

THE MEERFELDER MAAR LAKE DEPOSITS

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With 1 table supplement

ABSTRACT

A core from Meerfelder Maar, with a basal age of 29,000 years, provides a continuous sedimentary sequence from Late-Glacial times to the present. It includes the stratigraphical marker of the Laach Pumice Tuff. Sedimentological, geochemical, palynological, palaeobiological, palaeomagnetic and palaeontological analyses permit reconstructions of the history of the lake and its catchment area, and hence of the climate of the region, to be made. The discovery of Middle-Oligocene marine, detrital fossils in the maar sediments provides insights into the palaeogeography of the Eifel region during Tertiary times.

DIE SEDIMENTE DES MEERFELDER-MAARSEES

ZUSAMMENFASSUNG

Untersuchungen an Sedimenten des Meerfelder-Maarsees haben ergeben, daß das Maar ein Minimalalter von ca. 29.000 Jahren besitzen muß. Damit ist eine Sedimentsequenz vom letzten Hochglazial bis heute erhalten, die als zeitliche Marke den Laacher Bimstuff führt. Sedimentologische, geochemische, palynologische, paläobiologische, paläomagnetische und paläontologische Untersuchungsergebnisse dokumentieren die Seen-, Landschafts-, Vegetations-, Lebens- und Klimageschichte des Raumes.

Als außergewöhnliches Resultat ist der Fund detritischer, mariner, mitteloligozäner Fauna und Flora zu werten, der sogar Aussagen zur Paläogeographie des Tertiärs in der Eifel ermöglicht.

A core from Meerfelder Maar provides a complete sequence through Late Pleistocene and Holocene sediments, and documents the recent history of the Eifel region. As the results of our studies have been published elsewhere (Irion and Negendank 1984) we summarize the major conclusions in this paper.

The age of the maar is much older than previously assumed. Pollen analysis reveals a record from Mid-Weichselian—Late-Glacial to Recent times. This suggests that the maar dates back to the late stages of the last glaciation. A layer of tuff 5 cm thick of upper Alleröd age, thought to be the 'Laacher Bimstuff' (Laach Pumice Tuff), can be correlated with similar deposits in the Hitsche and Hinkelsmaar lake sediments.

Radiocarbon dating of carbonized plant fragments which were found at the base of the Meerfeld-tuffs in the NW of the maar, indicates a basal age of at least 29,000 years. An estimate based on palaeomagnetic data (secular variation) from these sediments,

when compared with measurements on dated sediments from the Black Sea, yields a similar value of 27,000 years.

Given the size of the maar it seems unlikely that the entire thickness of the nepton was recorded. A comparison with sediment profiles of the Eocene maar lake of Eckfeld (Negendank et al. 1982) indicates that only a minor portion of the entire thickness of the nepton was cored. A boulder may have terminated drilling B 4 (table 1).

The four cores show that the sedimentation of the lake was advancing from SW to NE.

The sedimentary sequence (table 1) reveals a distinct change from mineral sediments to diatom gyttja. This change corresponds to an amelioration of climate during the Older Tundra period and occurs in the same section which shows a shift from kaolinite/less chlorite to chlorite/less kaolinite sediments.

The change can be explained by examining the inflow of the Meerfelder Bach and its catchment in the SW. Weathering products rich in kaolinite were deposited in the lake initially, and then, after a phase of vertical erosion, the deposition of weathered Devonian rock material followed.

Investigations of pore water composition, indicate that the element distribution of the sediment fraction $<2\ \mu\text{m}$ (Na, K, Ca, Mg, Al, Si, Li, Ag, Fe and Sr) was very similar to results obtained from the Bodensee. The Bodensee profile is, however, only 3.5 m thick.

Changes in concentration, for example of K, Li and Si, occur simultaneously with increasing sediment depth, while Na-values in the pore water show the highest concentrations in the lower parts of the core. These changes in concentrations may indicate the first stage of diagenesis.

No statement can yet be made on the peculiar detritic, marine, brackish fauna and flora of the Upper-Middle-Oligocene — Upper-Oligocene. There is, however, enough evidence of the presence of these Tertiary sediments, even if their occurrence is only sporadic, as in the catchment of the Meerfelder Maar. The distribution of Tertiary fauna and flora along the entire lake sediment profile may lead to the assumption that relicts of this fauna and flora must still exist within the catchment today, although these have not yet been discovered.

Foraminifers, ostracods, cirripeds and fragments of molluscs are of the same age as the dinoflagellates, i. e. Upper-Middle-Oligocene — Upper-Oligocene. Similar discoveries have been made in Cyrenenmergel and Schleichsand in the Basin of Mainz (Mainzer Becken).

Therefore, the marine transgression must have advanced to these altitudes¹ and into this region since the environs of the maar are between 430 and 530 m a. m. s. l. The results of investigations of the Cenozoic sediments in the Eifel and Hunsrück region substantiates this conclusion, because evidence of an Upper-Middle-Oligocene — Upper-Oligocene marine transgression can be traced by the occurrence of these fossils. This transgression advanced from the Basin of Mainz (Mainzer Becken) and the strongly modified relief of the Hunsrück (Negendank 1983 a and b, Zöller 1983).

Pollen analysis and the investigation of various fossils provides evidence about the palaeoclimatic record. A distinct and abrupt amelioration of climate from the Late- to

¹ Investigations of Cenozoic sediments within the Mosel river catchment in the Eifel-Hunsrück region have shown that the area on the left bank of the Rhine has been subjected to uplift of about 200–250 m since the end of the Pliocene (Negendank 1983 a and b).

Post-Glacial resulted in a marked change in terrestrial vegetation and also dramatically modified conditions in the lake itself. This is reflected by a change in the character of the lacustrine sediments, from Glacial — Late-Glacial minerogenic to organic deposition during the Preboreal—Recent period. A corresponding, but less dramatic change characterizes the Older Tundra/Alleröd Boreal period. The older mineral sediments are probably of mid-Weichselian age, since the pollen spectrum is typical of glacial conditions, with 18 % pine, 0.5 % birch, and 80 % non-arboreal pollen (including 24 % poacees, 28 % cyperacees, 3 % *Artemisia*).

The following conclusions may be made about the occurrence and significance of the various fossils in the lake sediments. During the Mid-Weichselian (phase one) Cladocera are not present and *Diamesa* dominates among the Chironomides. During the Late-Glacial to Preboreal (phase two) *Daphnia* is the most important planktonic Cladocera. The chylorid fauna is represented by a "subarctic association". During phase three, which lasted from Boreal to Post-Glacial times, the plankton is dominated by a succession from *Daphnia* to *Bosmina longirostris*. The number of chylorid species increases, while the importance of pioneer species decreases. Litoral taxa dominate over the subfossil communities in oligotrophic and eutrophic maars. For this reason the subfossil association gives the impression of an eutrophic water body at the time. The major faunal changes are, however, related to climatic factors rather than a result of eutrophication.

The ostracod fauna cannot be described in details. The scarcity of ostracods today compared to their abundance during the Post-Glacial is related to eutrophication, which has increased over the last few decades. This limits the species diversity and restricts the living environment to areas of reed growth.

There is a great potential for further research on the sediments of the Meerfelder Maar. The study of diatoms has not been undertaken, so far. Fish remains and green algae (*Pediastrum*, *Chlorococcales*), identified in all samples by Dr. Weiler, have also not been studied in detail.

In conclusion, the sediments of the Meerfelder Maar reveal a record of regional development, and the habitat of both the terrestrial and lacustrine fauna and flora, since the last glaciation. The disastrous eruption of the Laacher See volcano is also recorded within the deposits.

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