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Exploring the feeding ecology and habitat of the primate from Daferno-3
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Introduction
The locality of Daferno is an Early Pleistocene locality situated in Kozani, Northwestern Greece, that was discovered in the early 90’s (Koufos et al., 1991). The aim of our study is to characterize the environmental context and feeding habits of the fossil genus Procomoscopitus/Paradolichopithecus (P/P) from the Early Pleistocene site of Daferno-3 (MNQ-17) (Kostopoulos et al., 2017 sub.). To achieve this, we explore the dental microwear texture of Eucladoceros ctenoides (n=3) and Metacercoceros rhenanus (n=6) from Daferno, because the microwear texture of herbivores, as direct plant consumers, is a good proxy to characterize paleoenvironments. To do so, our results are compared with those of two contrasted reference populations of extant Cervus elaphus (n=116), Lugar Nuevo, Southern Spain and Bialowieza (n=23), Eastern Poland. Also the dental microwear texture data and 3D enamel thickness (micro CT scan imaging) of the Procomoscopitus/Paradolichopithecus (P/PNQ-150) are explored and two indices that describe the molar flares are measured: molar flare index (MF) and dentine flare index (DFI) (F.Guy). The results are compared with a set of fossil Papio specimens (n=75) and 6 primate species with different dietary habits.

Dental Microwear Textural Analysis
i. Eucladoceros ctenoides (n=3), Metacercoceros rhenanus (n=6) from Daferno.
ii. Cervus elaphus, Lugar Nuevo (n=116), Bialowieza (n=23).
iii. Papio (P/PNQ-150).
iv. Fossil Papio (n=75).

Results
In our study, the fossil deer from Daferno are characterized by a diet plasticity that is not surprising if compared with the plasticity in dietary habits of modern Cervus elaphus but is at odds with traditional paleoenvironmental interpretations that consider the presence of fossil deer in a locality as a sufficient paleoenvironmental proxy to draw conclusions in terms of the existence of a tree cover in the habitat. The dental microwear textures of deer, rather than their occurrence, constitutes an adequate paleohabitat proxy. The dental microwear textures of Daferno deer are in favor of the availability of both browse and abrasive herbaceous monocious in the habitat, a result which is coherent with previous interpretations drawn on the basis of the faunal assemblage (Kostopoulos and Koufos, 1998). The lack of frank signal is indubitably influenced by the really small sample size for Eucladoceros ctenoides and Metacercoceros rhenanus, that has to be taken into consideration in order not to overvalue the interpretations.

Concluding remarks
- Comparisons of enamel thickness indicate that DFN3-150 from Daferno-3 possessed thicker average enamel than all the other taxa compared. However this measurement is biased by the size effect. If we remove the size effect (right), still DFN3-150 show the higher median value of 3D relative scale free enamel thickness.
- In our study, the fossil deer from Daferno are characterized by a diet plasticity that is not surprising if compared with the plasticity in dietary habits of modern Cervus elaphus but is at odds with traditional paleoenvironmental interpretations that consider the presence of fossil deer in a locality as a sufficient paleoenvironmental proxy to draw conclusions in terms of the existence of a tree cover in the habitat. The dental microwear textures of deer, rather than their occurrence, constitutes an adequate paleohabitat proxy. The dental microwear textures of Daferno deer are in favor of the availability of both browse and abrasive herbaceous monocious in the habitat, a result which is coherent with previous interpretations drawn on the basis of the faunal assemblage (Kostopoulos and Koufos, 1998). The lack of frank signal is indubitably influenced by the really small sample size for Eucladoceros ctenoides and Metacercoceros rhenanus, that has to be taken into consideration in order not to overvalue the interpretations.
- Comparisons of enamel thickness indicate that DFN3-150 from Daferno-3 possessed thicker average enamel than all the other taxa compared. However this measurement is biased by the size effect. If we remove the size effect (right), still DFN3-150 show the higher median value of 3D relative scale free enamel thickness.

Fig. 1. The locality of Daferno, Northwestern Greece (left) and the fossiliferous site DFN3 (right) (photos by D.S. Kostopoulos).

Fig. 2. 3D elevation model of DFN3-150 dental facet 9 microwear texture.

Fig. 3. Schematic representation of MF index (left), which is the intercuspal distance divided by the distance at the base of the molar (red lines). The DFI index (right) is the area of the dentine basin divided by the area of the whole dentine, both projected in two dimensions.

Fig. 4. The 3D average enamel thickness (MF) shows that DFN3-150 possessed thicker average enamel than all the other taxa compared. However this measurement is biased by the size effect. If we remove the size effect (right), still DFN3-150 show the higher median value of 3D relative scale free enamel thickness.

Fig. 5. Comparisons of the molar flare index (MF) (left) and dentine flare index (DFI) (right). The molar flare index value places Papio from Daferno-3 with the hominoids with diet consisted of hard food objects, but this comparison is not in the appropriate phylogenetic and temporal context (ske Singleton, 2003). The dentine flare index places P/P from Daferno-3 higher than the Papio sample indicating more pronounced flare, and this comparison seems more appropriate because it is in the same phylogenetic and relatively same temporal context.

Fig. 6. The wide range of dental microwear textures for both Eucladoceros ctenoides and Metacercoceros rhenanus from Daferno, occupying the entire espace between the reference localities, reflects the high plasticity of their diet. While there is no noticeable tendency in the textural signal of Eucladoceros ctenoides due to a small sample size (n=3), most Metacercoceros rhenanus (n=6) occupy a grazing ecospaces similar to the extant red deer from Lugar Nuevo.

Fig. 7. The position of the taxa on the plot derives from the percentage of the specimens that surpassed the cutpoint values for A/e and e/A, which have we set (1.5 and 0.083 respectively), the bubble width is proportional of the sample size. Even though P/P is represented only by two specimens, based on its position on the plot we can pre- sume that hard food objects was a part of its diet and the dietary habits are similar to fossil and modern day baboons.

Fig. 8. The position of the taxa on the plot derives from the percentage of the specimens that surpassed the cutpoint values for A/e and e/A, which have we set (1.5 and 0.083 respectively), the bubble width is proportional of the sample size. Even though P/P is represented only by two specimens, based on its position on the plot we can pre- sume that hard food objects was a part of its diet and the dietary habits are similar to fossil and modern day baboons.

Fig. 9. Comparisons of the molar flare index (MF) (left) and dentine flare index (DFI) (right). The molar flare index value places P/P from Daferno-3 with the hominoids with diet consisted of hard food objects, but this comparison is not in the appropriate phylogenetic and temporal context (ske Singleton, 2003). The dentine flare index places P/P from Daferno-3 higher than the Papio sample indicating more pronounced flare, and this comparison seems more appropriate because it is in the same phylogenetic and relatively same temporal context.

Materials and Methods

Terrestrial Group

References
Singleton, S., (2003). Exploring the feeding ecology and habitat of the primate from Daferno-3: a preliminary app...