

BIOCHRONOLOGY OF THE MUGELLO INTERMONTANE BASIN (NORTHERN APENNINES, ITALY)

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ABSTRACT - *Biochronology of the Mugello intermontane basin (northern Apennines, Italy)* - *Il Quaternario*, 8(1), 1995, 5-10 - The fluvio-lacustrine succession of the Mugello Basin developed in two main sedimentary phases. During the first (the fluvio-lacustrine phase), the basin hosted a lake, along whose shores fan delta sands and gravels accumulated. The quieter areas were marshy, and peat bogs formed. During the second (the fluvial phase), a terraced alluvial succession developed. A revision of some of the fossil material from the basin has allowed the identification of distinct faunal assemblages, and the attribution of the fluvio-lacustrine sedimentation to the early Pleistocene (Tasso - Farneta F.U.). It has instead proven impossible to determine if the deposition of the fluvial phase began during the early or middle Pleistocene.

RIASSUNTO - *Biocronologia del bacino intermontano del Mugello (Appennino settentrionale, Italia)* - *Il Quaternario*, 8(1), 1995, 5-10 - La successione fluvio-lacustre del bacino del Mugello si è sviluppata attraverso due fasi sedimentarie. Durante la prima (fase fluvio-lacustre) il bacino è stato interessato dalla formazione di un lago ai cui margini progradavano apparati di delta conoide. Nelle zone riparate si aveva lo sviluppo di un ambiente palustre caratterizzato dalla formazione di torbiere. La seconda fase (fase fluviale), è stata caratterizzata dallo sviluppo di una successione di terrazzi alluvionali. La revisione di parte del materiale fossile rinvenuto in questo bacino consente di riconoscere associazioni faunistiche distinte e di collocare la sedimentazione della fase fluvio-lacustre nel Pleistocene inferiore (U. F. Tasso - Farneta). Non è invece possibile stabilire con precisione se l'inizio della deposizione della fase fluviale si sia verificato durante il Pleistocene inferiore o nel primo Pleistocene medio.

Key words: Mammalia, biochronology, fluvio-lacustrine succession, Mugello Basin, late Villafranchian, early Pleistocene, middle Pleistocene, Tuscany, Italy

Parole chiave: Mammalia, biocronologia, successione fluvio-lacustre, bacino del Mugello, Villafranchiano, Galeriano, Pleistocene inferiore, Pleistocene medio, Toscana, Italia

1. INTRODUCTION

Systematic revisions of assemblages from known fossiliferous localities, combined with preliminary studies of assemblages discovered in the past decade, have led to a better understanding of the biochronological succession of the late early Pleistocene and earliest middle Pleistocene mammal assemblages of the Italian Peninsula (Torre *et al.*, 1992; Sala *et al.*, 1992; Masini *et al.*, in press). In view of these new findings, and the stratigraphic and sedimentological study of the Mugello Basin carried out by Benvenuti (1994a), we deemed it worthwhile to carry out a preliminary systematic revision of some mammal fossils from the basin, so as to integrate the biochronological data with the reconstruction of sedimentary succession. A detailed analysis of the mammal remains will be presented separately (Abbazzi *et al.*, in progress); the main conclusions are presented. The first reports of vertebrate faunas in the sediments of the Mugello Basin are by Ristori (1889) and De Stefani (1891), though a more detailed faunal list was only published later by Nelli (1923). Simonelli (1922) described other fossils from the Mugello stored at the Museo Capellini, Bologna. More recently, in the course of general revisions of individual systematic (Azzaroli, 1947; Merla, 1949; Mazza, 1988; Masini, 1989), stratigraphic (Sanesi, 1965) and biochronologic (Azzaroli, 1977; Azzaroli *et al.*, 1986; Azzaroli *et*

al., 1988; De Giuli *et al.*, 1983) studies, the mammal assemblage was assigned to the Farneta Faunal Unit of the late Villafranchian (late early Pleistocene).

2. GEOLOGICAL SETTING

The Mugello Valley is an intermountain basin located north of Florence. It is oriented WNW-ESE, and is about 25 km long and 15 km wide (Fig. 1).

The depositional evolution followed a pattern common to other Plio-Pleistocene basins of the Northern Apennines (Upper Valdarno, Casentino, Tiber Basin, etc.; Martini & Sagri, 1993), in which a fluvio-lacustrine succession developed.

The deposition of terrigenous sediments in this basin probably began between the end of the Pliocene and the beginning of the Pleistocene (GEMINA, 1962; Sanesi, 1965; Bernini *et al.*, 1992). The basin was filled by two main sedimentary phases (Benvenuti, this volume). During the first (the fluvio-lacustrine phase; Late Pliocene?-early Pleistocene), a succession characterized by silty lacustrine, locally lignitiferous clays that interfinger with fan delta sands and gravels along the margins of the basin, was deposited. This fluvio-lacustrine sequence overlies a few tens of meters of alluvial gravels, whose presence has been observed only through bore

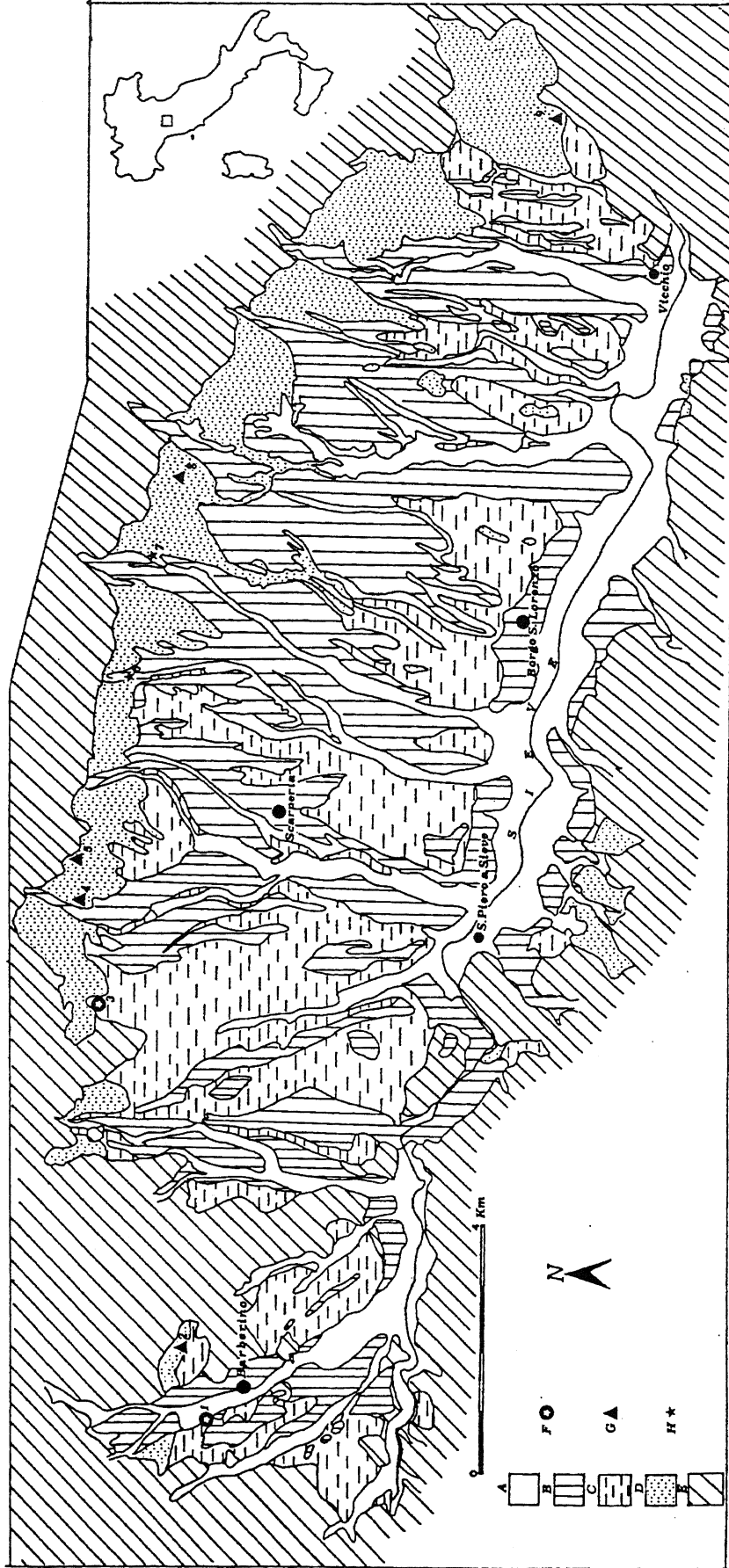


Fig. 1 - Geological sketch map showing the locations of major fossiliferous localities in the Mugello Basin. A: recent alluvium; B: terraced alluvium (Early?/Late Pleistocene); C: lacustrine-swampy lignitiferous clays (Late? Pliocene/Early Pleistocene); D: fan delta sands and gravels (Late? Pliocene/Early Pleistocene); E: pre-lacustrine substrate; F: fossiliferous localities located in the lignites mentioned in old collections; G: fossiliferous localities located in the fan delta mentioned in old collections; H: newly discovered fossiliferous localities; 1 - Palliao; 2 - Soderà; 3 - Lurnena; 4 - S. Agata, various sites; 5 - S. Clemente; 6 - Torrente Bagnone; 7 - Grezzano; 8 - Pulicciano and Poggio-Striano; 9 - Collina.

Schema geologico sintetico ed ubicazione delle principali località fossilifere del bacino del Mugello. A: alluvioni recenti; B: alluvioni terrazzate (Pleistocene inf./sup.); C: argille lacustro-palustri lignitifere (Pliocene sup./Pleistocene inf.); D: sabbie e ghiaie di delta conoide (Pliocene sup./Pleistocene inf.); E: substrato pre lacustro; F: località fossilifere delle vecchie collezioni site nelle ligniti; G: località fossilifere delle vecchie collezioni site nei depositi di delta conoide; H: nuove località fossilifere; 1 - Palliao; 2 - Soderà; 3 - Lurnena; 4 - S. Agata, vari siti; 5 - S. Clemente; 6 - Torrente Bagnone; 7 - Grezzano; 8 - Pulicciano e Poggio-Striano; 9 - Collina.

	1	2	3	4	4'	5	6	7	8	8'	9	10
<i>Mammuthus meridionalis</i>		///	///		///		///		///	///	///	
<i>Mammuthus meridionalis vestinus</i>									///			
<i>Stephanorhinus cf. hundsheimensis</i>			///					///				
<i>Stephanorhinus sp.</i>				■	■	■						
<i>Equus stenorhis</i>		///										
<i>Hippopotamus sp.</i>				■			■			■		
<i>Sus strozzii</i>										///		
<i>Leptobos furtivus</i>			///									
<i>Leptobos aff. vallisarni</i>	///		///	?			///					
<i>Eobison sp.</i>												■
<i>Bos primigenius</i>			■									■
Bovini indet.					■							
<i>Eucladoceros sp.</i>	///	///	///									
<i>Megaloceros (Megaceroides) verticornis</i>												
<i>Megaloceros (Megaceroides) sp.</i>					■							
<i>Pseudodama cf. nestii</i>	///		///									
<i>Ursus cf. etruscus</i>	///		///									
<i>Enhydriactis cf. ardea</i>	///		///									
<i>Macaca sylvana florentina</i>	///											

- | | |
|--------------------------------|-------------------------------|
| 1 - Pallaio | 6 - Fosso Bagnone |
| 2 - Soderà | 7 - Grezzano -Luco di Mugello |
| 3 - Lumena | 8 - Poggiolo-Striano |
| 4 - S. Agata - Campiglia | 8' - Pulicciano |
| 4' - S. Agata - Poggio Cavallo | 9 - Collina (Vicchio) |
| 5 - S. Clemente | 10 - Uncertain provenience |



Fig. 2 - Distribution of taxa identified in the various fossiliferous localities.
Distribuzione dei taxa riconosciuti nelle differenti località fossilifere.

holes ("Complesso sabbioso-conglomeratico", in GEMINA, 1962). At the end of the fluvio-lacustrine phase the basin was completely filled up, and its surface was covered by alluvial fan deposits (Benvenuti, 1994b).

The second phase (the fluvial phase; early?/middle Pleistocene-Holocene) was characterized by alluvial sedimentation, and can be divided into three major episodes that produced a typical sequence of alluvial terraces (Sanesi, 1965).

3. THE FOSSILIFEROUS LOCALITIES OF THE MUGELLO BASIN

A systematic study of the fossil assemblages found in the basin has revealed the presence of forms belonging to different faunal units (Fig. 2).

The assemblage found in the Lumena locality contains taxa referable to the Olivola and Tasso faunal units (Late Villafranchian), and includes *Leptobos cf. furtivus* and the small sized deer, *Pseudodama cf. nestii*. *L. furtivus* is characteristic of the Late Pliocene (Senèze), and seems to have survived into the early Pleistocene, at least up to the Tasso faunal unit, in which it is represented by a form with more derived characteristics (Masini, 1989). *Pseudodama nestii* is characteristic of the Olivola and Tasso faunal units of the Italian Peninsula; however, the remains attributed to *P. cf. nestii* present specific ad-

vanced morphological characteristics (for example pre-molar length and antler morphology) that are comparable to those of finds from the Tasso F. U. assemblages (Casa Fratta and other localities of the Upper Valdarno). *Stephanorhinus cf. hundsheimensis*, *Leptobos aff. vallisarni*, and *Ursus cf. etruscus* are comparable to the forms found at Pietrafitta (Umbria), and are therefore referable to the subsequent Farneta Faunal Unit.

The discovery of *Mammuthus meridionalis vestinus* at Poggiolo-Striano, reveals the presence of other levels referable to the Farneta Faunal Unit (Azzaroli, 1977).

The assemblage from Soderà, which includes *Mammuthus meridionalis*, *Eucladoceros sp.*, and *Equus stenorhis* can generically be attributed to the late Villafranchian.

Other localities have yielded an assemblage that indicates the presence of levels belonging to more than one faunal unit. For example, the Pallaio locality has produced an assemblage whose characteristics are analogous to those of the Lumena and Soderà assemblages, but which also includes rare specimens of *Megaceroides verticornis*, a taxon characteristic of the Galerian Mammal Age.

A horn core attributable to the primitive bison, *Bison (Eobison) sp.*, of unknown provenience, marks the presence of the transition between the Villafranchian and the Galerian. A closely related species, *Bison (Eobison) degiulii*, has in fact been found at Pirro (Gargano, Italy; De Giuli *et al.*, 1987; Masini, 1989), and belongs to a faunal assemblage that, though still Villafranchian in

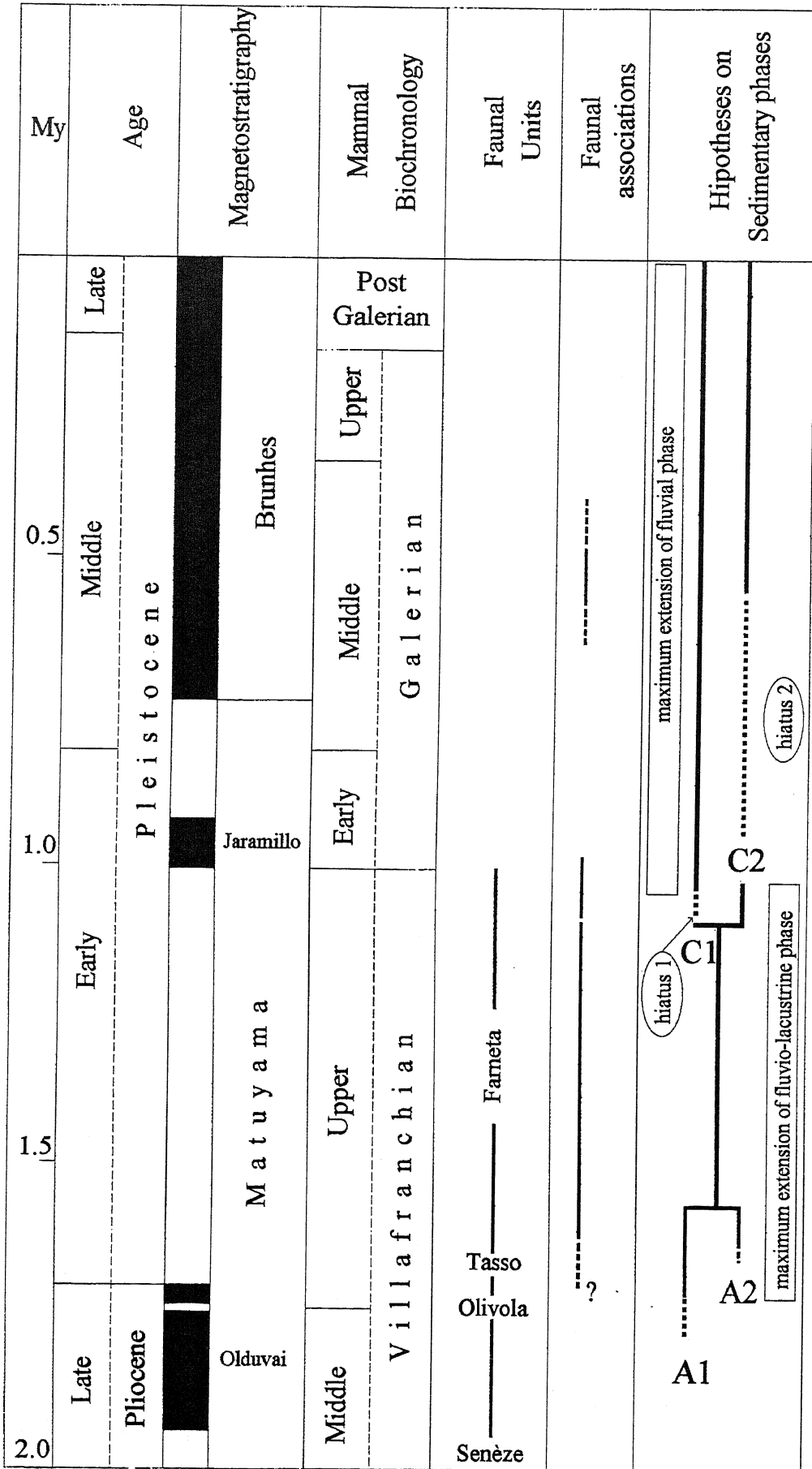


Fig. 3 - Summary of the biochronologic data, indicating the extent of the sedimentary phases in the Mugello Basin (see text for explanation).

Schema di sintesi dei dati biocronologici con indicazione dell'estensione delle fasi sedimentarie del bacino del Mugello (vedi testo per la spiegazione).

character, contains taxa that display more advanced evolutionary stages than those observable in the other faunas of the Farneta faunal unit (Pietrafitta, various localities in the Val di Chiana), together with forms that record important dispersals, including that of the bison.

A single find of *Megacerooides* sp., a proximal fragment of an antler, which came from S. Agata-Poggio Cavallo, displays derived characteristics (a marked inclination of the plain of the rosette with respect to the axis of the shaft, and the absence of basal tines) that occur in the middle Galerian forms of *Megacerooides*. This specimen also bears a close resemblance to the megacerine forms from Isemia la Pineta (Molise), (Abbazzi & Masini, in progress).

Rare tooth fragments attributable to *Bos primigenius*, whose exact provenances are unknown, also date to the Galerian or the Post-Galerian.

4. CONCLUSIONS

The revision of the mammal remains found in the Mugello Basin reveals a fairly complex picture, in which the fossils that document the fluvio-lacustrine phase are distributed over a period that includes part of the Tasso and Farneta Units (late Villafranchian). In particular, the remains collected from the lignitiferous sediments, *Pseudodama* cf. *nestii* and *Leptobos furtivus*, could belong to the former unit. The presence of *Archidiskodon meridionalis*, whose size is similar to that of the subspecies *vestinus* (Azzaroli, 1977), and of a rhinoceros with characteristics similar to those of *Stephanorhinus hundsheimensis* (Mazza, 1988; Fortelius *et al.*, 1993), confirms the existence of levels attributable to the Farneta F. U. Because of the absence of a direct stratigraphic control, we cannot however exclude the possibility that all these taxa belong to a single assemblage, which would in this case document a unit intermediate between the Tasso and Farneta Units.

The presence of a horn core attributed to the primitive bison *Bison* (*Eobison*) sp. could document the most recent phase of the late Villafranchian. The systematic study has also allowed the identification of forms characteristic of Galerian assemblages (*Megacerooides verticornis*, *M.* sp.). The precise provenance of the specimens is unknown, and therefore their stratigraphic relationship with the earlier late Villafranchian assemblage remains unknown. The stratigraphic relationships between the deposits of the fluvio-lacustrine and fluvial phases in the Galliano-Sant'Andrea sector (Benvenuti, 1994) allow us however to refer, the isolated *Megacerooides* sp. specimen, whose characteristics appear indicative of a middle Galerian assemblage, to deposits from the earliest episode of terracing and flooding of the fluvial phase. To the contrary, the discovery of a Galerian form (*M. verticornis*) with Villafranchian forms, at Pallaio (in the Barberino di Mugello Sector), could mark the infilling that closed the fluvio-lacustrine phase.

In summary, the biochronological study of the suc-

cession of the Mugello Basin (Fig. 3) allows us to refer the fluvio-lacustrine phase to the early Pleistocene, although there are uncertainties regarding the precise chronological positions of the beginning and end of the phase, which can be expressed in the form of alternative hypotheses (A1 - A2 and C1 - C2, respectively). In the first hypothesis (A1), the presence of elements of the Tasso Faunal Unit in the assemblage could indicate that the fluvio-lacustrine phase began at the beginning of the early Pleistocene, though it does not rule out the possibility that the deposition of the "Complesso sabbioso-conglomeratico" began in the latest Pliocene (GEMINA, 1962; Sanesi, 1965). Alternatively (hypothesis A2), the simultaneous presence of elements from the Tasso and Farneta Units could represent a transitional assemblage, thus suggesting that the beginning of the fluvio-lacustrine sedimentation was slightly more recent.

With regards to the passage from the fluvio-lacustrine to the fluvial phase, according to hypothesis C1, the faunas of the latest Villafranchian belong to the fluvial phase, which therefore began at the end of the early Pleistocene. Alternatively (hypothesis C2), the forms are from sediments referable to the end of the fluvio-lacustrine phase, which therefore extended to the latest early Pleistocene. If hypothesis C1 is correct, the duration of the hiatus between the two phases was slight, while it was much longer if hypothesis C2 is correct.

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Manoscritto ricevuto il 26. 4. 1994
 Inviato all'Autore per la revisione il 21. 12. 1994
 Testo definitivo ricevuto il 1. 2. 1995