

# VOLCANOES AND THE GREAT DYING: THE END-PERMIAN EXTINCTION AND ITS PARALLELS WITH TODAY

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Around 252 million years ago, the majority of multicellular species on Earth went extinct. At about the same time, the Siberian flood basalts intruded into and erupted onto the Siberian craton, producing about three million cubic kilometers of lava. The flood basalt event is among several possible causes for the end-Permian extinction, the largest extinction in Earth's history. About a decade ago we assembled an interdisciplinary team of scientists from eight countries to make progress on whether the similar ages of the volcanism and the extinction were coincidence, or causality.

Some researchers had suggested there was no connection between the basalts at the extinction. Others hypothesized that only carbon dioxide release was important. Our team also hypothesized that the magmas caused the injection of sufficient volatiles into the atmosphere to produce global climate change, but we found evidence for a far broader spectrum of chemicals. In Siberia, the magmas intruded a 12-km-deep evaporate basin containing hydrocarbon reservoirs. The complex interactions of heat and rock with silicate, hydrous, and hydrocarbon fluids produced rich ore bodies, a variety of magmatic rocks including carbonatites, and significant volumes of carbon, sulfur, chlorine, and fluorine-bearing volatiles.

Through five field seasons in Siberia, laboratory analysis of samples, and the use of climate models based on field and laboratory data, we have tested our hypotheses. With surprising parallels with the current day, extinction at the end-Permian was likely caused by chemical changes in the atmosphere that radically altered climate and atmospheric and ocean chemistry.