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Extending the ^{81}Kr-Dating range down to 10 ka

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The Atom Trap Trace Analysis (ATTA) method has allowed routine analysis of the long-lived noble-gas radioisotope ^{81}Kr, ^{85}Kr, and ^{39}Ar, which are ideal tracers for environmental water and ice samples. Together with ^{14}C, they cover an age range from a few to 1.3 million years. In this talk we will report the latest developments on radiokrypton and radioargon dating in our laboratory at the University of Science and Technology of China (USTC).

We'll show the recent progress on two fronts. First is that we have developed the ability to perform high precision ^{81}Kr-dating. For groundwater younger than 70 ka, the analytical uncertainty of the relative abundance of ^{81}Kr approaches 1%, which translates to an age uncertainty around ± 4 ka. The lower dating limit of ^{81}Kr thus is extended to about 10 ka. This extension fills the dating gap previously existed between ^{14}C and ^{81}Kr and allows direct comparison between these two dating techniques. The second one is that the ^{39}Ar-ATTA at USTC is up and running. The system is capable of analysing small (1 – 5 kg) environmental water or ice samples and has precisions better than 15% in the range of 250 – 1,300 years. Moreover, to reduce the measurement time, we have developed a pre-enrichment system that increases the isotopic abundance of ^{39}Ar in Ar samples by a factor of 100 before the atom-trap analysis. Quantitative analysis has been demonstrated with pre-enriched samples. These developments will enable large scale applications of ^{39}Ar dating.

Website: http://atta.ustc.edu.cn