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Micrometeorite PGEs: Opening the window to ancient atmospheres

Friction heating of FeNi metal micrometeorites during atmospheric transit causes melting and oxidation by atmospheric gases. Due to differences in the oxidation and evaporation rates of platinum group metals, this process causes Os/Ir fractionation. The Os/Ir ratio increases as a function of extent of oxidation because Os is easily oxidised and evaporates at low temperature as an oxide, whereas Ir is not oxidised. We have found through LA-ICP-MS of a large number of modern micrometeorites that there is a broad range of Os/Ir ratios, reflecting the range of particle sizes and atmospheric entry velocities and angles, which produces a range in the duration of atmospheric entry that is characteristic of the modern Earth's density and O2 concentration. We hypothesise that this range could be compared with that found in ancient fossil micrometeorites, or the Os/Ir of bulk rock samples, to investigate differences in atmospheric density at specific points in geologic time. Our next steps will be to model the entry conditions experienced by micrometeorites as a function of atmospheric density, and to conduct bulk rock analyses of ancient sedimentary rocks lacking detrital input.

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