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Comment on Shpansky *et al.* 2016, ‘The Quaternary Mammals from Kozhamzhar Locality (Pavlodar Region, Kazakhstan)

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Abstract: Here, we comment on the reliability of a recently published young radiocarbon date for the Siberian ‘unicorn’ (*Elasmotherium sibiricum*) from Kozhamzhar (Pavlodar Region, Kazakhstan).

The paper by Shpansky *et al.* (2016) bases the claim that the Siberian ‘unicorn’ (*Elasmotherium sibiricum*) survived in Eurasia as recently as 29,000 years before present on a single specimen. Our laboratory performed the AMS ¹⁴C analysis on protein (“collagen”) extracted from the bone using an ultrafiltration method which separates molecules by size (Brown *et al.*, 1988; Bronk Ramsey *et al.*, 2004). For the blank (background) correction we analysed the Latton mammoth bone (Lewis *et al.*, 2006) from gravels thought to correlate with Marine Isotope Stage 7 (>190,000 years before present) provided by Dr. Fiona Brock, Oxford University.

Criteria for assessing the quality of collagen for radiocarbon dating has been discussed in the literature for decades and recently has been highlighted in Rodriguez-Rey *et al.* (2015). The dated *Elasmotherium sibiricum* bone appeared well preserved and had a whole-bone nitrogen content of 0.9% suggesting there would be sufficient collagen remaining (Brock *et al.*, 2010). Percent carbon was 34.7, well within the recommended range of 34.8±8.8 (van Klinken, 1999). The collagen yield, however, was only 0.3% which is below the recommended threshold of 1% (van Klinken, 1999) and may have resulted in a larger proportion of contamination (such as younger humic acids) retained in the ultrafilter (Brock *et al.*, 2013). There was insufficient collagen for stable isotope or elemental analysis so no further quality assurance measures were available. Although our laboratory would not normally proceed with analysis for low collagen yield samples, because there was no other sample available

and the whole bone nitrogen content and percent carbon were suitable, we did provide the date (UBA-30522) but cautioned the authors that it should not be considered reliable.

Analysis of further specimens is necessary before this claim is validated.

Within our laboratory, bone samples meeting the initial criteria (whole-bone nitrogen content, % collagen yield, % carbon) are analyzed for stable isotopes and C:N ratios only if sufficient material is available after radiocarbon dating. There are some Holocene age samples, however, such as tooth roots, which are exceptionally well preserved and meet the initial criteria, but are too small to analyze for both radiocarbon and stable isotopes. These samples can still provide reasonably dependable dates but should be treated prudently. Our laboratory has taken additional steps to ensure that samples which do not meet the initial criteria are not analyzed for ¹⁴C and therefore not reported.

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