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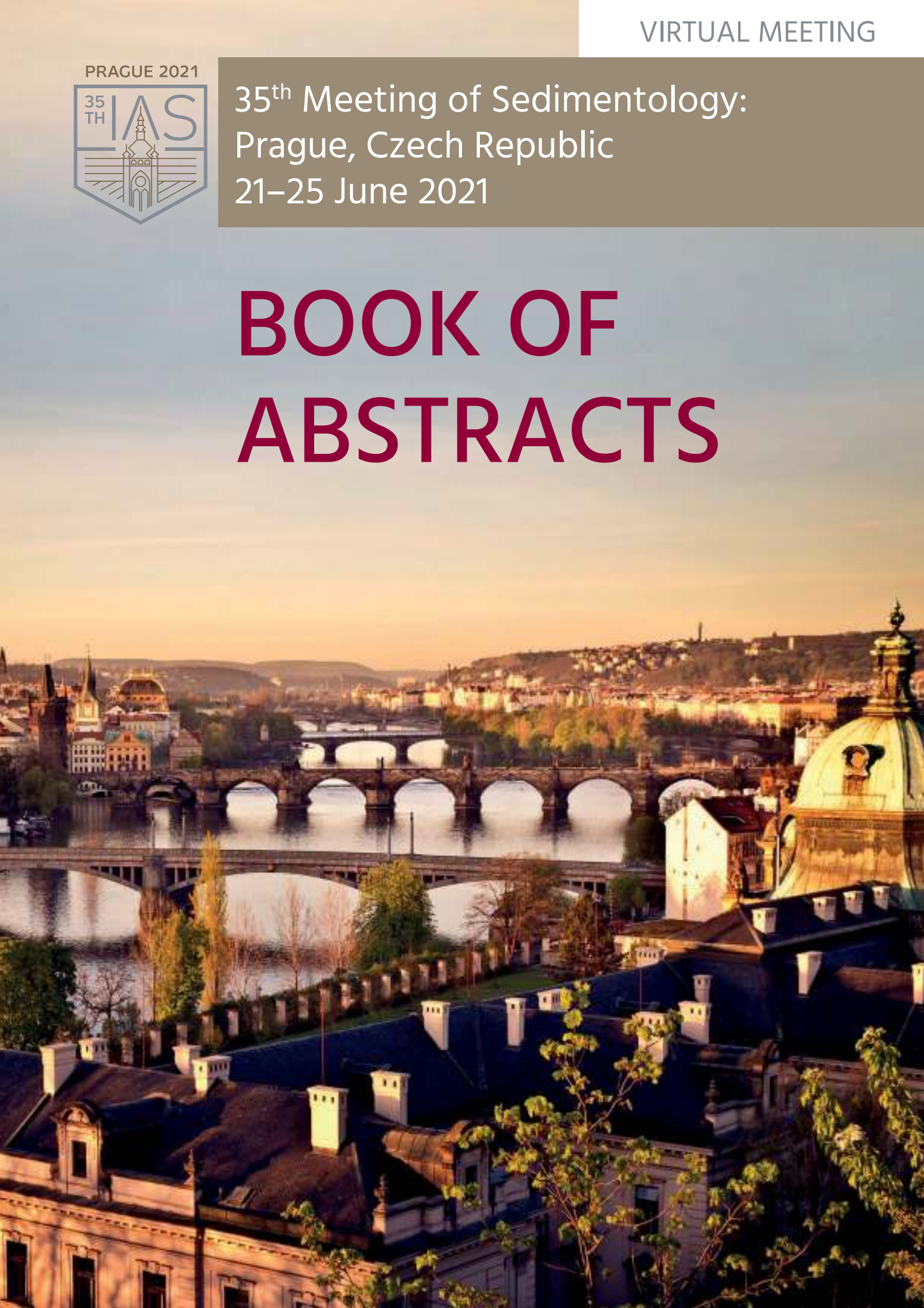
21–25 June 2021

BOOK OF ABSTRACTS



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Deposition of black shales of the Ediacaran Khatyspyt Formation in Siberia

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Terminal Ediacaran Khatyspyt Formation (556–544 Ma) of northeastern Siberia, specifically the palaeobiology, sedimentology, and geochemistry have been in the focus of attention. This primarily carbonate succession has been known to comprise black shales with total organic carbon (TOC) content up to 12–14%, that have been considered as the source rock for the flanks of the Anabar anteclise; however, the mineral and organic matter (OM) geochemistry of the black shales have been poorly studied. We have filled this gap, studied geochemical characteristics of the black shales and OM and attempted a reconstruction of the origin of the black shales and the diversity of the biota that provided the source for the fossil OM. The origin of black shales in general is far from clearly understood, with two possible scenarios emerging: either decreased oxygen supply or increased oxygen demand. The Khatyspyt black shales occur as 10–15-cm-thick intervals interstratified with thin-bedded limestones at the base of thick transgressive systems track. Composition of the two analysed black shale samples collected from outcrops along Khorbusuonka River comprises carbonates (25–27%), TOC (9.7–10.2%), sulphur (1.1–1.2%), and bitumen (0.32–0.39%). The bitumens in turn consist of 14% of saturated hydrocarbons (HCs), 19–28% of aromatic HCs, 57–65% of resins, 0.7–1.5% of asphaltenes. Both saturated and aromatic HCs were analyzed by gas-liquid chromatography and gas chromatography-mass spectrometry.

Alkane n-C17 dominates among normal ones, pristane (Pr) and phytane (Ph) dominate among isoprenoid alkanes. Pr/Ph ratio is 0.95–1.06. Carbon preference index is 1.1 on average. Low concentrations of 12- and 13-monomethylalkanes are established. Stigmastane (C29/C27 = 2.5–2.6) prevails among the identified C27–C29 steranes; 4-methylstigmastane is found as well. Hopanes and homohopanes prevail among terpanes (69–71%). The content of cheilantanes is 24–25%, moretanes is 4%, tetracyclanes is 2%. Sterane/hopane ratio (0.1) is less compared to that earlier established for the Khatyspyt Formation (0.2–0.5). Homohopane ratio C35/C34 is 0.82–0.85, Ts/Tm ratio is 0.5, moretanes C32S/C32R ratio is 1.4–1.5. Gammacerane concentration is anomalously low (<0.1%) compared to Khatyspyt carbonate rocks in general (0.7–9.9%). Dibenzotiophene, methyl- and dimethyldibenzotiophenes are identified in aromatic fractions, along with phenantrenes and aromatic steroids.

Comparative analyses of the biomarkers leads to the following conclusions. Bitumens from the black shale are depleted in saturated HCs. The Pr/Ph ratio, both low homohopane C35/C34 ratio and gammacerane concentration speak against water stratification and bottom-water hydrogen sulfide contamination during the black shales deposition, which is in agreement with the overall transgressive trend in sedimentary basin development. The black shales most likely resulted from basin expansion (an increase in accommodation space), coupled with sediment starvation and local rise in bioproductivity. The high sulphur content in carbonates and in sulphur-associated HCs suggest bacterial sulfate reduction during diagenesis. Archaea, eukaryotes and prokaryotes were the source of OM in the sediment. The dominance of hopanes and homohopanes over tri- and tetracyclanes as well as terpanes over steranes imply that microbial communities (possibly cyanobacteria) were the main source during formation of the black shales.

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