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Exploring the feeding ecology and habitat of the primate from Dafnero-3

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Introduction

The locality of Dafnero 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 *Procynocephalus/Paradolichopithecus* (*P/P*) from the Early Pleistocene site of Dafnero-3 (MNQ-17) (Kostopoulos *et al.*, 2017 sub.).

To achieve that, we explore the dental microwear texture of *Eucladoceros ctenoides* (n=3) and *Metacervoceros rhenanus* (n=6) from Dafnero, because the microwear texture of herbivores, as direct plant consumers, is a good proxy to characterize paleo-environments. 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 Białowieża (n=23), Eastern Poland. Also the dental microwear texture data and 3D enamel thickness (micro CT scan imaging) of the *Procynocephalus/Paradolichopithecus* (DFN3-150) are explored and two indices that describe the molar flare 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.

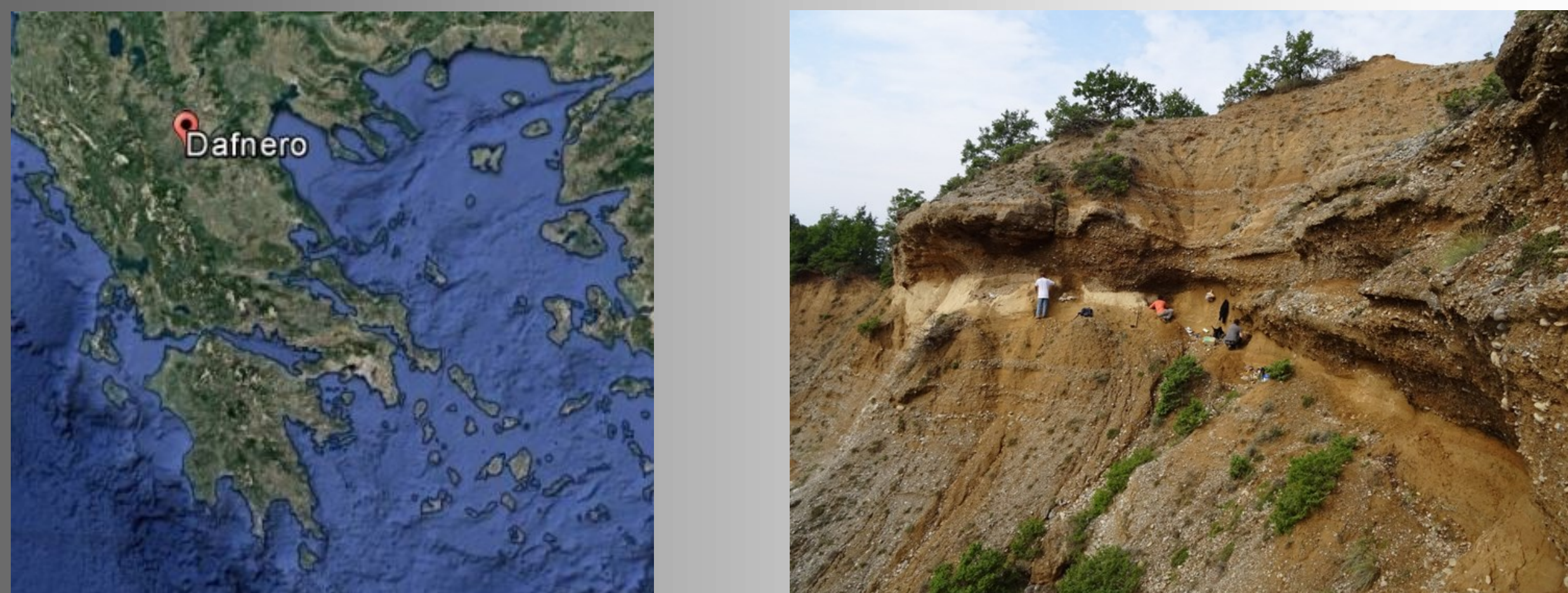


Fig. 1 The locality of Dafnero, Northwestern Greece (left) and the fossiliferous site DFN3 (right) (photos by D.S. Kostopoulos).

Materials and Methods

Dental Microwear Textural Analysis (DMTA)

- Eucladoceros ctenoides* (n=3), *Metacervoceros rhenanus* (n=6) from Dafnero.
- Cervus elaphus*, Lugar Nuevo (n=116), Białowieża (n=23).
- P/P* (DFN3-150).
- Fossil *Papio* (n=75).
- 6 extant forms (Scott *et al.*, 2012).

3D Enamel Thickness, Molar Flare and Dentine Flare.

- Papio anubis* (n=3), *Papio hamadryas* (n=1) and *P/P* from Dafnero-3.
- Micro CT, CT-scans using EasyScan (Rx solutions) (Centre de Microtomographie at the University of Poitiers).
- © Avizo v7, © Geomagic studio 2013.

Dietary habits

Environmental context of Dafnero-3 P/P

Dental capabilities

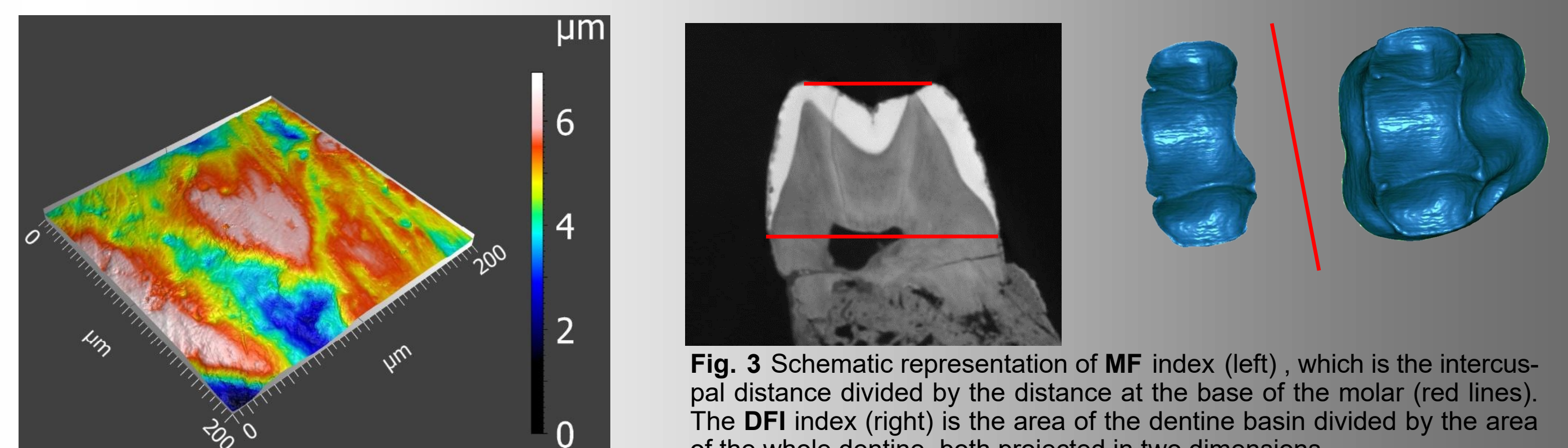


Fig. 2 3D elevation model of DFN3-150 dental facet 9 microwear texture.

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.

Results

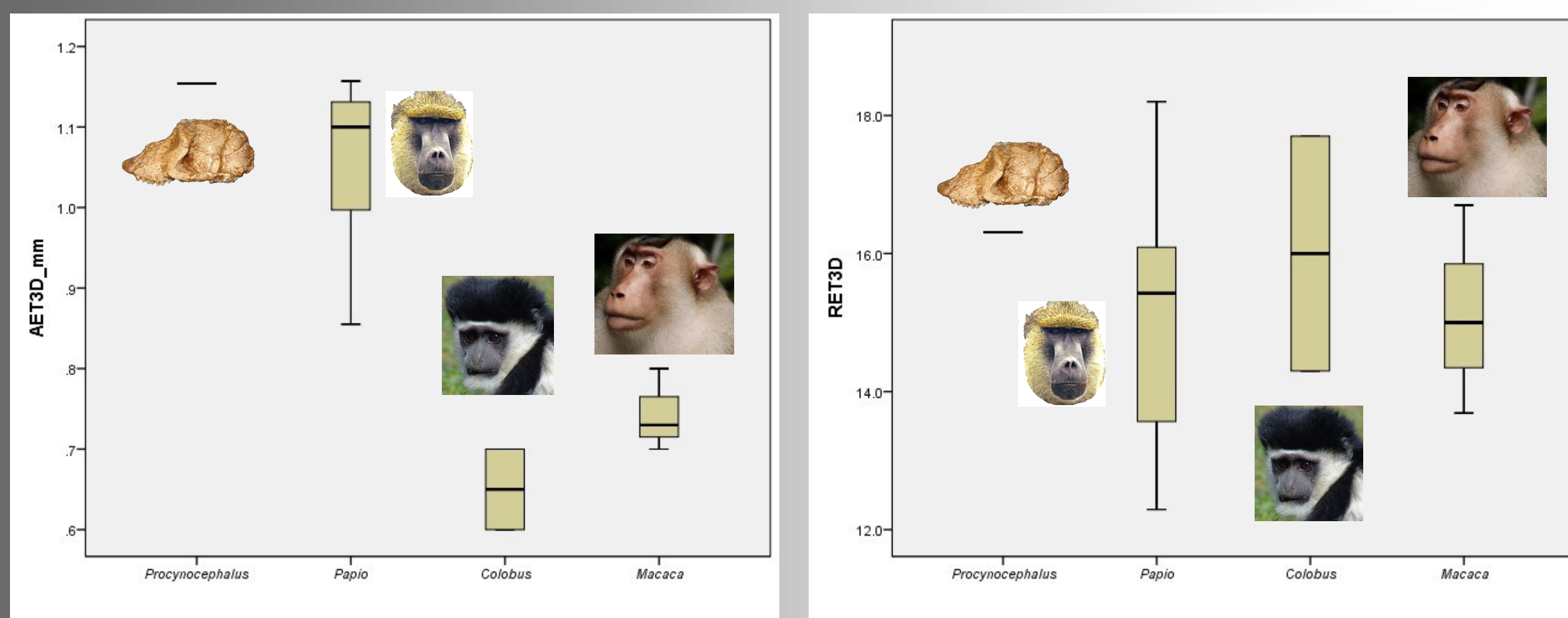


Fig. 4 The 3D average enamel thickness (left) shows that DFN3-150 possessed thicker average enamel than all the other taxa compared. However this measurement is biased by the size effect. If we remove the size effect (right), still DFN3-150 show the higher median value of 3D relative scale free enamel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

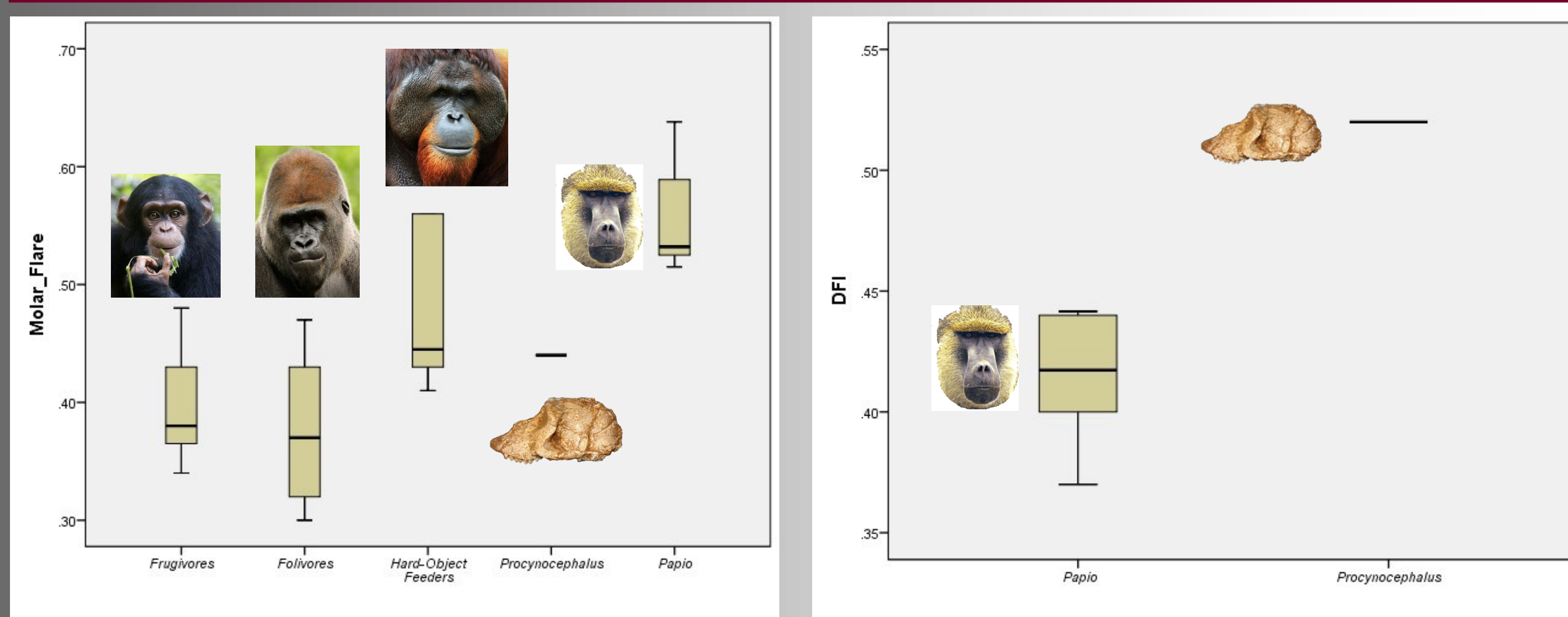


Fig. 5 Comparisons of the molar flare index (MF) (left) and dentine flare index (DFI) (right). The molar flare index value places *P/P* from Dafnero-3 with the hominoids with diet consisted of hard food objects, but this comparison is not in the appropriate phylogenetic and temporal context (vide Singleton, 2003). The dentine flare index places *P/P* from Dafnero-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.

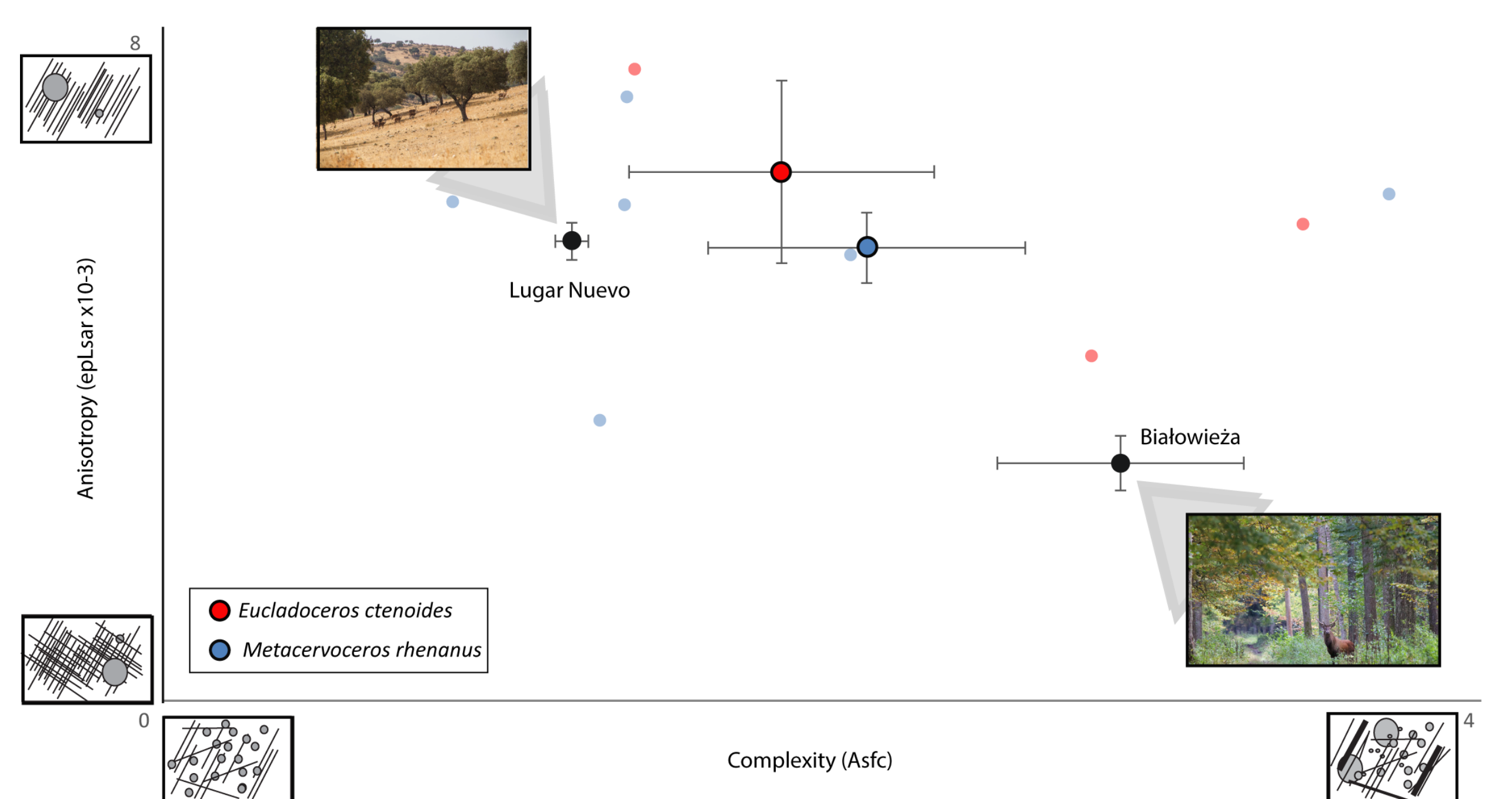


Fig. 6 The wide range of dental microwear textures for both *Eucladoceros ctenoides* and *Metacervoceros rhenanus* from Dafnero, occupying the entire ecospace between the reference localities, reflects the high plasticity of their diet. While there is no noticeable tendency in the textural signal of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

Concluding remarks

- In our study, the fossil deer from Dafnero 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 paleo-habitat proxy.**
- The dental microwear textures of Dafnero deer are in favor of the availability of both browse and abrasive herbaceous monocots 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 undoubtedly influenced by the really small sample size for *Eucladoceros ctenoides* and *Metacervoceros rhenanus*, that has to be taken into consideration in order not to overvalue the interpretations.
- Comparisons of enamel thickness indicate that DFN3-150 from Dafnero-3 possessed thick enamel.
- The comparisons of the MF and DFI indices show that *P/P* from Dafnero-3 possessed pronounced flare.
- The dietary strategy and habits of *P/P* from Dafnero-3 resemble the ones of modern and fossil baboons and possibly was dependent on seasonal and spatial availability of food resources.
- All available data for *P/P* suggest drier and colder conditions at Late Pliocene to Early Pleistocene and support interpretations of open and dry grass lands with scarce wood cover for Dafnero locality during that time period.

Terrestrial Group

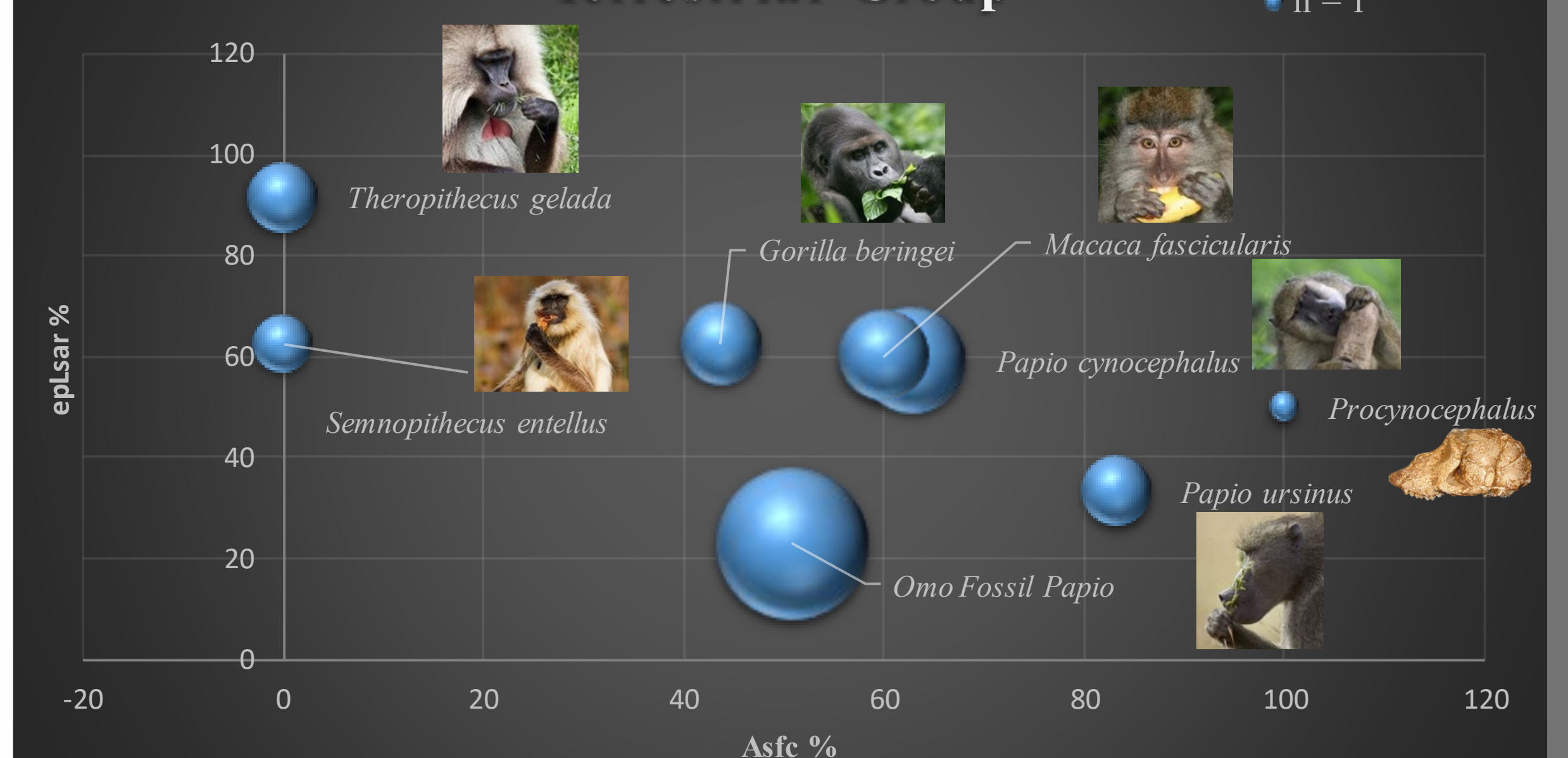


Fig. 7 The position of the taxa on the plot derives from the percentage of the specimens that surpassed the cutoff values for Asfc and eplSar that we have set (1.5 and 0.003 respectively), the bubble width is proportional of the sample size. Even though *P/P* is represented only by two specimens, based on its position on the plot we can presume that hard food objects was a part of its diet and the dietary habits are similar to fossil and modern day baboons.

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