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Article *in* The Science of Nature · March 2007

DOI: 10.1007/s00114-006-0173-3 · Source: PubMed

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Naturwissenschaften (2007) 94:107–112
DOI 10.1007/s00114-006-0173-3

ORIGINAL ARTICLE

Evidence of earliest human occurrence in Europe: the site of Pirro Nord (Southern Italy)

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Received: 16 May 2006 / Revised: 23 August 2006 / Accepted: 4 October 2006 / Published online: 24 October 2006

Abstract Some flint lithic artifacts were discovered in the fissure fillings of the well-known Pirro Nord site (Apulia, Southern Italy). The lithic industry, composed by three cores and some flakes, has been found to be associated to an Early Pleistocene vertebrate fossil assemblage. The fossil association contains a wide range of micromammals, including *Allophaiomys ruffoi* and *Episoriculus gibberodon* and large mammals including *Bison degiulii* and *Equus altidens* together with African elements as the gelada baboon *Theropithecus* and the saber-toothed cat *Megantereon whitei*. It defines the latest Villafranchian chronological unit (Pirro Nord Faunal Unit) in the Western European mammal biochronology. The lithic industry of Pirro Nord represents the oldest occurrence of the genus *Homo* in Europe as it is attributable to a chronological interval between 1.3 and 1.7 Ma. This supports the hypothesis that the genus *Homo*, with Oldowaian technology, extended its range in Europe, probably from western Asia, during the first half of the Early Pleistocene. The new discovery from Pirro Nord changes the chronology of the first arrival of hominids in Europe and offers new perspectives in the debate about the human dispersal in the Early Pleistocene.

Keywords Early *Homo* · Lithic artifacts · Early Pleistocene · *Allophaiomys ruffoi* · Pirro Nord site · Italy · Dispersal events

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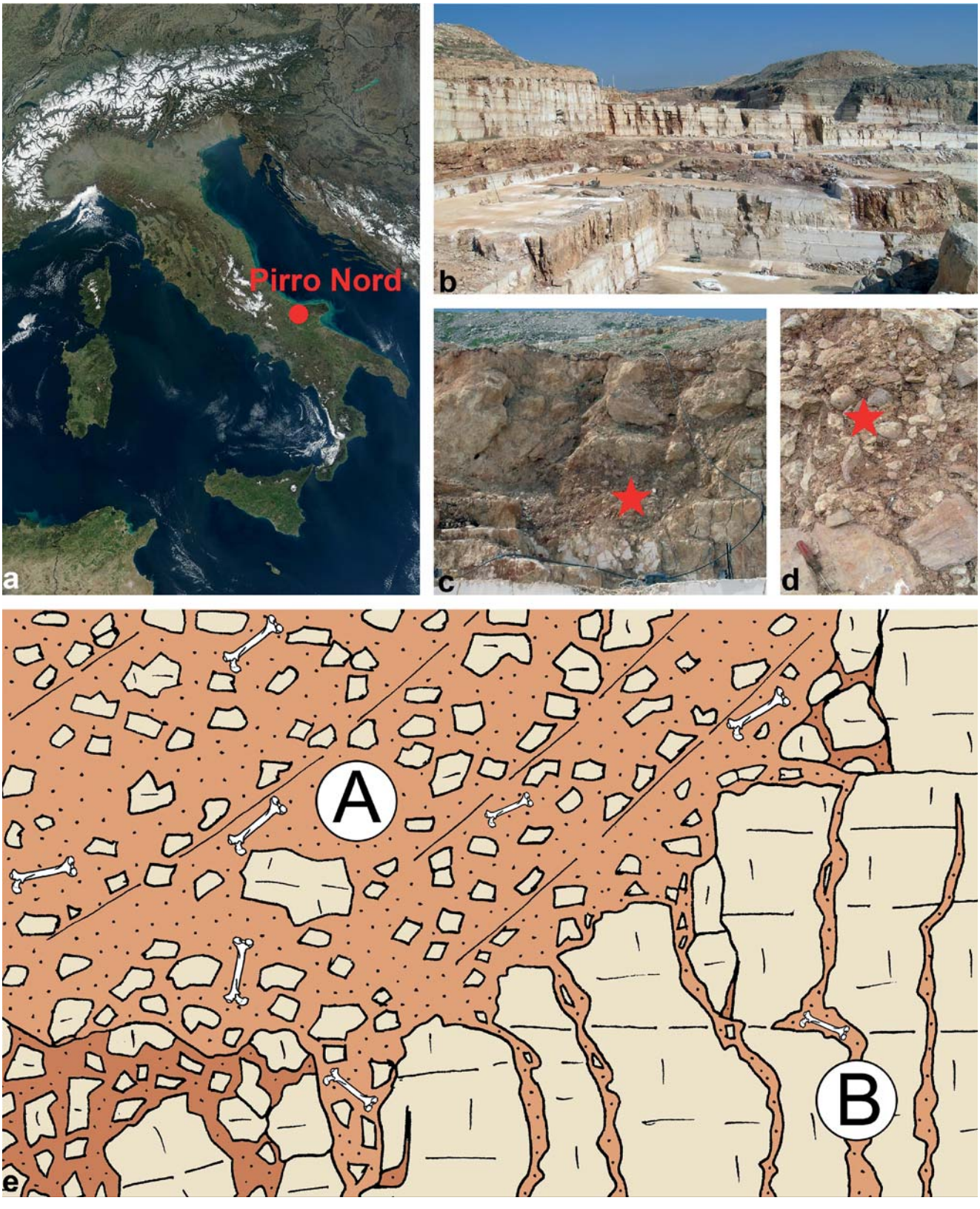
Introduction

The timing and pattern of hominid dispersal and initial occupation of Europe is now the focus of an ongoing debate, after critical assessment of ill-founded views and dramatic increase of available evidence in recent years (Martínez-Navarro et al. 1997; Carbonell et al. 1999; Gabunia et al. 2000; Oms et al. 2000b; Roebroeks 2001). In this study, we offer new evidence of ancient human occupation in southern Europe, represented by lithic artifacts reflecting technological behavior directed to the production of flakes in an ancient chronological interval between 1.3 and 1.7 Ma. These lithics have been found at the site of Pirro Nord (also known sometimes as Cava Pirro or Cava Dell'Erba), situated at the northwestern margin of the Gargano promontory, close to the village of Apricena (Foggia District, Apulia; 41°48′07″N, 15°23′05″E; Fig. 1a,b). The discovery of lithic artifacts at Pirro Nord (Apulia, Southern Italy) documents an early hominin occurrence in the older part of Early Pleistocene, and thus now constitutes the oldest record in Europe. The lithic artifacts are found,



associated with a very diverse and now well-documented fossil vertebrate assemblage, within the fillings of an extensive karst network on the Gargano peninsula. The Pirro Nord mammal fauna is uncommonly diverse, of post Olduvai subchron age, and constitutes a reference (local) fauna for the European late Villafranchian (Gliozzi et al.

◀ **Fig. 1** Location map and view of Pirro Nord quarries with the fossiliferous karst fissure. **a** Satellite image of Italy with the position of Pirro Nord. **b** Panoramic view of the quarries. The name Pirro Nord is usually used to indicate the assemblage coming from fillings of a karst network developed in Mesozoic limestone (Calcare di Apricena Formation) and along the interface between the Calcare di Apricena and the overlapping Plio-Pleistocene carbonate succession (made up by calcarenites locally named "cappellaccio"). Karst fissures yielding rich material of Pleistocene continental vertebrates are exposed along the quarry fronts as the limestone extraction proceeds. **c** and **d** Closer views of the karst deposit in which the greater part of the lithic artifacts has been found; in particular, the *stars* indicate the position where the flint core has been collected. **e** Sketch of the quarry front showing in detail the places where lithic artifacts come from. *A* The gravely deposits of the surficial karst structure above the stepped upper surface of Calcare di Apricena. *B* Sandy–clayey sediment with scattered calcareous pebbles filled in into fractures. *Bottom center* Note the fissure network and, on the *left*, fissure deposit resulting from downslope movement of blocks. The *darkest color* of infillings represents the first phase of breakage of Apricena limestones, which was cemented just before the principal and more pervasive infilling phase colored in *light colour*

1997). It includes African elements and is indicative of an open environment reflecting predominantly arid conditions.

Geological and taphonomical setting

The occurrence of vertebrate fossils in the area has been documented in the 1970s (Freudenthal 1971) and during the next decades, systematic field studies have been carried out there by several research teams (De Giuli et al. 1987; Abbazzi et al. 1996). The fossil remains have been sampled from different karst fissures of the adjacent quarries, actually representative of the same karst network. Consistency of taxonomic composition and evolutionary status of all taxa in all sampled fissures, as well as the sedimentary pattern of fissure infilling affords evidence that the fissures were filled over a quite short span of time. Thus, all the residues are considered as broadly contemporaneous in geological terms (Abbazzi et al. 1996).

The accumulation of fossils of large mammals has been due to the infall or entrapment of carcasses within the wider cavities, and by subsequent transport within the karst network when it was flooded. As a matter of fact, the occurrence of karst deposits having a number of articulated mammalian skeletons is suggestive of circumstances dominated by accumulation of carcasses without fluviatile transport.

Nonetheless, in deposits with lithic artifacts, disarticulated, sometimes worn, or deeply abraded bones do occur and suggest fluviatile transport and preburial effects; but, the state of fossil preservation allows exclusion of any demonstrable taphonomical reworking. Fossil bones fail to show any taphonomical alteration, such as differences in sediment infillings into pores and cavities which, contrariwise, always correspond to the surrounding matrix, or in fossil diagenesis which is equivalent in any sample, or in cement encrustation. The only difference among specimens is the frequent manganese black coating, usually initiated as punctate dendritic etching, that may become pervasive within small and thin bones and on pebbles. The abundance of bones and coprolites of *Pachycrocuta brevirostris*, as well as the occurrence of numerous gnawing and bite marks on fossil bones, suggests that this giant hyaenid species played an important role in local bone accumulation.

Paleontological context

The Pirro Nord vertebrate assemblage comprises 20 species of amphibians and reptiles (Delfino and Bailon 2000), 47 species of birds (Bedetti 2003), and over 40 mammal species (Abbazzi et al. 1996; Rook et al. 2004; Rook and Sardella 2005). The latter assemblage is characterized by the occurrence of many carnivore remains, of a large-sized gelada baboon (*Theropithecus* sp.), of a large and robust porcupine (*Hystrix refossa*), and by the first occurrence in Italy of *Bison* and of *Equus altidens* (Gliozzi et al. 1997). Among

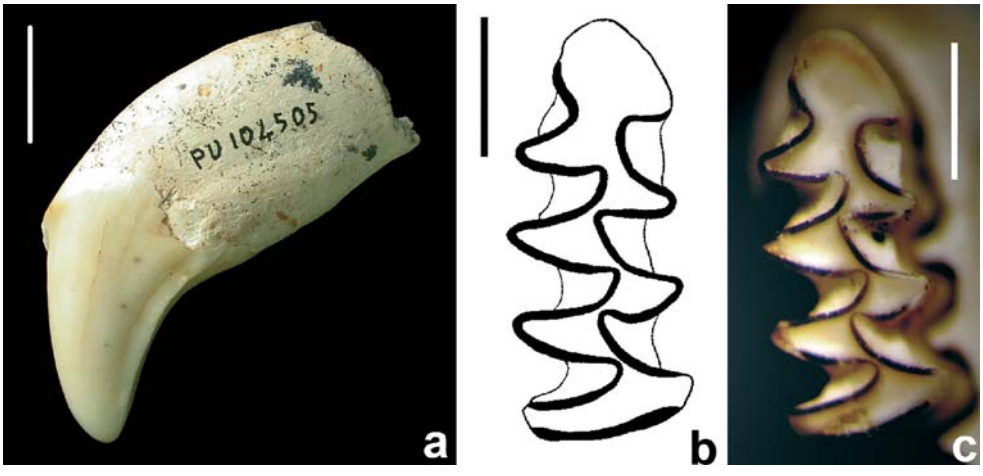


Fig. 2 Vertebrate remains from Pirro Nord found associated with lithic artifacts. **a** PU 104505, left I^3 of *Pachycrocuta brevirostris*, labial view; **b** and **c** PU 101603, right M_1 of *Allophaiomys ruffoi*, occlusal view. **a** *Scale bar* represents 1 cm; **b** and **c** *scale bar* represents 1 mm

carnivores, *P. brevirostris* (Fig. 2a) is the most abundant and occurs alongside *Homotherium latidens*, *Megantereon whitei*, *Acinonyx pardinensis*, and *Canis mosbachensis* (in all, 10 species of four families). Pirro Nord large mammals are considered a reference assemblage in the Western European biochronology, and a faunal unit (Pirro Nord Faunal Unit) is accordingly recognized, and defines the latest Villafranchian Faunal Unit (Gliozzi et al. 1997).

The nature of the Pirro Nord landscape can, to an extent, be inferred from the composition of its vertebrate assemblage. The occurrence of perissodactyls, cheetah, large sized porcupine, abundant vole *Allophaiomys*, and presence of bird species of Otidae, Pteroclidae as well as abundant Alaudidae are all suggestive of open landscape with a basically arid climate. However, environment with patchy humid areas is documented by the occurrence of *Triturus* and *Emys* within the herpetofauna, Anatidae, and Charadriiformes within the avifauna, as well as the soricid shrew *Episoriculus gibberodon*.

Among rodents, the arvicolid vole species *Allophaiomys ruffoi* is present (Fig. 2b,c). Morphometric analyses have been carried out on a sample of 12 first lower molars collected by screen washing sediments yielding lithic artifacts. The enamel presents negative differentiation and size and shape match perfectly those of previously studied populations of Pirro Nord (De Giuli et al. 1987; Masini and Santini 1991). *A. ruffoi* is known from various Italian Early Pleistocene sites (Pietrafitta, Cava dell'Erba, Cava Sud, and other fissure fillings of northeastern Italy; Maul et al. 1998), all correlated with late Villafranchian/early Biharian biochronological unit, and with "*Mimomys savini–Mimomys pusillus* zone", that is between 1.3–1.7 Ma (Gliozzi et al. 1997; Maul et al. 1998). Moreover, *A. ruffoi* has been reported from the Early Pleistocene Spanish site of Venta Micena (Agustí 1998), correlative with the earliest Early Pleistocene "*Allophaiomys pliocaenicus* zone" (Oms et al. 2000a) and, as well with the previously studied (De Giuli et al. 1987; Masini and Santini 1991) Pirro Nord locality. Furthermore, A/L values of *A. ruffoi* population associated with lithic artifacts at Pirro Nord exhibit the same variability as those from Venta Micena (Agustí and Madurell 2003). The biochronological attribution of Pirro Nord is further strengthened by recent paleomagnetic investigations: the fossiliferous sediments have afforded a negative magnetization and are referred to Matuyama post-Olduvai Chron, at a date not much younger than 1.7 Ma (Napoleone et al. 2003).

The hitherto oldest European occurrence of lithic artifacts, coassociated with vertebrate remains, have been found in Spain, at the sites of Barranco Leon-5, and Fuente Nueva-3 (in Andalucia), and at Atapuerca/Trinchera Elefante (in Leon) (Oms et al. 2000b; Martínez-Navarro et al. 2004; Palmqvist et al. 2005; Pares et al. 2006). All the aforementioned localities are referred to the European Early Pleistocene (late Villafranchian/early Biharian) biochronological unit "*M. savini–M. pusillus* zone". In those assemblages, however, the vole species *Allophaiomys* cf. *lavocati* has been reported (Laplana and Cuenca-Bescós 2000; Agustí and Madurell 2003). *A. lavocati* is an advanced form, broadly confluent T4T5, positively differentiated enamel, and a large A/L ratio. It is related to the *A. burgondiae* group and is subsumed within the "*A. burgondiae* zone" (Oms et al. 2000a; Martínez-Navarro et al. 2003). In these papers, the correlation is effected with the middle–upper part of the Early Pleistocene and considered correlative with the important Monte Peglia locality (early Galerian/early Biharian) (Masini and Santini 1991), and hence notably younger than that of Pirro Nord (Maul et al. 1998).

The lithic artifacts

The known lithic artifacts, composed by some cores and flakes, have been localized within three different karst fissures of the Pirro Nord network (Fig. 1c–e). As to the contemporaneity of these deposits bearing fossil bones and lithic tools, such samples were collected in two sorts of depositional circumstances. First, most artifacts (in particular the three cores) come from the roughly clino-stratified sediments (point A in Fig. 1e) which are, in this study, interpreted as the first infilling phase of a surficial karst structure (like a sinkhole) developed into the Apricena limestones. A second mode is from the fissure infillings (point B in Fig. 1e) which clearly fed from the bottom of the aforementioned sinkhole. It is worth noting that no preservation differences are found among all the fossils collected there, and in any case taphonomical reworking

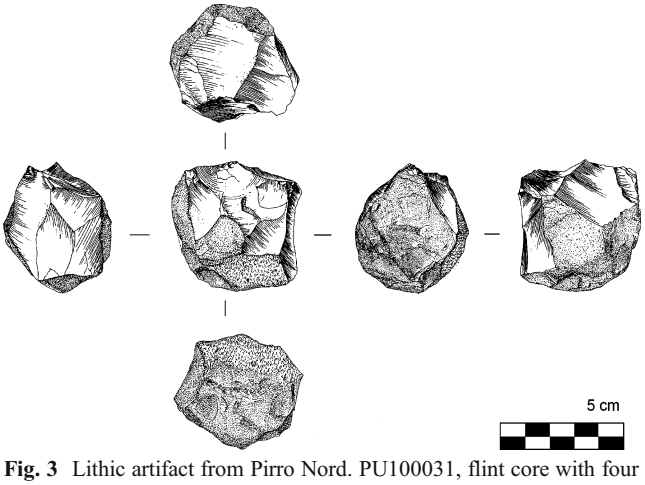


Fig. 3 Lithic artifact from Pirro Nord. PU100031, flint core with four striking platforms from which middle to large sized flakes have been detached (L>45 mm). The discard of the core cannot have been due to the exhausting of raw material, nor to the absence of *contraintes techniques* (angle, convexity), nor to the occurrence of fractures within the row material (Drawings by D. Aureli)

can be excluded as already stated. Of course, some chronological difference in age must exist between the two depositional circumstances, but the slightly younger age of the superficial karst deposits does not contravene the essential isochrony of sediments and paleobiological samples of both deposit types. This assumption is also supported by the fossil vertebrate set which always circumscribes the Pirro Nord Faunal Unit, having characteristic taxa such as *Bison degiulii*, *E. altidens*, *A. ruffoi*, *H. refossa*, *P. brevirostris*, *C. mosbachensis*, *H. latidens*, and *M. whitei*.

The lithic material of Pirro Nord, until now, comprising only three cores and six flakes (Fig. 3), is insufficient for a complete techno-economic analysis, whereas it does constitute crucial documentation of hominid lithic production in Europe during an archaic phase of the Early Pleistocene. The debitage has been performed on flint pebbles, derived from the Cretaceous successions of the Gargano promontory and locally available to early humans in secondary circumstances, in torrential streambeds or alluvial deposits. We should stress that sediments infilling these fossiliferous fissures do not contain clasts of (unknapped) flints, other than in the size fraction of <4 mm. The superficial status of the lithics is well preserved, although patinas or marginal pseudoretouches are absent, attesting to unimportant transport of these materials. The complexity of the debitage, apparent on the cores and on the scars of the flakes, the technological homogeneity of the material, and the geological context, all clearly exclude any attribution to geofacts. The reduction sequence seems brief for the small pebbles (up to 10 cm), as they have been knapped through only one striking platform. Conversely, it attends more complex and integrated treatment of larger pebbles for which more striking platforms, with a centripetal or a SSDA (surfaces of alternate debitage) (Forestier 1993) organization, have been employed in the exploitation strategy. The debitage suggests the primary production of flakes, characterized by a natural or flat thick butt, lacking in the preparation of a striking platform, and by an *angle de chasse* (detachment) close to 90°. All flakes are exclusively produced by direct percussion, employing a hard stone hammer. Flakes have generally middle/small dimensions, and a triangular to trapezoidal form that is coherent with a centripetal or orthogonal removal method. On a distal fragment of flake, in transversal position, a continuous, convex, short, and low retouch is present; it suggests the presence of a secondary reduction sequence directed to obtain retouched pieces and, probably, reflective of diversified use activity.

Conclusions

Despite the small quantity of human lithic material recovered thus far, the Pirro Nord lithic industry compares closely with that of Dmanisi, Georgia (Dzaparizde et al. 1989; Vekua 1995; Gabunia et al. 2000; De Lumley et al. 2005), as well as to their younger counterparts from Fuente-Nueva-3 and Barranco León-5 (Oms et al. 2000b; Palmqvist et al. 2005), and from Atapuerca Trinchera Elefante, Spain (Parés et al. 2006). Hence, it is possible to envision a more ample geographic context, within which lithic industries characterized by relatively brief reduction sequences, that finalize the attainment of flake products from one or more striking platforms employing a generally centripetal or orthogonal method, accompanied ancient European hominin occupation.

In a broader context, the Pirro Nord site confirms that it was within the first half of the Early Pleistocene that the genus *Homo*, with Mode 1 technology (Leakey 1975; Roche 1989; Texier 1995), first extended its range out of Africa into Europe (and western Asia). The Pirro Nord lithic artifact sample represents a recognized technocomplex, perfectly coherent with that of the hitherto known early human spread into Europe, but in this study documenting its first appearance to a time span older than 1.3 Ma.

Acknowledgements Our work in the Apricena quarries has been possible thanks to the kindness and collaboration of the quarry owners, Franco and Gaetano Dell'Erba, who granted access to the working area. Dott. G. Andreassi (Soprintendente per i Beni Archeologici della Regione Puglia), authorized the still ongoing survey. We thank F. C. Howell for the discussions and criticism of the early version of the manuscript. L. Abbazzi, L. Bellucci, R. Bevilacqua, A. Cipullo, M. Delfino, M.P. Ferretti, E. Martinetto, and M. Zunino for their help in the field and discussions on fossil record and biochronology; D. Aureli, for drawings of the lithic artifacts. This research was supported by grants from the Universities of Firenze, Roma "La Sapienza" and Torino.

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