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Phreatomagmatic Pipes of the Tunguska basin (Siberia): Improvement of End-Permian Mass Extinction Model

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Formation of the Siberian Traps Large Igneous Province is regarded as key phenomena responsible for the end-Permian mass extinction. Extinct event was accelerating due to release of enormous amount of gases throughout numerous basalt pipes, originated from contact aureoles of dolerite sills intruded into Tunguska Basin.

Tunguska sedimentary basin consists of Precambrian and Paleozoic evaporites, carbonates and terrigenous rocks including Late Paleozoic coal-bearing strata. Precambrian and early Paleozoic oil source rocks contain numerous high potential oil and gas fields. Paleozoic evaporites contain rock and potassium salts deposits of commercial grade. Tunguska Basin evaporites are considered as a regional seal for the mineralizing brines. Permian-Triassic volcaniclastic rocks overlie this sequence and intrusive rocks have the numerous evidences of magma-sediment interaction result in basalt pipes formation.

Compilation of available Russian literature gives us a chance to make a conclusion that hundreds of basalt pipes occur in the Tunguska Basin. The basalt pipes cross over all known dolerite intrusions and are filled with breccias of magmatic, volcaniclastic and sedimentary rocks altered to varying extents. Pipes from the Tunguska Basin south have a phreatomagmatic origin that is supported by ubiquitous occurrence of altered sedimentary clasts and volcaniclastic lapilli, corroded by brine during initial stages of magma-evaporite (brine) interaction. Corroded lapilli rimmed by diopside, chlorine-bearing hornblende, apatite and magnetite. Our recent study of magnetite-rich coarse lapilli tuffs revealed the garnet lapilli rimmed with magnetite cemented by altered clay groundmass enriched by native metals (Cu, Sn, Zn). This result corroborates our hypothesis about magnetite formation during initial stage of magma-sediment-brine interaction.

We suggest that these observations could shed light on end-Permian aerosol flux originated from basalt pipes and could provide new information for improvement of our model.