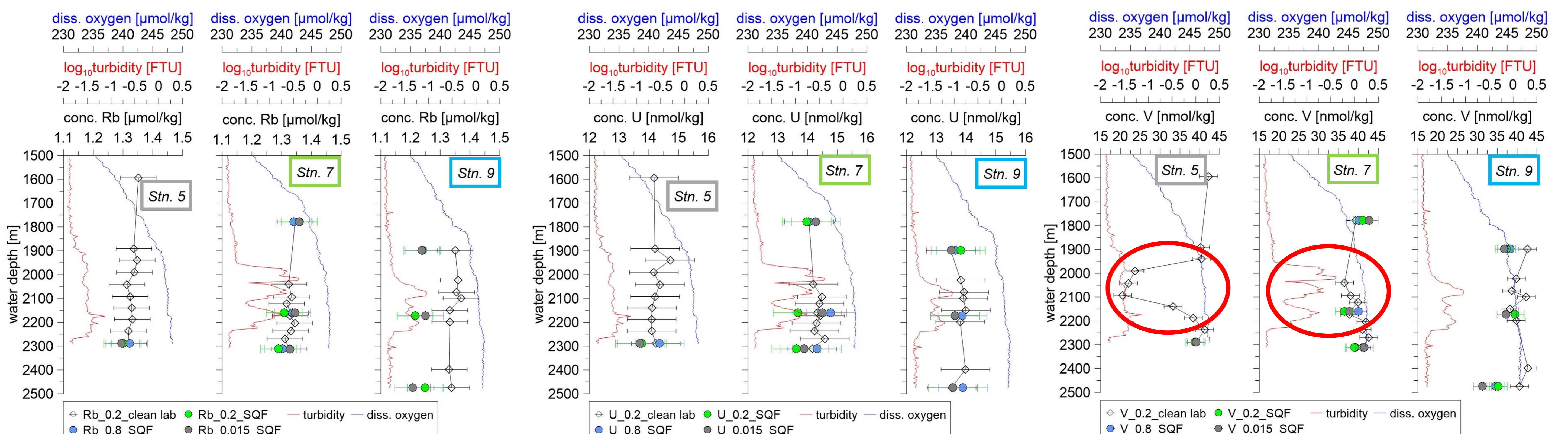


Analysis

- Quadrupole ICP-MS (NEXion 350x, Perkin Elmer in standard and KED (kinetic energy discrimination) mode; later one to suppress polyatomic matrix interferences)

Results and discussion

- **Stn 5** (36.229°N, 33.903°W) → Rainbow vent site was expected here, though low turbidity recorded (note logarithmic x-axis)
- **Stn 7** (36.231°N, 33.903°W) → slightly north-west of stn.5, high turbidity signal (1950–2250m), close to vent site, oxic water column
- **Stn 9** (36.276°N, 33.895°W) → further north, plume still traceable through turbidity though shifted closer to seafloor (2050–2250 m)



Rb:

- All stns.: distribution with depth within uncertainty of method
 - 0.2 μm aliquots from cl and SQF are similar, no fractionation into different size fractions
- Rb shows conservative distribution

U:

- All stns.:
 - Distribution with depth within uncertainty of method – conservative conc. profiles
 - 0.2 μm aliquots cl and SQF are similar
 - No significant difference in size fractions
- All U truly dissolved
 → U does not deviate from conservative profiles since euxinic conditions are missing (low oxygen + sulphidic cond.)

V:

- Stns. 5 and 7:
 - Decrease in conc. in plume depth range
 - No difference in size fractions (SQF)
- All V truly dissolved
- Stn. 9:
 - Conservative distribution with depth
- Influence at stns. 5 and 7 could be a signal of a different vent site since no decrease observed at stn. 9

Conclusion

- Rainbow plume does not affect Rb, concentration is similar to typical seawater concentration → can be used as conservative reference element
- In the non-buoyant oxic plume, U behaves conservatively as well
- Scavenging on plume particles can result in loss of V from the water column – potential scavenging on Fe oxide colloids?

Outlook

- Analysis of filters collected during SQF
- Digestion and analysis of sediments
- Comparison with nutrients and particulate data on U (provided by GEOMAR)

References

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