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### Introduction

During the 1920s, the aficionado M. Guérin collected fossils at Sant Quirze in Catalonia, northern Spain. Later, the collection passed to the Museu i Laboratori de Geologia del Seminari in Barcelona (MLGSB). While studying the fossil suids from this collection, one of us (JvdM) found an isolated tooth of a pliopithecid. Although unrecognized as such, this was the first pliopithecid to be found in Spain, half a century before the announcement of pliopithecids from Castell de Barberà, Can Feliu and Torrent de Febulines (Terrassa) (Crusafont-Pairo, 1975, 1978; Golpe Posse, 1982).

Comparison of the upper molar from Sant Quirze demonstrates that the tooth belongs to *Pliopithecus*, but from a species hitherto unknown from localities in Spain. Only three species of Spanish pliopithecids have been previously recorded: *Pliopithecus* cf. *antiquus* from Castell de Barberà<sup>1</sup>

(MN 8), *Egarapithecus narcisoi*, a newly-described crouzeliin from Torrent de Febulines<sup>2</sup> (MN 10), and a medium-sized crouzeliin of uncertain status from Can Feliu (MN 8) (Crusafont-Pairo, 1978; Golpe Posse, 1982; Moyà Solà *et al.*, 1989–1990, 2001; Andrews *et al.*, 1996). However, beyond simply adding to pliopithecid regional diversity, it is likely that the specimen from Sant Quirze belongs to a new, undescribed species (see Comparisons below). The specimen is of further interest because it is among the oldest known pliopithecids from Spain, correlated with MN 7+8, and it is one of only a few pliopithecid specimens that co-occurs at sites in Eurasia with early hominids. For these reasons, we consider the isolated find from Sant Quirze of sufficient interest to present a brief report that describes the specimen and discusses its possible taxonomic affinities.

<sup>1</sup>The Castell de Barberà material is morphologically very similar to and falls within the lower end of the size range for *P. antiquus* from the type locality of Sansan, France. There are, however, a few differences in molar morphology, most notably the relatively narrower crowns, that might eventually prove to be of some taxonomic significance. Nevertheless, in the absence of adequate comparative samples we prefer to consider these differences as due to intraspecific variation and to

refer the material to *P. cf. antiquus*. We do not consider the Castell de Barberà material to be as distinctive as indicated by Begun (2002).

<sup>2</sup>In recognizing *E. narcisoi* as a crouzeliin we follow Andrews *et al.* (1996) and Moyà-Solà *et al.* (2001). We do not accept Begun's contention that *E. narcisoi* is a specialized pliopithecid that has converged in aspects of its molar morphology on the crouzeliins (Begun, 2002).

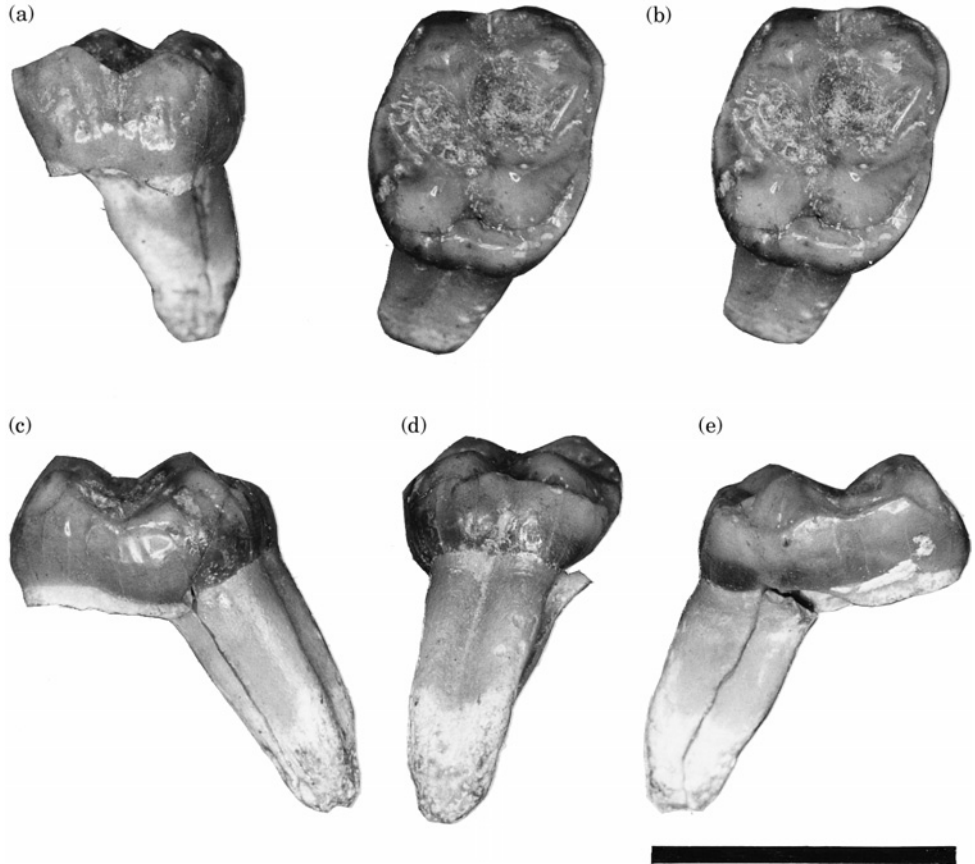


Figure 1. *Pliopithecus* sp. (MLGSB 48874) from Sant Quirze. (a) buccal, (b) occlusal (stereo pair), (c) distal, (d) lingual and (e) mesial view. The scale bar represents 10 mm.

### Description

The specimen from Sant Quirze (MLGSB 48874) consists of a well-preserved and slightly worn right  $M^2$  (Figure 1; see Table 1 for measurements). The crown is subrectangular in occlusal outline, with the lingual moiety being somewhat shorter mesiodistally than the buccal moiety, and with a slight distal taper. The tooth is moderately broad (see Harrison & Gu, 1999), with a length–breadth index of 83.1 (see Table 1). The four main cusps are relatively low and are pyramidal in shape. The protocone is the most voluminous cusp, but somewhat less elevated than the paracone

and metacone. The preprotocrista passes mesiobuccally from the apex of the protocone to join the mesial marginal ridge at a small, but distinct paraconule. The fine postprotocrista passes mesiobuccally to meet the hypometacrasta, and together they form a relatively low crista obliqua. There is no development of a metaconule. The paracone is similar in elevation to the metacone, but is more voluminous. The smaller size of the metacone is associated with the distal narrowing of the crown and the receding buccal margin. A short preparacrasta passes mesially and slightly lingually to terminate at a small parastyle. A slender, but sharply defined hypoparacrasta originates at the base

**Table 1** Dimensions (in mm) of the Sant Quirze upper molar compared with those of other pliopithecids\*

	Mesiodistal length of M <sup>2</sup>		Buccolingual breadth of M <sup>2</sup>		Length-breadth index†	
	Mean	Range	Mean	Range	Mean	Range
Sant Quirze (MLGSB 48874)	7.3		8.9		82.0	
<i>Pliopithecus antiquus</i> (n=4)	5.7	5.6–5.8	7.1	6.8–7.5	79.9	77.3–83.8
<i>Pliopithecus vindobonensis</i> (n=2)	6.4	6.3–6.5	8.8	8.5–9.0	73.2	72.2–74.1
<i>Pliopithecus platyodon</i> (n=8)	6.7	6.3–7.2	8.6	8.1–9.2	78.1	72.5–82.1
<i>Pliopithecus zhanxiangi</i> (n=3)	7.2	7.1–7.3	9.7	8.4–10.0	73.9	71.0–77.6
<i>Laccopithecus robustus</i> (n=10)	7.4	6.7–8.5	9.0	7.9–10.7	82.8	76.5–96.3
<i>Anapithecus hernyaki</i> (n=8)	8.0	7.5–8.5	9.4	8.8–10.1	83.3	77.0–85.9
<i>Platodontopithecus jianghuaiensis</i> (n=1)	7.1		9.2		77.2	
<i>Dionysopithecus shuangouensis</i> (n=7)	5.2	4.7–5.8	6.5	6.1–6.8	80.1	73.1–86.9

\*Sources: Pan *et al.* (1989); Harrison *et al.* (1991); Harrison & Gu (1999); Kordon & Begun (2001); Harrison, unpublished data.

†Index = mesiodistal length × 100/buccolingual breadth.

of the preparacrista, and follows a sinuous course transversely across the crown to meet the preprotocrista midway along its length. Mesial to the hypoparacrista is a narrow, obliquely-oriented mesial fovea. The postparacrista passes distally to meet the shorter premetacrista. The premetacrista and postmetacrista are subequal in length. The latter crest distolingually to terminate at a small metastyle. The hypocone is only slightly smaller than the metacone. The low, short prehypocrista passes mesiobuccally to terminate at the base of the protocone. The posthypocrista arcs distobuccally to become continuous with the distal marginal ridge. The lingual cingulum is prominent, and it forms an L-shaped ledge around the mesial and lingual margins of the protocone, disrupted only by a short crest originating from the base of the protocone. The lingual cingulum continues part way around the hypocone, where a short ledge is discernable on its mesiolingual face. Three small fissures arranged radially around the base of the hypocone may represent further remnants of the cingular shelf distally. The trigon basin is well-defined, relatively deep, and quite narrow—the buccolingual breadth and

mesiodistal length of the sides are approximately equal. The groove system within the basin is relatively simple, with no development of secondary wrinkling. The distal fovea is shallow, but quite extensive, covering an area only slightly smaller than that of the trigon basin. It is disrupted by fine and irregular crests that originate from the hypocone and crista obliqua, but there is no direct connection between the hypocone and metacone. The buccal cingulum is moderately well-developed, forming a narrow discontinuous ledge along the mesiobuccal face of the paracone, between the paracone and metacone, and along the distobuccal face of the metacone. The lingual root is intact, while the buccal roots are broken off at their bases. Mesial and distal contact facets are present.

### Comparisons

The Sant Quirze specimen is close in size to the corresponding teeth of the large crouzeliins, *Anapithecus hernyaki* and *Laccopithecus robustus* (see Table 1), but it differs markedly in its morphology. Unfortunately, the upper molars of the western and central

European crouzeliins belonging to *Plesiopliopithecus* (i.e., *Ples. lockeri*, *Ples. auscitanensis*, *Ples. rhodanica*, and *Ples. priensis*) and *Egarapithecus* are unknown. Of these latter taxa, only *Ples. priensis* from France (Welcomme *et al. et al.*, 1991) and *E. narcissi* from Spain (Moyà Solà *et al.*, 2001) are likely to be consistent in size with the specimen from Sant Quirze; the other species are smaller. However, given that crouzeliins share important specializations of the lower molars (for details see Andrews *et al.*, 1996; Harrison & Gu, 1999; Moyà Solà *et al.*, 2001), we can presume that the suite of distinctive features that characterize the upper molars of *Anapithecus* and *Laccopithecus* are likely to be typical of the clade as a whole. The crouzeliins share the following characteristics of M<sup>2</sup> that distinguish them from pliopithecins as well as from the Sant Quirze specimen: (1) the hypocone is much smaller than the main cusps of the trigon; (2) the distal fovea is relatively small and lacks secondary wrinkling of the enamel surface (the combination of these first two features means that the trigon dominates the occlusal surface); (3) the lingual moiety of the crown is mesiodistally shorter than the buccal moiety; (4) the prehypocrista is weakly developed to absent, with a more distinct separation of the hypocone from the trigon; (5) the lingual cingulum is narrower and often discontinuous around the protocone, and not developed at all around the hypocone; (6) the trigon cusps tend to be higher, more conical and more widely spaced (although in *Laccopithecus* the cusps appear to have become lower and more rounded secondarily as a unique specialization); and (7) the crown tends to be relatively narrower (see Table 1). The absence of this suite of features in the Sant Quirze upper molar provides sufficient evidence to indicate that its affinities are with the pliopithecins rather than with the crouzeliins.

The Pliopithecini currently contains a group of closely related species all assigned

to a single genus, *Pliopithecus* (Andrews *et al.*, 1996). The Sant Quirze specimen conforms to the general morphology typically seen in *Pliopithecus*, and there can be little doubt that it should be assigned to this genus. The four currently recognized species of *Pliopithecus* differ from one another in overall dental size, structure of the incisors, and the morphology and proportions of the upper and lower cheek teeth (Andrews *et al.*, 1996). In terms of size, the Sant Quirze upper molar is larger than those of *P. antiquus* and *P. vindobonensis*; the largest upper molar known for each of these species is only 67.0% and 90.0% of the occlusal area of the Sant Quirze specimen (Table 1). It falls just in the upper end of the size range of upper molars of *P. platyodon*, and is slightly smaller than the mean value for the largest species, *P. zhanxiangi* (Harrison *et al.*, 1991; Andrews *et al.*, 1996; Table 1). The Sant Quirze molar is relatively narrow compared with most pliopithecins, although it does fall within the upper end of the range for the length–breadth proportions of *P. antiquus* and *P. platyodon* (Table 1).

The Sant Quirze specimen differs morphologically from the upper molars of *P. antiquus* (as exemplified by the specimens provisionally referred to this species from Castell de Barberà) in having (1) a better developed lingual cingulum that continues distally onto the hypocone; (2) a less prominent buccal cingulum; (3) more voluminous trigon cusps; and (4) a relatively larger hypocone. It differs from *P. vindobonensis* in having: (1) a relatively narrower trigon; (2) a more extensive distal basin; (3) a relatively larger hypocone; (4) a less pronounced lingual cingulum; and (5) a better developed postmetacrista. It differs from *P. platyodon* in having a slightly narrower trigon and a relatively larger distal basin. Finally, it differs from the slightly larger *P. zhanxiangi* in having a relatively narrower crown, a larger distal fovea and a tendency to have a less well-developed buccal cingulum. Metrically

and morphologically it is evident that the Sant Quirze specimen cannot be attributed to *P. antiquus* (the only species of *Pliopithecus* previously recorded from Spain) or to *P. vindobonensis* from central Europe. However, the specimen is consistent in size and proportions to the corresponding teeth of *P. platyodon*, although it differs morphologically in some minor details. It is also generally similar in size to *P. zhanxiangi*, but differs in the relative proportions of the crown and the detailed structure of the occlusal morphology. Without additional material, the taxonomic status of the Sant Quirze specimen cannot be easily resolved, but several possibilities can be entertained. (1) The Sant Quirze specimen might belong to *P. platyodon*, a species which is otherwise known only from earlier time periods (late Orleanian–early Astaracian, MN 5–6) and from sites in central Europe. Given that the closely related species *P. antiquus* apparently occupied a geographical range that encompassed western and central Europe (possibly as far east as southern Poland) through a similar time period (i.e., MN 5–9), it is certainly conceivable that *P. platyodon* may have had a distribution that extended from central Europe into Spain. (2) The Sant Quirze specimen could be assigned to *P. zhanxiangi*, which is otherwise known only from Tongxin in China (correlated with MN 5), but this possibility seems unlikely given the morphological differences (see above) and our present understanding of the biogeographic provinciality of Miocene catarrhines (Bernor, 1983; Andrews *et al.*, 1996; Andrews & Bernor, 1999). (3) The Sant Quirze specimen may well represent a previously unknown species of *Pliopithecus*. Given that the Sant Quirze upper molar exhibits some unique features, and the *Pliopithecus* species are generally quite difficult to discriminate on the morphology of their upper molars, we feel that this option may prove to be the most justifiable. Until such time as adequate material becomes available

for comparison, we provisionally refer the specimen from Sant Quirze to *Pliopithecus* sp.

### Discussion and conclusions

The isolated upper molar from the late Astaracian (MN 7+8) locality of Sant Quirze is here assigned to *Pliopithecus* sp. Comparisons show that it is distinct from *P. vindobonensis* and *P. antiquus* (including material from the site of Castell de Barberà, previously the only locality in Spain to have yielded the remains of *Pliopithecus*). It is closest in size and morphology to *P. platyodon* from central Europe, and to a lesser extent to the slightly larger *P. zhanxiangi* from China. Nevertheless, morphological differences may indicate that the Sant Quirze specimen belongs to a distinct, previously undescribed species. If so, the specimen would add to the known diversity of pliopithecids from the later Miocene of Spain, which currently comprises *Pliopithecus* cf. *antiquus*, *E. narciso*, and a medium-sized crouzeliin of uncertain status. The Sant Quirze specimen is among the oldest known pliopithecids from Spain, being close in age to the material from Castell de Barberà and Can Feliu (late MN 8), but probably slightly older (Mein, 1986, 1999; Moyà Solà *et al.*, 1989–1990; Andrews *et al.*, 1996; Agustí *et al.*, 2001).

Interestingly, Sant Quirze is one of only a handful of examples of localities in Eurasia where pliopithecids co-occur with early hominids. In addition to the pliopithecid specimen, Sant Quirze has yielded a fragmentary molar referred to *Dryopithecus laietanus* (Harrison, 1991). The only other localities at which pliopithecids and hominids apparently co-occur are: (1) Castell de Barberà, Spain (*P.* cf. *antiquus* and *D. laietanus*), but see Begun (2002) for a different interpretation of the *Dryopithecus* canine from this locality; (2) ?Eppelsheim, Germany (“*Semnopithecus*” *eppelsheimensis*

and *Paidopithecus rhenanus*) according to Harrison (in Andrews *et al.*, 1996), but see Begun (1989, 1992) and Andrews *et al.* (1996) for an alternative perspective; (3) ?Salmendingen, Germany (*Anapithecus* cf. *hernyaki* and *D. brancoi*) according to Begun (1989), but see Andrews *et al.* (1996) for different viewpoints; (4) Devinska Nova Ves (Neudorf-Sandberg), Slovakia (*Pliopithecus* sp. and *Griphopithecus darwini*); (5) Rudabánya, Hungary (*A. hernyaki* and *D. brancoi*); and (6) Shihuiba, Lufeng, China (*Laccopithecus robustus* and *Lufengpithecus lufengensis*). This low incidence of co-occurrence is remarkable given that pliopithecids and hominids have been recovered from a total of 60 localities in Europe (excluding the insular Tusco-Sardinian and southwestern Asian paleozoogeographic provinces where hominids occur in the absence of pliopithecids). As previously suggested by Harrison (in Andrews *et al.*, 1996) these distributional differences may be explained by the fact that pliopithecids and hominids had somewhat different habitat preferences which allowed them only minimal geographical overlap under certain ecological conditions. Improved data on the paleoecology of European Miocene localities should shed light on the nature of this ecological partitioning, but a closer scrutiny of the ecological factors common to the localities where the taxa co-occur may not prove so rewarding given the diversity of the species involved.

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