

1. Supplementary materials

1.1 Collections and accession numbers of all samples

All samples have been obtained from museum and research collections: CBGP: Centre de Biologie et Génétique des Populations (Montpellier, France); MHNG: Muséum d'Histoire Naturelle de Genève (Geneva, Switzerland); uB_BGS: Biogéosciences, Université de Bourgogne (Dijon, France); uB_BGS_PBL: Collection Patrick Brunet-Lecomte, Biogéosciences, Université de Bourgogne (Dijon, France); NHC_NHM: Natural History Collection of the Natural History Museum (Edinburgh, UK); MNP_Les Eyzies: Muséum National de Préhistoire (Les Eyzies-de-Tayac-Sireuil, France); Lazaret_HNHP: UMR Histoire Naturelle de l'Homme Préhistorique (Nice, France).

Supplementary Table S1. Accession numbers, collections and species identification in collection (see SupplementaryTable1.csv file).

1.2 Peyrazet (Lot)

The Peyrazet cave-rockshelter (Creysse, Lot) lies in the Haut-Quercy region on the edge of the Martel limestone plateau, several hundred meters from the current Dordogne River valley. Excavations carried out between 2008 and 2016 have shown an archaeo-sequence constituted of five archaeological levels dated from Late Glacial period [35-36]. This sequence yields an abundant and diversified sample of microvertebrate remains [37]. Sampled fossil teeth for this study come from the lower level 4 and 5. These levels have been dated between 16,054 and 16,601 cal. BP corresponding to the end of the Heinrich Stadial 1, which precedes the Bølling [37] and yielded as Microtini *Microtus oeconomus*, *M. arvalis* and *Microtus arvalis/agrestis*. A total of 98 teeth attributed to *M. arvalis* and *M. arvalis/agrestis* have been drawn.

No typical *M. agrestis* first lower molars have been recognized, contrary to upper levels of this sequence, in which this species has been clearly identified with first lower and second upper molars [36]. Indeed, few samples from levels 4-5 have been randomly selected to check second upper molars. A total of 339 second upper molars have been looked, which represent around 40% of Microtini individuals observed in these random samples, and no one shows the supplementary loop characteristic of *M. agrestis*. On the opposite, for the upper levels 1 and 2, on 74 second upper molars checked (which represent less than 30% of Microtini individuals identified in these levels), 18 show the supplementary loop of *M. agrestis*.

1.3 Blénien Cave (Alsace)

The Blénien Cave is located close to the village of Wolschwiller in the Haut-Rhin department in Alsace. A survey conducted in 2012 shows the presence of many lithic and faunal remains attributed to Late Glacial period [38]. Twenty-two teeth attributed to *M. agrestis* have been selected in one sample coming from the level 10/11. Within the same sample, no *M. arvalis* teeth have been isolated. Identification of these fossil teeth have been operated based on their global aspect, without further analyses. The level 10/11 dates most likely from the beginning of Holocene, but due to archaeological context of this level a mix with material coming from the end of Late Glacial is not totally excluded. Associated with *M. agrestis* teeth, *Arvicola amphibius*, *Chionomys nivalis*, *Clethrionomys glareolus*, *Apodemus sylvaticus*, *Glis glis*, *Sorex araneus* and *Sorex minutus* have been identified.

1.4 Lazaret cave (Alpes-Maritimes)

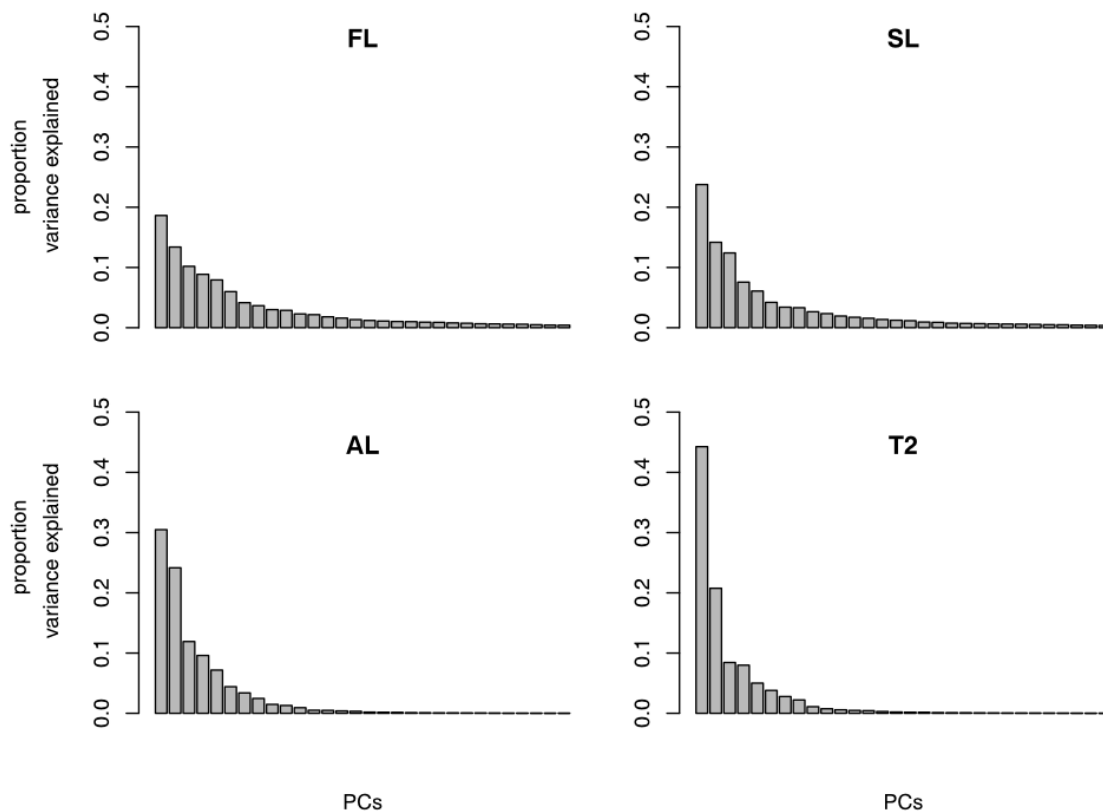
The Lazaret cave is located at Nice, 26 m close to the Mediterranean Sea. This large cave delivers a long sequence with 28 levels going from the end of Middle Pleistocene to the Middle of Late Pleistocene [e.g. 58]. Among the many microvertebrate remains isolated, 18 teeth analyzed in this study have been identified as *M. agrestis* by Abbassi [39], based on the length of M1, the T4 tilt and the ratio T4/T5. They come from stratigraphical units C3 and C2, which have been roughly dated from the MIS 6. Few upper M2 presenting a supplementary loop have been observed by Abbassi [39], clearly attesting presence of this taxon within deposits. Due to the small size of individuals, Hancquet (2011) has preferred to assume they belong to *Microtus arvalis/agrestis*.

1.5 Arma delle Manie (Liguria, Italy)

The cave of Arma delle Manie is located at the north-east of Liguria, at 2 km of the Mediterranean Sea coast (Isetti and Lumley, 1962). This study is based on 28 teeth coming from levels VII, which are roughly assigned to the Würm 2 period (End of MIS 5 and MIS 4). Population of Microtini of this level has been attributed to *M. agrestis* based on the same criteria used for Lazaret individuals [39]. As this last, few upper M2 presenting a supplementary loop have been observed by Abbassi [39].

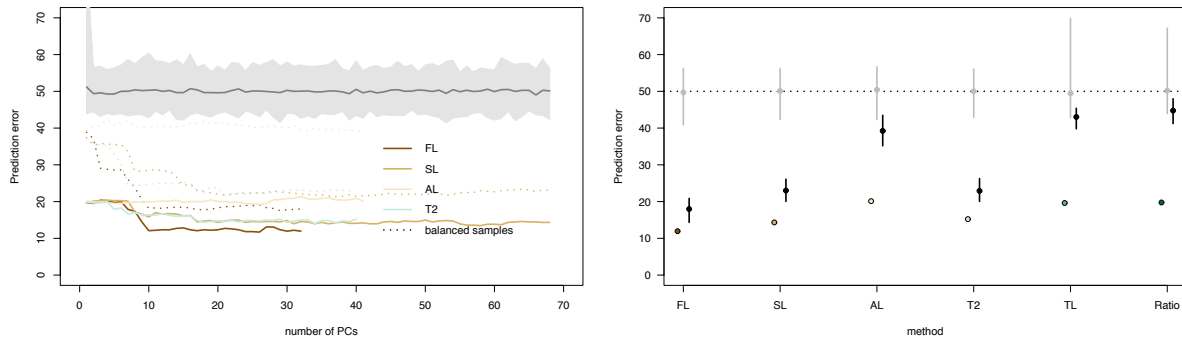
2. Supplementary results

2.1 The *agrestis*-*arvalis* morphospace



Supplementary Figure S1. Percentage of variance explained by each principal component given the landmark scheme.

2.1 The *agrestis-lavernedii* model training



Supplementary Figure S2. Model prediction error for the four landmark schemes given the number of PCs used. Continuous colored lines correspond to the prediction error observed for the initial sample. Associated colored dashed lines correspond to the prediction error for the set of 100 balanced samples randomly generated from the initial sample (for clarity purpose, only the mean error prediction is reported). The grey line corresponds to the mean prediction error for the set of 100 balanced samples with random reassignment of species (null model of correct classification only due to chance). The associated 95% confidence interval is figured in light grey. The right figure corresponds to the model prediction error for the four landmark schemes (considering all PCs) and the two biometric measurements. Colored dots correspond to the observed prediction error. Associated black dots correspond to the mean prediction error plus their 95% CI for the set of 100 balanced samples. The prediction error for a null model of correct classification only due to chance is figured by grey dots (mean prediction error) and associated grey segments (95% CI).

Supplementary Table S2. *Agrestis-lavernedii* attribution using the FL model.

Locality	<i>M. agrestis</i>	<i>M. lavernedii</i>
Allemagne	58	3
Alpes Haute Provence	19	3
Bretagne	37	5
Champéry	8	20
Cheserex	12	10
Cote Or	64	2
Dordogne	29	55
Espagne	5	10
Grand Est	33	0
Isere	57	19
North Jura	73	9
Kilpisjarvi	92	0
Maine et Loire	45	10
North Scotland	25	4
Palasjervi	65	1
Sion	1	14
South England	29	1
Sud Ouest	10	5
Vosges	17	0
Yonne	86	4

3. Supplementary references (not cited in the main text)

58. Lumley, H.D.; Tavano, A. La stratigraphie des couches supérieures de la grotte du Lazaret. *Mémoire de la Société Préhistorique Française* 1969, 7, 17–24.
59. Hanquet, C. Évolution des paléoenvironnements et des paléoclimats au Pléistocène moyen, en Europe méridionale, d'après les faunes de micromammifères Thèse de Doctorat, Université Montpellier 3: Montpellier, France, 2011.
60. Isetti, G.; de Lumley, H. Prima Segnalazione di un Giacimento Musteriano Nell'area Delle Manie (Finale). *Rivista Ingauna e Intemelina* 1962, 18, 44–49.