



## **Siberian Trap Pipe Eruptions as Agents of Environmental Deterioration**

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The Siberian Traps have commonly been cited as the trigger for the end-Permian mass extinction via volcanically induced global warming and the release of environmentally sensitive gases. We propose that chemical pollution of aqueous systems by volcaniclastic debris may have had a more immediate and intense effect on ecosystems. Hundreds of breccia-filled explosion pipes formed as part of the Siberian Traps have been identified in the Tunguska Basin, Siberia (Svensen et al., EPSL, 2009). Rooted above sills at  $\sim 4$  km depth in organic-rich evaporites and marls, the pipe structures are believed to have formed by violent release of volatilized water, carbon and halogen gases. Investigation of a closed sedimentary lacustrine system preserved above one of these pipes indicates the pipe ejecta are comprised of basaltic ash, altered volcaniclastics, hydrothermal ores, and clastic country rock. Multiple eruption phases in the hundreds of pipes across Siberia would have resulted in significant unconsolidated volcanoclastic debris littering the landscape, significantly affecting the physical and chemical characteristics of aqueous systems. Rapidly leached and remobilized by fluvial systems, debris transport into the lowland lacustrine, swamp, and shallow marine environments may have triggered primary poisoning and anoxia-inducing algal blooms leading at least to mass-mortality and potentially initiating the ecosystem collapse that culminated in the end-Permian extinction event.