

Reply to Bocherens: Dental microwear and stable isotopes on bone collagen are complementary to sort out cave bear diets

Based on a dental microwear analysis, we demonstrated that cave bears from Goyet, Belgium, were generalist omnivores before dormancy (1). Bocherens (2) states that this interpretation may have been biased by the taxonomic composition of our comparative database, specifically by the absence of brown and black bears. First, the statement that these extant bears have a diet composed of grass, nuts, berries, and underground plant parts (2) provides an incomplete picture of the dietary ecology of bears. Actually, as expected for omnivores, diets of extant brown and black bears may be much more diverse, ranging from carnivory to herbivory depending on a great number of parameters (e.g., refs. 1, 3–5). Second, we do not believe that the addition of these extant species in our database would have altered our conclusions. It has been demonstrated that the differences in dental microwear pattern between extant species of carnivores do not reflect phylogenetic relationships, but feeding habits (6). Our database therefore aimed to cover all diets known in carnivorous mammals, which was more pertinent than completely covering one family only, e.g., Ursidae. Third, isotopic data mentioned by Bocherens (2) do not contradict our results. Isotopic studies provide an average diet over several years to a lifetime, whereas dental microwear analysis provides a perspective on seasonal variation in cave bear diet, e.g., the predormancy period (1). This finding indicates that studies only based on multiple approaches (morphology, geochemistry, dental microwear analysis) may provide a rather complete knowledge of the biology of an extinct species.

Stéphane Peigné^{a,1}, Cyrielle Goillot^b, Mietje Germonpré^c, Cécile Blondel^d, Olivier Bignon^e, and Gildas Merceron^f

^aMuséum National d'Histoire Naturelle, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 7207 Centre de Recherches sur la Paléobiodiversité et les Paléoenvironnements, CP 38, 8 rue Buffon, 75231 Paris cedex 05, France; ^bUniversité de Toulouse-Paul Sabatier, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 5563 Mécanismes et Transferts en Géologie, 14 avenue Edouard Belin, 31400 Toulouse, France; ^cKoninklijk Belgisch Instituut voor Natuurwetenschappen, Departement Paleontologie, Vautierstraat 29, 1000 Brussels, Belgium; ^dUniversité de Poitiers, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 6046, Institut International de Paléoprimatologie, Evolution et Paléoenvironnements, 40 avenue du recteur Pineau, 86022 Poitiers cedex, France; ^eMaison Archéologie et Ethnologie, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 7041 ArScAn, 21 allée de l'Université, 92023 Nanterre cedex, France; and ^fUniversité Claude-Bernard - Lyon 1, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 5125 PaléoEnvironnements et PaléobioSphère, Bâtiment Géode, 2 rue Raphaël Dubois, 69622 Villeurbanne Cedex, France

1. Peigné S, et al. (2009) Predormancy omnivory in European cave bears evidenced by a dental microwear analysis of *Ursus spelaeus* from Goyet, Belgium. *Proc Natl Acad Sci USA* 106:15390–15393.
2. Bocherens H (2009) Dental microwear of cave bears: The missing temperate/boreal vegetarian “carnivore.” *Proc Natl Acad Sci USA*, 10.1073/pnas.0910368106.
3. Mattson DJ (1998) Diet and morphology of extant and recently extinct northern bears. *Ursus* 10:479–496.
4. Mowat G, Heard DC (2006) Major components of grizzly bear diet across North America. *Can J Zool* 84:473–489.
5. Jones ES, Heard DC, Gillingham MP (2006) Temporal variation in stable carbon and nitrogen isotopes of grizzly bear guardhair and underfur. *Wildl Soc Bull* 34:1320–1325.
6. Goillot C, Blondel C, Peigné S (2009) Relationships between dental microwear and diet in Carnivora (Mammalia)—Implications for the reconstruction of the diet of extinct taxa. *Palaeogeogr Palaeoclimatol Palaeoecol* 271:13–23.

Author contributions: S.P., C.G., M.G., C.B., O.B., and G.M. designed research; S.P., C.G., M.G., C.B., O.B., and G.M. performed research; S.P. and C.G. analyzed data; and S.P. wrote the paper.

The authors declare no conflict of interest.

¹To whom correspondence should be addressed. E-mail: peigne@mnhn.fr.