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TRIDENT: sheep, dental tribology, and paleoecology

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Tracking the diet of a given species is a challenge critical for reconstructing its ecology. Most frequently the teeth, the only well-preserved organ in the paleontological record and the very first elements of the digestive system, are thus inescapable data sources for reconstructing the ecology of fossil species. Among taxon-free tools, one of the most innovative used in paleontology is dental microwear texture analysis (Scott et al., 2005; Schulz et al., 2010; see also Calandra and Merceron, 2016 for a review). The TRIDENT (DENTtal TRIbology) project is fully dedicated to develop and improve the latter approach.
Although early studies made important contributions to the field of dental microwear textural analysis, they all failed to pinpoint to which extent each food item contributed to the different types of textures. Such issues can only be resolved by the development of controlled-food testing. Up to now, only one study has been conducted with controlled-food testing (Schulz et al., 2013). The TRIDENT project conducts a controlled-food experiment on 180 domestic sheep clustered into dozens of dietary classes.
This unique set of dual data (diet composition and dental microwear textures) constitutes the raw data to identify the relationship between diet properties (toughness, silica content, hardness) and dental microwear textures. Turnover timing of dental microwear textures, exploration of textural parameters, sample size, sampling processes, representativity of a given scan size or dental facet or tooth are explored through this unique dual dataset.
We here present one of our experiments testing the effects on dental tissues of the consumption of different seeds (different size and hardness) Forty ewes were clustered into four different controlled diets: clover alone, and then three diets composed of clover together with either barley, corn or chestnuts.
The seed-eating groups (barley, corn, chestnuts) all show higher complexity than the seed-free group. The sheep that were fed barley show a significantly higher complexity than the groups that ate clover alone or clover with corn or chestnuts. The sheep fed on chestnuts and barley show also a higher heterogeneity of complexity than those who had access to clover alone.
Canonical discriminant analysis is successful at correctly classifying the majority of clover and seed-fed ewes. It is worth mentioning that the higher rate of misclassification is obtained for the harder grains. Although this study focuses on diets which all fall within a single dietary category (browse), the groups show significant differences in dental microwear textures in relation with differences in dietary bolus. This highlights the limitations of using broad categories for dietary inferences in fossil taxa, and the high variability of the physical properties of the foods falling under the browsing umbrella and their potential role as selective factors to the emergence of dental innovation.

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