

Borehole in situ dissolved noble gas sampling for gathering paleoclimatic data from aquifers

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Abstract

This proposal seeks funds to test a method of *in situ* dissolved noble gas sampling down boreholes, which if effective will provide a valuable proxy for paleoclimate at the time of aquifer recharge. Dissolved noble gases (Xe, Kr, Ar, He, Ne) can provide estimates of recharge temperature through absolute concentrations and their relative ratios [e.g., Andrews and Lee, 1979; Stute et al., 1992], as well as date the time of recharge into an aquifer through ⁴He accumulation [e.g., Andrews and Lee, 1979; Torgersen and Ivey, 1985]. Conventional noble gas sampling is done by pumping water from a surface water body or well through a copper tube at the surface and sealing it. This can be problematic if the sample was originally at depth in a well, because as the sample is raised to the surface it experiences a decrease in hydrostatic pressure, allowing the sample to partially degas prior to being sealed. The borehole *in situ* noble gas sampling system in this proposal sends the copper tube down the borehole, collects the sample, and then pressurizes the sample to slightly above hydrostatic pressure and maintains that pressure until after the sample is brought to the surface and sealed. By maintaining the pressure the water experienced at depth, the method prevents the sample from degassing and thus produces samples with gas concentrations equal to those found at the sample depth. The borehole *in situ* dissolved noble gas sampler is easy to use and requires relatively little equipment, so it could be a lower cost method for noble gas sampling down wells. The method was tested earlier this year by collecting samples from wells in the Samail Ophiolite, Oman, but these samples have yet to be analyzed. If this proposal is successful, analysis of these samples will be carried out and hopefully prove the efficacy of the sampling method. Any problems with the method should also be revealed and the method may need to be refined and retested. Borehole *in situ* noble gas sampling is a relatively new procedure, so preliminary results may be leveraged to acquire government grants for further research in the area.