

17 The earliest occupation of Europe: a reappraisal of artefactual and chronological evidence

A reappraisal of the artefactual and chronological evidence for the earliest occupation of Europe – with proper attention to its limitations and its reliability – makes for a short chronology. The first solid traces of hominid activities in this part of the world are around 500,000 years old.

1. Introduction

Establishing the earliest documented evidence for human occupation has always involved controversy, usually centred around the *artefactual character* of assemblages and/or their *chronological position*. Examples of such controversial cases are Brixham cave, the eolith-problem, Calico Hills, the KBS-tuff controversy and, very recently, the age of the earliest hominid remains from Java (Swisher *et al.* 1994). Our science thrives on such disagreements; discussions (ideally) test the strength of data and hypotheses and thus provide us with constant fresh and solid ground to build our archaeological theories.

One of the reasons to plan a workshop on 'The Earliest Occupation of Pleistocene Europe' was the virtual absence of scientific discussions on this subject. Despite the large number of meetings devoted to Europe's first traces of settlement (e.g. Andernach 1988: "Die erste Besiedlung Europas"; Paris 1989: "Les premiers peuplements humains de l'Europe" [Bonifay and Vandermeersch 1991]; Milan 1990: "The Earliest Inhabitants of Europe") the dates given to the first 'Europeans' vary enormously, depending on the book or the journal one opens. On the 'very old' side, Bonifay and Vandermeersch (1991) present a number of sites allegedly dating from earlier parts of the Early Pleistocene, around two million years ago (*cf.* Ackerman 1989; Delson 1989). An age of about one million years is considered a good estimate for the first occupation of Europe by most workers (*cf.* Rolland 1992), referring to sites such as Le Vallonet in France (De Lumley *et al.* 1988) and Kärlich A in Germany (Würges 1986; 1991; Bosinski, this volume). In contrast to these long chronologies we demonstrate in this paper that Europe's earliest human traces are considerably younger, dating from well into the Middle Pleistocene. We have come to this conclusion while trying to give a synthesis of the evidence presented in pre-circulated papers by attendants of the Tautavel-meeting and

data collected in our own research. Our paper begins with a short review of the artefactual character of assemblages and the chronological framework of the Quaternary, focussing on how sites are put in a chronological succession (section 2). In section 3 we survey the biostratigraphical position of important mammalian assemblages (from both archaeological and non-archaeological sites), while section 4 reviews early sites in central and northwestern Europe. We then turn to evidence from other parts of Europe and close with brief discussion of the implications.

2. The earliest occupation of Europe: artefacts and chronology

2.1. EVALUATING THE ARTEFACTUAL CHARACTER OF ASSEMBLAGES

One century ago, Palaeolithic archaeologists were involved in a fierce debate over the alleged existence of Tertiary humans in Europe. *Eolithophiles*, both on the continent and in Britain, presented thousands of flints from Tertiary deposits, that in their opinion were humanly worked implements. The long lasting debate over the character of 'eoliths' assemblages produced a vast literature on the subject, summarised in popular handbooks from those days, like Sollas *Ancient hunters and their modern representatives* (1911), Obermaier's *Der Mensch der Vorzeit* (1912) and Boule's *Les Hommes Fossiles* (1921). This debate led to very detailed field observations and experiments and so created a vast body of knowledge concerning the variety of artefact-like forms produced by various natural processes. The crux of the matter is elegantly summarized by Warren (1920:250):

"What is important, however, is the fact that such phenomena as the flaking of flints and occasional bulbs and also edge-knapping are produced by causes entirely apart from direct human effort. The likeness between the flaking produced by Nature and that produced by human agencies is sufficient to shift any burden of proof upon those who maintain the human origin of the stones; and this must not be done by a careful selection of picked specimens, but by a survey of the whole group" (Warren 1920: 250).

The artefactual nature of 'primitive' assemblages has been an omnipresent issue ever since. In 1958 for instance, J. Desmond Clark's study of natural fractures of pebbles showed very convincingly (in the African context of 'Kafuan' industries in river valleys) that nature can make 'pebble tools': they are produced by a sharp 'follow through' blow, very unlikely under water, but possibly the result of a rock falling from above on to a wedged pebble (Clark 1958). These fractures can simulate artificial fracture to such a remarkable degree, that these specimens would not be out of place in any "Pebble Culture" context. His studies once again stress that one cannot build a strong argument for early occupation on the basis of pieces with only a few negatives, selected out of river-laid deposits. In fact, any analysis of early sites must take into account the whole range of natural conditions at the site that could produce artefact-like forms, as well as the geological setting of the find-spot (see Raynal *et al.*, this volume, for a good example of such an approach).

It is for these reasons that for instance Tuffreau (1987) and Tuffreau and Antoine (this volume) do not accept the Ferme de Grâce (Somme) terrace material as evidence for Early Pleistocene occupation of northern France (*contra* Bourdier *et al.* 1974), or that Santonja and Villa (1990) and Raposo and Santonja (this volume) consider isolated pieces collected from Iberian river terraces as too rare and undiagnostic to prove human settlement in the Early Pleistocene, while Mania (this volume) has serious doubts about the German *Schotter-Paläolithikum* (gravel-palaeolithic).

In section 4 we evaluate some important early sites by the issues in the eolith debate. It is of course necessary to have a good knowledge of the assemblages and their context, either by a detailed site-publication or by first-hand knowledge. Unfortunately, only a small number of 'early' sites have been published in such a detail that evaluation of interpretations concerning the artefactual character of 'primitive' assemblages is possible. We start our review therefore with the evidence from central and northwestern Europe, where we have first-hand knowledge of the relevant assemblages. The findings from that area are confronted with those from other areas in section 5.

2.2. THE CHRONOLOGICAL FRAMEWORK

The classical subdivision of the Pleistocene period is by the glacial-interglacial scheme, based on the extensions of glaciers in the Alpine area and in northern Europe. Four different extensions were recorded in the Alpine area (Günz, Mindel, Riss and Würm), and in northern Europe only three (Elster, Saale and Weichsel). Glacigenic deposits were linked with cold intervals in which ice-sheets formed,

separated from each other by warm-temperate intervals. Detailed investigations of pollen-bearing deposits in northwestern Europe yielded a rather complete record of the complex history of the vegetation in that area. Palaeobotanical data was transformed into palaeoclimatic information, making a terrestrial chronostratigraphical subdivision of the Pleistocene (cf. Fig. 1 and Zagwijn 1985), a scheme that has been the standard for northwestern Europe.

Preliminary results of recent investigations in an open lignite mine at Schöningen near Helmstedt (Germany) and in the Don-Basin (Russia) indicate, however, that the figure 1 subdivision is incomplete. The Pleistocene sediments exposed in the Schöningen quarry date from the Elsterian to the Holocene and are rich in palaeobotanical, malacological and palaeontological information, while Middle Pleistocene artefacts are present too (cf. Thieme *et al.* 1993). Studies of the Middle Pleistocene sequences indicate that there were at least three phases with a distinct, well developed interglacial vegetation between the Elsterian and the Saalian till. It is however not clear yet whether the two older warm-temperate periods there were separated from each other by a distinct cold (glacial) phase. Theoretically they might have been separated by an important but relatively short cooler fluctuation, more or less comparable to the stronger intra-Eemian fluctuations recently reported by the GRIP-members (GRIP 1993), or to the intra-Stage 7 'cold' interval, sub-Stage 7b (cf. Andrews 1983).

Long sequences in the Don Basin show at least five glacial/interglacial cycles in the time span between the Brunhes/Matuyama boundary and the Oka (= Elsterian) glaciation. Two ice-sheet extensions earlier than the Elsterian could be recorded in the sections. The most important ice-sheet there was that of the Don Glaciation, covering the Don Basin much further south than the ice-caps of the Oka-Elster, the Dnjepr-Saale and the Valdai-Weichsel. Two distinct interglacial intervals and one cold phase separate the Don Glacial from the Oka Glacial phase. Correlation between the Don Basin and northwestern Europe, mainly on the base of mammal fauna-associations, indicates that the northwestern standard subdivision is incomplete for the lower part of the Middle Pleistocene, i.e. in the first half of the "Cromerian Complex". The incompleteness of the standard continental subdivision is also apparent when comparing it with the oxygen isotope record, which counts 9 interglacial and 9 glacial phases within the Brunhes Epoch.

The oxygen isotope record, the most detailed subdivision of the Quaternary so far, is regarded as the timescale one should try to refer to. It is a global record, thought to reflect changes in the total amount of ice the world over, as there is remarkably little variation among cores taken from different areas. It is also a rather continuous record,

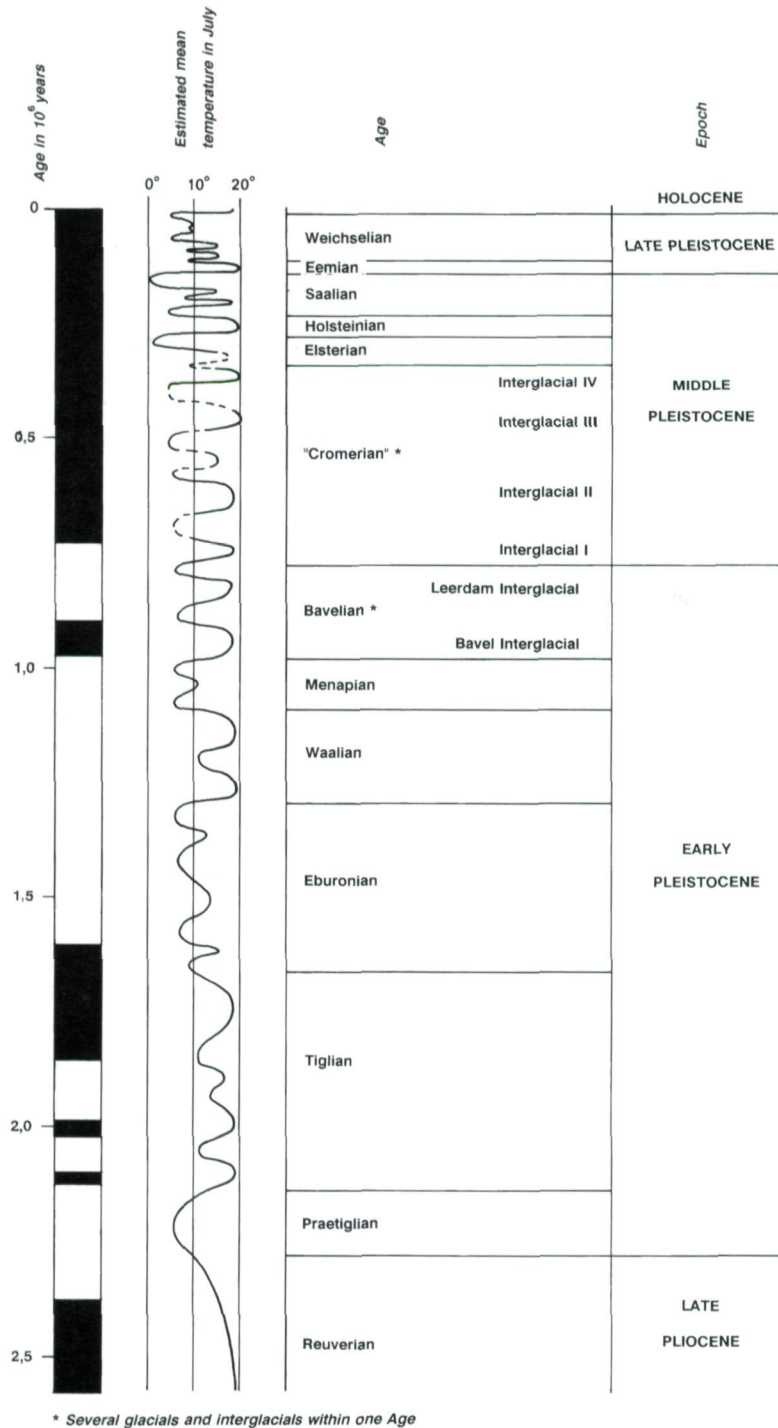


Fig. 1. Climate curve for the Quaternary in the Netherlands (after Zagwijn 1985). Age in million years. Temperature in degrees C, estimated mean for July. * includes several glacials and interglacials.

providing an arguably complete survey of the entire Quaternary. And it is a kind of 'Esperanto' record, easy to 'understand' for workers from various parts of the world, not bothered by the details and intricacies of the various regional subdivisions such as the northwestern European one mentioned above. This 'user-friendliness' is certainly a very important factor in the increased usage of the deep-sea record for correlation-purposes. We must however not forget that correlation to the oxygen isotope stages is often mainly based on very simple 'counting' procedures, on the results of absolute dating methods and on (often implicit) assumptions, for example that the maximum inland-ice extension corresponds to the highest O^{18} -values. Unfortunately, terrestrial sections are dominated by gaps. Absolute dates, in many cases contradictory and inaccurate, should not be the only base for a chronological correlation. Using the maximum ice-extension for land-sea correlations poses problems as soon as one exchanges the narrow 'national' perspective for a broader 'European' one: the southernmost extension in Great Britain was the Anglian (= Elsterian), in the Netherlands it was the Saalian ice-cap, and in the Don Basin it was the Don glaciation! These problems can lead to different correlations between the continental subdivision and the oxygen isotope record (see the two options presented in Fig. 2).

Although not denying the enormous advantages of the deep sea record over the terrestrial climatic data we prefer the continental subdivision of the Quaternary (Fig. 1) as the basic framework for correlation over the oxygen isotope record as long as there are no reliable correlation methods (in other words: as long as the absolute dating methods are contradictory and inaccurate). Uncritical use of the deep sea stages creates a pseudo-certainty that hides the basic stratigraphical problems inherent in all kinds of terrestrial correlations.

3. The chronology of Quaternary mammalian fossil assemblages

The use of palaeobotanical evidence for long distance correlation to the standard terrestrial subdivisions is hampered by the absence of evolutionary trends in plants and by the inter-regional variations in characters of vegetation. Mammalian fossils are alternative important biostratigraphic indicators. Their use in dating and correlating deposits is based on the fact that most of the mammals have an extensive distribution area and that a number show a rapid evolution and/or migratory shifts within the Quaternary (cf. Lister 1992). The composition of the mammalian fauna has changed relatively fast during the Quaternary due to the processes of evolution, extinction and migration of species; a number of mammal biozonations have been established by different authors. Some of these

are based on the smaller mammal fauna, others on the larger or on both. However, most of these zonations have not been defined according to the guide for stratigraphic nomenclature published by Hedberg (1976) and the terminology used by some authors is furthermore extremely confusing (cf. Van Kolfschoten 1990).

Many palaeontologists work with the biostratigraphical subdivision of the Quaternary based on the Arvicolidae succession, as proposed by Fejfar and Heinrich (1981), which is in fact a modification of the Hungarian smaller mammal zonation established by Kretzoi (see e.g. Kretzoi, 1965; Kretzoi and Pécsi, 1979; Van der Meulen, 1973). Fejfar and Heinrich (1981) established three well defined biozones (stages in their terminology) for the Pleistocene: Villányian, Biharian and Toringian. A biozonation on the basis of changes in the larger mammal fauna was constructed by Italian palaeontologists (Azzaroli *et al.* 1988). Their subdivision of Villafranchian and Galerian faunas is used in large parts of Europe and Asia despite the fact that the boundary between both biozones is poorly defined, as will be discussed below.

3.1. THE SMALLER MAMMALS: BIHARIAN - TORINGIAN

Biharian faunas differ from the preceding Villányian faunas by the occurrence of *Microtus*. The Villányian faunas can be recognised by the dominance of *Mimomys*, the Biharian faunas by the co-occurrence of *Microtus* and *Mimomys*, and the Toringian "Stage" by *Arvicola* - *Microtus* assemblages. The Biharian is divided into two "sub-stages": the Early Biharian with *Microtus* (*Allophaiomys*) and the Late Biharian with *Microtus* (*Microtus*).

The transition from the Villányian to the Biharian in the Early Pleistocene corresponds more or less with the Tiglian/Eburonian transition. Faunas such as Tegelen (the Netherlands) belong to the Villányian, while the Early Biharian comprises faunas such as Le Vallonet (France), Monte Peglia (Italy) and Betfia 2 (Romania).

The transition of *Microtus* (*Allophaiomys*) to *Microtus* (*Microtus*), marking the transition from the Early to the Late Biharian, dates to the early part of the Bavelian complex, roughly correlated to the Jaramillo.

Faunas such as West Runton (Great Britain), Stránská Skála, Prezletice (Czechia), Tarkö (Layer 16) (Hungary), Ilynka I-II and Ilynka IV (Russia) belong to the Late Biharian. The genus *Mimomys* is represented by only one species, the large *Mimomys savini*, in most of these faunas. A second *Mimomys*, a smaller form often referred to *Mimomys* (*Cseria*) *pusillus*, occurs only in the faunas Kärlich C and E (Germany) and in Ilynka IV and Ilynka I-II. The occurrence or absence of the smaller *Mimomys* is probably a stratigraphical marker, which can be used to subdivide the Late Biharian faunas into an older group with,

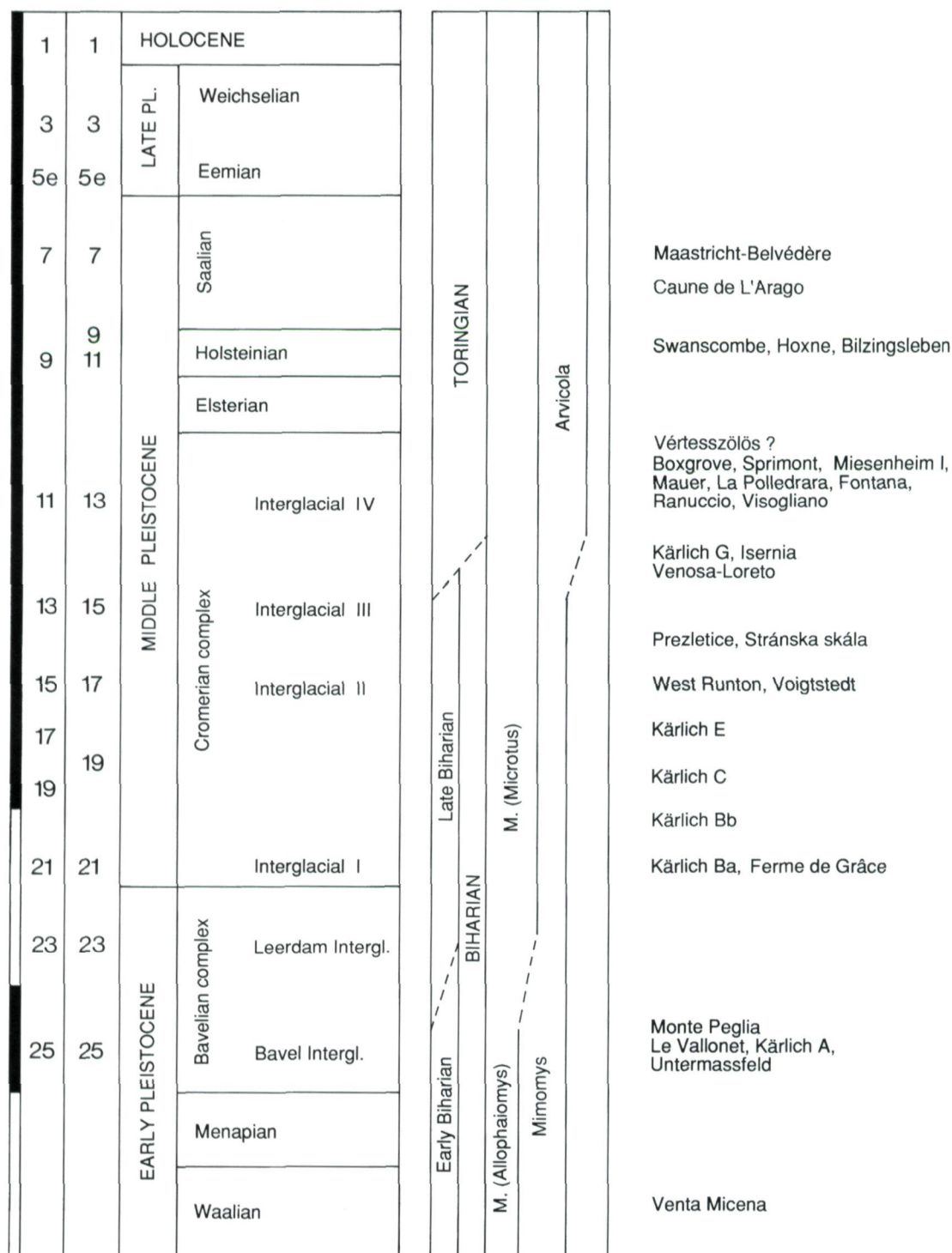


Fig. 2. Tentative correlation of small mammal biozonations and faunal assemblages to the northwest European subdivision of the Quaternary and to various oxygen isotope stages.

and a younger group without the smaller *Mimomys*. The faunas Kärlich C and E date from the Brunhes Epoch which indicates that the smaller *Mimomys* disappeared later than the Brunhes/Matuyama boundary.

An extensive study of the smaller mammal faunas from the Don Basin resulted in a subdivision of the Late Biharian faunas on the basis of evolutionary trends in the M_1 of lagurines ((*Prolagurus* and *Lagurus*) and the M_1 of *Microtus* (*Terricola*) (= *Microtus* [*Pitymys*]) (Kasantseva 1987). A correlation between the western and central European Late Biharian faunas and faunas from the Don Basin is hampered by the mainly easteuropean distribution of lagurines. Furthermore, our knowledge of the different *Microtus*-morphotypes present in the western and central European faunas is insufficient. One can only say that the Late Biharian covers the later part of the Bavelian complex and most of the Cromerian complex, a time span with at least five glacial/interglacial cycles. The faunas with two *Mimomys* species date from the earlier part of that time span, the faunas with only *Mimomys savini* from the later part.

A very important stratigraphical marker is the transition of *Mimomys savini* to *Arvicola terrestris*, which corresponds to the Biharian-Toringian boundary, in the second half of the Cromerian complex (Van Kolfschoten 1990; Von Koenigswald and Van Kolfschoten, in press). Since the most primitive representative of the genus *Arvicola*, *Arvicola t. cantiana* (often cited as e.g. *Arvicola cantiana* or *Arvicola mosbachensis*), is known from Cromerian Interglacial IV deposits (Van Kolfschoten 1990), the transition took place before Interglacial IV of the Cromerian Complex. *Arvicola* appears for the first time in the Kärlich section in the fauna from Kärlich G. The heavy-mineral association of the Kärlich G deposits and the mammal fauna indicate a Cromerian Interglacial III or a (beginning of) Cromerian Interglacial IV age (Van Kolfschoten and Turner, in press; Von Koenigswald and Van Kolfschoten, in press). The *Mimomys*-*Arvicola* transition has been documented in western (Chaline 1986), central (Fejfar and Heinrich 1981) and eastern Europe (Terzea, in press). In northwestern Europe the transition took place in the second half of the Cromerian-complex. This seems to have been the case in other areas too, as for instance documented by the occurrence of *Arvicola terrestris* before the Elsterian in Central Europe (Terzea, in press) and the occurrence of very advanced *Mimomys savini* in faunas from the Don Basin, dated to second interglacial before the Oka-Elsterian glaciation (Kasantseva 1987). It is to be expected that there was an asynchronicity within the regional transition from *Mimomys* to *Arvicola*, but such transgressions fall outside the chronological resolution of our present dating methods for this time-range.

A problem in this respect is the age of the *Arvicola*-fauna from Isernia (Italy), supposed to be late Early Pleistocene on the basis of radiometric dates for crystals from the site matrix and some palaeomagnetic data (Coltorti *et al.* 1981, McPherron and Schmidt 1983). Isernia has yielded fossil remains of *Arvicola terrestris cantiana* (assigned to the junior synonym *Arvicola mosbachensis* by Sala 1983; Coltorti *et al.* 1982). A study of the material, including that sampled in the period after 1982, allowed the second author to characterize the finds of Isernia as a primitive population of the genus *Arvicola*. Only 80% of the molars (only a few are juvenile) are rootless, whereas 20% show indications for root formation, but are still rootless. The fauna with *Arvicola*, *Elephas* (*P.*) *antiquus*, *Stephanorinus hundsheimensis* and without *Mimomys savini*, *Mimomys pusillus* and *Microtus* (*Allophaiomys*) sp. suggests a Middle Pleistocene age, as it is comparable to central European faunas as Mosbach and Mauer (cf. Sala and Fortelius 1993).

One could accept a late Early Pleistocene age for Isernia only by suggesting an earlier occurrence of *Arvicola* in Italy, in a more or less isolated area of Europe. This is not a plausible argument, however, as there are no indications of a barrier isolating the mammalian faunas in Italy from those of central and western Europe during the Pleistocene. On the contrary, the abundant similarities in the composition of the Early, Middle and Late Pleistocene faunas of Italy and eastern, central and western Europe show a general and almost continuous faunal exchange between these areas during the Quaternary (Von Koenigswald and Van Kolfschoten, in press).

This is a context in which in our opinion the 'absolute' dates for the site cannot be taken at face value, and the site cannot be seen as yielding unambiguous evidence for occupation of Europe at the very end of the Early Pleistocene. A reevaluation of the total dating evidence is necessary, and in the meantime we seriously question the significance of the palaeomagnetic and radiometric dates for the Isernia site.

Toringian faunas can be divided into two groups: an older one with *Arvicola terrestris cantiana* and so-called relict species (such as *Talpa minor*, *Trogontherium cuvieri*) and a younger group with the more evolved *Arvicola terrestris* ssp. A and B, co-occurring with a modern smaller mammal fauna (see Van Kolfschoten, 1990). The first group comprises faunas such as Miesenheim I, Kärlich G, Mauer (Germany), Boxgrove, Westbury-sub-Mendip (Great Britain), Sprimont (Belle Roche) (Belgium), Tarkö (Hungary) with *Arvicola terrestris cantiana* together with *Sorex* (*Drepanosorex*) sp. and *Pliomys episcopalidis* and a number of faunas e.g. Swanscombe (Great Britain), Bilzingsleben (Germany) younger in age and without *Sorex* (*Drepanosorex*) and *Pliomys episcopalidis*.

Late Toringian faunas can be recognized by evolutionary changes in the *Arvicola* molars. Since the early Saalian thinning of the convex sides of the dentine triangles has resulted in changes in the relative thickness of the enamel band of the *Arvicola* molars. This development can be used for stratigraphical correlations of younger, i.e. post-“Holsteinian” faunas, such as those from Caune de l’Arago (Desclaux 1992a; 1992b), Maastricht-Belvédère and Weimar-Ehringsdorf (cf. Van Kolfschoten 1990).

3.2. THE LARGER MAMMALS: VILLAFRANCHIAN - GALERIAN

The widely used Italian biochronology, with a subdivision in Villafranchian and Galerian faunas, is mainly based on changes in the larger mammal fauna. The Villafranchian, starting about 3 million years ago, covers part of the Pliocene and the Early Pleistocene. It has been subdivided into an early, a middle and a late phase, a subdivision refined by Azzaroli (1977), who divided the Villafranchian faunas into six more or less well-defined faunal units. The beginning of the Villafranchian itself, of some of its units and its end are characterized by pronounced dispersal events (Azzaroli *et al.*, 1988; Sala *et al.* 1992). Azzaroli *et al.* (1988) state that the Villafranchian-Galerian transition (the end-Villafranchian event, 1.0-0.9 Myr BP) saw a complete faunal turnover, with massive extinctions and new, previously unknown adaptations. Late Villafranchian taxa such as *Eucladoceros*, *Dama nestii*, *Leptobos etruscus*, *Sus strozii* and *Archidiskodon meridionalis* became extinct whereas many taxa (*Megaceros*, *Soergelia* sp., *Praeovibos priscus*, *Bison schoetensacki*, *Equus süssenbornensis*, *Ursus deningeri*) appear during the Early Galerian.

The transition of the late Villafranchian to the Galerian did not take place at once. According to Azzaroli *et al.* (1988) the transitional phase was of (geologically) short duration because only a few sites have ‘naturally mixed’ assemblages – an assumption partially based on the inferred Early Pleistocene age of Isernia. They assign a late Matuyama age to the Isernia fauna, and hence infer that faunas from normally magnetized deposits (such as the faunas from West Runton and Voigtstedt) have to be correlated with the Jaramillo event. In such a scenario the Villafranchian/Galerian faunal shift indeed seems both very pronounced and relatively abrupt. In our opinion the faunas from Isernia, West Runton and Voigtstedt are of Middle Pleistocene age, which means that the faunal turnover could have taken place more gradually. For us the ‘faunal watershed’ is simply the result of a giant temporal collapse, caused by an accumulation of correlation errors.

This interpretation is confirmed by the fauna from Venta Micena, dated at around 1.2 Myr BP, yet already containing

several Galerian immigrants (*Megaloceros*, *Praeovibos*, *Soergelia* and *Bison*) (Agusti *et al.*, 1987). The end-Villafranchian ‘event’ in the sense of e.g. Azzaroli *et al.* (1988) therefore probably has a long stratigraphical range, which necessitates a re-definition of the late Villafranchian-Galerian boundary. At the current state of knowledge the terms late Villafranchian or Galerian are of little biostratigraphical value.

4. The earliest occupation of central and northwestern Europe

4.1. THE EARLY PLEISTOCENE

The pseudo-artefact problem is especially apparent in some central European Early Pleistocene sites where various (amateur-) archaeologists sampled huge amounts of gravels and came up with primitive looking ‘choppers’ and ‘chopping-tools’. A very good example is the Beroun site, near Prague (Fridrich 1991), where about 80 artefacts were collected from the top of Early Pleistocene river gravels, exposed over an area of about 2000 m². Two overlying levels yielded 10 more ‘items of industry’. The 80 rolled ‘artefacts’, mostly ‘side-choppers’ with only a few negatives, were collected from the gravel surface ‘after rain’. According to Fridrich (1991:11), the assemblage “includes choppers, bifaces, proto-bifaces, picks, cleavers, polyhedrons, subspheroids, representing Acheulean s.l., comparable to the African finds ... The age of the set is more than 1.5 million years, serving thus as an evidence that both Europe and Africa were settled approximately in the same time by people with analogous cultures”. The finds, both those published and those displayed in the Prague National Museum, are in the range of what can be collected from natural gravel deposits; they are not acceptable evidence of Early Pleistocene occupation (see Kozłowski 1992 for a comparable interpretation).

The same applies in our opinion to the Musov and Ivan assemblages, described by Valoch (1991 and this volume). Both sites, approximately 40 km south of Brno, were visited by an amateur-archaeologist, who collected hundreds of ‘choppers’ and ‘chopping-tools’ from reworked Miocene deposits, present on top of Early or early Middle Pleistocene deposits. As in Beroun, we are dealing with a selection from thousands and thousands of non-modified pebbles. The ‘artefacts’ have in general only a few irregular negatives, and almost all ‘chopping-tools’ display completely blunted ‘working edges’.

Comparable arguments apply to the other Early Pleistocene sites in Moravia (Brno-Cernovice, with one good flake though, not recovered *in situ*, and Brno-Cernovice Kopec). A nice polyeder from Mladec cave, found in a calcite layer covering the Early Pleistocene sediments there, has no chronological context.

Early Pleistocene artefacts from the river deposits exposed in the Kärlich section (Kärlich A) were found and published by Würges (1986) and Bosinski (this volume). Three 'pebble tools' were flaked on one surface only. The 'best' piece is a pebble, broken along a quartz vein, with two negatives. The pieces fall in the range of naturally produced 'artefacts' (cf. Clark 1958) and they were not recovered in a controlled situation; at best they are to be treated as typical examples of *incertofacts*, a category of pieces of which the artificial character can neither be established with certainty nor excluded. Such pieces (*possiboliths* would also be a good term!) can of course never be used as a solid basis for archaeological theories. The same applies to the trachytic tuff core from Kärlich Ba, recovered outside stratigraphical context (Vollbrecht 1992).

4.2. THE MIDDLE PLEISTOCENE

Most archaeology textbooks mention the Czech site of Prezletice as one of the earliest sites in Europe. Palaeomagnetic and faunal studies (a fauna with *Mimomys*) have placed it in the beginning of the Middle Pleistocene. The find of what was once thought to be a human molar (now a *Ursus* sp. molar, see Fridrich 1989:29) initiated archaeological excavations (1969-1985) that focused on sediments deposited near an ancient lake at the foot of a lydite massif. The excavation yielded 4 horizons bearing "artefacts" produced out of locally occurring lydite debris. Fridrich (1991, *passim*) himself stressed that it was very difficult to differentiate between

"flaking and natural fracturing of raw material in lydite debris.... There is complete lack of flakes or, on the contrary, of primitive cores... treatment of raw material, manufacturing of half-products and their waste fracturing occurred along hidden cleavages in raw material. There are not typical traces after working, namely bulbus, therefore the possibility to recognise and differentiate between artificial working and natural fracturing is extremely low" (Fridrich 1989:35).

Nevertheless, the drawings in Fridrich (1989) display many negatives of flaking and retouch on the 'proto-bifaces', 'picks' and other artefacts recognised among the lydite debris. There is a big discrepancy between the drawings and the photos of the objects. Likewise, the pieces on display in the Prague National Museum in our opinion do not show any convincing traces of human interference.¹

The site of Stránská skála I, near Brno, yielded a Late Biharian fauna comparable to Prezletice. In 1968 Valoch described some "flakes of hornstone suggestive of human workmanship" recovered from early Middle Pleistocene scree-deposits in the 1910-1945 excavations. He thought the

site was problematic because "Weathered nodules, often naturally cracked and broken, occur in the debris in considerable quantity, making it difficult to identify those chips that could have been flaked and utilised by man" (Musil and Valoch 1968:538; also Valoch 1972). Since then new palaeontological fieldwork has yielded more finds, which have led Valoch to give up his doubts about the artificial character of the stone assemblage selected from the slope deposits and from within two small caves in the Stránská skála exposure (see e.g. Valoch 1987). Three dozen artefacts have been identified by him. These hornstone fragments display no clear traces of human workmanship: there are virtually no bulbs (only three observed), no clear negatives and no ripples. While visiting the site with Dr Valoch the first author could pick up hornstone fragments from the scree-section, which is full of hornstone debris; one wonders what the ratio between 'discarded' and 'accepted' pieces within this deposit actually was.

On these grounds, arguments concerning context and attributes of the finds, the site cannot be considered as proof for an early Middle Pleistocene occupation of Moravia. We therefore support Valoch's early doubts concerning the artefactual character of the assemblage². The site certainly needs another season of fieldwork, this time focused on the archaeological agenda.

The first good evidence from this part of central Europe comes from Sedlesovice near Znojmo, where a quartz artefact was discovered in a loess profile, in the fossil soil PK VI ('Holstein'; see Valoch 1984). The first finds from Poland (Trzebnica) are from around this time horizon too (Burdukiewicz and Winnicki 1988; 1989; also Kozłowski 1992).

For the western part of central Europe, Bosinski (this volume) reports Würges (1986) claims for earlier finds from the top of the Kärlich Mosel gravels (Kärlich Bb). Over an area of 40 × 40 m Würges collected a set of 8 quartzite pieces, some from the top of the gravel deposits, some from the base of the gravels, having slid downslope. Some of the pieces are heavily rounded, others less so. It took Würges more than one year to assemble this set (pers. comm. 1993), very clearly a selection of pieces, whose number is infinitesimally small compared to the whole. The 'primitive' morphology of the pieces and their context lead us to doubt the artefactual character of these, and to interpret them in the same way as Tuffreau did with Ferme de Grâce material.

In our opinion western central Europe has its earliest solid evidence for human occupation around the Cromer IV Interglacial (OIS 11 to 13?), in the form of the finds from Kärlich G, the primary-context Miesenheim I site and the Mauer mandible, all associated with *Arvicola terrestris*

cantiana faunas (see Bosinski, this volume). From that time period onwards there are more primary context sites in central Europe, both from temperate and from colder, dryer settings (see Bosinski, this volume; Roebroeks *et al.* 1992).

In the northwest region the earliest solid traces of occupation are more or less contemporaneous with the Miesenheim I site, for example the well preserved find scatters at Boxgrove in southern England (Roberts 1986; 1990; Roberts *et al.*, this volume) and the earliest sites in the Somme valley of northern France (Tuffreau 1987; Tuffreau and Antoine, this volume). The Boxgrove site is tentatively correlated to OIS 13 (Roberts *et al.*, this volume).

Independent of their correlations to the deep-sea record the earliest sites from both central and northwest Europe fall in the *Arvicola terrestris cantiana* range. This also applies to the fauna from the La Belle Roche site at Sprimont (Belgium) (Tuffreau and Antoine, this volume). From that period onwards, there is a large number of well documented primary-context sites in the northwest-central region, with conjoining knapping debris preserved in fine-grained fluvial and aeolian deposits (cf. the contributions to this volume by Bosinski, Mania, Roberts *et al.*, Tuffreau and Antoine, and Roebroeks *et al.* 1992).

5. Other regions, comparable results?

Like those in the northern regions, Iberian river terraces have yielded isolated pieces, whose human manufacture or precise age have been doubted by various researchers (see above, and Raposo 1985; Santonja and Villa 1990; Raposo and Santonja, this volume). Claims for the existence of Early Pleistocene artefacts and human fossils come from localities in the Guadix-Baza basin near Orce-Vente Micena (cf. Gibert 1992; Raposo and Santonja, this volume), but further fieldwork is necessary to turn these claims into compelling evidence.³

Raposo and Santonja (this volume) place the earliest unambiguous traces of human occupation of Iberia in the beginning of the Middle Pleistocene, though such traces are very rare. Some of the best sites are in the Guadix-Baza depression (Granada), famous for its rich Early Pleistocene mammalian faunas. The oldest site, Cullar de Baza, has yielded only a few pieces (six flakes and two choppers), in association with a Middle Pleistocene fauna. The faunal list varies from author to author (cf. Santonja 1992:57), but on biostratigraphical grounds the site is very probably contemporaneous with the earliest sites from the northwest-central region.

The handaxes reported from Atapuerca TD6 date from the Middle Pleistocene, on stratigraphical grounds possibly from OIS 13 (Aguirre 1991; Carbonell and Arsuaga 1992). The fauna from the TD6 level resembles the late Cromerian faunas mentioned above, with one notable exception

though: the presence of *Mimomys* (Carbonell and Arsuaga 1992; Gil and Sese 1991). This suggests that we are dealing with an archaeological site somewhat older than the ones reviewed upon till now. A recent study of the material by A.J. van der Meulen (pers. comm. 1994) however shows that some of the Arvicolids display indications of endemism, and furthermore that the stratigraphical range of *Microtus (Allophaiomys)* is longer in Iberia than in other parts of Europe. This might also be the case with the Iberian *Mimomys savini*.

Endemic features, also well-known from the Colchis area in the Caucasus (Ljubin and Bosinski, this volume), hamper a straightforward correlation between sites in Iberia (and for that matter: the Caucasus) and other parts of Europe. It must be stressed that the time-range of *Mimomys savini* in Iberia is not clear, just as the relationship between the Iberian form of *Arvicola*, *A. sapidus*, and *A. terrestris*, which only occurs in the extreme north of Spain, in the Pyrenees (cf. Van Kolfschoten 1993). Such information is, however, necessary to establish a correlation between the Atapuerca faunas and faunas from non-Iberian parts of Europe. At the current state of affairs the excavators interpretation of the Atapuerca TD6 level as dating from around 500 Kyr BP seems the best option. The five artefacts recently reported from Atapuerca TD4 (Carbonell and Rodriguez 1994) come from a lower level, but their artefactual character is not uncontested (cf. Raposo and Santonja, this volume).

Italy's settlement history shows no unambiguous indications for an Early Pleistocene occupation (Mussi 1992; this volume). A number of the 'old' Italian sites are surface sites, where a 'primitive' morphology of artefacts has led some archaeologists to infer a high age. In view of its correlation problems, the site of Monte Poggiolo does not provide very firm evidence for Early Pleistocene occupation, though preliminary palaeomagnetic studies indicate that it deserves our attention as a possible candidate (Gagnepain *et al.* 1992). Another problematic site is Monte Peglia, where lithic implements were recovered outside of a stratigraphical context, while the artefactual character of the only piece found *in situ* is questionable (Mussi, this volume). All unquestionable archaeological sites with solid dating evidence date from well into the Middle Pleistocene, and those with abundant faunal remains are more or less comparable in age to the Boxgrove and Miesenheim I sites in the north: Fontano Ranuccio (with hominid remains), Visogliano (human fossils too) and probably also Venosa-Loreto. As already explained, in our opinion, Isernia falls into this time range too (see above).

The Villafranchian⁴ bone breccia of the Sandalja I cave (Croatia) yielded an incisor, once considered to be a hominid fossil (Malez 1976 vs. Cook *et al.* 1982) and one

small and primitive 'chopper', a single find too undiagnostic to provide a firm ground for Early Pleistocene occupation of former Yugoslavia.

The evidence from Greece, reported by Darlas (this volume), tentatively points to the second half of the Middle Pleistocene for the earliest traces of human occupation there.

While the regions discussed as yet have not yielded solid proof of human occupation prior to the Middle Pleistocene, there are some sites in southern France that seem to be older: a group of sites in the Massif Central, and the famous cave-site of Le Vallonet.

The Massif Central has a large number of sites with rich Early Pleistocene faunas, recovered in a good stratigraphical context. The stone assemblages collected from some of these sites (cf. Bonifay 1991) consist in general of small series, selected out of natural pieces occurring in often coarse-grained deposits. The short communications on these assemblages do not deal with the problems of differentiating between natural and humanly modified pieces (cf. Raynal *et al.*, this volume). In many ways an exception is the Chilhac III site, excavated by Chavaillon (1991; see also Guth and Chavaillon 1985) in order to test Guth's earlier assessments of the site. Among the split pebbles and rocks present in the Chilhac III deposits Chavaillon could identify 46 indisputable artefacts. The age of these artefacts is uncertain for the time being, for reasons elaborated by Chavaillon (1991). In his words "Tout est possible pour Chilhac III" (1991:87; but see: Raynal *et al.*, this volume).

Another well-known Massif Central site is Soleilhac. Unfortunately its lithic assemblage has not been published in detail yet. According to Bonifay, we are dealing with a small assemblage of primitive technology. The quartz pebbles have been more 'shattered' ('brisés') than flaked, whereas the majority of the 'objets de grande taille en basalte' have been made out of natural fragments (Bonifay 1987:13). More important is that the Soleilhac fauna (with *Arvicola*, *Elephas (P.) antiquus* and *Hippopotamus* (Bonifay 1991) could fit very well into the late Cromerian faunas mentioned above, and it has indeed been correlated to the fauna from Isernia (see e.g. Thouveny and Bonifay 1984). Awaiting the results of further study of the chronology of the site, we see no good reason to infer that Soleilhac provides good indications for an Early Pleistocene hominid occupation (see also: Raynal *et al.*, this volume, for a comparable interpretation).

Le Vallonet has been well published, in a way that allows a detailed evaluation of the artefactual character of the assemblage. The cave has yielded a rich fauna (with *Microtus [Allophaiomys] pliocaenicus*) and a small lithic assemblage, recovered from sediments of 'Jaramillo'-age (age assessments by means of biostratigraphy, absolute

dating (ESR) and palaeomagnetic studies (see various contributions in *L'Anthropologie* 92, 1988; also Bonifay 1991:74-75).

The lithic assemblage comes from stratigraphic Unit III (couches B1, B2, C), loamy sands with many angular rocks and pebbles. These sediments are to a large extent reworked from the Roquebrune Miocene conglomerate deposits present above the cave⁵. The sand and rock/pebble fraction flowed into the Vallonet cave through chimneys and fissures. After Unit III was formed, the sediments were subjected to intensive geochemical weathering, leading to all kinds of "déformation" of the rocks and pebbles in the matrix: "Les cailloux et les galets de ces niveaux sont souvent craquelés avec déplacements de fragments" (De Lumley 1988:416). Excavations in the stony deposits yielded in total seventy pieces from a 'fairly underdeveloped stone tool industry'. Fifty nine of these are interpreted as intentionally modified. Virtually all artefacts were made from limestone pebbles from the Roquebrune Miocene conglomerate. The artefacts consist primarily of flaked pebbles, among which 'percussion tools', 'pebbles with a single convex chip' are the most common (n=13). Well represented are pebbles 'with a single concave chip' (primary choppers, n=8), but these are badly fragmented. Pebble tools (choppers, chopping-tools and atypical chopping-tools) are present (n=10), though not standardised and mostly of mediocre quality. The dorsal surface of half of the 26 flakes consists of 100% cortex, only five flakes have no cortex at all. The majority of the flakes have no butt or a 'reduced' one. At first glance, the Le Vallonet flakes share their main features – absence of platform and bulbs, acute angle with pebble surface – with the majority of naturally produced flakes⁶.

The Le Vallonet limestone pieces, partially decarbonated, are occasionally extremely fragile. Some of the rocks and pebbles were fractured, 'craquelés' as a result of the chemical weathering mentioned above. The non-modified as well as the flaked pebbles and rocks in the Unit III matrix display several kinds of surface modifications, with ridges and protruding parts smoothed, or displaying a glossy surface polish. This applies to about 60% of the natural stones present in the matrix. It is to be stressed that comparable phenomena are present on the 'flaked' pieces: "Les pièces de l'industrie lithique découvertes dans le remplissage du Pléistocène inférieur de l'ensemble III n'échappent pas à cette règle générale: un important émousé adoucit parfois les arêtes et oblitère le modelé des enlèvements. La surface de ces pièces présente souvent un lustrage caractéristique" (De Lumley *et al.* 1988:505).

It is clear that the lithic assemblage from Le Vallonet is a selection of 'primitive' pieces picked out from a matrix rich in rocks and pebbles derived from Miocene deposits (see

Table 1. *Schematic* differences within the European Palaeolithic record between the period before and after about 500 Kyr.

BEFORE 500 Kyr BP	AFTER 500 Kyr BP
small series consisting of isolated pieces collected from a natural pebble background	large collections from excavated knapping floors with conjoinable material
disturbed context (coarse matrix)	primary context sites (finegrained matrix)
contested 'primitive' assemblages	uncontested 'Acheulean' and non-Acheulean industries
no human remains at all	human remains common

the photos of the Unit III sediments in De Lumley *et al.* 1988, Figs 1 to 7). Their characteristics suggest that we are dealing with an assemblage that was not modified by human agents, and instead displays all the characteristics of a selection out of a natural deposit.⁷

6. Implications

By our reading of the evidence, there is a difference between the European 'archaeological' record from before the *Arvicola terrestris cantiana* time range (for convenience sake here: from about 500 Kyr BP) and the later one (cf. Table 1; also Dennell 1983 for a comparable interpretation). *Before* 500 Kyr virtually all finds come from a disturbed, coarse matrix, afterwards we have primary context sites in fine-grained deposits. The assemblages dating from *before* 500 Kyr BP are virtually all the result of selection of isolated pieces from natural deposits; younger ones are often excavated from knapping floors.

There are two basic ways to interpret these differences. The pre-500 Kyr finds could reflect the sparse traces of intermittent occupation of Europe by people with 'primitive' Oldowan-type toolkits, substantial colonization of Europe taking place from about 500 Kyr BP onwards (cf. Turner 1992). Nevertheless, the differences in geological context and recovery procedures between pre- and post-500 Kyr BP sites are problems to be explained by those adhering to this long chronology.

In view of the attributes of the 'artefacts' and contexts of the pre-500 Kyr BP sites we instead interpret these differences as indicating that there is *no undisputable proof for human occupation of Europe prior to about 500 Kyr BP*. The first primary context sites with good archaeological evidence date from a later period within the Middle Pleistocene, possibly from about OIS 13 onwards.

Our scenario has several advantages. A first one is that it is *very easy to falsify*. The find of only one Early Pleistocene primary context site in the area reviewed here would disprove it, and one would have to conclude that before about 500 Kyr BP occupation existed (but was largely intermittent). New studies of some sites mentioned in our short survey could lead to this result.

A further advantage is that our short chronology is supported by a body of data *independent* of arguments concerning stone tools: the chronological distribution of human remains. The discrepancy between the inferred high age of the earliest European artefacts and the relatively recent date for the earliest European hominid fossils, the Mauer lower jaw and the human remains from Fontana Ranuccio and (possibly) Visogliano, has been a conspicuous problem in the search for the earliest Europeans. From the 'Mauer' time period onwards we have Middle Pleistocene human remains all over Europe: Altamura, Arago, Atapuerca, Biache-Saint-Vaast, Bilzingsleben, Cava Pompi, Castel di Guido, La Chaise, Ehringsdorf, Fontana Ranuccio, Fontéchevade, Grotte du Prince, La Rafette, Lazaret, Mauer, Montmaurin, Orgnac III, Petralona, Pontnewydd, Steinheim, Swanscombe, Venosa, Vergranne, Vértesszöllös and Visogliano, to mention them in an alphabetical order (cf. Cook *et al.* 1982). The recently discovered tibia from Boxgrove, a site with one of the earliest *Arvicola terrestris cantiana* faunas, of course fits very well into our scenario too (Roberts *et al.* 1994; Roberts *et al.*, this volume; see also Gamble 1994).

From the long period before the *Arvicola terrestris cantiana* range we do not have a single (uncontested!) tooth yet, despite the huge amounts of other mammalian fossils. Absence of evidence of course is no evidence of absence, and negative evidence has rarely proved durable in

archaeology. But absence of exposures of older deposits is not a good counter-argument here. At a large number of palaeontological sites, early Middle and/or Early Pleistocene faunas are recovered from fine-grained deposits. Some of these have been under observation for many decades or even centuries, yielding huge amounts of faunal remains: for instance the Tegelen pits in the Netherlands, Untermassfeld, Voigtstedt and Süssenborn in Germany, West Runton (England), S  n  ze (France), Deutsch Altenburg in Austria and the Val d'Arno exposures in Italy. Europe is without any doubt the most heavily researched part of the Old World, with a high-quality record to which many hundreds of workers have contributed over a period of one-and-a-half centuries.

In our scenario Europe is extremely 'marginal', late in time as compared to for instance the Asian evidence as that stands now. The human spread out of Africa went eastwards first, via Ubeidiya (Israel) and Dmanisi (Georgia; see Dzaparidze *et al.* 1989), and hominids were present in the eastern parts of Asia at the end of the Early Pleistocene, at around 800 to 1,000 Kyr BP (Schick and Zhuan 1993, or even earlier, if one accepts the Swisher *et al.* [1994] dates). Europe was occupied later. Soon after we see the first undisputable traces, humans are virtually 'everywhere' in Europe (with as notable and interesting exceptions the Russian plains and Scandinavia).

At issue is not only *whether* the first Europeans arrived much earlier than 500 Kyr BP. What, if any, ecological, climatical or social factors were triggering the occupation at about 500 Kyr BP, or, formulated in another way, what kept hominids out of Europe before 500 Kyr? Some avenues worth exploring may be developments in the social domain (such as the emergence of dispersed mating networks), neural developments associated with brain expansion and differences in the character of the Lower as opposed to the Middle Pleistocene glacial-interglacial cycles⁸ (cf. Zagwijn 1992; see also Gamble 1993; Gamble, this volume).

In our scenario the 500,000 'wave' represents the first occupation, virtually synchronous throughout Europe south of the ice sheets. In this view Europe does not seem to have presented big problems to the first occupants, be it perhaps in the northern- and easternmost parts. This image of a swift occupation can very well be the result of the *low chronological resolution* of our dating methods for the

Middle Pleistocene (as compared to 14C, whose resolution allows our American colleagues to infer that Palaeoindians colonized the entire New World in just a few centuries: Meltzer 1993). These analogues yield fascinating thought-experiments that have the additional advantage of moving our field into the domain of other disciplines studying the migration of mammal species (cf. Gamble 1993).

While those adhering to (various forms of) a long chronology can make the case for a very gradual adaptation by Out of Africans to the wide range of European habitats, our short chronology supports another view, a rather fast (within the time resolution limits) adaptation, once they are in this *cul de sac* of the Eurasian continent that we call Europe. In this respect our interpretation fits very well into a highly punctuated chronology of what Gamble (1993) has recently called "staccato bursts of colonization", as opposed to earlier views of hominids leaving their African homeland in a slow continuous spread. It is for such reasons that we need to discuss the empirical values and implications of the various long and short chronologies. We hope that our paper can contribute to such an 'updating' of the first 'Europeans'.

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notes

1 In her recent taphonomic study of the Prezletice fauna, Stopp (1994) also did not find any indication of human activity at the site.

2 The first author wants to emphasize his gratitude towards Dr Karel Valoch, who showed him the Moravian assemblages while in Brno, and took him to the Stránská skála site. Despite our scientific disagreement about the interpretation of some assemblages I keep a very good memory of that visit.

3 Apart from discussions over the presence of humans in the Early Pleistocene in that region there is a discrepancy between the age given to the faunal assemblage from Venta Micena and other sites by Gibert and his co-workers (1.8 Myr BP) and the estimates of Agustí *et al.* (1987), who think the Venta Micena assemblage is about 1.2 Myr old.

4 The larger mammal fauna referred to as 'Late Villafranchian' mainly consists of so-called Galerian species, with a range into the later part of the Cromerian-complex).

5 "Les poudingues [puddingstone] affleurent partout ailleurs; il s'agit de galets roulés, généralement grossiers, souvent calcaires mais parfois gréseux, péliques ou cristallins, durement cimentés par une matrice gréseuse. Généralement compacts et bien stratifiés, ils se présentent en bancs réguliers avec parfois des lentilles de grès, de taille et de granulométrie variées" (Chamagne 1988:403).

6 Among others, Warren published descriptions and photographs of flaked flints found below Eocene beds (at Grays, Essex), with both bulbs and striking platforms. Some of these even were conjoinable (e.g. Warren 1920, Plate XV, 22: "Photograph of two conjoined flakes showing normal pressure-characters", or 23: "Photograph of four conjoined flakes, also showing normal pressure-characters, but 'struck' from an apparently well-prepared platform").

7 After the publication of the *Antiquity* version of this paper (september 1994) we were informed of the results of White's (1995) study of the Le Vallonet assemblage, also stressing the absence of traces of human activities at this site.

8 Such differences could have resulted in an environmental setting more favourable for a migration of hominids into Europe. There are, however, no clear environmental changes observable in the second half of the Cromerian complex, neither in the palaeobotanical, the malacological or the vertebrate record. Late *Mimomys* faunas (West Runton and Voigtstedt) and early *Arvicola* ones (Boxgrove,

Miesenheim I, Mauer) show many similarities and no distinct differences in their composition. All these faunas indicate more or less comparable environmental conditions.

The fact that the appearance of *Arvicola terrestris cantiana* coincides more or less with the immigration of *Elephas* (*Palaeoloxodon*) *antiquus* and *Hippopotamus* during the late Cromerian (Von Koenigswald and Van Kolfschoten, in press) might suggest that we are dealing with a kind of faunal turnover. However, we have to realize that our chronological resolution for this time range is fairly limited. One of the earliest *Arvicola* faunas is the one from Kärlich G (Neuwied Basin, Germany). The fauna is associated with artefacts (Bosinski, this volume) and most probably dates from the transitional period of Glacial C to Interglacial IV or from the earlier part of Interglacial IV of the Cromerian complex (Van Kolfschoten and Turner, in press). There is good evidence that the fauna predates the Interglacial IV optimum with conditions favourable for the immigration of *Elephas* (*P.*) *antiquus* and *Hippopotamus*, which implies that the three species most probably did not appear simultaneously.

Even the Elsterian glaciation (OIS 12?), the first glaciation in which the northern parts of central and northwestern Europe were covered with inland ice, did not cause a dramatic floral and faunal turnover. Many species - including a number of smaller mammals (*Talpa minor*, *Trogotherium cuvieri*, *Sorex* (*Drepanosorex*) sp.) regarded as relicts from the Early Pleistocene - survived the Elsterian Glacial. Only the large carnivores *Homotherium*, *Megantereon*, *Pachycrocuta perrieri* and *P. brevirostris* are not known from post-Elsterian deposits in Northwestern and Central Europe (Turner 1992). Recent studies of the faunal remains from the Reinsdorf Interglacial (OIS 9?) deposits at Schöningen (Mania, this volume) indicate that *Trogotherium cuvieri* also survived the "glacial" conditions between the Holsteinian (OIS 11?) and the Reinsdorf Interglacial. These species became extinct during the next cold period, which separates the Reinsdorf Interglacial from the Schöningen/Belvédère Interglacial (OIS 7?). The extinction of *Trogotherium cuvieri* coincides with an acceleration of the evolution in the enamel differentiation in the molars of *Arvicola terrestris*, as indicated by the faunal remains from Ariendorf 1 (Van Kolfschoten 1990). The Ariendorf 1 fauna (OIS 8) includes *Dicrostonyx*, *Lemmus lemmus*, *Mammuthus*, *Coelodonta antiquitatis* and *?Rangifer tarandus* (Van Kolfschoten 1990; Turner 1991; Roebroeks *et al.* 1992), and is one of the earliest cold stage faunas with a composition indicative for a "Mammoth Steppe" environment; the fauna is comparable to late Saalian (OIS 6) cold stage faunas from Schweinskopf and Wannen in the Neuwied Basin (Germany) and to late Weichselian glacial faunas. The Ariendorf I fauna is indicative for the earliest extension of the Mammoth Steppe that far to the west, roughly coinciding with the first appearance of *Mammuthus primigenius*, the immigration of *Coelodonta antiquitatis* in western Europe and some changes in the horses.

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