



The Siberian Traps during the onset of flood volcanism: Volcanic facies and the distribution of tuffs in the north-western part of the province

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Four key processes link the Siberian Traps Large igneous province to the end-Permian carbon cycle perturbation and mass extinction: 1) degassing of subaerially emplaced lava flows, 2) explosive volcanism and tephra eruptions, 3) phreatomagmatic pipes rooted in the evaporates of the Tunguska Basin, and 4) degassing following contact metamorphism around coal, shale, and evaporate lithologies in the Tunguska Basin. In this contribution, we address the nature of explosive volcanism and tephra eruptions. Thick deposits of basaltic tuff and tephra have been reported as widespread in the lower succession of the Siberian Traps, for instance in the Maymecha region (300 meters of basal mafic tuffs), commonly taken as direct evidence for the explosive nature of the initial phase of volcanism. This is puzzling as explosive volcanism is unusual in low viscosity and volatile-poor basaltic systems. As few modern studies have documented the extent and nature of these tuff deposits, especially in the areas outside the ore-rich regions around Norilsk, this may have contributed to their enigmatic status. Here we report on new findings from a July-August 2010 field campaign to the north-western part of the Siberian Traps, with localities in the Khantaika, Dyupkun, Kureika, and the Severnaya areas. The main purpose of the fieldwork was to 1) investigate the nature and characteristics of the transition between the end-Permian Tunguska Series sediments and the lower part of the volcanic sequence, 2) identify tuff deposits reported in the literature, and 3) map the extent of tuff interbedded with lava flows. The main findings show that tuffs are virtually absent along a 125 km long transect along the Dyupkun lake, even though tuff is shown on available geological maps (likely miss-interpreted from lava flow crusts). The cross section represents about 1000 meters of lava stratigraphy measured from the base of the flood basalts. Towards the south and west, the transition between the end-Permian sediments and the flood basalts is either characterized by minor (<2 meters) to no tephra deposits (Khantaika area), hyaloclastites and associated lake-deposited tephra (Kureika area), or massive tephra deposits from local eruptive centers (Severnaya area). The new results questions the notion of province-scale explosive volcanism in Siberia during the onset of flood volcanism, its continuation up into the stratigraphy as many maps suggest, and stress that local eruptive centers dominated, likely triggered by the presence of surface water.