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Developments of ^{39}Ar Dating by Atom Trap Trace Analysis

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With a half-live of 269 years, ^{39}Ar covers the dating range from 50 years to 1800 years. Due to its gaseous and inert properties, ^{39}Ar is an ideal tracer for dating water and ice. However, its analysis is very difficult because of its extremely low isotopic abundance in the environment (10^{-17}-10^{-15}). Atom Trap Trace Analysis (ATTA) is a promising tool that can make ^{39}Ar dating widely used with a smaller sample size, higher precision and higher sample throughput. In this talk, we will present the latest developments of ^{39}Ar analysis using ATTA[1], including increased ^{39}Ar detection efficiency and a reduced ^{39}Ar background, resulting in a two-fold increasement in the upper age limit of ^{39}Ar dating. The sample size is about 10 kg of groundwater. The analysis uncertainty is about 10% for modern samples. Moreover, with a ^{39}Ar pre-enrichment system[2,3] based on mass spectrometric techniques, the ^{39}Ar count rate is up to 1000 atoms/h, two orders of magnitude higher than in previous efforts. This allows for a considerably higher sample throughput.

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