Sampling and Sample Preparation for Radiokrypton Dating of Groundwater, Glacier ice and Ocean water

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The long-lived noble-gas isotope ^{81}Kr, ^{85}Kr, and ^{39}Ar are ideal tracers for environmental water and ice samples. Together with ^{14}C, they cover an age range from a few to 1.4 million years. ^{81}Kr-dating, a concept pursued over the past four decades has become available recently to the earth science community at large due to the development of the Atom Trap Trace Analysis (ATTA) method. In order to meet the increasing demands from the earth science community, we have established a new laboratory dedicated to radiokrypton and radioargon dating. For Kr-dating, we can measure samples as small as 1-2 uL STP of Kr gas. which is contained in about 20-40kg of water or 10-20kg of ice. This allows to perform radiokrypton dating not only on groundwater but also on glacier ice and ocean water.

Here, we present the degassing and purification systems developed for these applications. Groundwater is degassed in the field by a device based on a membrane contactor. For ice samples an extraction system has been developed that can be shipped to where the ice samples are stored. Ocean water samples instead are extracted in our laboratory by ultrasound-assisted vacuum-degassing. Besides the existing krypton purification we will discuss the progress in the dual separation of krypton and argon from one sample for future ^{39}Ar-dating.