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Dating Kaali Crater (Estonia) based on charcoal emplaced within proximal ejecta blanket

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The Kaali impact field consists of nine identified craters located on the Saaremaa Island in Estonia. The largest crater is 110 m in diameter (centered around 58°22'21.94"N, 22°40'09.91" E). It was formed by impact of an IAB iron meteoroid into Silurian dolomite target rocks covered by up to a few meters of glacial till (Veski et al. 2007).
The age of the Kaali impact structure is still a matter of debate, and the estimates provided by different authors vary considerably between ∼6400 BC (Raukas et al. 1995, Moora et al. 2012) and ∼400 BC (Rasmussen et al. 2000, Veski et al. 2001). These ages were derived by 14C dating of marker horizons, characterized by a slightly elevated iridium content within the nearby Piila bog yielding a calibrated age of 800-400 BC (Rasmussen et al. 2000, Veski et al. 2001) and occurrences of glassy siliceous material in the Piila bog (∼6400 BC: Raukas et al. 1995) or iron microspherules in an organic-rich layer of the Reo gravel pit (6400 BC: Moora et al. 2012). However, the source of the foreign material within those layers was never unequivocally connected with the Kaali crater. 14C dating of material from post-impact organic sediments within Kaali impact craters yielded ages between 1800-1500 BC (Saarse et al. 1991, Veski et al. 2004) and 1450-400 BC (Aaloe et al. 1963). These dates underestimate the age of impact as organic sediments within the crater started to form at unknown period after the impact. On the other hand, Veski et al. (2004) suggested a reservoir effect that might have caused artificially "aging" of the organic matter because the crater was emplaced within Silurian dolomite which is rich in old carbon.
The aim of this study is to determine the age of the Kaali crater by 14C dating of organic material covered by the continuous layer of proximal ejecta. This research was conducted in conjunction with a new structural investigation of Kaali Main (Zanetti et al. 2015).
Ten samples collected from different locations within the trench (located ∼12 meters to the SW from the rim crest of the main crater) and at different depths in respect to the ejecta-till boundary were processed separately. 14C dating was per-formed at the Vienna Environmental Research Accelerator at the University of Vienna (Austria).
The calibrated (95,4% probability) time ranges of eight out of ten samples span the time interval from ∼1650 BC to ∼1400 BC. This age is based on dating charcoal within the ejecta blanket which makes it directly linked with the impact structure, and not susceptible to potential reservoir effects.

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