Settlement Dynamics of the Middle Paleolithic and Middle Stone Age

Volume II

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Abstract. Interaction between Neanderthals and Pleistocene landscapes of southeastern Spain is considered at two sites, one on the coast, the other 90 kilometres away in the uplands of the interior. Both sites afford palaeoenvironmental information that indicates they enjoyed favourably mild conditions. It is suggested these sites may have been in unusual locations, characterised by being exceptional refuges for plants and wildlife appropriate for sustained human subsistence, rather than being necessarily typical of ice-age environments across the region as a whole.

Résumé. La relation entre néandertaliens et paysages du Pléistocène est considérée autour de deux gisements fouillés du Sud-Est espagnol, un desquels est situé près de la côte méditerranéenne, l'autre, séparé par 90 kilomètres, est dans l'arrière-pays montagneux. Néanmoins, les deux gisements présentent information des environs anciens, indicative de conditions salutaires. Peut-être ils étaient situés dans lieux insolites avec caractères de refuges exceptionnels pour les plantes et les animaux convenables pour la subsistance continuée humaine, et qui n'étaient pas nécessairement typiques des environs d'époque glaciaire de toute la région en général.

RESOURCES, ENVIRONMENTS, PROBLEMS
This chapter discusses environmental aspects of two sites in their regional context. The two sites are separated from each other in both time and space. Abundant faunal remains, Middle Palaeolithic artefacts, and Neanderthal hominid bones and teeth have been excavated at Sima de las Palomas ("Dove Hole") del Cabezo Gordo (SPCG) and Cueva Negra ("Black Cave") del Estrecho del Río Quípar (CNERQ)
Vegetative remains at the two sites are given in Tables 1 and 2. Some paleoenvironmental inferences can be drawn from them, although detailed statistical and taphonomical results are still being prepared. At SPCG many bones of both small and large animals, including hominids, had been burnt. A hearth in our “upper cutting” might have been used to roast meat or dispose of rubbish, including bones abandoned by other predators and scavengers that were also present (fig. 2). Large herbivores would have grazed below the site (fig. 3) on a wide coastal plain fringed with marshes where Hippopotamus lived in or beside what today is a coastal lagoon (“Mar Menor”). Scallops (Pecten maximus), cockles (Cardium edule), and other molluscs were occasionally taken to the site. Neither fish bones nor otoliths have been found, despite wet-sieving of excavated soil through superimposed, nested, 8, 6 and 2 mm meshes.

Shrubs and trees are sparse near the barren, arid hill of Cabezo Gordo today. Scattered bush or woodland was suggested by the presence of Red and Fallow Deer at SPCG. Pollen analysis at SPCG shows there was a mosaic of trees and shrubs, with marked floristic diversity (Carrión García et al. 2003). Pines (Pinus), evergreen and deciduous oaks (Quercus), and many thermophilous species were present (Olea europaea, Myrtus communis, Pistacia lentiscus, Ephedra fragilis, Smilax aspera, Cistus sp.pl., Chamaerops humilis, Cosentinia vellea, Selaginella denticulata, Ruta, Coris). It is noteworthy that there were also Ibero-North African taxa which are ill-adapted to regeneration after frosts (Periploca angustifolia, Maytenus europaea, Withania frutescens, Oysris quadripartita). Mesophilous taxa are also represented (Betula, Corylus, Fraxinus, Ulmus, Alnus) and junipers (Juniperus), and there is abundant pollen of helio-xerophytic taxa characteristic of open landscapes (Artemisia; Chenopodiaceae). Samples taken for pollen analysis come from our “upper cutting” which has given both an AMS radiocarbon date of 34,450 ± 600 BP (OxA-10666: courtesy of R.E.M. Hedges and T.F.G. Higham; publication in preparation), and from 2 metres below that date a U-Th estimate of 56,000 (+13,000 - 10,000) years ago (Garcia Orellana 1997; Sánchez-Cabeza et al. 1999). Difficult as it is to undertake spatial reconstruction of the vegetation, pollen-rain research into the southeastern Spanish Upper Pleistocene brings to life a landscape of broad woodlands alternating with dense shrubland and areas with sub-steppe and halophilous taxa (implying saline substrates)—Chenopodiaceae, Artemisia, Lycium, Tamarix (Carrión García 1992a, 1999b; Carrión García et al. 1995a, 1995b, 1999; Carrión García and Munuera Giner 1997; Carrión García et al. 2003). Middle Palaesolithic pollen from Cueva Perneras (slightly more inland) is rather similar, though SPCG has greater floristic richness, and more mesophytes, reflecting warm, damp, coastal conditions, and far greater spatial heterogeneity than exists nowadays.

It is worth insisting here—and this is also applicable to CNERQ—that our research shows temperate trees surviving in Pleistocene refuges, in particular deciduous and evergreen oaks and other mesothermal elements typical of damp Mediterranean woodland ecosystems. Whilst it is beyond doubt that southern
Table 1. Sina de las Palomas del Cabezo Gordo: vertebrate fauna.

| Class Mammalia | Order Primates | Homo sapiens subsp. neanderthalensis |
| Order Carnivora | Panthera pardus subsp. banisianus |
| | Felis (Lynx) sp. |
| | Felis sp. |
| | Canis sp. |
| | Vulpes sp. |
| | Meles meles subsp. |
| | Equus (Asinus) sp. |
| | Equus africanus |
| | Equus (Artiodactyla) |
| | Equus (Equidae) |
| | Equus (Hippopotamidae) |
| | Equus (Bovidae) |
| | Equus (Camelidae) |
| | Equus (Artiodactyla) |
| | Equus (Equidae) |
| | Equus (Hippopotamidae) |
| | Equus (Bovidae) |
| | Equus (Camelidae) |

Table 2. Cueva Negra del Estrecho del Rio Quipar: vertebrate fauna.

| Class Aves | Order Anseriformes | Anser sp. |
| | Order Ceratogallinidae | Ceratogallinidae |
| | Order Piciformes | Picidae |
| | Order Columbiformes | Columba sp. |
| | Order Ciconiiformes | Ciconia sp. |
| | Order Galliformes | Gallus gallus |
| | Order Charadriiformes | Charadriiformes |
| | Order Falconiformes | Falco sp. |

Note: The avian fauna cannot be separated easily from birds found on the hill in recent times. Bird species found in the undisturbed Upper Pleistocene deposits of our "upper cutting" have °; however, these species, along with most avian remains, characterize other deposits that were made by nineteenth-century miners (in our "lower cutting" inside the cave, or in their dumps outside on the hillside; avian species only found in hillside mine rubble have a °).

CNERQ gives us two ice-age refuges of Mediterranean woodland with deciduous trees: one close to the sea, the other in an inland river valley over 700 m a.s.l. They probably belong to very different oxygen isotope stages, however. It is especially noteworthy that we have identified deciduous oaks near the Murcian coast because...
they demonstrate that rainfall there during the last ice age was undoubtedly significant.

In the light of the foregoing, it is convenient to outline the palaeopallynology at CNERQ (fig. 4), before turning to its fauna. Pollen from samples taken between layers 2b and 5e at the cave show that the surrounding landscape contained humid Mediterranean woodland, with a prevalence of both deciduous and evergreen oaks (*Quercus*), and to a lesser extent pines (*Pinus*) (Carrión García et al. 2003). Also represented are cluster pine (*Pinus pinaster*), hazel (*Corylus avellana*), beech (*Betula celtiberica*), ash (*Fraxinus angustifolia*), maple (*Acer granatense*), yew (*Taxus baccata*), arbutus or “strawberry tree” (*Arbutus unedo*), and heather (mainly *Erica arborea*). Hazel, beech and ash were likely to have been phreatophytes, given that there is also pollen of elm (*Ulmus*), willow (*Salix*), and cat-tails or bulrushes (*Typha*), which are usually found beside water-courses. The prevailing species characterise each pollen curve without much variation, indicating local environmental stability (notwithstanding minor oscillations between curves) without migration or arrival of new competitors becoming apparent. Throughout the sequence we see thermophilous Mediterranean taxa such as pistachio (*Pistacia lentiscus*), rock rose (*Cistus*), wild olive (*Olea europaea*), and mock-privet (*Phillyrea*). Nevertheless, pollen of the association Poaceae-Artemisia-Ephedra-Chenopodiaceae (sometimes with Asteraceae present also) reflects periglacial conditions away from the site, similar to those elsewhere in ice-age Europe. Juniper (*Juniperus*) seems to have been dispersed among the steppe ecosystems (probably as prostrate biotype). In short, the hinterland of Murcia was dominated by steppe vegetation of herbaceous plants and shrubs, whilst woodlands thrived in valleys of the Segura drainage basin. Very few other Spanish caves have pollen records that reflect woodlands over lengthy periods of time during the last ice age (Dupré Olivier 1988; Carrión García et al. 1999), important exceptions being Cova Beneito in the northern Alicante Mountains (Carrión García and Munuera Giner 1997) and most particularly, further north still, Abric Romani in Catalonia (Burgachs and Juliá 1994).

A moist wooded environment near CNERQ is suggested by amphibian bones and occasional fish otoliths retrieved by wet-sieving excavated soil over fine mesh, and by bones and teeth of Macaque, Giant Deer (*Megaceros*), and what is either Fallow or perhaps Roe Deer, in addition to Red Deer. Among the abundant birdlife were diving ducks which require deep water, and not only Wildfowl (*Tadorna, Anas, Netta, Aythya*, etc.), but also small wading birds like the Little Stint (*Calidris minuta*) and Sandpiper (*Tringa hypoleuca*). Geological traces of ancient Pleistocene or Plio-Pleistocene lakes abound in the Quipar valley upstream from CNERQ. These
in the foraging range of the rock-shelter. Open woodland (probably thickest along
the slopes of what then was a shallower valley than today) would have supported
the Woodpigeons, Owls, Nightjar, Woodpecker, Woodlark, Thrushes, Jay and some of
the Finches. Broad-leaved trees must have existed, including some species of
Quercus whose autumn acorns are most important in the diets of Jays and
Woodpigeons, at which seasons they and many other species of birds and mammals
engage in vigorous competition to gather and store these fruits. Other bird remains
tell us there was open country near CNERQ, both grassland as a niche for Larks and
Plovers (the latter being winter visitors or on passage), and moorland feeding
grounds for Coughs, Eagles and Falcons. Cliffs higher up in the sides of the valley
and in surrounding mountains offered an avian habitat similar to today's. Soft sedi-
ments, like those still present across the valley from the cave, gave accommodation
to Beaters and Sand Martins. Crag and clefts above and around CNERQ afforded
nest and roosting sites for resident species such as Coughs, Rock Doves, Crag
Martins, Swallows, Swifts, and Rock Thrushes (not unsurprisingly, cliff-roosting
birds are frequent at Mousterian cave sites, where they may best be seen as fellow
tenants with hominids, rather than as hunted prey; they feed on soil-living insects
and larvae). All the Hirundins, Apodidae and Beaters are good seasonal indicators,
being summer visitors with fairly precise dates of arrival and departure. If they were
predated upon by hominids, and not, as may be more probable, natural casualties,
they might even suggest a summer occupation of the cave to complement the autumn
and winter data presented by the water birds.

Analysis of CNERQ avifauna and pollen reveals a vanished landscape, where
different ecological habitat zones or biotopes intersected: (a) lakes and rivers with
temperate woodland, (b) open mixed woodland, (c) open grassland and moorland, as
well as (d) the crag and steep mountainsides which dominate an otherwise monoton-
onous open, dry landscape nowadays with scrub and occasional Pines. A small fresh-
water spring lies below CNERQ on the hillside today, but it is plausible that when
the site was used the source provided water very close to the site. Environmental
analyses at other Mousterian sites often reveal the presence of several biotopes, if
enough avian remains are sufficiently well preserved to allow the identification of
species. This is not always possible—as, alas, at SPCG, where pollen analysis
nonetheless reveals a landscape of great diversity, with warm-loving shrubs and
trees, as well as open country; furthermore, the presence of species that cannot rea-
dily tolerate frost, as well as evergreen oaks and other mesophilous trees, point to
warm, damp conditions, rendering it unlikely that any contemporaneous glacio-
estatic marine regression had drained the Mar Menor which, even if not a coastal
lagoon as at present, must at least have been a vast brackish swamp fed by copious
streams.

Head-parts of large mammals are noticeable at CNERQ where they were excava-
ted in sealed layers. Three allochthonous stone flakes and fragments, and a
Neanderthal canine tooth, were touching a rhinoceros skull: a parsimonious infer-

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ence implies hominin impingement. This was excavated next to a rhinoceros mandible and a large vertebra, but limb bones near the skull were limited to a Neanderthal forearm bone (ulna) and just two fragments of long bones of unidentifiable large mammals. Was the rhinoceros dismembered elsewhere, whether hunted or scavenged by hominids or carnivores, and brought to CNERQ by Neanderthals? Another rhinoceros hemimandible (Stephanorhinus h. mitoechoeus), from a lower level, has an ascending ramus that had been gnawed by carnivores, Neanderthals—or maybe both. Yet another rhinoceros mandibular fragment was excavated in a still deeper layer. An elephantid mandibular ramus was excavated in a high, but sealed layer; it covered an almost complete tortoise carapace. An immature elephantid vertebra was also found in another part of the site; no elephantid teeth have been found, therefore species identification cannot be made.

Hunting lions and hunting hominids stand alone as predators of mature elephants, but young elephants can be brought down by predators or leopards, or perhaps hunting hyenas. Lion has not yet been found at CNERQ, whereas Homo and Hyaenas have. A frontal fragment of Giant Deer (Megaceros) sprouting massive antler crown-beams was excavated in another part of CNERQ. A small block of Red Deer frontal bone was also excavated with the pedicle and base attached to it of a whittled-back antler crown beam—plausibly a knapping billet. (Two other whittled-down crown beam fragments perhaps were knapping billets, or “soft” hammers, that broke at the pedicle during use; it is unlikely we have mistaken porcupine gnawing for whittling, as there are neither porcupine bones, teeth, or quills, nor yet tell-tale marks on the long bones of middle-sized mammals, on which they prefer to gnaw: cf. Brain 1981. A Megaceros crown-beam fragment from Cueva Victoria could well also have been a knapping billet: see Gibert Clots 1989.) Now, stag antlers remains attached to the skull from mid-autumn to mid-spring, which, together with avian inferences, indicates CNERQ was in use during the coolest seasons of the year. Did people preferentially retrieve head-parts of animals already partly devoured by hyaenas or other carnivores (cf. Stiner 1995)? That conjecture, however, will have to be contrasted against our future results of taphonomical analysis of fragments of those long bones which defy faunal attribution, in line with a proposal that commensal scavengers gnawed head-parts lying around after Palaeolithic people ate the meat and then extracted marrow from the bones (Marean and Assefa 1999). This need not imply, of course, that there was never a schlepp effect (Perkins and Daly 1968) that might arise from selectively taking home some scavenged head-parts of large game from which the fat might be gleaned that is essential as a hominid energy-source when carbohydrates from edible plants are scarce in winter time (cf. Speth, 1987, 1990; Speth and Spielmann 1983). Nonetheless, the excellent preservation of extraordinarily abundant skeletal fragments of birds and small mammals from the area we have excavated at CNERQ is in contrast to a relative paucity of fragments of postcranial bones of larger mammals, which therefore were doubtless dismembered outside that area.

Signs of burning are sometimes found on bones of small mammals, birds, and fragments of egg-shell at CNERQ, though no fireplaces have been identified. Perhaps roasting took place in front of CNERQ (which might explain why CNERQ had relatively fewer burnt bones and teeth of large mammals than SPCG), on land removed by down-cutting of the river Quipar following lower pleniglacial times; the vestigial terrace in front of the rock-shelter today may well have been inside it before erosion and earthquakes cut back the overhanging roof of CNERQ (cf. Walker et al. 1998). Perhaps rubbish was swept to the dark rear of the rock-shelter. More important, the signs of burning imply that it was hominids who roasted and ate lago-morphs, birds, and eggs. True, very many kilograms are needed to provide the same amount of food as, say, a single Wild Boar. Nevertheless, minimum numbers of large fauna are so low that it may be wondered whether large game was really a significant source of food. For instance, although Wild Boar are plentiful near CNERQ today, this species is represented there by only one excavated fossil (a mandibular fragment with teeth). At SPCG burnt lagomorph bones are extraordinarily abundant in our “upper cutting.” A continuing difficulty here is that fragments of large mammals tend (a) to be small, and (b) to have come from our sieving of rubble strewn on the hillside below the site, very likely derived mainly from upper layers the miners dug out. Equid, bovid and cervid bones and teeth are abundant. Moving herds on the vast plain below must have been seen easily from SPCG on the hillside above.

The north-facing CNERQ rock-shelter must also have been a good look-out for scrutinizing herbivore or carnivore activity in water-meadows and swamps of the former flood-plain in a gorge shallower than today, and thence southwards over flat-topped uplands behind it, or northwards down the Quipar valley. Wildfowl and avian game are consistent with reliance on fat during cold months by predators. Migratory birds build up fat reserves for the next stage of their journey when they rest at wetlands en route; thus they become heavier and are then easier to catch when they try to fly away. Even the nearest former lakes was at least half-an-hour’s walk from CNERQ, and it therefore seems unlikely that, say, diving ducks were brought by non-human carnivores to the site.

Moreover, food for thought is provided by the absence at both CNERQ and SPCG of vulture bones, especially given that nowadays the (“Alpine”) Lammergeier occurs 50 kilometres from CNERQ (four vulture species still live in Spain today: Gypaetus barbatus austaus, Gyps fulvus, Aegypius monachus, Neophron percnopterus). This absence of scavenging birds contrasts with the presence of birds of prey at both sites. If this is more than a sampling error, it may imply that carrier was uncommon and offered slim pickings for scavengers, whether vultures, hyaenas or hominids. It is convenient here to remark that a handful of protected Red Deer still survive in the northwestern Murcian uplands, and barely 50 kilometres from CNERQ Spanish Iber survive also in the Sierra del Segura.

The Mediterranean biogeographical provinces known as Murcian-Almerian, Raetian, and Castilian-La Mancha-Maestrazgo overlap in northwestern Murcia,
terrace, the top of which lies some 10 metres above the rivers, had formed during the last interglacial period ca. 130,000-115,000 BP; cf. López Bermúdez 1973.)

Logically, therefore, the next major terrace up, glacial-terrace B (gtB), the top of which usually lies about 35 metres above the rivers, does not need to be any older than the lower pleni-glacial of the last ice age (rather than the penultimate interglacial period). Radiocarbon dating is no longer accurate here. For the top of this formation there are dates of about 40,000 BP and Palaenolithic artefacts are sometimes found in relation to calcareous crusts of about that date (Cuenca Payá and Walker 1986a; Vita-Finzi 1976). There are known instances of multiple terraces dating from within the Upper Pleistocene in England and elsewhere (Brown 1997: esp. pp. 34-37 and refs.). At roughly 70 and 100 metres above the rivers of the Segura Basin lie, respectively, gtC and gtD; although their ages are unknown, there is no overwhelming reason for presuming them to be other than Middle Pleistocene, and tectonic instability, with consequent erosion, is likely to have been responsible for the paucity of both continental land-forms and coastal formations from before half-a-million years ago (Cuenca Payá et al. 1986).

Evidently, gtB corresponds to a vastly greater accumulation of sediment than gtA which, of course, could only begin to form once erosion, by fluvial rejuvenation, had removed most of the gtB sediment throughout its 35-m depth, leaving but vestiges on valley slopes. Although these are often at some distance from modern water-courses, vestiges of both gtA and gtB lie quite close to the River Quipar where it emerges from the gorge. Even here, for every 10 cubic metres of gtA there must have been 150-250 cubic metres of gtB, of which little more than 10% survives. Erosion on such a massive scale seems unlikely if the requisite increase in available surface water were to have been limited to a relatively short interpleni-glacial stage, for example, one of some 10,000 years prior to the onset of the upper pleni-glacial around 29,000 BP, which tended to colour the thinking of twenty years ago. It becomes more plausible now that the upper and lower pleni-glacia!s may well have been separated by about 25,000 years. Furthermore, detection of many short climatic oscillations during the Upper Pleistocene (Davies et al. 2000 and refs.), combined with recognition of an ever-increasing number of complex neotectonic phenomena in the Segura Basin, could mean that not all the dates of about 40,000 BP should be dismissed out of hand.

Below CNERQ the River Quipar follows an inverse fault. The onset of the Middle Pleistocene broadly coincided with a change in the direction of predominant geodynamic activity in the Murcian region, which now involved compression on a NW-SE axis and brought about a significant increase in relief along inverse faults which cross that axis (Martínez Díaz and Hernández Enríque, 1992). This neotectonic activity first brought about uplift west of the river which thus was diverted eastwards, about two kilometres north of CNERQ, by the end of the Middle Pleistocene, whereas in former times it had flowed northwards to join the River Argos at a lake where the town of Caravaca de la Cruz now stands (González Hernández et al.
place on the east flank of the Quipar gorge, such that the surface of the CNERQ sedimentary fill is higher than the surface of g1B on the west side of the valley opposite the cave. Any lake present just where the new, eastward course of the river was evolving would have been within easy walking distance from CNERQ. The immediate vicinity of the rock-shelter would have afforded excellent views downstream, taking in the erstwhile lake.

Although the CNERQ sediments lie at roughly the same height above the river as those of g1B opposite the cave, and might therefore be considered contemporaneous, a less parsimonious conjecture that the cave fill is older than g1B is by no means unthinkable. The fill might be a vestigial remnant of Middle Pleistocene alluviation in the valley, protected under the roof of the rock-shelter, which very likely extended further outwards than today, from removal by erosional processes responsible for erasing g1B sediments outside the cave that had backed up against an earlier fill inside. New results from relative dating methods provide some support for this conjecture.

Absolute geophysical dating (OSL, TL and C-14) at CNERQ has so far failed to be of help. Recent organic material, which must have fallen into the deep retraction fissures that penetrate the Pleistocene sediments, has given only modern radiocarbon dates on three samples sent to Oxford. Absence of prehistoric radiocarbon dates might hint that the sediments themselves are beyond the range of radiocarbon dating. The cave was visited in Roman times as archaeological finds testify, used by renegades after the Spanish Civil War (1936-1939) who dug pits as hide-aways, and still more recently served as a pen for sheep and goats. Unfortunately, heat-cracked chert fragments were found to be insufficient at Oxford for thermoluminescence dating, and sediment samples taken under the control of Oxford's portable gamma-ray spectrometer gave inadequate signals for age estimation there. New attempts at OSL dating have commenced in 2003.

Relative dating is provided by mammalian palaeontology and Palaeolithic archaeology. Extinct mammals such as Stephanorhinus hemitoechus, Bison, Megacerus, Macaca and Prolagus suggest an age probably no later than oxygen isotope stage 5 (OIS 5). Preliminary analysis of numerous fossil rodent teeth from CNERQ, recovered by washing excavated sediment on a 2-mm mesh, implies an age no later than OIS 5 by comparison with other well-studied Spanish Middle Pleistocene rodent sequences. The remarkably large molar teeth of the Field-Mouse Apodemus at CNERQ invite comparison with those of Apodemus aff. mystacinus at the Middle Pleistocene site of Huéscar 1 in nearby Granada province. Mimomys and Arvicola are vole taxa which, despite similar molar occlusal shape, differ by having closed (rhizodont) and open (arhizodont) roots, respectively. CNERQ has several teeth of both kinds (help in identifying them was kindly given by Dr. A. Ruiz Bustos of Granada University). The CNERQ Arvicola lower first molars have a mean length of 3.04 mm (n=34), comparable to other Spanish Arvicola specimens from the
ears ago corresponds to the Lower to Middle Palaeolithic boundary in the Levant (Bar-Yosef et al. 2002). CNERQ could belong to the period between 300,000 and 200,000 years ago, so indeed the *Mimomys-Arvicola* transition lasted until OIS 9 in south-east Spain.

The CNERQ sediment mainly consists of products from erosion of the Miocene (Tortonian) sandy limestone, containing very fragmented bioclasts, in which the rock-shelter lies, along with 10-15% of fine, angular, microscopically-pitted, siltine particles, comparable to wind-blown loess (Walker et al. 1998). No sorted gravel have yet been found such as might have been left had the River Quipar ever wandered into the cave across a swampy floodplain. Angular scree and fallen rocks occur, doubtless caused by earthquakes or frost-shattering: tremors are common in southeastern Spain and frost occurs in CNERQ in late autumn and winter in today's interglacial period. CNERQ faces north, which is most uncommon for a Mousterian cave site. It must have experienced bitterly cold, ice-age winters, mounds rising to 1,500 m overlook CNERQ. Others reach 2,000 m only 30 km away, and 150 km to the south the highest peaks of the Sierra Nevada reach up to 3,000 m, which were surrounded sporadically by ice-age glaciers above 2,000 m.

CNERQ's Mousterian knappers brought pebbles of flinty, calcareous chert, card, fine-grained, metamorphosed siliceous dolomite, and limestone, or some other rock varieties, and very occasionally good flint, mostly from 800 m away on the north slope, where these all occur (along with complete Pectinid and Ostroid shells) in a 50-m diameter conglomerate outcrop in Miocene (Tortonian) calcarenite immediately beneath the strata wherein CNERQ lies. A post-orogenic, late Tertiary beach formed here when Tethys Sea waves washed metamorphic nodules of a former sea cliff of Jurassic limestone. Part of the reason why the Miocene stage Sea was washed Jurassic cliffs, rather than cliffs of rocks formed in later epochs, that here, as elsewhere in the region (cf. Baena et al. 1973), the mid-Tertiary to present sub-Betic Zone has brought about overthrusting of the Jurassic with respect to Cretaceous and early Tertiary rocks, though traces of these occur not far in important outcrop (one of them contains traces of the worldwide Palaeocene-Neogene layer of extra-terrestrial meteoric origin). The conglomerate, which represents the former Miocene beach in front of the cliffs, has been exposed by nick-point erosion of a gully during the Quaternary. Its useful cobbles were thus visible to eolithic knappers who certainly used them.

Thus a recurrent centripetal Mousterian disc core comes from the conglomerate proper. Nodules, blanks, and worked artefacts were taken from the outcrop to ERQ. The intractability to knappers of most of the raw materials to hand at ERQ has led us to define categories as simply: flattish side scrapers, denticulates, notched pieces; carinated pieces and very steep or end-scrapers; recurrent central disc cores; gravels; chopping tools; struck flakes without retouch; hammerstones; nodules and cobbles; knocking débitage. Petrological diversity and irregular weathering make it often difficult to distinguish the various aspects of raw material used in order to rejuvenate either nodules or flake-blanks, from retouch of either in order to produce clearly identifiable tool types from them. Spatiotemporal clusters of knapping débitage have been identified. There are neither Levallois points nor stubby points (or thick convergent scrapers), in marked contrast to Sima de las Palomas (SPCG). It is worth remarking that CNERQ lacks any of the pebbles of ultrabasic and basic rocks, schists, or slates, that were brought down by the River Quipar, from its distant headwaters among mountains characterized by igneous and metamorphic rocks. Together with limestone cobbles, these other raw materials occur sporadically in the eroded side of Quipar well below the level of the cave mouth. As already remarked, the sidefill of Quipar, those cobbles would have lain invisibly below that flood plain, unknown and hence unsought.

Just how far afield people went from CNERQ to get flint is unknown. White flint very occasionally occurs both at CNERQ and at the conglomerate outcrop, though the nearest major sources are some 40 km south. Large blocks of zoned flint were not taken to CNERQ, although it has long been known that they occur widely in the local Jurassic (Jiménez de Cisneros 1909; cf. Jiménez de Cisneros 1904, 1910). Moreover, they are also plentiful in the Tertiary and Quaternary fluvialite loose gravel 20 kilometres upstream from CNERQ, in which Mousterian retouched flakes have been found below the Sierra de las Junqueras. Their abundance in these gravels perhaps implies that they were an outcome of continental erosion of conglomerates formed by Miocene marine erosion of Jurassic beds. Some dark flint at CNERQ could have come from a very small Piélagos outcrop of transitional flint (i.e., formed by a volcanic vent in the Tethys Sea bed), 15 kilometres upstream near Los Rios, from a few kilometres from a prominent hill whose twin peaks are just visible on clear days from the CNERQ terrace, peeping just above the southern horizon and so affording a line of sight on which to journey. If there had been a view in the opposite direction, taking in lakes and swamps downstream, CNERQ takes on added significance. Maybe the cold, north-facing CNERQ was preferred partly because of likely significant lines of sight. Maybe also, if fowlers were indeed exploiting wintering wildfowl and waders on nearby lakes, then it could well have been to their advantage to have been facing away from south-easterly winds drawn in by high-pressure atmospheric cells over the high ground that characterizes most of the Iberian Peninsula. Yet, no Mousterian artefacts occur at the flint outcrop near Los Rios, and the Quipar could have changed course even before CNERQ came into use. One small fragment of rock crystal (transparent quartz) probably came from the coastal region; perhaps this rarity means there was no contact to speak of with the coast.

At Cabezo Gordo, 90 km from CNERQ, rock crystal was knapped at SPCG. This and other forms of quartz occur widely in the Sierra Minera which runs behind the southern Murcian coast, of which Cabezo Gordo is an outlying hill. It is an isolated Triassic marble massif where, as well as marble, metamorphism produced crys-
transparent rock crystal, micaceous slate, micacite, greenish micaschists, magnetite, iron hydroxides, iron pyrites, and copper and manganese oxides (Cohron et al. 1994). E-W faults separate the hill's steep northern peak from its elongated southern limb at a saddle lying at 175 m a.s.l. where quartz and micaceous slate outcrop in beds a few metres thick. No flint sources have been found anywhere, though mining and quarrying may have eliminated them or rubble heaps may have covered them; none are known either to quarymen at a vast century-old marble quarry, or local conservationists, nor has our survey of the hill found any as yet. A plausible conjecture is that Middle Palaeolithic flint was brought from either the Sierra Minera 20-30 km south or the Sierra de Carrascoc 20 km to the NW, in both of which flint or chert sources are known. Oddly, neither continental nor marine terraces line the hillside, though Quaternary marine terraces and continental formations abound both to its north and inland to its east. This makes it impossible to tell whether occupation might have extended outwards from the mouth of the SPCG shaft, and whether the hillside could have supported woodland.

Mining ended before World War I at Cabezo Gordo (de Gálvez-Calero 1913). Detailed records about individual mining concessions have disappeared, and at SPCG archaeological research alone has reconstructed the sequence of operations. Originally SPCG was a natural karstic cave system with more vertical than horizontal development. Today there are three entrances to the main chamber: the upper and middle give direct access, whereas the third is by a mine level. The main chamber today gives access to a descending natural passage ending in a karstic shaft. Careful archaeological excavation, together with new geological research, is beginning to clarify the complex evolution both of the natural system and its sediments, as well as of how mining altered them. The following detailed explanation is necessary in order to understand what the cave system was like when hominids were present.

A small vein of magnetite close to the middle entrance was removed by miners who then climbed down what was very likely a narrow open rift about ten metres deep. It is plausible that some 15-20 m below the magnetite vein water seeped out on the hillside, but that the only way miners could reach this precious resource was to climb down to its underground source. The hillside has one other source of water, over half a kilometre north-west, which is the Cueva del Agua ("Water Cave"). Unlike SPCG, this cave still contains water which, moreover, is about 15 m higher than the surrounding plain of the Campo de Cartagena. Probably hydrostatic pressure in an aquifer under the plain is responsible. The Cueva del Agua is mostly a large mine. At the end of a long mine level rock-cut steps lead down to a water sump. A side gallery leads, via a square doorway, cut artificially through a rock wall, into a natural karstic passage, which descends to water beyond the sump, albeit at a deeper situation. Here it became dry recently although the higher water was maintained, suggesting separate aquifers, which may owe to steeply-lying, impermeable micaschists alternating with the marble of the hillside. At the inner end of the SPCG rift, through a rock wall, leading into a natural karstic passage, which descends steeply to a 6-m deep terminal shaft with a sandy floor, where SPCG ends. The parallel is highly suggestive.

No magnetite veins can be seen inside SPCG, so it is most likely that the water at the bottom of the cave was the object of the miners' activity. Archaeological excavation in our "lower cutting" indicated that the miners seem first to have gathered up a large quantity of skeletal or decomposing remains of rock doves, choughs, bats, and vermin, burnt them at the foot of the entrance rift, and then rapidly covered them up with sediment they had to dig out further inside the cave (breaking an implement that left iron nails among the rubbish). The "marbled" appearance of the sections of our "lower cutting" are typical of ancient anthropic disturbance. Thus buried, small needle-sharp bones ceased to be a threat to feet shod only in esparto grass sandals. Although we initially thought the remains were a pointer to direct low-lying Pleistocene access to the main chamber through the lower part of a rift communicating horizontally with the outside, we know now they were burnt where the rift becomes an impassable, enclosed niche. The miners widened the rift and built a typical stone revetment reaching half-way up to serve as a landing for their wooden ladders. Water would have been carried or hauled up in skins or buckets. After dynamite was patented in 1875 its use spread rapidly and before mining ceased in 1913 a mine level was blasted from the outside towards the base of the rift, so that donkeys could bring out water in panniers. Although its floor was at a height equivalent to the top of the soil and rubble dumped by miners in the bottom of the rift, the rift itself lacked width enough to receive the wide mine level. Widening the internal space destroyed the north wall of the rift and brought to light (and tumbling down!) a tower of soil and slabs that lay hidden behind it, thereby opening up the main chamber, into which both the upper and middle entrances open now above. This is the column of Upper Pleistocene fossiliferous breccia that extends 18 m upwards to the upper entrance of SPCG. How far down it goes is unknown. What we can say is that excavation reveals that the fill in the bottom of the rift had nothing at all to do with the Pleistocene deposit.

So when and how did the breccia column form? Optical sediment luminescence, OSL, has given a maximum age of $157,000 \pm 22,500$ years ago from a sample from a core taken half-way down the breccia column (courtesy of Drs. M. S. Tite, S. Hall and E. Rhodes of the Oxford University Research Laboratory for Archaeology and the History of Art; Dr. Rhodes' comment that "sample grains may not have been exposed to sufficient light to zero fully the signal at the time of deposition" was quoted in Walker et al. 1998). Being a maximum age, it does not contradict uranium-series, U-Th estimates for the base of the breccia column on samples of pure calcium carbonate of $117,000 \pm 29,000$ years ago, and of $118,000 +20,000 -16,000$ years ago on impure calcium carbonate, both taken at one place, and of 124,000 $(+20,000 -15,000)$ years ago on impure calcium carbonate taken at another; counting used
high-resolution low-background alpha-spectrometry (García Orellana 1997; Sánchez-Cabeza et al. 1999). Background irradiation was subsequently determined at 1.25 Gray per millennium, using the Oxford laboratory’s portable gamma-spectrometer. It is also in order to comment here on three ESR estimates on stratiﬁed bone from mine rubble around the site, made by Dr P. J. Pomery and D. U. N. Centre of the University of Queensland. They were made before erection in 1994 of scaffolding tower inside the shaft that enabled excavation of the “upper cutting” to begin, and their purpose was to support our attribution of the ﬁnds to the Middle Pleistocene, and hence a request for public funds to pay for erecting a tower in order to get unﬁtted access to the breccia column, which hitherto could only be reached by abseiling down a rope or climbing down a scarpological wire ladder. Because dosimetry had not yet been carried out, the three alternative estimates were provided by Dr. Pomery in terms of alternative conjectural background irradiations at 1 or 2 Gray/ky, namely, as follows: either 83,000 or 42,000 years ago; either 146,000 or 13,000 years ago; and either 532,000 or 266,000 years ago: Gibert et al. 1994. The two pairs fall within a range that seems broadly commensurable with the other thods. The third pair seems anomalous, unless perhaps it is dating material that might have come from somewhere as deep as the lower sediments excavated in our lower cutting.”

As already mentioned, the uppermost part of the breccia column has given both AMS radiocarbon date of 34,450 ± 600 BP (OxA-10666: courtesy of R.E.M. Gjessing and T.G.F. Higham; publication in preparation) from our “upper cutting,” from 2 metres below that date there is a U-Th estimate of 56,000 (+13,000 yearly) years ago (García Orellana 1997; Sánchez-Cabeza et al. 1999).

The breccia column was at ﬁrst described as containing three approximately 6 m thick units of cemented lutite, silt, sand, and angular stones (Gibert Clois et al. 1994; Iker et al. 1999a), separated by calcretes, which perhaps formed on partly-erosion surfaces of pleniglacial aggradations. In 1999, the geologist Elizabeth Richards (department of Geography, CATA, Carmarthen, UK) subdivided the visible breccia column further and her observations form the basis of the following account. Sections of calcrete ﬂowstone all around the top of the shaft imply the breccia ﬁll was sealed until mining reopened the shaft. The uppermost 3.2 m of ﬁll, containing “upper cutting,” form a lithostratigraphical unit comprising wind-blown silt, scattered rock and scree. Below it are 1.2 m of stony limestone breccia, used under seismic or freeze-thaw conditions, or both, as tremors and earthquakes not inefﬁcient throughout Murcia. Underneath that is an inclined, graded, water-ﬁll, deposit of sand, silt, and gravel, 20 cm thick, resting on large angular stones; it deﬁes a period marked by an increase in available surface water. Below this are 40 cm of scattered rock and scree, wind-blow, sand, and silt, resting on an inclined 5 thick calcrete ﬂowstone that probably indicates a dry interlude. This covers a 30 thick wedge of collapsed scree, in turn lying on top of nearly 3.8 m of scattered k and scree in sand and silt, caused by aeolian and seismic or freeze-thaw processes. There follow 7.2 m of shattered rock, scree, and sand, probably caused by similar processes over a long period.

The lowest 2.8 m are rather different. From above downwards, the breccia here takes on an increasingly crumbly appearance, and the soil has a grossly mottled appearance, with irregular lenses of colours that may be black, whitish-grey or red. The red lenses seem to be rich in haematite. The whitish-grey lenses were subjected to burning, because gas chromatography implies paucity of organic matter, and X-ray diffraction analyses highlight a preponderance of sand that implies thermal effects; this in contrast to the presence of carbonates, phosphates, as well as sand, in over- and under-lying sediments (Walker et al. 1999a). This zone might suggest repeated inundation and reworking of the breccia ﬁll by ﬂuctuating water levels in aquifers, rising up from beneath the surrounding plain. Plausibly, some of the burnt and calcined skeletal remains of Neanderthal hominids could well have come from these or similar layers, even though they were found in unstratiﬁed situations during clearance of mine rubble beside the foot of the breccia column. Likewise, a skull, mandible and postcranial bones (all unburnt) of Panthera pardus subsp. lunellenism were found before excavation at a similar level by local conservationists who entered the cave and later gave the specimens to us; it is a late Middle Pleistocene taxon which possibly survived at least well into the last interglacial period.

Settlement hydrodynamics (in both senses of the phrase) have played a singular part at SPCG. We propose that hydrostatic pressure during the humid last interglacial period not only ﬁlled the terminal shaft but also the shaft where the ﬂoﬀerous breccia column formed, and that both shafts were separated by impermeable rock walls from the rift whereby the miners later entered. When hominids visited the site, they found a rock-shelter where the upper entrance to the main chamber now is, in which there was a deep pool of water or spring beside which they stayed, sweeping ash from ﬁreplace into it along with rubbish, some of which was also burnt, including some hominid bones. Later on, the water table fell and rubble and soil were washed into the pit. By the time the Neanderthals around 35,000 BP were visiting the site, the pit had completely ﬁlled up and probably offered an earth ﬂoor with rubble. No doubt there was a spring of fresh water on the hillside, perhaps the same one that evoked the miners’ attention and energies in recent times, probably in the gully below the entrance to the mine level. Presence of water beside SPCG was perhaps a decisive factor in preferring to use the site rather than other rock-shelters that may have existed. It certainly is entirely consistent with the palaeoecological evidences from the “upper cutting” that the palaeoenvironment of Neanderthal folk at SPCG was humid enough for there to be deciduous oaks in the landscape. Below SPCG, where the hillside meets the plain, geothermal water is present at a depth of barely 20 m, and it is very likely that hot springs were present in the Upper Pleistocene and may have helped frost-resistant shrubs and plants to survive in a very restricted microenvironment.
At SPCG the Middle Palaeolithic artefacts, both those excavated in the "upper cutting," and those found by sieving mine rubble, are of flint, chert, quartz, rock crystal, quartzite, marble and limestone. Flake tools are mainly sidescrapers, endscrapers, stubby points (or convergent scrapers), denticulates, among which we include Tayac points, following Debénath and Dibble (1994), Lévallois and pseudo-Lévallois triangular points (though we heed warnings by Boëda 1994 and Perpère 1989), unretouched flakes, hammerstones, and two extraordinary pieces that look like thick, oval, Lévallois flakes, with a t a tiny, low, awl-like "nose" flanked by two notches and itself strengthened by diminutive, steep, flake scars. These may have been awls or borers, possibly used for piercing skins. An incisor of a small Hippopotamus has an artificial transverse groove (perhaps to ensure that a thong or string stayed attached to it); the tooth, worn down almost to its neck, showed no root canal exposed. Comparison of stratified and unstratified pieces in terms of rock type reveals disproportionately abundant representation, especially with respect to quartz pieces, of both marble/limestone and chert/flint in the unstratified collection when contrasted against the excavated one. This could reflect spatiotemporal differences as yet undisclosed by our systematic excavation of but a small volume of the breccia column. Chert/flint predominates in our collection, followed by quartz and marble/limestone in similar proportions. It seems that locally available limestone was knapped at or beside the site as need arose, whereas more care was taken of chert/flint that was carried uphill from further afield and was subject to more resharpening or reuse.

**SETTLEMENT DYNAMICS AND THE NEANDERTHAL LANDSCAPE**

SPCG and CNERQ aside, other undoubtedly important Middle Palaeolithic sites are Cueva Perneras, Cueva del Cuchiño, and probably also Cueva de la Zájara I (fig. 5, found at the end of this chapter). At Perneras, Upper Palaeolithic layers followed Mousterian layers (Montes Bernádez 1989a; Siret 1893, 1931) that possibly are no earlier than the interplenigacial period during the last ice age. The Cueva del Cuchiño Mousterian need be no earlier (Cuena Payá and Walker 1974) and "Audi" backed flakes suggest a similarly advanced phase for the Cueva de la Zájara I assemblage (Almagro Basch 1947; Siret 1931). Other stratified Mousterian assemblages within otherwise archaeologically sterile beds suggest fleeting occupation (e.g., Cueva Antón). Figure 5 shows almost fifty Middle and Lower Palaeolithic sites or find spots, though only half provide confirmed Middle Palaeolithic artefacts, and most of these are poorly stratified or unstratified surface collections that may often be mixed assemblages. New open sites with Mousterian artefacts published in the past decade lend support to a thirty-year old view that the hinterland offers relatively more Middle than Upper Palaeolithic sites when compared to coastal areas (Cuena Payá and Walker 1977). Artefacts at open sites are not always in situ. Sometimes they seem to come from nearby gravels (e.g., Cuena Payá and Walker 1986a; López Campuzano et al. 1995; Montes Bernádez et al. 1996). Others are scatters that may reflect differential loss over the landscape, especially where no obvious source can be seen. The impression received is that surface finds often lie on gît or have been eroded out of upper part. Some surface collections come from supposedly "provisioning" or "working" sites, where stone raw materials were used or modified not only during the Palaeolithic but also in later prehistoric and even historical times. To complicate matters further, it is not just a matter of one kind of raw material, such as flint or chert, because quartzite, quartz, and limestone often form a noteworthy proportion of Middle Palaeolithic assemblages (cf. Montes Bernádez 1983, 1984, 1985a, 1985b, 1986, 1989a).

To what extent many of the stations shown in figure 5 reflect settlement patterns is a moot point. Indeed, to what extent "settlement of a landscape" is a meaningful notion depends on how "fine-grained" a focus we can achieve (cf. Gamble 1986). The more that undatable assemblages are included to justify the notion, the more "coarse-grained" and intangible becomes the ghostly vision we conjure up. Attention should perhaps be focussed first on the dynamics of landscape change as not to lose sight of both temporal parameters and also spatial ones. The latter can no more be avoided than the former, were erosional features in the landscape to imply removal of artefacts from some areas now bereft of them, and burial of others now out of view. Is "What we see, What we get"? Or does what we see reflect skewed distributions that may have come down to us? Here, the importance of caves with deep sequences may be their ability to offer a microenvironmental "anchor" for our conjectural models about Palaeolithic landscape dynamics. This may be particularly important were such cave sites to have been chosen precisely because they were situated in unusual locations that were especially environmentally friendly with respect to prospects for stable homind survival, perhaps because they afforded a wider range of bioenergetic (and mineral) resources than did perhaps 95% of the landscape of an ice-age region during much of the Upper Pleistocene.

That is a disturbing and unorthodox thought. It may, however, help towards explaining the extraordinarily wide range of biotopes that have left palaeoecological and palaeontological traces at CNERQ and SPCG, ranging from closed to open landscapes, and wetlands, without a need to presume in advance, what is now a future task of scientific inquiry to ascertain, namely, that the entire region, from the coast to the headwaters of the rainfall basins, might have been covered by a rich, heterogeneous patchwork of alternating microenvironments invoking the maxim that "absence of evidence need not imply evidence of absence"; but this surely cannot be a null hypothesis of choice, particularly since not even with favourable interglacial conditions can this be shown to have been the case here during the past few thousand years (Cuena Payá and Walker 1985a, 1985b, 1986b, 1986c, 1986d, 1986e; Walker 1981, 1986).

Null hypotheses have an important part to play in developing an archaeology with a scientific epistemology (Binford 1989; Murray and Walker 1988; Walker 1990). As Clark and Lindly (1989) have remarked, "little is to be gained by ignoring
what to do and where to go within it? Is to imagine tracks, whether following meandering valley bottoms, or across moorlands between and merely crossing the valleys which dissect our Murcian uplands (or both, criss-crossing every which way), really saying anything more interesting than that bipedal primates can walk much further than can the quadrupedal chimpanzees? Or is it more like those simple-minded puzzles we give to four-year-olds who jump on numbers on paper with lines and clap their hands in delight when a pussy cat is revealed? Mummy does not clap her hands in glee, because she knew the numbers were (a) not scattered randomly, and, in a self-serving fashion, (b) a prearranged finite set. We are in no position to know either (a) or (b) about our numbers on figure 5. Perhaps, then, we should go back and consider whether sites with deep stratigraphical sequences might not offer us a perspective, not so much as "our view from CNERQ" or "our view from SPCCG," as that of a microenvironmental "anchor" for our imaginary models about Palaeolithic landscapes. We repeat that this may be especially relevant where those or similar cave sites to have been selected for repeated visits precisely because they were situated in atypical locations that were particularly environmentally-friendly as regards prospects for stable hominid survival, on account of their proximity to a wider range of bioenergetic (and mineral) resources than were available in similar concentrations in most of the ice-age landscapes of our region during long periods of the Upper Pleistocene.

The other interpretative approach we mentioned is that of site-catchment analysis and the consideration of site exploitation territories in long-vanished environments that might be envisaged. This also can be simple-mindedly applied to draw a stunningly banal inference that hominids, as with all large mammals, have to eat and drink a good amount every day. Indeed, the approach presents several problems, some less obvious than others, but by and large this palaeoecological approach may be compared to Lew Binford's concept of "middle-range theory" (Bailey and Davidson 1983). A major drawback of the palaeoecological approach, from an epistemological point of view, is its realist premise (cf. Murray and Walker 1988; Walker 1990). Provided this can be satisfactorily dealt with, a major advantage of the palaeoecological approach is its potential to be a contrastive one. Middle-range theory has much in common with plausible conjectures about processual models. To that extent, the palaeoecological approach may help us to highlight some problems and may inspire novel working hypotheses that enable us to look harder at them. It assumes, as a reasonable starting point, that, in so far as human beings are creatures whose survival depends on enough regular food and water, and avoidance of prolonged exposure to extremes of temperature, some plausible conjectures can be made about what behaviour might be minimally satisfactory.

The palaeoecological approach to considering how a prehistoric community might, in all likelihood, have managed to survive, can be summed up by, "What we find is what we got." This implies that we must first excavate sites where people stayed; secondly, attempt the archaeological recovery of organic remains of animals
and plants at these sites, usually, try, from those remains, to reconstruct the environment at each site (i.e., what was caught or taken); and fourthly, compare the catchment we have thereby defined with what was likely to have been available for exploitation in the territory around a site (Vita-Finzi and Higgs 1970; Vita-Finzi 1977). It requires that account be taken of geological and geomorphological processes in our attempts at reconstructing ancient landscapes, and it regards palaeoentological, palaeobotanical, palaeoecological, and palaeoclimatological findings as signalling what was likely to have been available or unavailable in them. Far from being disarmed by findings that past behaviour sometimes seems to lack clear-cut actualistic analogies among modern hunters and gatherers, the palaeoeconomic approach accepts the past for what it was, "warts and all," taking a long-term view about evolution of hominids and their behaviour, which is not particularly bothered about whether the distant past was specially like the present or not.

Herein, perhaps, lies its Achilles' heel, namely, a tendency to replace a uniformitarian assumption about an actualistic ethnographical present with a uniformitarian tacit assumption that there were very long periods indeed—thousands of years or even tens of thousands of years—that were characterized by unchanging long-lost behavioural responses to an unchanging long-lost palaeoenvironment. However reasonable the assumption may have seemed forty years ago, it is surely open to question in the light of today's detailed knowledge about multiple Upper Pleistocene climatic oscillations (cf. Davies et al. 2000), and, in so far as we question this embedded uniformitarian postulate, we must strongly take issue with traditional processualist interpretations and dissociate ourselves from them.

In part, no doubt, the assumption reflects both an inability of archaeological excavations to document brief oscillations stratigraphically, let alone to date them precisely before 35,000 years ago, and an archaeozoological need sometimes to bundle together—despite having been excavated in different layers of a site—those skeletal parts that can be accurately separated into different species of larger mammals, in order to obtain minimum numbers of individuals which might show statistically significant differences between the species represented by the bones and teeth, whereas all too often insufficient care and attention have been paid to retrieval of the remains of small creatures in great numbers (cf. Chase 1991). Careful avian palaeoentology is beginning to show that there was a more widespread and more eclectic exploitation of birds at sites with Middle Palaeolithic occupation in western Europe than at its Lower or Upper Palaeolithic sites.

In part, also, the assumption reflects an "adaptationist" outlook, presuming that which it should be the task of scientific endeavour to determine: namely, that archaic folk at a given site only survived there because they had somehow become stastically well-adapted to their surroundings and hence stayed rooted to the spot. This calls to mind a mischievous parody of Darwinian theory as merely asserting that "survivors survived," whereas of course Darwin argued that natural selection implies that survivors survived with differences, which is a dynamic concept, not a static one.

Moreover, that survivors survived differentially is also intrinsic to Darwinian theory, which carries logical implications that some adaptive features of species in the fossil record may have been short-lived, or even incompatible with "static" survival. It is a matter of theoretical interest in anthropology just how far evolutionary processes in human biology may have been different from, or similar to, those responsible for human culture and behaviour (cf. Boyd and Richerson 1985). A matter for speculative conjecture, furthermore, is whether the evolution of behaviour, even as recently as the earlier Upper Pleistocene, could have been intrinsically different in such biologically divergent palaeoanthropological groups as were Neanderthal and Crô-Magnon humans in western Eurasia.

The palaeoeconomic approach, nevertheless, accepts without qualms that prehistoric people depended on species of animals and plants that were noticeably different from those near to their sites nowadays. It is often hard for us to envisage what their ancient landscapes looked like. Furthermore, there may even be doubts about just how typical, indeed, were those that we can reconstruct around particular sites—particularly were widespread geological and geomorphological changes throughout a region to have left us with sites that might be unrepresentative of those around which Palaeolithic folk usually gathered, fowled, fished, scavenged, and hunted. Consideration of landscape evolution is therefore essential. Nevertheless, archaeo-


cological excavation is indispensable at those sites which have survived and offer well-conserved deposits. Excavating sites is fundamental to our inquiry into Middle Palaeolithic and Neanderthal sites in the Segura drainage basin and adjacent areas of southeastern Spain.

Moreover, a contrastive approach underpinned our programme of excavation at two Neanderthal sites that are in very different surroundings today, namely, lowland SPCG near the coast and upland CNERQ in the hinterland. Whereas an initial hypothesis was that such environmental contrasts as those could have been greater still during the Pleistocene, this is not supported by our findings. To our surprise, they reveal palaeoenvironments for which a modern analogy is lacking. The similarity of these suggests they were refuges of biodiversity capable of supporting hominids, within a region (fig. 5) where such refuges of biodiversity, characterized by wetlands and temperate woodlands, were separated by large expanses of barren arid steppe. Perhaps, then, a new parsimonious working hypothesis should be that palaeoenvironmental geography was seen from uniform. Our previous uniformitarian inferences about landscape evolution (Cuena Payá and Walker 1986a) seem now to have been premature: the past seems even harder to imagine than we can easily envisage from our standpoint today.

This raises further matters about conjectural settlement dynamics. Whereas we had conjectured that sites such as SPCG and CNERQ, separated today by geography, environment, and climate, might have played different seasonal roles in mobile subsistence economies (without, however, implying that SPCG and CNERQ themselves formed part of a single system: cf. Davidson 1983: figs. 8,7 and 8,8), our
...economic findings instead seem consistent with the possibility of each site being used at any time during the year. It does not seem necessary to invoke foraging areas greater than those usually assigned to Palaeolithic sites at large.

The varied avifauna at CNERQ has counterparts at well-known Middle Palaeolithic sites (e.g., Combe Grenal in France: Mourer-Chauviré 1975; Covarrubias de Bellus, El Salt, Gorham's Cave, and Buhlen upper cave: Eastham 1998, 1999). As with all of those sites, CNERQ lies at the intersection of several different biotopes, each with characteristic flora and fauna. This hints strongly at elaborate and eclectic Middle Palaeolithic attitudes to exploiting birds for food. Large ranges of about 5-6 kilometres (Eastham 1989) are indicated from considerations both of those species taken back to the sites and the ecological zones where they had to have been culled, because different avian species have different vocal patterns and particular niche requirements. The ancient wetlands in the Parque Aragonés and Argos valleys imply a similar foraging range from CNERQ. We offer foraging ranges of one-way walking distances of up to three hours away from SPCG and CNERQ for their possible site exploitation territories (figs. 3 and 4), could be added here that proposals for site exploitation territories of Middle Palaeolithic sites in the southern Murcian coastal belt have also been offered (Bernández 1989a), which take into account both changing shore-lines during the Pleistocene (Montes Bernárdez 1985a, 1985b, 1986, 1987, 1989a, b; Rodríguez Estrella and Montes Bernárdez 1985) and sea shells of edible molluscs found at excavation, (Montes Bernárdez 1985a, 1985b 1986), which underline the diversity of Mousterian diets and the inclusion in them of small creatures whose action is imagined by some theoreticians to have provided too small a return on investment of time and energy expended.

How long did prehistoric people actually stay at a site? Permanently and continuously? Or just fleeting for a few days or hours at a time? Are the answers different in different layers at a site? Did they use the site, or did they use it, in different ways at different times? Many years of fieldwork will be needed to answer clear-cut answers. A difficulty with excavation strategies is they are often determined, especially when two sites are under investigation. This means that we are not ready to offer internal spatial analyses of our two sites. Another set of problems is how to detect whether the excavated remains of animals and plants represent what human beings obtained and ate. Might other predators have been responsible for all or some of them? Might wild creatures have lived at the site sometimes? Do we relate quantities found by us with quantities obtained by prehistoric people? Thus, if we find one seed, does this mean seeds were not generally used? Or does it mean that they were but that their perishability means we cannot expect to find them usually? Are the answers different in different layers at a site? Again, many years of fieldwork and taphonomical laboratory research will be needed to eventually answer.

Such problems impinge on spatiotemporal questions about how much energy was put into obtaining resources, and just what resources might have been offered by the local environmental catchment of an exploitation territory around a Pleistocene site. There is a widespread presumption that maximal energy sources would have been obtained for the least possible output of energy (a so-called max-min option for foraging strategy). At the same time, energy sources should be left untouched for regeneration of energy sources to be available in the future to the same human group for a similarly low output of energy. Some ethnographical analogies suggest that a cut-off point for the strategy corresponds to about no more than a two-hour walk away from a site for getting most foodstuffs (which on flat ground broadly corresponds to a 10 kilometre radius), though most bioenergetic resources might well be culled within a half-hour walk each way; however, the catchment for some highly mobile creatures, or raw materials such as flint, might mean a walk of many hours.

This raises possibilities such as perennial bases from which foragers ranged widely, sometimes with a need to camp overnight away from home, or long-stay bases between which a group moved seasonally, each base having its own catchment, reflecting either the different foodstuffs available or, perhaps, seasonal migration of a staple food source. The notion of such an extended site territory for mobile hunters and gatherers was proposed by Sturany (1972, 1975). It is often taken rather for granted that Middle Palaeolithic communities were stationary, and that mobile economies only appeared during the Upper Palaeolithic. Still, it should not be presumed that even though Upper Palaeolithic communities may have sometimes moved seasonally between sites in different localities, each Middle Palaeolithic one normally remained fixed in one circumscribed locality for years, generations, or perhaps millennia. The widespread presumption enshrines a hidden notion of evolutionary progressivism. It is possible to accept a null hypothesis proposal that, because some Upper Palaeolithic assemblages show more elements in common with those of some modern hunters and gatherers (some of whom practise seasonal movement) than do Middle Palaeolithic assemblages, then these assemblages are likely to reflect non-modern behaviour (Binford 1989)—without our having to draw an inference that Mousterian behaviour was rooted to the spot in an archaic manner that was mysteriously peculiar to fossil hominids.

It needs to be stressed here that our inference that there can have been differential use of a far from uniform region in which some Middle Palaeolithic sites can be regarded as microenvironmental “anchors” does not at all imply that these sites had somehow to be those of discrete stationary hominid groups, each of which stayed put in splendid isolation for scores of generations at a stretch. That we may envisage the sites as microenvironmental “anchors” in developing working hypotheses for future corroboration or refutation by no means implies an actualistic conjecture that Neanderthals fifty-thousand years ago had to be anchored to them. Our proposals for redirecting future research are one thing, what happened in the past is another.
achieve, a long-term goal must be to use sceptical, critical, pessimistic, bleak scientific realism as a lode-stone for separating scientific working hypotheses that are potentially refutable, from conjectures proposed by simple-minded, uncritical, naïve realists which are inaccessible to investigation in the record from the distant past, no matter how respectable a pedigree of optimistically neopositivist reasoning they bring from social philosophy and disciplines about recent or contemporary human or animal behaviour (cf. Binford 1983). Nevertheless, our counter-intuitive proposals here could well have appeal to those “post-processualists” who seek “hermeneutic, narrative readings” of a prehistoric past, if only they were willing to countenance a possibility that a scientifically-based evolutionary perspective on that past might be no less helpful than one seen through self-serving, relativistic spectacles, tinted by the self-styled “Humanities.” (Is the self-justifying capital initial “H” a last-ditch, “narrative” attempt to convince us that the emperor’s new clothes are real?)

May not scientifically testable parameters serve as boundaries within which to contain and constrain a past that otherwise seems quite beyond our comprehending? Is this idea really so offensive to “post-processualist” archaeologists? If it is, maybe it is because of a deep unwillingness to admit that appearances taken at face value can mislead us about reality, that routes which lead to our ability to grasp underlying reality are few and limited, and that they often seem to lead away from a (simple-minded) common sense presumption of what is real and what is not, rather than towards one. Put another way, our observations must be boiled down into data, about which models of anticipated patterns can be held up against the regular irregularities or irregular regularities (cf. David Clarke 1968) of those aspects of our observations that those anticipations lead us to select and transform into data.

This is how middle-range theories slowly get cobbled together by working scientists. A doctor sees a patient with mad cow disease, but selection and transformation of aspects of his or her observations point to invisible prions as a fundamental and necessary reality. You flick a light switch and accept that invisible electricity is a fundamental and necessary reality for the lamp bulb to light up the room. In short, scientifically ordinary reality “seems” to be extraordinarily unreal, unlikely, counter-intuitive, against common sense, theoretical and absurd (as adage puts it, truth is stranger than fiction!).

It is precisely because scientifically ordinary reality so often seems to go against common sense, that working scientists frequently take a bleakly sceptical view of their own inferences about reality. They treat them with some provisionality, and even uncertainty, unlike self-styled social “scientists” who draw on analogies from social philosophy and apply them to untransformed observations as though “Near enough is good enough”—in other words, applying false analogies. When all is said and done, not even those philosophers of science who argue that scientific realities are relative, and that alternative conjectures to account for them are equally valid be...
Did this involve frequent, perhaps daily, hikes of several hours to bring back is or hares that were available in different places at different times of the year, all which were in reach of a favoured living site? Certainly, one well-known school Neandertal palaeoanthropological analysis, championed by Erik Trinkaus (1983, 1987), considers that skeletal robusticity from early childhood onwards was in part an genetical response to strenuous daily exercise.

\section*{Including remarks}

\subsection*{Meaningful is the notion of "research design" for the study of regional spatio-temporal dynamics during the Middle Palaeolithic? Is it applicable, and, If so, \textit{why}?}

Just as in evolutionary biology, so also in the study of Palaeolithic behaviour, there is a creative tension between a concept of self-organising, unrepeatable, amic, dissipative processes and a concept of uniformitarian, repetitive stasis. In evolutionary biology Darwin championed the dynamic view and inferred natural selection for the origin of species, from a macro-evolutionary standpoint. From a neo-evolutionary perspective, Hardy and Weinberg laid the foundations of population genetics on the basis of a uniformitarian premise: the anticipated statistical station of which, for particular sets of data, facilitated recognition of several processes (by no means always dynamic and ongoing) responsible for demogentic characterization, of which natural selection is but one. Anticipated refutation of a null hypothesis is fundamental to that sceptical or critical realism which the basis of scientific inquiry designed to highlight the non-uniformity of the data seen (Murray and Walker 1988; Walker 1990). It is to presume in advance that position which surely it ought first to have been the task of scientific enquiry to understand. As with understanding the onslaughts of critical sceptics, that a timeless or universal present" gives satisfactory uniformitarian actualistic grounds on which to assert a simple-minded conception of spatiotemporal behavioural stasis is an uncut claim that "Near enough is good enough." This border on the anti-evolutionary in its reluctance to admit that what archaeologists dig up might have been maladaptive enough to either disappear altogether or evolve into something else to admit that in middle-latitude environments, far from our African kin, hominid survival may only have been possible from generation to generation in local refugia of floral and faunal biodiversity capable of sustaining the calorie bioenergetic needs of a very large omnivorous Primate—which is a not altogether implausible Darwinian scenario.

The epistemological heart of the matter is that, whereas analogous conjecture of univocal stasis can become a self-fulfilling prophecy in so far as short-term field surveys <<10 years) designed to identify scatter of artefacts are usually able to indicate that many are distributed across swathes of landscape, Nevertheless long-term excavations (>>10, >20 years) at just a very few sites within it be enough to indicate whether these are in typical environments or not. Our hypothesis should be that these sites are within typical environments, but the problem for our research designs is just how sceptical we should be about its likelihood when choosing sites for excavation. It is all too easy to be seduced by accommodation a priori notions that are hardly parsimonious, such as possibly seasonal reciprocity between coast and hinterland, for which our excavations find not a shred of evidence: a far more parsimonious working hypothesis is that from a palaeoecological standpoint unusual refuges rendered at best peripheral any long-distance seasonal movements. More sites with deep stratigraphy need to be excavated in our region in order to refute or corroborate our working hypothesis. It should certainly not be thought that a research design which promotes the "few" ("unrepresentative") over the "many" ("representative") is somehow "unscientific." Rather, the study of those sites which have a broad range of numerically abundant different kinds of components is probably more useful than the study of sites that only have stone artefacts. Moreover, the geographical distribution of a few favoured sites may be contrasted against other sites in conjectures about differential use of the landscape.

In some academic ivory towers with mullioned windows (and some academic concrete blocks with plate-glass windows), it is fashionable to downplay the importance of archaeological excavation in seminars where students chatter on endlessly in front of their research supervisors about how and why archaic folk trekked around during the ice age, drawing on analogies from Kung bushmen, Nunamit eskimos, Australian aboriginals, mammoths, baboons and chimpanzees, with ill-digested theoretical dollops of cognitive evolution or evolutionary epistemology. In some circles it is well-nigh "politically incorrect" to propose long-term fieldwork projects (for instance, to many self-styled "cultural resource managers"). Nevertheless, perhaps we need a moratorium on fashionable arm-chair archaeology and a return to old-fashioned field-work and excavation, even if its 10-year-plus time-scale is inconvenient even for those beginning doctoral students who are outstanding enough to anticipate getting a post-doctoral research fellowship later on. Still, their 50- to 60-year-old research supervisors, with tenure, seniority, and enough prestigious publications to attract research funding, might consider going into the field instead of grand-standing on local, national, and international committees, gatherings, book-signings, film-making, and interminable television and radio appearances for the last ten or fifteen years of their university engagement, if only to give those enthusiastic and energetic postgrads a chance both to succeed in life and to succeed them!

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Caves with Neanderthal Bones and Middle Palaeolithic Artefacts


3. Cuevas Umbria (Gilbert Clots et al. 1989). Sites with Lower Pleistocene artefacts occur also near here at Orce, but as they are not relevant to this map they are not shown.

Other Caves with Confirmed Middle Palaeolithic Artefacts

4. Cueva Antón (Martínez Sánchez 199a, 199b).

5. Abrigo de la Ambros (López Campuzano 2000).


13. Cueva del Cuchino (Soler García 1956).

Open Stations with Confirmed Middle Palaeolithic Artefacts

14. Sierra de las Junqueras (Unpublished). Mousterian implements have recently been found here by M. J. Walker and I. Serrano Izquierdo, after M. Martínez Andreu provided information of finds of flint in the neighbourhood without having identified any Mousterian forms.

15. El Pedernaloso (Jiménez Lorente et al. 1996; López Campuzano 1994; Montes Bernárdez 1989a, 1989b). Perhaps this was where C. Montenuit told me he had found a Levantian flake and pebble tools in 1944 in a quarry beside the road going from Elche de la Sierra towards Jara in the side of a river terrace 10 m above the river (cf. Montenuit 1973).


25. La Cocha (Fernández Pérez 1995). Perhaps this was the same Mousterian site as Ape, that Obermaier (1924: 195) said had been identified by J. Jiménez de Cisneros (cf. Almagro Basch 1947).

Caves with some Possibly Middle Palaeolithic Artefacts


Fig. 5. Segura River Basin and Adjacent Areas.

A distinction is made between, on the one hand, sites in caves and rockshelters, which sometimes have stratified sequences, and, on the other, open stations, which hardly ever offer such sequences.

A distinction is also made between sites that have unequivocally Middle Palaeolithic artefacts on the one hand, and, on the other, those where:

1. Middle Palaeolithic materials may have become mixed up with later ones (Cueva de la Zájara II; El Pedernaloso; Rámbla del Agua Salada or Agua Amarga).

2. Lower and Middle Palaeolithic materials either may have been collected together or where there might be a Middle Pleistocene "pro-" or "proto-Mousterian" with bifacial artefacts or unstruck flakes (Fuente de Hellín; El Cerro or La Fuente de la Villa de Jumilla; Los Almaderes; Pico de Alcazar).

3. not enough is known or published about the Palaeolithic assemblage or the circumstances of its collection (Cueva de la Moneda; Ayora; Fuente de la Zarza; Barranco de la Serena; Castillo del Rio; Cabeço do presto da Perdiz; Puente del Lemosinho; Rámbla de Libor arriba de la presa de Leão; La Cañada; Coy; Cortijo de Tarrabla; Garrucha); or

4. doubts have been raised about whether fractured stones are due to human rather than natural causes (Harchillo).

For further information about these matters at a given site, the references given should be consulted.
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