Holotype specimen of *Donrussellia magna*, an adapiform primate from the early Eocene (MP7) of Southern France

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Abstract: This project presents a µCT dataset and an associated 3D surface model of the holotype of *Donrussellia magna* (UM PAT 17; Primates, Adapiformes). UM PAT 17 is the only known specimen for the species and consists of a well-preserved left lower jaw with p4-m3. It documents one of the oldest European primates, eventually dated near the Paleocene Eocene Thermal Maximum.

Key words: Adapiformes, Holotype, Early Eocene, Primates, Southern France

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TECHNICAL AND SPECIMEN-RELATED PARAMETERS

Specimen inventory number	UM PAT 17
Species	*Donrussellia magna*
Repository institution	Université Montpellier, ISE-M
3D data acquisition institution	ISE-M-MRI Xray µCT
3D data acquisition method	X-ray µCT
3D data acquisition facility model	SkyScan 1076
3D data acquisition operator	R. Lebrun
Voxel size of original dataset	0.036*0.036*0.036 mm
Author of derived 3D surface model	S. Bédécarrarts and R. Lebrun
Model IDs	M3#17_UM PAT 17 (surface model) M3#18_UM PAT 17 (µCT dataset)
Short description	3D surface file model and µCT dataset of UM PAT 17. The teeth (and roots) were manually segmented.

*abbreviations used: UM: Université Montpellier; PAT: Palette

METHODS

The teeth of *Donrussellia magna* were separated manually from the mandibular bone within a labelfield module of AVIZO 7.1 (FEI), using the segmentation threshold and brush tools (see Figure 1 for a representation of the 3D model in labial orientation). The two meshes representing the teeth and the mandibular bone are provided in .PLY format, and as such can be opened with a wide range of freeware. Additional files specific to ISE-MeshTools software (Lebrun, 2014) are provided in order to visualize the mandible and its associated teeth in standard orientation.

SYSTEMATIC PALAEONTOLOGY

Order: **PRIMATES** Linnaeus, 1758
Suborder: **EUPRIMATES** Hoffstetter, 1978
Infraorder: **ADAPIFORMES** Hoffstetter, 1977
Family: **NOTHARCTIDAE** Trouessart, 1879
Subfamily: **CERCAMONIINAE** Gingerich, 1975
Genus: **DONRUSSELLIA** Szalay, 1976
Donrussellia magna Godinot, 1987

Holotype: UM PAT 17, a left lower jaw preserving p4-m3.

Type locality: Palette, Early Eocene, department of Bouches-

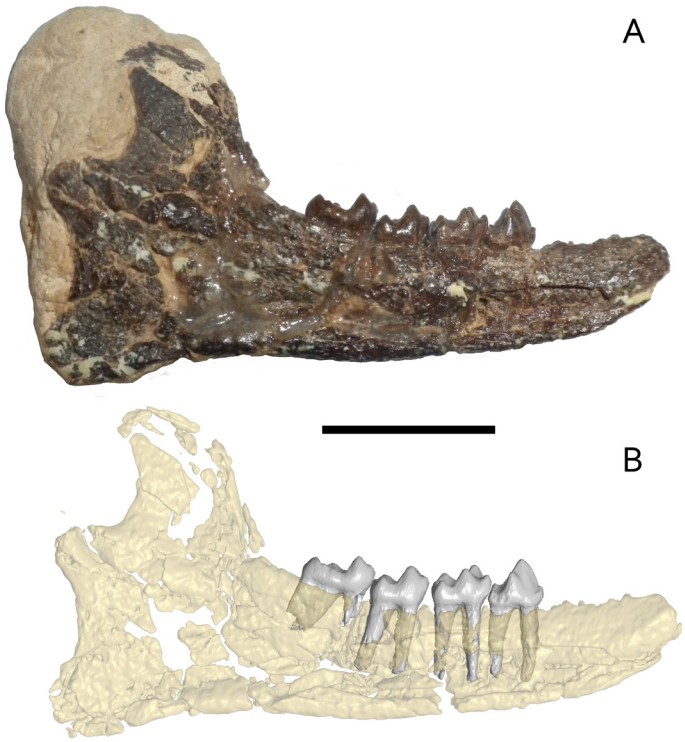

Figure 1: Left mandible of *Donrussellia magna* (UM PAT 17) in lingual view. A: Photograph of the original fossil specimen. B: 3D surface model showing the mandibular bone and the teeth. Scale bar: 1 cm

du-Rhône, Southern France. The locality of Palette is dated close to MP7 (MP, Mammal Paleogene reference level) (see Marandat et al., 2012; Yans et al., 2014).

Diagnosis [after Godinot et al., 1987: p275]: *D. magna* is significantly larger than *D. provincialis*. Teeth in the two species are very close in morphology. The p4 talonid is shorter than in *D. provincialis*. The third lobe of the m3 is shorter and broader than that of *D. provincialis*, and it is isolated by a deep transversal groove.

Description: UM PAT 17 is a well-preserved left lower jaw with p4-m3. It was first described by Godinot (in Godinot et al., 1987), who noted several key differences that distinguish this specimen from other *Donrussellia* species: measurements, size of the m1-2 entoconid, morphology of the m3 terminal lobe, which is isolated from the hypoconid by a transversal groove. The dentary is almost complete, showing the coronoid process. The top of the articular condyle is at the level of the posterior prolongation of the alveolar line, which is curved. Our observations on the µCT virtual slices and on the segmented 3D surface model of the mandibular bone confirm that the angular process of *Donrussellia magna* is well-preserved, and has a rounded outline (see Fig. 1), which stands in contrast with the straight and long angular process of the early Eocene omomyiform *Teilhardina asiatica* (see Ni et al., 2004). The symphyseal region is strongly inclined anteriorly [for a detailed description, see Godinot et al. (1987)].

DISCUSSION

Cercamoniines represent a European radiation of adapiform primates, possibly also present in Asia. They are closely related to the North American notharctines. Initially not very diverse during the early Eocene, a rapid diversification yielded a wide ecological spectrum of cercamoniines during the middle Eocene, with body masses ranging from 60g (*Anchomomys quercyi*; Ramdarshan, 2011; Ramdarshan, et al., 2012 a and b) to 4000g (*Protoadapis brachyrhynchus*; Fleagle, 2013) and varied diets based on insects, fruit, leaves and gums (Ramdarshan, 2011; Ramdarshan et al., 2012 a). However, this group almost disappears at the same time as adapids (i.e., *Microadapis*, *Adapis*, *Leptadapis*) appear in the European fossil record; exceptions are the tiny anchomomyins, which survive longer (e.g., Godinot, 1998; Marigó et al., 2013).

Among the first members of the adapiform radiation, *Donrussellia* is the most primitive cercamoniine genus (Godinot, 1978, 1998; Rose et al., 1994), and is registered in the fossil record during the earliest Eocene in several European localities considered close to MP7 with *D. lusitanica* from Silveirinha, Portugal (Estravis, 2000), *D. provincialis* from Rians, Provence, Southern France (Godinot, 1981), and *D. magna* from Palette. The youngest currently known species, *Donrussellia gallica*, is from Avenay (reference level MP 8+9) (Russell et al., 1967).

The genus *Donrussellia* was first described by Szalay (1976), based on material originally referred to the omomyid *Teilhardina* as *Teilhardina? gallica* by Russell et al. (1967). However, differences with other *Teilhardina* species led Szalay (1976) to describe a new genus. Better material and the description of the new species *D. provincialis* confirmed the validity of this genus and showed it to be an adapiform (Godinot, 1978). The discovery of UM PAT 17, a nearly complete lower jaw, increased the number of species of the genus, its size range, and completed its anatomical knowledge.

Donrussellia magna remains however only documented by the holotype, and the morphology of its upper dentition is unknown to date. Godinot (1992 and 1998) proposed that *D. magna* and *Cantius* shared a suite of derived characters suggesting that these two taxa are probably closely related. This hypothesis remains tentative in the absence of more material but the subgenus *D. (Palettia) magna* was erected to reflect this relationship (Godinot, 1992). In fact, Godinot (1998) suggested that if the upper molars further separated *D. magna* from *D. provincialis* from a morphological standpoint, a new separate genus, *Palettia*, should be erected for this taxon. This would furthermore raise the question of the dispersal of three instead of two adapiform genera at the PETM. However, more evidence is needed to support such an idea; a convergence with *Cantius* in some dental characters of a large species of *Donrussellia* is possible.

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BIBLIOGRAPHY

Estravis, C. 2000. Nuevos mamiferos del Eoceno Inferior de Silveirinha (Baixo Mondego, Portugal). Coloquios de Paleontologia, 51: 281-311.

Fleagle, J., 2013. Primate Adaptation and Evolution: 3rd Edn. Academic Press.

Godinot, M., 1978. Un nouvel adapidé (primate) de l'Eocène inférieur de Provence. Comptes-Rendus de l'Académie des Sciences de Paris, Série D, 286 : 1869-1872.

Godinot, M., 1981. Les mammifères de Rians (Eocène inférieur, Provence). Palaeovertebrata 10(2), 43-126.

Godinot, M., 1992. Apport à la systématique de quatre genres d'Adapiformes (Primates, Eocène). Comptes rendus de l'Académie des sciences. Série 2, Mécanique, Physique, Chimie, Sciences de l'univers, Sciences de la Terre 314(2), 237-242.

Godinot, M., 1998. A Summary of Adapiform Systematics and Phylogeny. Folia Primatologica 69 (suppl. 1), 218–249. DOI:10.1159/000052715

Godinot, M., Crochet, J., Hartenberger, J., Lange-Badré, B., Russell, D., Sigé, B., 1987. Nouvelles données sur les mammifères de Palette (Eocène inférieur, Provence). Münchner Geowissenschaftliche Abhandlungen A 10, 273–288.

Lebrun, R., 2014. ISE-MeshTools, a 3D interactive fossil reconstruction freeware. 12th Annual Meeting of EAVP, Torino, Italy.

Marandat, B., Adnet, S., Marivaux, L., Martinez, A., Vianey-Liaud, M., Tabuce, R., 2012. A new mammalian fauna from the earliest Eocene (Ilerdian) of the Corbières (Southern France): palaeobiogeographical implications. Swiss Journal of Geosciences 105(3), 417-434. DOI: 10.1007/s00015-012-0113-5

Marigó, J., Minwer-Barakat, R., Moyà-Solà, S. 2013. *Nievesia sossisensis*, a new anchomomyin (Adapiformes, Primates) from the early Late Eocene of the southern Pyrenees (Catalonia, Spain). Journal of Human Evolution 64: 473-485. DOI:10.1016/j.jhevol.2012.11.004

Ni, X., Wang, Y., Hu, Y., Li, C., 2004. A euprimate skull from the early Eocene of China. Nature 427, 65-68. DOI: 10.1038/nature02126

Ramdarshan, A., 2011. Adaptive Radiations and Ecological Diversity of Primates during the Early Tertiary. PhD, Université Montpellier 2.

Ramdarshan, A., Marivaux, L., Merceron, G., 2012 (a). Adaptive radiations and ecological diversity of European adapiforms in Western Europe. Journal of Vertebrate Paleontology 32 (special issue), 160.

Ramdarshan, A., Merceron, G., Marivaux, L., 2012 (b). Spatial and temporal ecological diversity amongst Eocene primates of France: Evidence from teeth. American Journal of Physical Anthropology 147 (2), 201–216. DOI: 10.1002/ajpa.21638

Rose, K.D., Godinot, M., Bown, T.M., 1994. The early radiation of euprimates and the initial diversification of Omomyidae. In: Fleagle, J.G. and Kay, R.F., editors. Anthropoid origins. Pp. 1-28. New York: Plenum Press. DOI: 10.1007/978-1-4757-9197-6_1

Russell, D., Louis, P., Savage, D., 1967. Primates of the French early Eocene. University of California press.

Szalay, F. S., 1976. Systematics of the Omomyidae (Tarsiiformes, Primates) : taxonomy, phylogeny, and adaptations. Bulletin of the American Museum of Natural History 156, 159–449.

Yans, J., Marandat, B., Masure, E., Serra-Kiel, J., Schnyder, J., Storme, J. Y., Marivaux, L., Adnet, S., Vianey-Liaud, M., Tabuce, R. (2014). Refined bio-(benthic foraminifera, dinoflagellate cysts) and chemostratigraphy (δ13Corg) of the earliest Eocene at Albas-Le Clot (Corbières, France): implications for mammalian biochronology in Southern Europe. Newsletters on Stratigraphy, 47(3), 331-353. DOI: 10.1127/nos/2014/0050