Current events

Fuente Nueva-3 (Orce, Granada, Spain) and the first human occupation of Europe

Introduction

The section of Fuente Nueva (in the Orce region) comprises sediments that form part of the infilling of the intramontane Guadix-Baza Basin, which was isolated in the Betic Chain (Southern Spain). This chain was formed after the collision between the meso-Mediterranean block (Internal Zones of the Betic Chain) and the South Iberian continental margin (External Zones). This collision took place during the Middle Miocene. The sediments infilling the basin are from Upper Miocene, Pliocene and Pleistocene, with abundant outcrops and an excellent paleontological record.

The most recent sediments of the basin infill are continental, with a clear distinction between two domains, marginal and distal. The Guadix formation is the most important among the marginal ones (fluviatile sediments), while the Baza formation is the most representative of the distal domain (mainly lacustrine sediments).

The local stratigraphy of the Fuente Nueva sector (Figures 1 and 2) is made up of three members belonging to the Baza Fm: Lower (lacustrine calcareous), Middle (fluviatile detrital), and Upper (lacustrine silty-calcareous) (Vera et al., 1985; Soria et al., 1987). Two sections have been studied: FN-1 and FN-3.

In the FN-1 section, all the members are represented (Lower member: from bottom to 3 m; Middle member: from 4 m to 12 m; and Upper member: from 13 m to top), while in the FN-3 section, only the Upper member occurs (Figure 2).

Paleomagnetism

The FN-1 section (see Figures 1 and 2) was chosen for paleomagnetic studies (Oms et al., 1996) because it is the most complete of the area. Along the section, 24 sites were sampled in situ with a drilling machine and also by hand using a special device for soft sediments. At least, three cores were collected from each site. Samples were cleaned with thermal demagnetization.
Figure 1. Schematic geological map of the Guadix-Baza basin (top) and location of the studied or referred sections (bottom) (modified from Soria et al., 1987).
and the remanence was measured using a cryogenic magnetometer. Stepwise demagnetization was carried out in up to 13 steps of about 40°C. Demagnetization was always stable enough to derive paleomagnetic field components. The demagnetization of samples is composed of two components (Figure 3). Initially there was a secondary component that generally was removed at maximum temperatures between 150 and 275°C. Next, at higher temperatures between 350–500°C, a primary characteristic remanent magnetization (ChRM) was removed. For each sampling level, the mean virtual geomagnetic pole (VGP) was calculated from the level averaged ChRM direction. Along the section, only a clear succession of reversed paleopoles was observed, although some normal chronozones may not have been sampled or may not be represented because of a hiatus. The studied section must have been deposited before the Brunhes normal polarity chron. According to the correlation on Figure 2, the FN-3 section would be located in the reversed chronozone found at the FN-1 section.

Figure 2. Paleomagnetic results (latitude of the virtual geomagnetic polarities, after Oms et al., 1996) of the Fuente Nueva-1 section (FN-1) and stratigraphic correlation with the Fuente Nueva-3 section (FN-3). Paleolatitudes are always negative, thus indicating a deposition before the Brunhes normal epoch. See location of the sections in Figure 1. The archaeological site at Fuente Nueva-3 comprises the span from 9 m to 14 m in the FN-3 section.
The mean of all the secondary components was attributed to the present-day field direction and may have been caused by recent weathering of rocks. The mean of the characteristic components (Oms et al., 1996) was coincident with those expected for the reversed paleopoles from the stable zone of the Iberian Peninsula.

**Stratigraphic synthesis of the archeological site of Fuente Nueva-3**

The locality under study is found in carbonatic sediments of the section (see Figure 2). In this area it was possible to conduct a precise geological study of the sedimentary cycle of the paleo-lake of Orcet to a depth of some 5 m. From one upper limestone level to another lower limestone and marl level, six geological units have been identified (see Table 1): (I) assemblage of limestones and marls; (II) carbonated clays; (III) clays and silts; (IV) carbonated clays and marls; (V) green clays oxidized at their summit; (VI) marly limestones.

Parallel with this deposit, three archaeological levels with an extension that can be exploited for more than 100 m² have been identified. These are characterized by an accumulation of fauna and the more or less abundant presence of lithic artefacts. The archaeological level 1 is found in the geological unit III, the archaeological level 2 in the geological unit V, and the archaeological level 3 in the geological unit VI. Since deposition, the stratigraphic sequence has not suffered any significant post-depositional modifications.

**Faunal assemblage**

The assemblage of mammal fauna at Fuente Nueva-3 includes the following species: *Mammuthus meridionalis*, *Hippopotamus antiquus*, *Stephanorhinus etruscus*, *Equus altidens*, *Megaloceros*. 

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Figure 3. Standard Zijderveld (orthogonal) plots of limestones of the FN-1 section. Note a normal secondary component (attributed to an overprint of the present-day field) and a primary characteristic remanent magnetization (ChRM). Some samples required the use of demagnetization circles to recover the ChRM.

This faunal assemblage is associated with Lower Pleistocene contexts and is totally distinct from any associated with the Middle Pleistocene, present in the Baza basin at the locality of Cúllar Baza-1 (Ruiz Bustos, 1976), and very different from the Upper Pliocene fauna found in the Lower member at the site of Fuente Nueva-1 (FN-1) (Moyà-Solà et al., 1987). The macromammals of Fuente Nueva-3 correspond to those of Fuente Nueva-2 (FN-2) in the same area and the neighbouring site, Venta Micena, situated some 3 km away in the same basin, where the fossil register is more ample and more widely known (Martínez Navarro, 1991; Palmqvist et al., 1996). In this last deposit there exists evidence of a truly spectacular change of fauna produced in the Lower Pleistocene, as a result of the arrival in Europe of new Asiatic and African immigrants. The former consists mainly of ruminants, and the latter essentially of carnivores such as Pachycrocuta brevirostris (Howell & Petter, 1980) and Megantereon whitei (Martínez Navarro & Palmqvist, 1995), as well as Hippopotamus antiquus and Equus altidens (Guerrero et al., 1997). In the latter site the presence of Homo sp. has been cited (Gibert et al., 1994; Gibert & Palmqvist, 1995; Martínez Navarro, 1996), but due to continuing problems concerning the taxonomical determination of the piece VM-0 (Agustí & Moyà-Solà, 1987; Palmqvist, 1997; Moyà-Solà & Köhler, 1997) it is impossible, as of yet, to confirm this presence. However, a faunal assemblage similar to that of Venta Micena and Fuente Nueva-3...

Table 1  Fuente Nueva 3: stratigraphic synthesis

<table>
<thead>
<tr>
<th>Geological stratigraphy</th>
<th>Archaeological stratigraphy</th>
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<tbody>
<tr>
<td>Assemblage I</td>
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<tr>
<td>Level 1 hard limestone</td>
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<tr>
<td>Level 2 limestone with nodules</td>
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<td>Level 3 limestone and marls</td>
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<tr>
<td>Assemblage II</td>
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<td>Level 4 gray carbonated clays</td>
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<td>Level 5 darker carbonated clays</td>
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<td>Level 6 white carbonated clays</td>
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<td>Level 7 marled carbonated clays</td>
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<tr>
<td>Assemblage III</td>
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<td>Level 8 gray-green clays</td>
<td>One manuport in level 5</td>
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<td>Level 9 blue-green silt</td>
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<tr>
<td>Level 10 layered clays</td>
<td>Level 1 minor lithic industry, abundant macrofauna (elephant, hippopotamus, rhinoceros, horse, bovids, deer) and microfauna.</td>
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<td>All possibly with carbonated lenses</td>
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<tr>
<td>Assemblage IV</td>
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<tr>
<td>Level 1 carbonated clays passing laterally into limestones and clays with limestone nodules</td>
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<tr>
<td>Assemblage V</td>
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<tr>
<td>Level 12 oxidation of level 13a or 13b</td>
<td>Level 2 abundant lithic industry (numerous debitage products, nuclei and “pièces esquillées”, and their waste products), and fauna (horse, elephant, bovids, red deer), rare microfauna.</td>
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<tr>
<td>Levels 13a and 3b clays (13a) or greenish sands (13b)</td>
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<tr>
<td>Assemblage VI</td>
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<tr>
<td>Level 14 limestone passing into marls with limestone nodules</td>
<td>Level 3 lithic industry and fauna (horse, rhinoceros).</td>
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<tr>
<td>Level 15 hard limestone</td>
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has been recorded at the sites of Dmanisi (East Georgia), where there exists evidence of a human presence (Dzparidze et al., 1989; Gabunia & Vekua, 1995), and at Apollonia-1 and Ravin de Voulgarakis (Mygdonia Basin, Macedonia, Greece) (Koufos, 1992; Kostopoulos & Koufos, 1994; Kostopoulos, 1996; Martínez Navarro & Palmqvist, 1996).

Regarding micromammals from the archaeological level 1 (see Figure 4), Allophaiomys bourgondiae of Fuente Nueva-3 presents a morphology identical to some examples of species from Monte Peglia B (Italy) (Allophaiomys sp. B) (Van der Meulen, 1973). Allophaiomys chalinei of Fuente Nueva-3 displays a primitive morphology, with enamel differentiation of the M imomys type, similar to several examples of the type-locality from Cueva Victoria (Spain) (Alcalde et al., 1993). M imomys savini is represented by large-sized specimens similar to those found in other localities of the Gaudix–Baza Basin, such as Loma Quemada-I. M imomys oswaldoregi is a smaller but more highly evolved form of M imomys that until the present has been recorded only in the southern part of the Iberian Peninsula (Agustí et al., 1993).

The assemblage of large and small mammals and the degree of evolution of Allophaiomys bourgondiae (as well as of Allophaiomys chalinei) indicates that this locality is older than the lowermost levels of the Gran Dolina of Atapuerca (Spain), which are characterized by the following assemblage of mammals: Homo sp., Ursus sp., Felis sylvestris, Crocuta sp., Proboscidea.

Figure 4. Arvicolid from archaeological level 1 at Fuente Nueva-3: (1) Allophaiomys bourgondiae, right lower M1; (2) A. bourgondiae, left upper M3; (3) M imomys savini, right lower M1; (4) M. savini, right upper M3; (5) Allophaiomys chalinei, left lower M1; (6) A. chalinei, left lower M2; (7) A. chalinei, left upper M3.
indet., Equus caballus, Sus scrofa, Cervus daphus aff. acoronatus, Dama cf. dactoniana, Capreolus sp., Bos cf. primigenius, Pliomys episcopalis, Iberomys huetacarensis, Stenocranius gregaloides, Terricola arvalidens and others (Carbonell et al., 1995; Cuenca et al., 1995). This assemblage of the Gran Dolina of Atapuerca also includes some examples of Allophaiomys chalinei, but these, unlike those of Fuente Nueva-3, have enamel that is undifferentiated, or of the type Microtus (Cuenca et al., 1995).

All of this seems to indicate that the site of Fuente Nueva-3 occupies an intermediate biostratigraphical position between the levels with a diversified microfauna of rodents without roots (Microtus arvalidens zone) (Van der Meulen, 1973) and the levels with Allophaiomys pliocenicus, such as Venta Micena or Fuente Nueva-2. The lowermost levels of the Gran Dolina of Atapuerca are located in a reverse interval of Matuyama period (chron 1r.1r) while the highest levels are found in the normal period Bruhnes (chron 1n) (Parés & Pérez-González, 1995). Outside the Iberian Peninsula the deposit of Le Vallonet (France) also shows positive polarity, which has been correlated with the short normal period Jaramillo (chron 1r.1n) or with the older Bruhnes (base of the chron 1n) (Bonifay, 1980). As in the case of the Gran Dolina of Atapuerca, this locality contains examples of Microtus nivaloides (Chaline, 1985), more highly evolved than Allophaiomys bourgondiae of Fuente Nueva-3.

The Fuente Nueva series shows a record from the Upper Villanyan (MN17 zone at the site of FN-1) to the Upper Biharian (Allophaiomys bourgondiae zone) but the normal interval Olduvai (chron 2n) has not been localized, probably because of a hiatus. All the section must be included in the Matuyama period, where the FN-1 level must be located in the interval 2r (pre Olduvai), and the FN-2 and FN-3 levels in the interval 1r (post Olduvai) (Oms et al., 1996). Similar results have been obtained in other parts of the Guadix–Baza basin, the Cortes de Baza section (Oms et al., 1994). Based on this interpretation the Fuente Nueva-3 site is situated below the lowermost levels of the Gran Dolina of Atapuerca, probably one age before the normal interval Jaramillo (chron 1r.1n).

**Lithic artefacts**

The lithic artefacts of Fuente Nueva-3 are composed of limestone cobbles and knapped flint (Tixier et al., 1995; Turq et al., 1996). The former, around 100 altered objects, show no traces of having been intentionally worked. The diverse types of limestones present certain particularities of the modules, all weighing between 100 g and 2 kg, making it difficult to explain their presence at the site by any natural agent. The flint materials—composed until now of 114 pieces, 60 of them found in situ and the other 54 when cleaning the surface—originating from the alluvial formations of the paleo-channels which fed the lake. All display unquestionable signs of having been intentionally worked, and are found essentially in the archaeological level 2 (see Figure 5). All stages of the chaîne opératoire (operational/reduction sequence) are represented. The debitage (stone working) was performed with a hard, stone hammer (indicated by double bulbs of percussion and Siret-type accidents). The butts are cortical, plain, inclined, and rarely faceted. The intended use is still unclear, but apparently multiple (debitage products with nearly complete cutting edges, relatively thin flakes, rare cortically-backed flakes). The debitage modes are diverse, with reduction beginning directly from a raw block, or from a large flake (exploiting the inferior surface). The most frequent type consists of short series with relatively frequent changes of the debitage surface. The orientation of detachments can be unipolar, which yields products with a blade-like tendency, or centripetal. These characteristics are more common in the Middle Palaeolithic assemblages than in the more ancient series. In the assemblage from the archaeological level 2 a large
number of flakes are transformed, probably through utilization, into "pièces esquillées". These later, and the "bâtonnets", which are the characteristic fragments, represent by themselves close to 25% of the artefacts. Retouched tools are exceptional but present, represented by scrapers, notches and denticulates.

Conclusions

This lithic sequence, dated to the Lower Pleistocene, as with that of the base of the Gran Dolina of Atapuerca (TD-6) (Carbonell et al., 1995), which may be slightly more recent
confirms the existence in Western Europe of lithic industries older than 0.5 Ma BP (Dennell & Roebroeks, 1996). It represents a lithic assemblage that is original within the context of known Lower Palaeolithic series in Europe, displaying characteristics which more readily evoke those of the evolved O Iduwan in East Africa (Roche, 1989), O Iduvai (Leakey, 1971, 1975), or of the site, NY 18, Nyabusosi (Texier, 1995), which is dated between 1.5 and 2.0 Ma BP. These industries do not possess for the moment any criterion which would allow them to be included within the Acheulian (absence of bifacial working and of large flake production). The lithic sequences are few in both deposits (Fuente Nueva-3 and TD-6) and proceed from a very limited excavation, and thus do not permit the formation of definite conclusions, but these lithic artefacts are clearly distinct from our present image of the first European tools, which until now we have believed to be essentially composed of modified cobbles.

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