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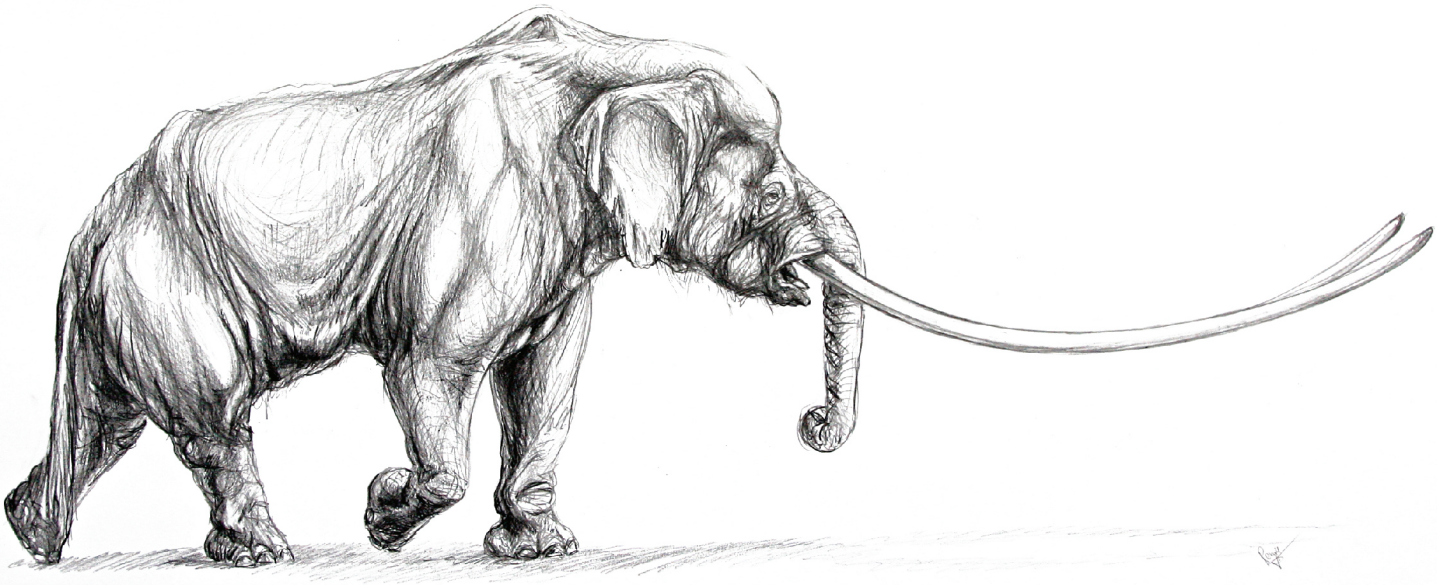

VIth International Conference on Mammoths and their Relatives

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ABSTRACT BOOK

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A modified technique for *in situ* micro-sampling of *Mammuthus* tooth enamel for stable isotope analyses

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Recent work on the timing of proboscidean tooth enamel formation has led to advances in the use of stable isotopes to understand the diet and behavior of these taxa (Dirks et. al. 2012, Metcalfe et al 2011). Although these techniques continue to yield excellent insights into the diet and behavior of mastodonts and mammoths (e.g., Metcalfe and Longstaffe 2012), sampling techniques typically require the removal of, sometimes large, sections of enamel ridge-plates. We have modified this technique to accommodate *in situ* micro-sampling of complete specimens (Fig. 1A). Precise movement of the specimen is controlled by a Newmark NSC-G, 3-axis motion controller. A 4-cm diameter ball joint is mounted to the 3-axis stage and is used to level the large metal plate (70 cm x 100 cm) that holds the specimen. The specimen is attached to the metal plate through the use of orthopedic thermoplastic. Thermoplastic softens above 70° C and, once heated, a cradle can be molded to conform to irregular specimen shapes. Machine screws are then punched through the thermoplastic and the specimen is firmly secured to the metal plate. A Proxxon 50/E drill, equipped with a 500 µm diameter burr bit, is affixed to the stationary arm above the 3-axis stage and is used to micro-sample the specimen.

Each specimen is sampled in multiple sets which each correspond to 1-cm of tooth growth. Each 1-cm set consists of ten samples and each sample consists of a series of vertical subsamples (Fig. 1B, 1C). Each 100 µm deep subsample is individually collected and processed through the entire thickness of the enamel. All enamel powder is collected in de-ionized water to; 1) maximize sample recovery, and 2) lubricate the bit. The sample nearest the enamel-dentin junction is analyzed for $\delta^{13}C$, $\delta^{18}O$ or $\delta^{87}Sr/^{86}Sr$ signatures. Although this technique is both time- and labor- intensive, it is minimally invasive and is capable of sampling enamel growth structures at high resolution.

References

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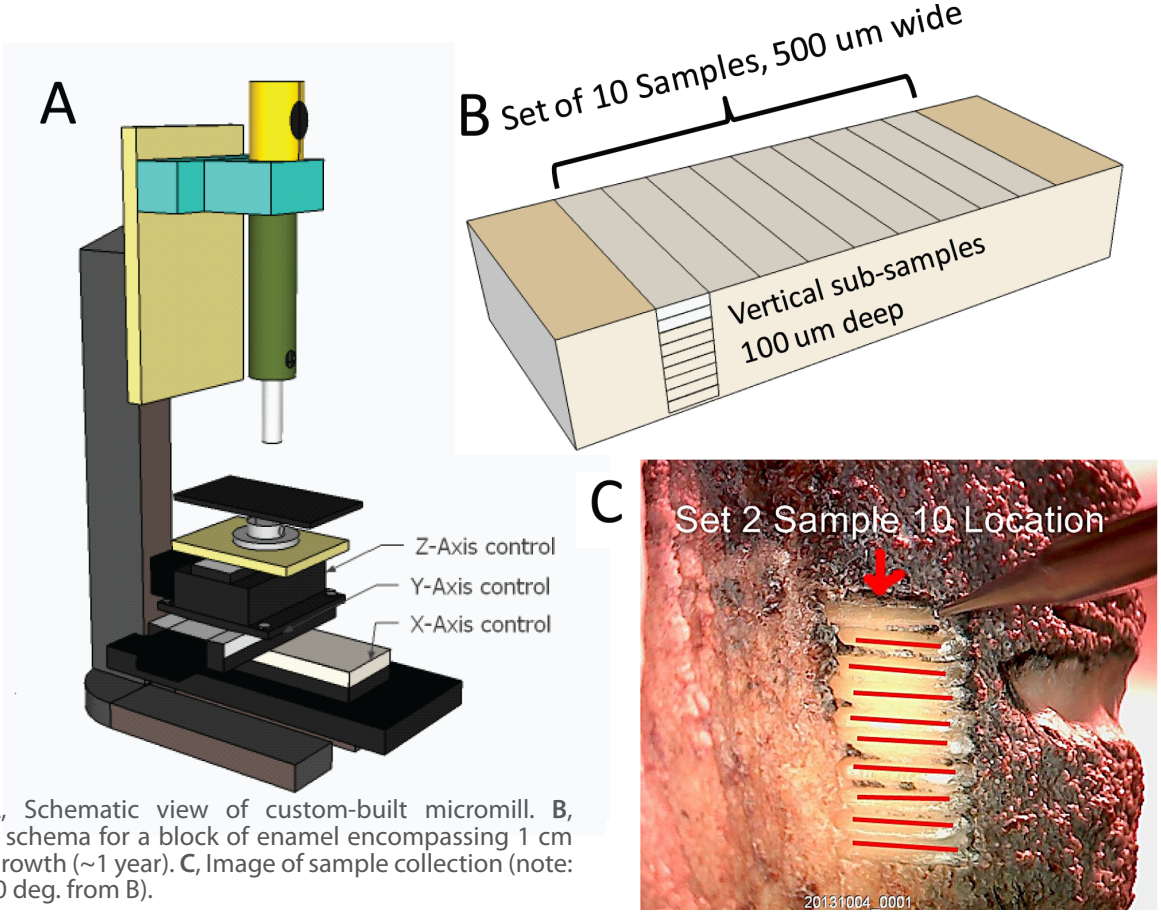

Fig. 1. **A**, Schematic view of custom-built micromill. **B**, Sampling schema for a block of enamel encompassing 1 cm of tooth growth (~1 year). **C**, Image of sample collection (note: rotated 90 deg. from B).