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Dolerite sills from the Siberian Traps (Tunguska basin, Russia) bear evidence of halogens mobilization from evaporitic host rocks

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The Tunguska volcanic basin in Siberia (Russia) hosts an extensive network of sills, part of the Siberian Traps Large Igneous Province. High-precision geochronology links the initial phase of sill emplacement to the end-Permian mass extinction [1]. Recently, direct evidence for elevated UV-B radiation during the end-Permian [2] strengthened the case for halogens implication in this mass extinction, as ozone layer destroyers. Siberian Traps sills emplaced within the Tunguska evaporitic and coal-rich series contributed to halogens outgassing, as suggested by whole-rock data [3]. We targeted 15 individual sills from deep boreholes drilled in five localities across the Tunguska basin to detect evidence of magma-evaporite interaction at the mineral scale. The investigated sills are geochemically correlated with Siberian Traps intrusions dated coeval with the main extinction horizon [4]. We found widespread evolved late-stage pockets hosted among the larger plagioclase and clinopyroxene crystals in the dolerites. We analysed and mapped the pockets by electron microprobe and scanning electron microscopy. The pockets show an evolved, volatile-rich mineralogy, dominated by biotite and quartz, minor K-feldspar, apatite, Cl-rich amphibole, sulfides and occasional baddeleyite and zircon. Biotite in the pockets is extremely Cl-rich, especially at the rims. Plagioclase surrounding the pockets shows highly albitic rims. Biotite is volumetrically minor in the dolerites, hence the sills do not function as net sinks of halogens, but we interpret high Cl concentrations as evidence for widespread halogens mobilization from the host-rocks concomitant with sills emplacement. Mapping of the region revealed hundreds of explosive pipes, demonstrating that thermogenic gases, including halogens, got transferred from the volcanic basin to the atmosphere [5].

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