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Ten years in the dump: An updated review of the Miocene primate-bearing localities from Abocador de Can Mata (NE Iberian Peninsula)

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ABSTRACT

More than ten years of paleontological fieldwork during the enlargement of the Can Mata Landfill (Abocador de Can Mata [ACM]), in els Hostalets de Pierola (Vallès-Penedès Basin, NE Iberian Peninsula) led to the recovery of >60,000 Miocene vertebrate remains. The huge sampling effort (due to continuous surveillance of heavy machinery digging activity, coupled with manual excavation and screen-washing of sediments) enabled generally rare faunal elements such as pliopithecoid and hominoid primates to be found. Thanks to detailed litho-, bio- and magnetostratigraphic controls, accurate dating is possible for all the recovered primate remains from 19 of the 235 localities defined along the 234 m-thick composite stratigraphic sequence of the ACM. Here we report updated estimated (interpolated) ages for these paleontological localities and review the timing of the primate succession in this area. Our results indicate that the whole ACM sequence is late Aragonian in age (MN6 and MN7+8) and includes seven magnetozones that are correlated to subchrons C5Ar.1r to C5r.2r (ca. 12.6 to 11.4 Ma). Great apes (dryopithecines) are first recorded at 12.4–12.3 Ma, but most of the finds (*Anoiapithecus*, *Pierolapithecus* and *Dryopithecus*) cluster between 12.0 and 11.9 Ma, followed by some indeterminate dryopithecine remains between 11.7 and 11.6 Ma. Pliopithecoids first appear at 12.1 Ma, being subsequently represented by *Pliopithecus* between 11.9 and 11.7 Ma. The small-bodied hominoid *Pliobates* is the youngest ACM primate, with an estimated age of 11.6 Ma. Although these primates probably overlapped in time, their co-occurrence is recorded only twice, at 11.9 Ma (a dryopithecine with *Pliopithecus*) and at 11.6 Ma (a dryopithecine with *Pliobates*). The rare co-occurrence between great apes and small-bodied catarrhines might be attributable to sampling biases and/or to presumed diverging ecological preferences of these groups. In the future, more detailed analyses of the fauna recovered from the long and densely-sampled ACM sequence will hopefully throw new light on this long-standing, unresolved question.

1. Introduction

The fossiliferous area of els Hostalets de Pierola (Vallès-Penedès Basin, NE Iberian Peninsula) is exceptional among the European Miocene in terms of the high diversity of extinct catarrhines recorded in a densely sampled stratigraphic sequence spanning more than one million years (Alba et al., 2011a). Paleontologist Josep R. Bataller, together with amateur collector Màrius Guerín, surveyed the area during the 1920s and first reported on its fossil fauna (Bataller Calatayud, 1938). Although Guerín collected a hominoid M^2, it was mistaken for a suid and it was not reassigned to *Dryopithecus* until much later (van der Made and Ribot, 1999). Subsequent surveys in the area were carried out by paleontologists Miquel Crusafont and Josep F. de Villalta during the 1940s (e.g., Villalta Comella and Crusafont Pairó, 1941a; Crusafont Pairó, 1944; Villalta and Crusafont, 1946). In the loosely-defined locality of Can Vila, these authors discovered a hominoid mandibular fragment with M_2–M_3 (Villalta Comella and Crusafont Pairó, 1941b,

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1944), first attributed to *Dryopithecus fontani* but subsequently used to erect *Sivapithecus occidentalis* (currently considered a nomen dubium; Moyà-Solà et al., 2004; Alba, 2012), as well as one or two additional molar crown fragments (Villalta Comella and Crusafont Pairó, 1944; Crusafont Pairó, 1958; see discussion in Golpe Posse, 1982; Alba et al., 2013). Many years later, Crusafont-Pairó and Golpe-Posse (1973) reported a female lower canine from Can Mata 1, which was formerly attributed to *Hispanopithecus laietanus* (e.g., Golpe Posse, 1993), but most recently assigned to Hominidae indet. (Alba, 2012).

For many years, Can Vila and Can Mata 1 were the only late Aragonian (late middle to early late Miocene) primate-bearing localities from the Penedès sector of the Vallès-Penedès Basin (Agustí et al., 1985; Casanovas-Vilar et al., 2011a). This situation drastically changed in late 2002 thanks to the beginning of paleontological surveillance, sampling and excavation associated with the removal of thousands of tons of Miocene sediments with heavy machinery during the building of a new phase of the Can Mata Landfill (Abocador de Can Mata [ACM]; Fig. 1a; Alba et al., 2006, 2009, 2011a). This paleontological work, carried out almost uninterruptedly (10.5 years of fieldwork in total) until early 2014, led to the recovery of more than 60,000 fossil vertebrate remains. This huge sampling effort enabled the recovery of rare taxa such as primates, leading to the description of three new hominoid genera (Moyà-Solà et al., 2004, 2009a; Alba et al., 2015) and a new pliopithecoid species (Alba et al., 2010). Detailed litho-, bio- and magnetostratigraphic control further enabled accurate dating of the more than 200 paleontological localities formally defined along the composite stratigraphic sequence of ACM (Moyà-Solà et al., 2009b; Casanovas-Vilar et al., 2011a). Although estimated ages have already been published for some of them (e.g., Casanovas-Vilar et al., 2011a, 2016; Alba, 2012), recent refinements in the calibration of the geomagnetic polarity time scale (Ogg, 2012; Hilgen et al., 2012) and additional field data have resulted in minor readjustments. The termination of fieldwork in 2014 offers a good opportunity to report a comprehensive list of updated estimated ages for ACM localities, thereby including an accurate dating for all of the identified primate remains that have been recovered from this area.

2. Geological background

The middle to late Miocene successions in the area of els Hostalets de Pierola are located in the Penedès sector of the Vallès-Penedès Basin. The latter is an elongated and NNE/SSW-oriented half-graben, situated between the Pre-littoral and the Littoral Catalan Coastal Ranges, which originated due to the rifting of the NW Mediterranean during the Neogene (Cabrera et al., 2004; de Gibert and Casanovas-Vilar, 2011). Except for some marine and transitional sequences from the early to middle Miocene, most of the basin infill consists of alluvial fan sediments that have provided a rich record of early to late Miocene continental vertebrates (Agustí et al., 1985; Casanovas-Vilar et al., 2011b, 2016a). The thick Miocene alluvial sequences of the ACM and surrounding areas mostly consist of reddish to brown mudstones, coupled with less abundant sandstones, breccias and conglomerates, which were deposited in the distal-to-marginal inter-fan zones of the coalescing alluvial fan systems of Olesa and els Hostalets de Pierola (Casanovas-Vilar et al., 2008; Alba et al., 2009, 2011a; Moyà-Solà

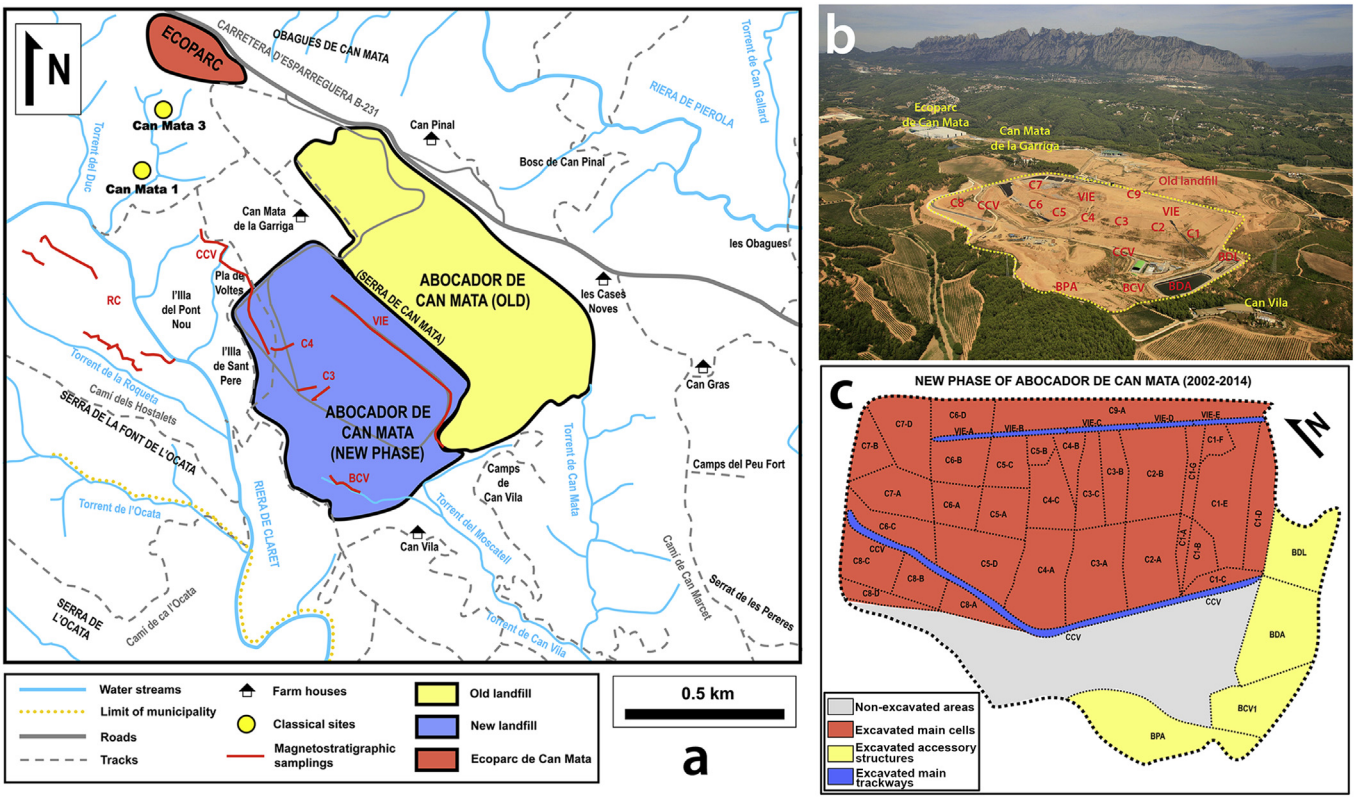

Figure 1. Abocador de Can Mata (ACM). (a) Map of the main fossiliferous area of els Hostalets de Pierola, indicating the location of the old and new phases of ACM, the nearby classical localities of Can Mata, and the magnetostratigraphically sampled sections (in red). (b) Aerial photograph of ACM (courtesy of CESPA Gestión de Residuos, S.A.U.), indicating the approximate location of the various sectors in which it was divided during fieldwork (in red). (c) Schematic map of the new phase of ACM, indicating the (sub)sector limits. Abbreviations: BCV, Barranc de Can Vila (Can Vila Ravine); BDA, Bassa de Decantació d'Aigues Pluvials (Settling Pond of Rainwater); BDL, Bassa de Lixiviats (Pond of Leachates); BPA, Base de la Pila d'Acopi (Base of the Stockpile); C1–C9, Cells 1 to 9; CCV; Camí de Can Vila (Can Vila's Trackway); RC, Riera de Claret; VIE, Vial Intern d'Explotació (Internal Operating Road). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)