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Identifying the stages of Great Khvalynian transgression of the Caspian Sea

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During the Late Quaternary dramatic changes in relative sea-level are known to have occurred in the Caspian Sea. Despite considerable research, the timing of the two sea-level high stages of the Caspian Sea during the Khvalynian transgression, the largest in the Late Quaternary, remains unresolved; based on clear palaeontological and geomorphological evidence, these must be significantly different in age. There have been several attempts to establish an absolute chronology for these sediments based almost entirely on radiocarbon dating (often of individual shells) however these have been unable to resolve the two transgression stages (Early and Late Khvalynian). Shells associated with both transgressions gave very scattered ages of between 8 and 50 ka (Arslanov et al, 2015). Inevitably, the timing of the the stage between Early and Late Khvalynian, known as the Enotaevka regression, is also controversial.

During fieldwork in 2014-2018 we focussed our effort on identifying and sampling a section fully reflecting the different stages of this sequence of events, with special emphasis on finding field evidence of clear continental sedimentation between the two Khvalynian transgressive series. Our chronology has been derived using quartz optically stimulated luminescence (OSL), and K-feldspar post-IR IRSL (pIRIR50,290) from grains extracted from 50 sediment samples collected along the Lower Volga River. Analyses were conducted on multi-grain aliquots of the sand-sized fractions of loess-like sediments, marine clays and the overlying modern soils from three exposed sections of Bykovo, Kosika, Leninsk, Srednyaya Akhtuba, Raygorod and Selitrennoye. The signals from all quartz samples were dominated by the fast component; there was no significant IR sensitivity, and no significant dependence of De on preheat temperature. The pIRIR50,290 signals from the 5 samples examined also met all laboratory-based criteria for a reliable estimate of equivalent dose. Resetting of the luminescence signals was investigated based on the differential bleaching rates of quartz OSL and K-feldspar signals; we conclude that all OSL signals were sufficiently reset prior to deposition.
Our results show unambiguously that the Early Khvalynian marine sediments were deposited post-LGM, between ~13.5 ka and ~20 ka ago. This luminescence based chronology has also allowed us to reconstruct the timing of the main stages of marine evolution during the second half of the Khvalynian transgression.

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