

Sedimentology and taphonomy of the Middle Pleistocene Mosbach Sands (Germany)

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Near the eastern city limits of the town Wiesbaden (Hesse) a series of Lower to Upper Pleistocene sediments, overlying limestones and marls of Miocene age, is preserved. Within this sequence, the so-called Mosbach Sands occupy a particular position, since they have produced a large amount of fossils since the early days of AGASSIZ and SCHIMPER in the 19th century, the time when the idea of the Ice Age first came to science.

Several fossil mammalian faunas of different biostratigraphic position have been reported from the Mosbach Sands and Gravels. The recorded taxa are mainly represented by disarticulated elements. The "lower fauna" (**Mosbach 1**) contains, for example, *Mammuthus meridionalis* and *Stephanorhinus etruscus*. It is poor in finds and species. In fact, as a result of the superposition of younger fossiliferous deposits, some of these species may actually belong to the subsequent, younger **Mosbach 2** fauna. The Mosbach 1 fauna originates from horizons with reversed magnetic polarisation, which are older than the Jaramillo Event (KOCI et al. 1973). The normally polarised sediments containing the Mosbach 2 fauna are attributed to a part of the Brunhes epoch. Most authors assign them to the early or middle Middle Pleistocene. Mosbach 2 is the type fauna for the Mosbachian age of the mammal stratigraphic scale. It comprises some 63 mammal species, including *Mammuthus trogontherii*, *Stephanorhinus etruscus/hundsheimensis* and *S. kirchbergensis*. According to MAUL et al. (2000), Mosbach 2 contains one of the oldest populations of the genus *Arvicola*.

Several authors (e.g. HEMMER et al. 2003) refer to the fact that the Mosbach 2 mammalian fauna is heterochronic and that no ecological balance exists in it. Indeed, in addition to many species that are not usable as indicators of a

climatic tendency, some of the recorded taxa indicate warmer others cooler climatic conditions (e.g. *Capreolus/Hippopotamus* versus *Rangifer/Gulo*). These differences led to the differentiation of a somewhat younger Mosbach 3 fauna by BRÜNING (1970).

Faced with some contradictory facts and opinions, a new look is necessary, not only at the fossils but especially at the sediment. For more than a century, fossils were collected from the Mosbach Sands without stratigraphic documentation. Investigations of the Monument Protection Office (state of Hesse) started in 1991 and have yielded one hundred mammalian finds with associated precise documented stratigraphical positions. From these, the first taphonomic conclusions arise.

The body of the Middle Pleistocene Mosbach Sands is part of a fluvial macrocycle. The sediments can be divided into three sequences, which are separated from each other by striking hiatuses (gaps). Fluvial architectural elements differ between the sequences, representing changing river morphology.

Sedimentological results lead to the assumption of the presence of at least three different taphocoenoses (these are attritional bone assemblages according to BEHRENSMEYER 1982) in the Mosbach 2 sands, corresponding to the fluvial sequences. Mosbach 2 sediments predominantly contain lithogenetic hints of a cooler climate. Nevertheless, within the enclosed channel assemblages there occur species with both cooler and warmer climatic preferences. The taphocoenoses contains a mixture of "cooler" and "warmer" mammalian species. Based on estimations of sediment accumulation rates and the completeness of the sedimentary sections, it is probably that the channel assemblages represent relative short intervals (in the order of possibly 10³-10⁴ years).

The “warmer”, interglacial faunal component does not entirely correspond with the character of the sediment. To some extent, it may represent a long-term accumulation. These assemblages were possibly concentrated during the periods of erosion or non-deposition that correspond to the striking gaps in the sedimentary record. They may represent long intervals (in the order of 10⁵-10⁶ years). In fact, a distinct proportion of all attritional assemblages show heavily diagenetic bone alteration, thus indicating longer accumulation episodes.

The few Nordic, cool-climate taxa (which are extremely rare in the Mosbach record), like *Rangifer tarandus stadelmanni* and *Gulo* cf. *schlosseri* (DÖPPES pers. comm. 2004), may document different taphocoenoses that

originated from shorter events and which are of limited importance when evaluating the entire fauna (the precise stratigraphic position of these few finds is unknown). From this point of view, the differentiation of a cool-climate Mosbach 3 fauna is not justified. Our field investigations support the interpretation that there are two, somewhat different, Mosbach 2 faunas present in the fossil record. It seems apparent that they were part of a temporal succession. All previous authors assume that the fauna including interglacial taxa precedes the subsequent steppe fauna. However, the new finds of plants and mammals from the upper part of the Middle Pleistocene Mosbach sediments fail to confirm this view.

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