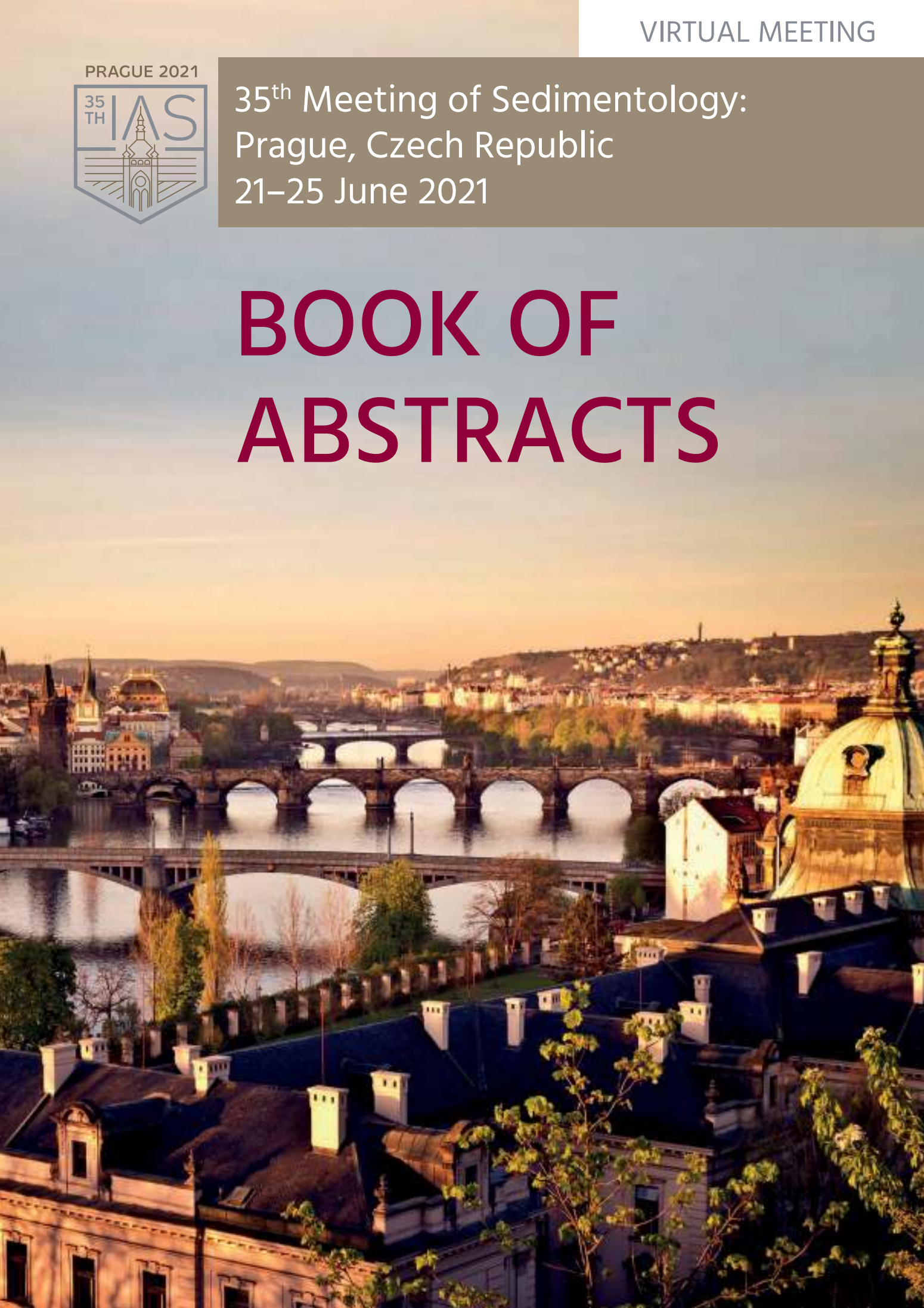
VIRTUAL MEETING

PRAGUE 2021

35th Meeting of Sedimentology:
Prague, Czech Republic
21–25 June 2021

BOOK OF ABSTRACTS



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Recognition of inundite deposits in shallow-marine clastics: towards a facies model

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A comprehensive sedimentological study was undertaken of exceptionally fossiliferous Ediacaran strata comprising a peripheral foreland basin in the northeast of the East European Platform (Russia), with the aim to constrain habitat environment and burial history of the Earth's oldest macroscopic organisms. Without this Lagerstätte, we would never have known the age of the oldest bilaterians, found the oldest evidence of motility, and discovered fossil-specific biomarkers; however, the habitat and burial conditions of this celebrated fossil biota remain elusive. Fieldwork analyses based on a continuous White Sea coastal cliff exposure in the Winter Mountains allowed a provisional identification of two depositional systems: wave dominated prodelta passing into distal delta-plain, both demonstrating strong influence of sustained turbulent flows. Interestingly, there is a sharp reversal in progradation and sediment dispersal trend between the prodelta and the overlying delta plain depositional systems suggesting changes in hydrodynamic process dominance as a result of the foreland basin evolution. The prodelta depositional system is characterised by isolated sandstone gutter casts, 0.3–0.4 m thick, with steep and overhanging sides, all aligned along the same direction. Gutter casts are thought to be a diagnostic feature of tempestites, specifically the bypass-zone of high-velocity, sediment-laden near-bottom water motions produced by storms. Other than that, there is no unequivocal evidence of storms and storm deposits in the sedimentary succession. The gutter casts are here re-interpreted as a product of buoyancy reversal of inundated flows of river-flood origin. A plunging dense flow is expected to accelerate and erode deep gutters in the underlying fine-grained sediment. As the gutters become immediately cast by coarser sediment, a partial discharge of the suspended load results in a decrease of the bulk flow density and a reversal of the buoyancy leading to a lofting of the flow. The delta-plain depositional system is characterised by isolated channelised sandstone packages, up to 1.8 m thick. Each package comprises planar-laminated sandstones infilling deep (up to 0.4 m) erosional scours (occasionally with accumulations of flat mud pebbles), followed by sandstones with unidirectional multi-storied cross-lamination. Importantly, the planar- and cross-laminated sandstones interstratify with wave-rippled sandstones suggesting a complete ceasing and subsequent rejuvenation of the unidirectional flow. In previous studies the channel casts were interpreted as distributary channels of fluvial origin. Careful re-examination of the channel-hosting sediment suggests that it is an intertidal depositional system. The channel casts are here re-interpreted as traction deposits (sediment fallout) associated with strong unidirectional inundated flows of river-flood origin in shallow-water environments dominated by weak oscillatory flows. The channel and gutter casts can be described in terms of clastic facies associated with hyperpycnal systems (Zavala et al. 2011), specifically the facies related to the collapse of suspended load in a subaqueous setting. With this information in hand, the sedimentary environments and facies of the fossil Lagerstätte can now be re-considered. Indeed, the prodelta and distal delta-plane depositional systems could represent subtidal to intertidal sediments with strong influence by river floods. The study is supported by Russian Foundation for Basic Research grant 19-05-00927.