Time series for PGE (Pt, Ir, and Rh) deposition at Dome Fuji, Antarctica since the 1950s

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Platinum group elements (PGEs) are extremely rare in the Earth's crust (0.05–0.4 ppb). Worldwide production of PGEs has been rising steadily over the past few decades because of the increased use of these metals, such as in catalysts, jewelry, and electronics. In particular, Pt, Rh, and Pd have been used in automobile catalytic converters, and their production has dramatically increased worldwide since the 1970s. The introduction of catalytic converters has resulted in air quality improvements but has also led to high occurrences of PGEs in the environment, specifically in urban air and soil. Currently, an assessment of the potential impact of this new contamination on humans and the ecosystem is of great interest. Antarctic snow preserves an atmospheric archive that enables the study of global atmospheric changes and anthropogenic disturbances from the past. Compared to the available data on PGE pollution levels close to source regions, however, relatively few time records of change in PGEs have been determined at remote polar locations because of the extremely low concentrations and associated analytical challenges. Here, we present the first time series for PGE (Pt, Ir, and Rh) deposition in Antarctica and determined the changes in the global background atmospheric level over a recent 50-year period based on determinations of Pt, Ir, and Rh in snow samples collected from Queen Maud Land, East Antarctica. The 50-year average PGE concentrations in Antarctic snow were 17 fg g^{-1} (4.7–76 fg g^{-1}) for Pt, 0.12 fg g^{-1} (<0.05–0.34 fg g^{-1}) for Ir, and 0.71 fg g^{-1} (0.12–8.8 fg g^{-1}) for Rh. The concentration peaks for Pt, Ir, and Rh were observed at depths corresponding to volcanic eruption periods, indicating that PGEs can be used as a good tracer of volcanic activity in the past. A significant increase in concentrations and crustal enrichment factors for Pt and a slight enhancement in enrichment factors for Rh were observed after the 1980s. This suggests that there has been large-scale atmospheric pollution for Pt and probably for Rh since the 1980s, which may be attributed to the increasing emissions of these metals from anthropogenic sources such as automobile catalysts and metal production processes.

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