

Argon and Krypton purification systems for noble gas radioisotopes measurement with Atom Trap Trace Analysis (ATTA).

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Noble gas radioisotopes are ideal environmental tracers because of their chemical inertness. In particular, ⁸¹Kr and ³⁹Ar are of great importance for dating environmental samples. However, they are very challenging to measure due to their extremely low isotopic abundance in the order of 10⁻¹³ and 10⁻¹⁶ and their long half-life of 229 000 and 269 years, respectively. With the emerging technique ATTA, the routine measurement of ⁸¹Kr and the analysis of ³⁹Ar have been enabled. The technique requires approx. 5 to 10 µL of pure krypton or 1 to 10 mL of pure argon. Therefore, two new extraction setups are being developed at the Institute of Environmental Physics at Heidelberg University. An argon purification system purifies argon from 10 to 25 L of groundwater, seawater or of about 10 Kg of ice using titanium sponge getters (Ti-getters) with a yield and purity of above 90% and 99%, respectively. A second setup is being developed to separate the krypton fraction out of 5 to 10 L of gas samples via gas chromatography on zeolite and MS5A columns. The remaining gas is either discarded or further purified in Ti-getters to also gain the argon fraction. We aim for a yield above 90% for both, argon and krypton samples. The sample gas required for the second setup is gathered directly in the field by degassing 100 to 200 L of groundwater with a degassing system based on a membrane contactor.