

The measurement of Pb in ancient Antarctic ice: Implications for source regions of aerosols and past environmental conditions

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†In memory of our friend and colleague

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The isotopic compositions and concentrations of Pb in ancient Antarctic ice cores has provided invaluable information in the investigation of past global climatic and environmental conditions, providing a useful method of fingerprinting sources of Pb deposited into the Antarctic environment. Whilst these studies have proved useful, they typically cover decadal to millennial time periods and relatively few data are available on annual or seasonal time scales. Such high-resolution studies are critical for the investigation of links between short-term meteorological conditions and the transport of impurities into the Antarctic environment which, in turn, complement the interpretation of the deep ice core records. However, to date, such studies have been unable to identify any regular seasonal variability in Pb concentrations and isotopes.

Consequently, an improved ice core lathe technique has been developed that allows ice cores to be sampled with low contamination and high spatial resolution; concurrently mass spectrometry techniques have been refined permitting Pb isotopic ratios and concentrations of Pb to be measured with accuracy and precision equivalent to much larger sample amounts. This technique has been applied to the sectioning of selected Law Dome, Eastern Antarctic ice cores dated to ~56 ky, ~16 ky and, the late 18th and 19th centuries, to gain a greater understanding of the deposition of Pb, in coastal Antarctica, on short-term and seasonal scales.

Synthesis, structures, compositions and properties of Uranium nanoparticles

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The structural and compositional details of approximately 30 nano-scale clusters of uranyl polyhedra will be examined. These clusters readily self-assemble under ambient conditions in either acidic or alkaline aqueous solutions. All of these clusters are built from uranyl peroxide polyhedra and some also include pyrophosphate or oxalate units. Their topologies are highly varied, incorporating combinations of squares, pentagons and hexagons. Many of these clusters are highly soluble in water, and small-angle X-ray scattering (SAXS) data has demonstrated that these clusters persist when dissolved in ultrapure water. Aggregation of such clusters into colloidal materials is readily triggered by addition of cations, as demonstrated by SAXS data.