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Palynological constraints on timing and duration of Siberian Traps volcanic events

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Lacustrine sediments intercalated locally in the voluminous flood basalts and pyroclastic rocks of the Siberian Traps igneous province are characterized by the presence of surprisingly diverse assemblages of macroscopic and microscopic plant fossils. In addition, these intertrappean sediments contain a wide variety of faunal remains, such as conchostracans, ostracodes, gastropods and insects. Outside the area of presently exposed flood basalt, plant fossils may also occur abundantly in the sedimentary infill of crater lakes above vent structures in the southern part of the Tunguska Basin on the Siberian Platform.

Because of a possible cause-effect relationship between Siberian Traps magmatism and end-Permian mass-extinctions, vegetation that must have grown in the immediate vicinity of the eruptive centres is one of the most obvious biota to be investigated for evidence of terrestrial biosphere crisis. On the basis of literature information and new palynological data from cored crater-lake sediments, in this presentation we briefly address the basic question to what extent the Siberian plant fossil record confirms *age-equivalence* between biotic and volcanic events.

At present, most published biostratigraphic interpretations of the floral and faunal records refute any correspondence of end-Permian biotic turnover with the Siberian Traps. In effect, the records are long since being used to advocate an exclusively Triassic age for the Siberian volcanism, the main phase of flood basalt eruption taking place during late Early Triassic (Olenekian) and early Middle Triassic (Anisian) times. However, re-evaluation of the chronostratigraphic significance of plant megafossils and faunal remains has resulted in alternative views, which suggest a Late Permian age for part or the whole of the volcanic sequence exposed on the Siberian Platform.

Compositional characters of palynomorph assemblages indicate age-equivalence of the flood basalts in the northern part of the Tunguska Basin and the crater-lake sediments associated with phreatomagmatic volcanism towards the south. Our interpretation of the palynological record corroborates a Late Permian age. Comparable assemblages are known from Permian-Triassic boundary sections in North China, the Russian Platform, the Barents Sea, Greenland and Canada. These records were previously regarded as earliest Triassic, but are now known to predate the first appearance of the conodont *Hindeodus parvus*, which formally defines the base of the Triassic. They are presently considered to represent the latest Permian (late Changshingian). A latest Permian age for the main phase of Siberian Traps magmatism confirms age concepts based on U-Pb and ^{40}Ar-^{39}Ar geochronology.

Palynomorph assemblages from sedimentary interbeds of the predominantly pyroclastic lower part of the Siberian Traps succession can be readily distinguished from those of the flood basalts and crater lakes. Yet they are also Late Permian in age, and can be correlated with similar assemblages from North China and the Russian Platform. It remains questionable whether the volcanic deposits of the Tunguska Basin cross the Permian-Triassic boundary. Triassic continuation of volcanic activity may be apparent in the West Siberian Basin and on the Taymyr Peninsula, but palynological information from these areas needs further verification.

It may be concluded that our palynological age-assessment of Siberian flood volcanism and coeval phreatomag-

matic activity in the Tunguska Basin would support a first-order causal link between the most prominent phase of Siberian Traps magmatism and the end-Permian biosphere crisis. Ongoing paleoecological analysis of the Siberian floral records may contribute to an understanding of the precise nature of this link.