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A Volcanic Ash-Fall at the Early/Mid Weichselian-Würmian Transition in the Peat Bog of Grande Pile (Vosges, France)

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Volcanic ash-fall, lacustrine sediments, carotte, Early/Mid Weichselian transition, radiometric dating, pyroxene clino, peat bog.
South Vogesen, Grande Pile, Haut Rhin

Abstract: A continuous core of lacustrine sediments from the well-known Grande Pile locality in northeastern France was analysed. We report here on a new ash bed, the "diopside ash-fall"; its stratigraphic position at the Early/Mid-Weichselian-Würmian transition is quite firm. At present, radiometric dating does not permit more precise dating of this ash bed than between 53,000—62,000 B.P. In total 5 ash beds have been reported from the peat bog of Grande Pile.

[Ein vulkanischer Aschen-Niederschlag an der Wende frühes/mittleres Weichsel — Würm im Torfmoor von Grand Pile (Vogesen, Frankreich)]

Kurzfassung: An einem zusammenhängenden Bohrkern aus quartären Seesedimenten von Grande Pile (Süd-Vogesen, Frankreich) wurden petrographische Untersuchungen durchgeführt und dabei eine weitere tuffitische Lage entdeckt, die durch Klinopyroxene (wahrscheinlich Diopsid) charakterisiert ist. Diese wird an die Wende der Hauptkaltphase der frühen Weichsel zum mittleren Weichsel gestellt. Nach ¹⁴C-Datierungen liegt das Alter zwischen 53 000 und 62 000 B.P.. Bislang wurden 5 tuffitische Lagen aus der Lokalität Grande Pile nachgewiesen.

1. Introduction

In the last 7 years, several volcanic ash layers have been discovered in the southern part of the Vosges, France.

SERET discovered an ash layer of Alleröd age in the peat bog of Frère Joseph/Vosges and the following heavy mineral suite was described: 33 % basaltic hornblende, 9 % highly pleochroic augite, 9 % euhedral zoned zircon, 5 % sphene and 44 % euhedral apatite. It is suggested that this ash was erupted in the Eifel (in FRENZEL 1978).

JUVIGNE (1976, 1977) described another heavy mineral suite for the ash layer of Frère Joseph: 58 % basaltic hornblende, 29 % clinopyroxene and 10 % sphene (3 % unknown). Volcanic zircon, apatite, and biotite could not be distinguished from local non-volcanic material.

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JUVIGNE (1978) mentioned the occurrence of a volcanic heavy mineral suite similar to that of Frère Joseph in two other peat bogs: Etang du Boffy and Grande Pile core II (WOILLARD 1975). The ash-falls of Frère Joseph and Etang du Boffy were correlated with the "Laacher See-Tuff 5 final" of Alleröd age but the ash-fall of Grande Pile core II occurred at 520 cm depth within the "Arcy-Kesselt interstadial" after a pollen diagram of WOILLARD (1975).

MÖRNER (1977, 1979, 1981), using X-ray analysis, described 2 other volcanic ash beds (Ash G and N) in a core (labelled B 963) which was taken in Grande Pile right beside core X of WOILLARD (1975):

- Ash G, 1023 cm depth, about 50,000 years B.P.
- Ash N, 18.00–18.10 cm depth, about 130,000 years B.P.

JUVIGNE & BASTIN (1982) discovered another ash layer at 435 cm depth in a core which was also taken very close to locality Grand Pile core X. Based on pollen evidence this ash-fall occurred during the Preboreal. A sample located at 462–465 cm below the surface at the same locality was dated at about 11,500 B.P. (MÖRNER 1981).

The ash layer lies 30 cm above this sample. The source vent was probably the Chaîne des Puys (Massif Central français). Designation "tuf des Vosges méridionales" was given to this ash-fall.

2. Research

Core B 963 of MÖRNER (1979, 1981) was investigated. This core was taken with the Swedish foil piston corer in two continuous segments (455–1194 cm and 1195–1846 cm depth). The 455–1194 cm section was microscopically analyzed by one of us (JUVIGNE). The lower segment of this core was not available because it was kept for additional paleomagnetic analysis.

2.1. Method

The core was previously cut in 3 cm-segments for paleomagnetic studies (MÖRNER 1979). A quarter of each segment (about 5 cm³) was treated as follows:

- Boil with H₂O₂ 50 V.
- Boil with HCl+HNO₃ (about 10 %).
- Wet-sieve through screens 420 mμ and 63 mμ.
- Dry fraction 63–420 mμ in oven.
- Separate in bromoform (d = 2,89) using a centrifuge.
- Mount heavy minerals in Canada balsam.
- Look for volcanic minerals in the slides.

2.2. Results

A few clinopyroxenes (less than 10 grains) are present in most of the samples; these are light green and often show a parallel stria set terminated by acicular features (fig. 1a). Basaltic hornblende is rare. Both volcanic minerals are considered to be reworked from their source with non volcanic deposits.

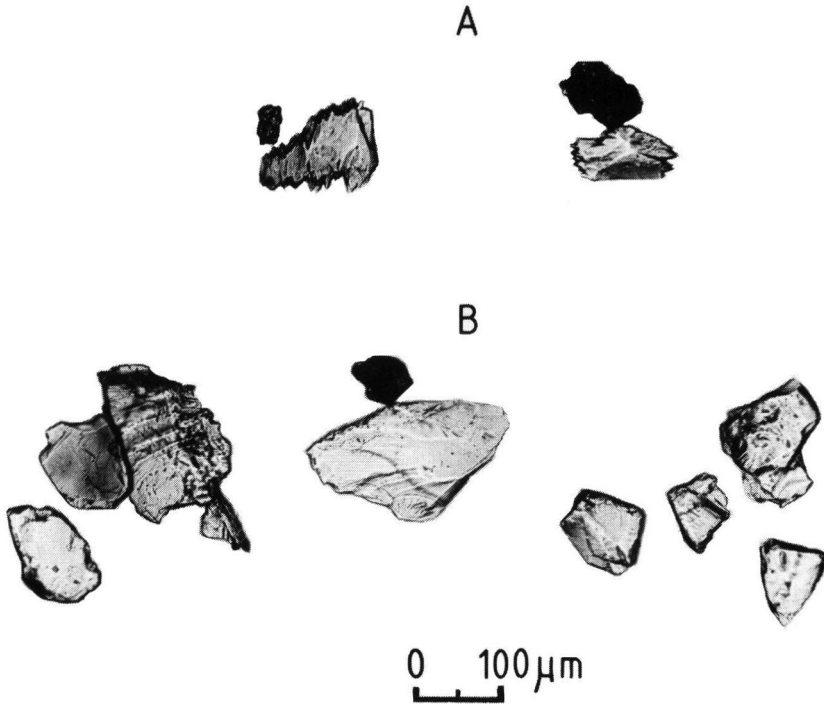


Fig. 1: Clinopyroxenes from grande Pile; (A) typical singular grains found in most of the samples, and (B) grains from the enriched horizon at the 1092–1095 cm depth.

The segment of 1092–1095 cm depth is greatly enriched in volcanic heavy minerals, although no significant change was visible in the core. In addition to 284 clinopyroxenes and 9 basaltic hornblendes, 528 biotites were found in the slide. Most of the biotite are believed to belong to the ash-fall because this abundance corresponds with a high enrichment of this mineral.

The clinopyroxenes are essentially colorless to pale green. Most of them are angular shards with no typical faces or cleavages (fig. 1b); a few of them are saw-edged. The coarsest grain was about 250 μm wide. These clinopyroxenes are suspected to be diopside. Because of previous use of different local terms for stratigraphical purpose (WOILLARD 1975), we propose to call this ash-fall “diopside ash-fall”.

Stratigraphically, this ash lies just above the 5b stadial of MÖRNER (1979, 1981) which represents the maximum coldness of the Early Weichselian-Würmian Glaciation (Glaciation Maximum II of MÖRNER 1979). Hence it marks the transition between the Early and Mid-Weichselian-Würmian.

In absolute age, it seems to fall between 53,000 BP and 62,000 BP (MÖRNER 1979, 1981; WOILLARD & MOOK 1982).

2.3. Search of Laacher See-Tuff in Grande Pile

We remind in the former introduction the occurrence of Laacher See-Tuff in two other peat bogs in the vicinity of Grande Pile (Etang du Boffy and Frère Joseph).

In Grande Pile core II (WOILLARD 1975), JUVIGNE discovered an enrichment in volcanic material with a heavy mineral suite similar to that of the "Laacher See-Tuff 5 final". The designation "tuf de Grande Pile" was given. This enrichment was within the "Arcy-Kesselt interstadial", based on a pollen diagram of WOILLARD (1975).

Five different cores from the area near the Grande Pile core X have been investigated in order to find the "tuf de Grande Pile" and/or the "Laacher See-Tuff". This research met with no success but another ash layer was discovered (JUVIGNE & BASTIN 1982).

Using mineralogical variations demonstrated by JUVIGNE & SHIPLEY (1983) and JUVIGNE (1983) all these ash layers could be correlated with each other but this would be incompatible with the pollen diagrams.

3. Conclusion

In the Grande Pile peat bog five ash-falls have been discovered.

Three of them were recognized by their heavy mineral suites in the fine sand fraction:

- the "tuf des Vosges méridionales" of preboreal age (JUVIGNE & BASTIN 1982).
- the "tuf de Grande Pile" of "Arcy-Kesselt interstadial" age (JUVIGNE 1978).
- the "diopside ash-fall" at the Early/Mid Weichselian-Würmian transition.

Two other volcanic layers have been discovered by X-Ray analysis; no specific volcanic heavy minerals were found in the fine sand fraction.

- Ash G about 50,000 years BP (MÖRNER 1979).
- Ash N about 130,000 years BP (MÖRNER 1979).

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