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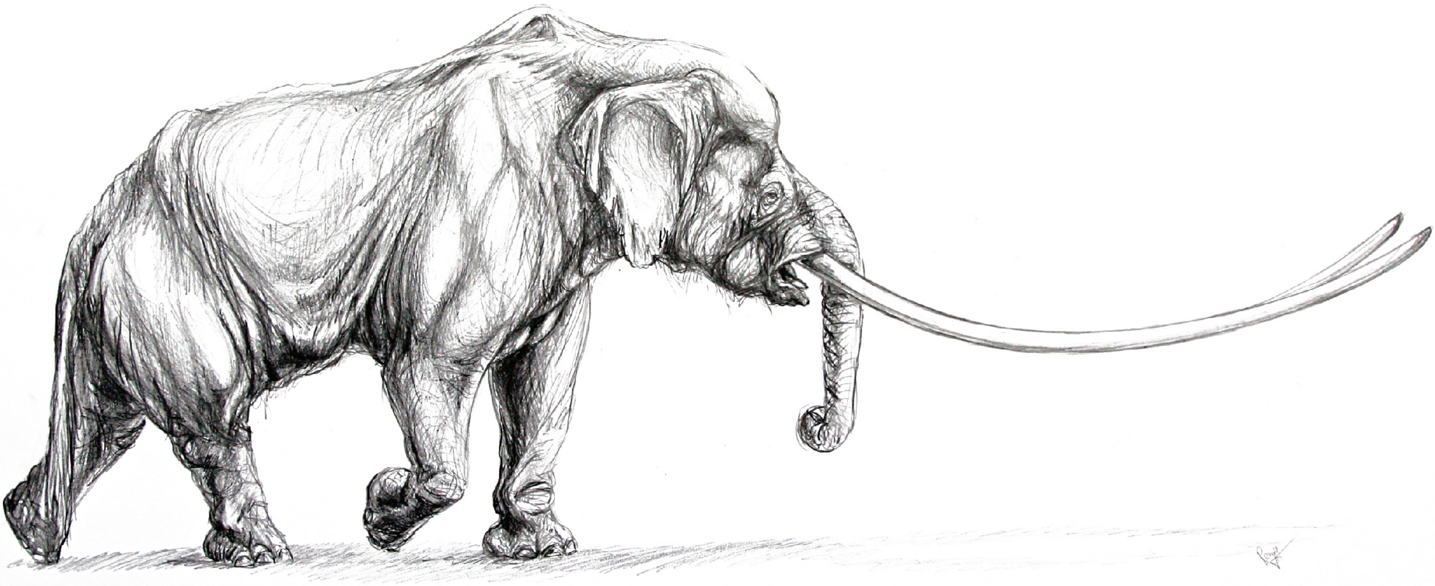

VI[th] International Conference on Mammoths and their Relatives

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ABSTRACT BOOK

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The effect of insular dwarfism on dietary niche occupation in mammoths: what were the pygmy mammoths from Santa Rosa Island of California eating?

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Tooth wear studies have been used extensively to elucidate paleodietary and environmental trends at both local and global levels. Proxies such as microwear studies have been shown to be particularly adept at demonstrating dietary behavioral differences in taxa with similar or even virtually identical gross tooth morphologies (Semprebon et al. 2004a; Semprebon & Rivals 2007; Rivals et al. 2007). Despite the recent flurry of studies aimed at reconstructing ungulate diets using microwear, relatively few studies have focused on proboscidean microwear.

We used dental microwear analysis to study a large sample of pygmy mammoths (*Mammuthus exilis*) from Santa Rosa Island of California and compared our results to those of extant ungulates, proboscideans, and mainland fossil mammoths and mastodons from North America and Europe. Microwear features such as pits and scratches were identified and quantified using a stereomicroscope in a square area of 0.16 mm^2 and an ocular reticle at 35 times magnification, and large pits, gouges, and scratch textures were assessed via differential light refraction

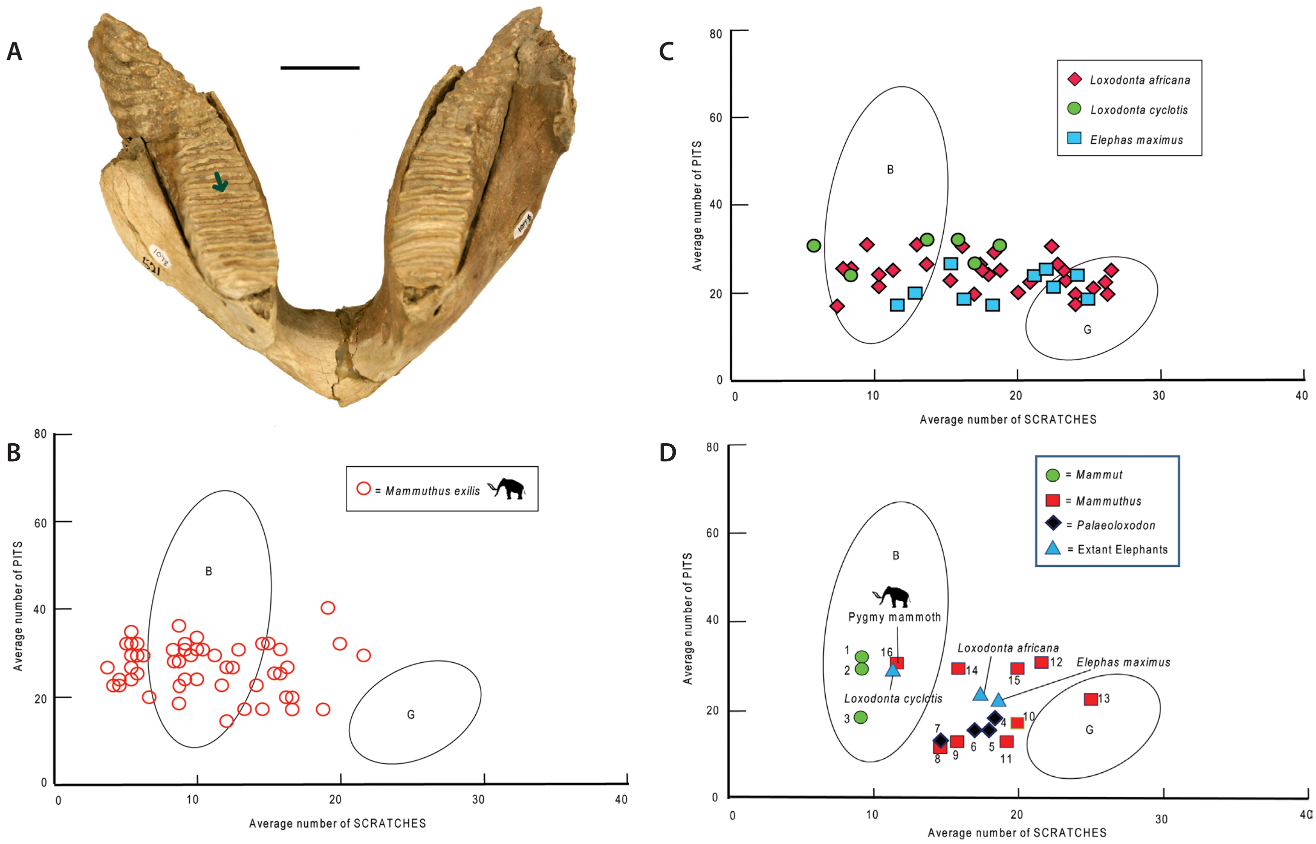

Fig. 1. **A**, Mandible of *Mammuthus exilis* from Santa Rosa Island, California. Specimen from Santa Barbara Museum of Natural History (catalogue number SBMNH-VP1078). Black arrow depicts sampling area for microwear analysis. Scale bar = 5 cm. **B-C**, Bivariate plots of the number of pits versus the number of scratches for the extant proboscideans analyzed and for *Mammuthus exilis* from Santa Rosa Island. Gaussian confidence ellipses (p=0.95) on the centroid are indicated for the extant browsers (B) and grazers (G) (convex hulls) adjusted by sample size (extant ungulate data from Solounias and Semprebon, 2002). **B**, Raw scratch/pit results for extant proboscideans. **C**, Raw scratch/pit results for *M. exilis*. **D**, Bivariate plot of the average number of pits versus the average number of scratches for extant elephants and fossil proboscideans plotted in reference to Gaussian confidence ellipses (p=0.95) on the centroid for the extant browsers (B) and grazers (G) adjusted by sample size. Comparative extant data from Solounias and Semprebon, 2002; comparative fossil proboscidean data from Green et al., 2005 and Rivals et al., 2012).

Taxon Key (centroids of samples are shown): **1** = *Mammut americanum* from Phosphate Beds, SC, USA, **2** = *Mammut americanum* from Ingleside, San Patricio Co., TX, USA, **3** = *Mammut americanum* from Gainesville, FL, USA, **4** = *Paleoloxodon antiquus* from Grays Thurrock, UK, **5** = *Paleoloxodon antiquus* from Aveley & Ilford, UK, **6** = *Paleoloxodon antiquus* from Crayford & Slade Green, UK, **7** = *Paleoloxodon antiquus* from Taubach, Germany, **8** = *Mammuthus meridionalis* from Wissenkerke, Netherlands, **9** = *Mammuthus* cf. *trogontherii* from Ilford, UK, **10** = *Mammuthus trogontherii -M. primigenius* from Crayford - Erith - Slade Green, UK, **11** = *Mammuthus primigenius* from Brown Bank, North Sea, **12** = *Mammuthus columbi* from Quarry G, Sheridan Co., NE, USA, **13** = *Mammuthus columbi* from Grayson, Sheridan Co., NE, USA, **14** = *Mammuthus columbi* from Phosphate Beds, SC, USA, **15** = *Mammuthus columbi* from Ingleside, San Patricio Co., TX, USA, **16** = *Mammuthus exilis* from Santa Rosa Island, California.

as detailed in Solounias and Semprebon (2002) and Semprebon et al. (2004b). The analysis was made from the central portion of the central enamel bands of the occlusal surface (Fig. 1A).

Results are presented in Figures 1B-D. Fig. 1B depicts raw scratch versus pit results for extant elephants compared to average scratch versus pit results for extant ungulate taxa of known dietary behavior whereas Figure 1C shows raw scratch versus pit results obtained on *M. exilis*. The raw scratch distribution of *M. exilis* is skewed more toward the low scratch browsing range much like that of *Loxodonta cyclotis*, indicating a more homogenous dietary regime than that found in *L. africana* and *E. maximus* which have broader scratch distributions more typical of modern mixed feeders. Fig. 1D shows average scratch versus pit results of *M. exilis* compared to extant ungulates (convex hulls) and living and fossil proboscidean average values. Fig. 1D clearly shows that *M. exilis* has average scratch and pit results nearly identical to the forest elephant (*Loxodonta cyclotis*) and distinctive from more mixed feeding forms (*L. africana* and *Elephas maximus*). Also, these results are more similar to those found in prior studies for the mastodon *Mammut americanum* than those found in extant elephants or extinct mammoths, the latter taxa displaying values more intermediate between the browsing and grazing extant morphospaces (Green et al., 2005, Rivals et al., 2012). Other microwear variable results in *M. exilis* such as large pitting, gouging, and scratch textures are similar to those of *Loxodonta* and *Elephas*, (very wide scratches) suggesting that bark was an important dietary item.

Prior work (Rivals et al., 2012) has shown that *Mammuthus* species often show dietary plasticity with browsing, grazing, and mixed feeding patterns observed. Results here clearly show a shift in mammoth dietary niche occupation as mainland mammoths colonized the Channel Islands. Our results suggest that *M. exilis* narrowed its dietary breadth from that of its mainland ancestor (*M. columbi*) and became more specialized on browsing on leaves and twigs rather than the more typical mammoth pattern of switching between browse and grass. These results are consistent with the Pleistocene vegetation history of Santa Rosa Island whereby extensive coastal conifer forests were available during the last glacial as well as *Pinus* stands, and sage scrub as the climate warmed (Anderson et al., 2010).

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