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# Revealing old ice with $^{81}$Kr

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The noble gas radioisotope $^{81}$Kr (half-life 229 ka) has early been identified as an ideal tracer for dating water and ice in the range of 50-1500 ka, particularly because it is inert, gaseous and of cosmogenic origin [1]. However, for a long time $^{81}$Kr dating was hampered by the lack of a detection technique that can meet its small abundance at a reasonable sample size. A few years ago, $^{81}$Kr dating was demonstrated on large (100-200 kg) ice samples from Taylor Glacier (Antarctica) with the laser-based detection method Atom Trap Trace Analysis (ATTA) [2].
Here, we report on $^{81}$Kr dating of ice samples as small as 6 kg with the latest ATTA instrument at the University of Science and Technology of China. We applied the method to samples from the Guliya ice cap of Tibet, and from blue ice areas as well as deep ice cores of Antarctica. The resulting $^{81}$Kr ages, ranging from <50 ka to >1200 ka, provide unambiguous constraints on the timescale of the ice. These recent advances underline the usefulness of $^{81}$Kr for dating existing ice cores as well as searching for old ice beyond 1 Ma.

[1] Z.-T. Lu, Tracer applications of noble gas radionuclides in the geosciences, *Earth-Science Reviews 138, 196-214*, (2014)
[2] C. Buizert, Radiometric $^{81}$Kr dating identifies 120,000-year-old ice at Taylor Glacier, Antarctica, *Proceedings of the National Academy of Sciences, 111, 6876*, (2014)

http://atta.ustc.edu.cn