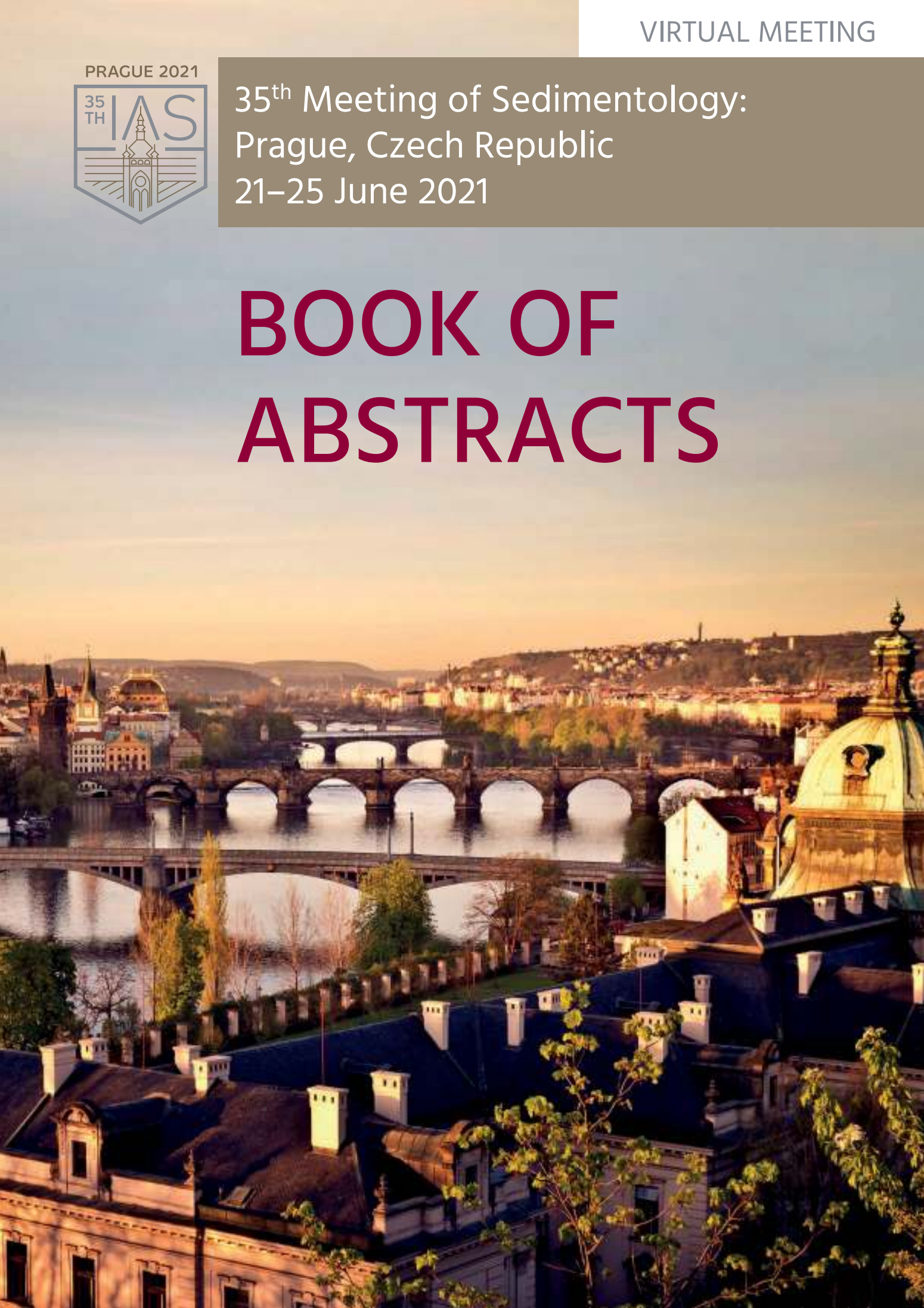
VIRTUAL MEETING

PRAGUE 2021

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

BOOK OF ABSTRACTS



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Lateral accretion of a stromatolitic reef by means of subhorisontal growth of stromatolite columns

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Stromatolites defined as 'an attached, laminated, lithified sedimentary growth structure, accretionary away from a point or limited surface of initiation' were capable of building reefs that occupied a variety of niches, similar to their younger counterparts: major barrier reefs adjacent to large seaways, patch reefs and pinnacle reefs located on gentle ramps facing open seaways, and even downslope bioherms that grew entirely within a deeper, quieter-water setting. Stromatolitic reefs could grow from deeper, quiet water settings upwards into the shallow zone of continual wave agitation to resist and continue growth in the zone of wave action and expand laterally to significant sizes so as to influence their surroundings by affecting circulation, salinity, and sediment production. Although Proterozoic stromatolitic reefs possess all the properties of true ecologic reefs, their basic frame-building constituent remains elusive (Grotziner & James 2000). I have addressed this question by studying a stromatolitic reef of the upper Tonian (<720 Ma) Uk Formation in one of the most complete and well exposed sections near the town of Ust-Katav (South Urals, Russia). Most notable are inclined and subhorizontal stromatolite columns, all growing in the same direction, that constitute asymmetric bioherms, with a steep nearly vertical side and a more gently sloping side. A comprehensive sedimentological study of this stromatolitic reef was undertaken with the aim to identify carbonate microfacies and reconstruct the architecture of the complex. I suggest that (1) the inclined and subhorizontal stromatolite columns in the Uk Formation have formed on a steep slope of a carbonate platform margin; (2) the Uk Formation in the section near Ust-Katav comprises a series of clinoforms with a relatively steep angle of progradation; and (3) each clinoform represents a parasequence consisting of distal fore-reef grainstones, proximal fore-reef grapestones, and stromatolite boundstone. The proximal fore-reef grapestones consist of aggregate grains, – micritised ooids, peloids, stromatolite clasts, and other grains bound together by carbonate cements, and coated by thin finely laminated, presumably microbially mediated micrite. There are a number of hypotheses about the controls on aggregate grains formation, each requiring that periods of bottom mobility alternate with periods of bottom stability (grapestone sites have been traditionally regarded as areas of nondeposition or at least reduced deposition). I argue that mechanism of the aggregate grain formation is dominantly abiotic and the loci of aggregation are determined by both carbonate saturation and sediment transport mode; abrasion seems to play an important role in the aggregate grain genesis. The distal fore-reef grainstones are characterised by the ubiquitous molar tooth structure, which is indicative of early carbonate lithification. The reef itself grew by lateral accretion manifested in the inclined and subhorizontal increment of individual stromatolite columns. The stromatolite columns consist of highly discontinuous laminae, consistent with an origin by sediment precipitation (as opposed to sediment binding). I interpret growth of the stromatolites to have been dominated by chemogenic precipitation in response to an increase in calcium carbonate saturation of surface seawater. The study is supported by Russian Foundation for Basic Research grant 18-05-00062.