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A LEAD (PB) ISOTOPE RECORD OF POLLUTION IN ANTARCTICA BETWEEN 1500 AD AND 1990 AD

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The efforts of Patterson and co-workers (Murozumi et al., 1969) to accurately measure Pb concentrations in Greenland and Antarctic snow and ice produced the first reliable determination of Pb pollution of the Earth's polar ice sheets. Since then, the sensitivity of measurements has improved dramatically and Pb isotopes can be used to identify pollution sources. Advances in ice core drilling techniques have facilitated the recovery of firn and ice from polar and continental ice sheets with some ice archives covering several hundreds of thousands of years. Developments in decontamination techniques, sample processing and analysis methods have substantially reduced the analytical blanks allowing significantly smaller samples to be analysed and vastly improving the sensitivity of pollution research.

Collaboration between leading laboratories in Australia, France and Italy has produced Pb pollution records from three different locations in Antarctica: Law Dome, Coats Land and Victoria Land. Collectively, these records cover the past 150 years in unprecedented detail, allowing the comparison of anthropogenic Pb fluxes to three different coasts of Antarctica and providing insights into the origins of Pb pollution in Antarctica. The first sustained incursion of anthropogenic Pb to Antarctica occurred between 1890 and 1910 AD. Based on Pb isotopic compositions and statistics of Pb production, this pollution event has been attributed to Pb and Ag mining and smelting operations at Broken Hill and Port Pirie in Australia. This pollution event was registered simultaneously at the three widely separated locations in Antarctica and shows that aerosols from continental Australia can be transported to coastal Antarctica. It also provides a chronological marker to support existing firn/ice core dating schemes. Pb isotopic compositions became more radiogenic between 1910 and 1950 AD, but were still significantly less radiogenic than pre-industrial compositions. From 1950 until the most recent samples (1980-1990) Pb isotopic compositions were less radiogenic, reflecting the growing use of leaded gasoline.