

## Exposure dating with $^{41}\text{Ca}$ analysis at the $10^{-16}$ isotopic abundance level

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$^{41}\text{Ca}$  is produced as a cosmogenic isotope via neutron capture process on the Earth's surface, resulting in a natural isotopic abundance of  $10^{-15}$ . The half-life of  $^{41}\text{Ca}$  is  $9.94 \times 10^4$  years. It is a good candidate for exposure dating of rocks in the range of 50 - 500 ka. It is also of interest for archeological dating of bones.

The atom trap trace analysis (ATTA) method has been successfully used in the analysis of  $^{81}\text{Kr}$ ,  $^{85}\text{Kr}$ , and  $^{39}\text{Ar}$  in water and ice core samples. We have developed an ATTA apparatus for  $^{41}\text{Ca}$  analysis, achieving 10% uncertainty of  $^{41}\text{Ca}$  abundance measurement at the  $10^{-16}$  level. With this novel method, we have analyzed the calcium-containing samples of granite, modern animal bones, ancient animal bones, ocean water. It requires 100 mg of metallic calcium reduced from the sample.