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Evidence of the Presence of the Eltville Tuff Layer in Dutch and Belgian Limbourg and the Consequences for the Loess Stratigraphy

Erik Meijs, Herman Mücher, Gerard Ouwerkerk,
Arie Romein & Henk Stoltenberg *)

Evidence presence, Eltville tuff layer, correlation, Kesselt paleosol, interstadial milieu, parent material, loess, grain size distribution, X-ray diffraction analysis, pit section, Weichselian, interpretation, heavy mineral.
Dutsch, Belgian Limbourg

Abstract: At the beginning of 1979 a tephra layer was found for the first time in the loess deposits of Southern Limbourg, The Netherlands (Meijs 1980a). On the basis of its stratigraphical position, its macroscopic appearance and its mineralogical composition, this tephra layer was correlated with the Eltville tuff.

In the present paper these arguments of correlation are treated more in detail and are supplemented by the results of micromorphological and x-ray diffraction analyses.

The discovery of the Eltville tuff in this region just beneath the Kesselt paleosol (= Horizon of Nagelbeek), means that this paleosol is stratigraphically equivalent to the E4 tundragley. This is in conflict with the prevailing concept in Belgium and The Netherlands, according to which the Kesselt paleosol is correlated with the Stillfried-B paleosol, formed during the Denekamp interstadial and lying in a stratigraphical position beneath the Eltville tuff (see e. g. Zagwijn & Paepe 1968). The Stillfried-B paleosol is about 10,000 years older than the E4 tundragley (Semmel 1967, Vogel & van der Hammen 1967).

[Der Nachweis des Vorkommens des Eltviller Tuffs in Belgisch und Niederländisch Limburg und die Folgen für die Löß-Stratigraphie]

Kurzfassung: Anfang 1979 ist zum ersten Male in den Niederlanden ein vulkanischer Tuff in den Lößablagerungen von Süd-Limburg gefunden worden (Meijs 1980a). Auf Grund der stratigraphischen Lage, des makroskopischen Aussehens und der mineralogischen Zusammensetzung wurde dieser Tuff mit dem Eltviller Tuff korreliert.

In dieser Veröffentlichung werden die Korrelierungsbeweisgründe eingehend behandelt und mit den Ergebnissen mikromorphologischer und röntgenologischer Untersuchungen ergänzt.

Die Entdeckung des Eltviller Tuffs in dieser Region gerade unter dem Kesselt-Paläoboden (= Nagelbeek Horizont) bedeutet, daß dieser Paläoboden ein stratigraphisches Äquivalent des E4-Naßbodens ist. Dieses steht im Widerspruch mit der in Belgien und die Niederlande herrschenden Ansicht, laut deren der Kesselt-Paläoboden mit dem im Denekamp Interstadial geformten Stillfried-B Paläoboden korreliert wird (z. B. Zagwijn & Paepe 1968). Der letztgenannte Paläoboden liegt aber stratigraphisch unter dem Eltviller Tuff und ist ungefähr 10.000 Jahr älter als der E4-Naßboden (Semmel 1967, Vogel & van der Hammen 1967).

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*) Addresses of the authors: E. P. M. Meijs, G. Ouwerkerk, A. Romein, Department of Physical Geography, University of Utrecht, Heidelberglaan 2, 3508 TC Utrecht, The Netherlands; H. J. Mücher, H. Stoltenberg, Laboratory of Physical Geography and Soil Science, University of Amsterdam, Dapperstraat 115, 1093 BS Amsterdam, The Netherlands.

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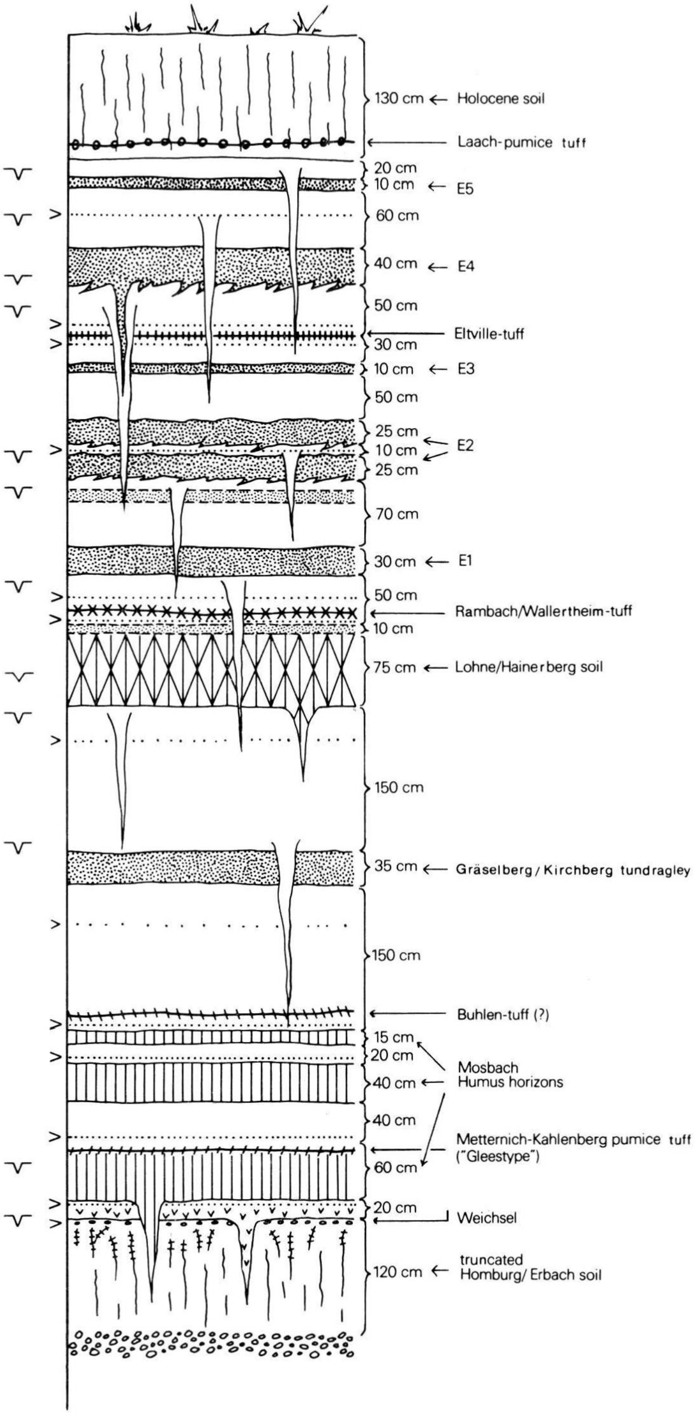

130 cm ← Holocene soil
Laach-pumice tuff
20 cm
10 cm ← E5
60 cm
40 cm ← E4
50 cm
Eltville-tuff
30 cm
10 cm ← E3
50 cm
25 cm
10 cm
25 cm
E2
70 cm
30 cm ← E1
50 cm
Rambach/Wallertheim-tuff
10 cm
75 cm ← Lohne/Hainerberg soil
150 cm
35 cm ← Gräselberg / Kirchberg tundragley
150 cm
Buhlen-tuff (?)
15 cm
20 cm
Mosbach
40 cm ← Humus horizons
40 cm
Metternich-Kahlenberg pumice tuff
("Gleestype")
60 cm
20 cm
Weichsel
truncated
120 cm ← Homburg/ Erbach soil

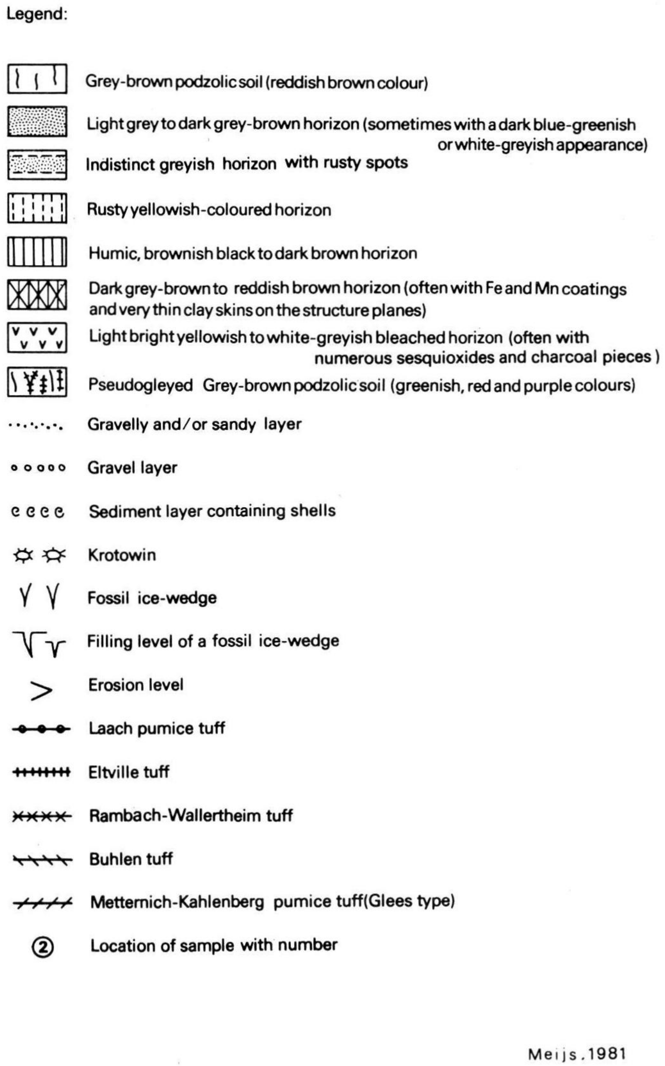


Figure 1: Idealized Weichselian loess profile, showing the stratigraphical position of the various tephra layers in Germany (according to BARTELS & HARD 1973; BIBUS 1973, 1980; BIBUS & SEMMEL 1977; BRUNNACKER & HAHN 1978; BRUNNACKER & TILLMANNS 1978; LÖHR & BRUNNACKER 1974; ROHDENBURG 1966; ROHDENBURG & MEYER 1966; SCHÖNHALS et al. 1964; SEMMEL 1967, 1968 and WINDHEUSER & BRUNNACKER 1978).

1. Introduction

1.1. Tephrostratigraphical loess research

Hitherto the most important topics in the Quaternary lithostratigraphical research on Dutch loess deposits have been paleosols, periglacial features and sedimentological characteristics.

In Belgium and Germany much research has been done into the macroscopic and microscopical tephrostratigraphy.

During the last 30 years various German loess investigators have discovered tephra layers in loess profiles further and further away from the volcanic Eifel. In this connection many publications have appeared about tephra layers in German loess deposits (see e. g. BIBUS 1980, WINDHEUSER & BRUNNACKER 1978). So far five distinct tephra layers have been found in German Weichselian loess sections in a wide area around the volcanic Eifel (SEMMEL 1967, LÖHR & BRUNNACKER 1974; see figure 1).

In Belgium much microscopical research has been done into the volcanic heavy minerals present in loess deposits (see e. g. JUVIGNÉ 1977, 1980). In addition to the Eltville tuff discovered in Rocourt by ROHDENBURG & SEMMEL (1971), one more macroscopically visible tephra layer has been found (Laach lake tuff-5; HULSHOF et al. 1968, PISSART & JUVIGNÉ 1980).

1.2. The Eltville tuff in Germany

In recent years the Eltville tuff has been recognised macroscopically over a wide area. According to BIBUS & SEMMEL (1977) the tuff was emitted by the „Korretsberg“ volcano (see figure 2).

The Eltville tuff often consists of 2 to 5 separate tephra layers. The maximum total thickness of the loess layers between the uppermost and lowest tephra layer is 15 cm. The colour of the Eltville tuff layers differs from area to area. The lower two layers have colours varying from olive-green to dark greyish black, the middle layer ranges from brown to dark greyish brown and the upper two layers from dark greyish black to black (BIBUS 1973, 1980; BIBUS & Semmel 1977; FRECHEN 1959; LÖHR & BRUNNACKER 1974; SCHÖNHALS 1959).

On the basis of differences in the colour and the mineralogical and morphometric composition of the Eltville tuff layers it would seem that the bottom layer is thicker in the Western part and that the top layer is thicker in the Eastern part of the distribution area of the Eltville tuff. The second and fourth layer seem to be restricted to rather a small area(about 80 and 40 km radius resp.) and the middle layer to rather a large area (about 160 km radius) around the "Korretsberg".

1.3. The tephra layer in the vicinity of Maastricht

In The Netherlands a thin blackish layer, present in the Upper-Pleniglacial loess, was correlated by MEIJS (1980a) with the Eltville tuff on the basis of its stratigraphical position.

In the same year an examination of the mineralogical composition of this layer revealed that it did indeed contain volcanic heavy minerals (OUWERKERK in MEIJS 1980b).

This paper reports on a study of the morphometric, mineralogical and micromorphological composition of the discovered tephra layer. The aim of the study was to test the correctness of the correlation of this layer with the Eltville tuff.

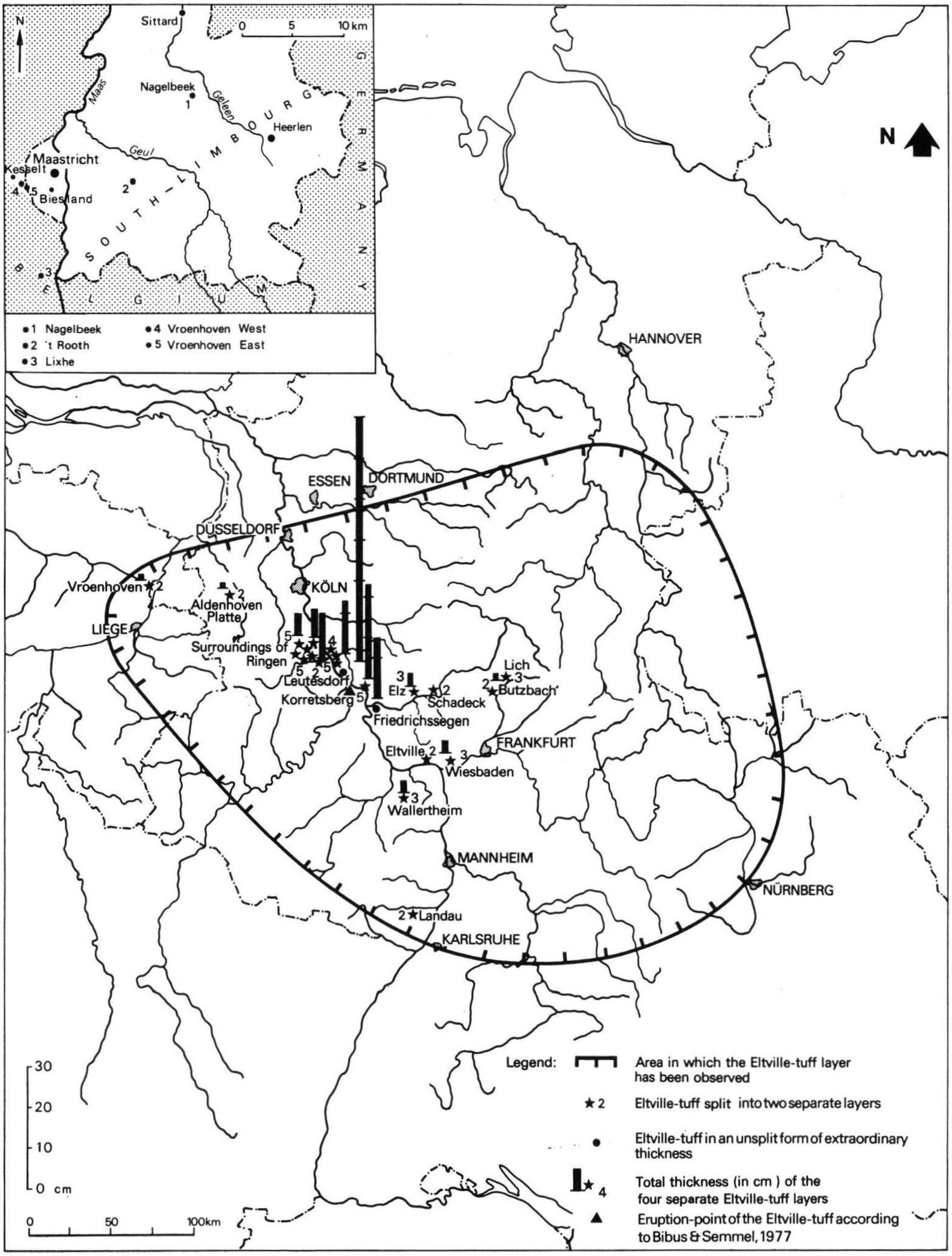
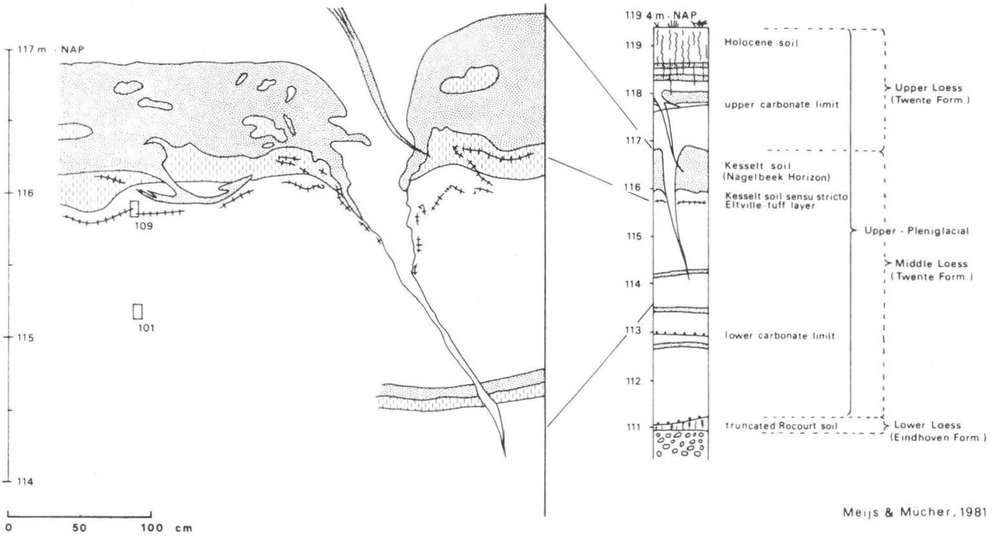


Figure 2: Distribution area of the Eltville tuff and the locations of the sampled loess sections, containing the Eltville tuff in Dutch and adjacent Belgian Limbourg.
(German area according to BIBUS 1973, 1980; BIBUS & SEMMEL 1977; FRECHEN 1959; LÖHR & BRUNNACKER 1974; ROHDENBURG & MEYER 1966; ROHDENBURG & SEMMEL 1971; SABELBERG & LÖSCHER 1978; SCHÖNHALS 1959 and SEMMEL 1967).

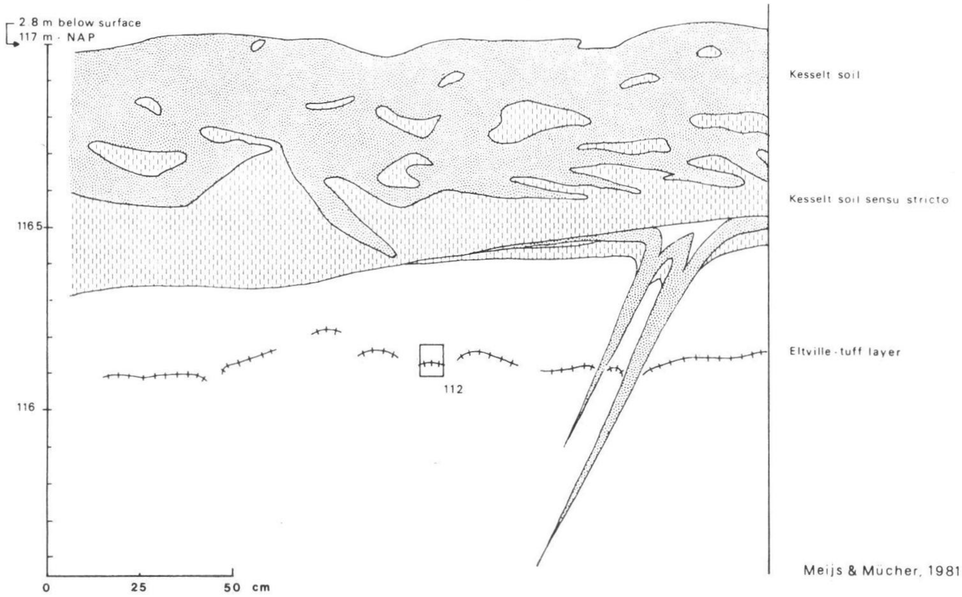
2. Results

Figure 2 shows the locations where the samples for laboratory research were taken. The loess sections at these locations, and the position of the tephra layer and the samples are indicated in figures 3 to 8.



Meijs & Mücher, 1981

Figure 3: Position of the Eltville tuff layer near a fossil ice-wedge in the Nagelbeek pit (strongly cryoturbated).



Meijs & Mücher, 1981

Figure 4: Position of the Eltville tuff layer in the Nagelbeek pit (weakly cryoturbated).

The tephra layer was sampled very carefully in order to prevent contamination with adjacent loess material.

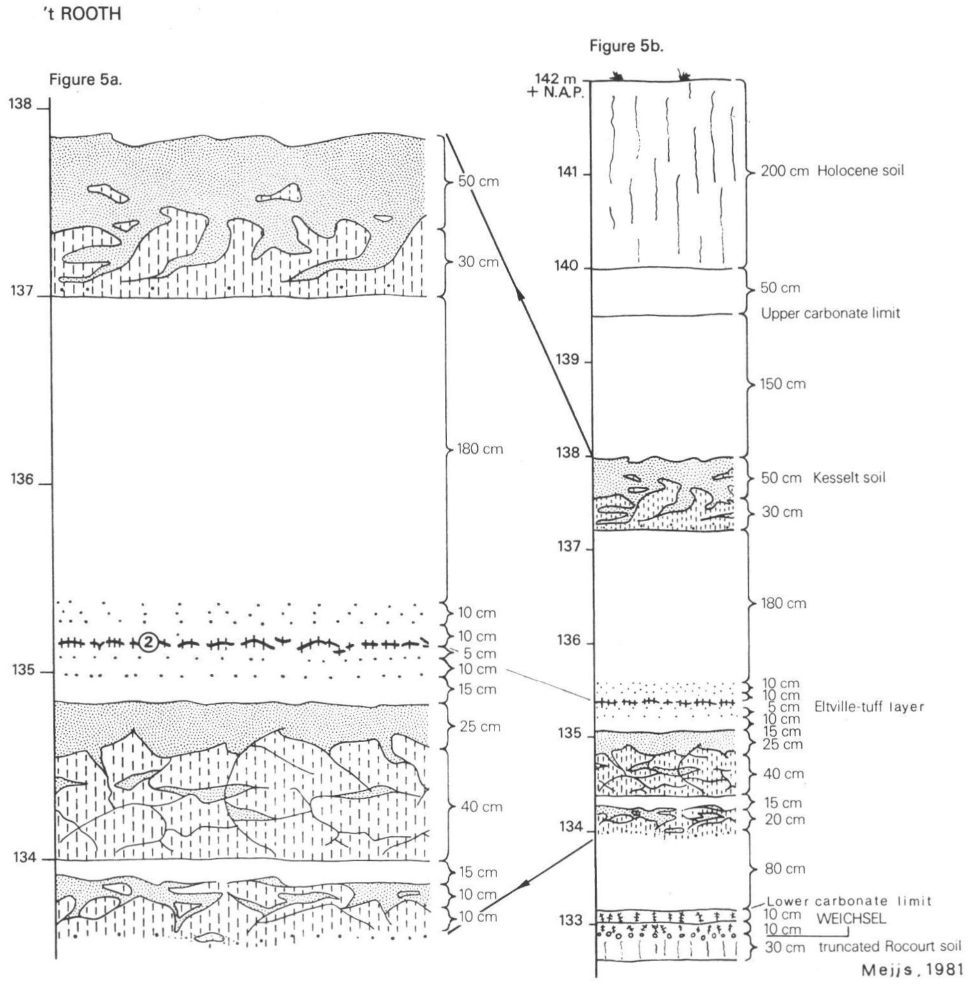


Figure 5: Position of the Eltville tuff layer in the Nekamie quarry near 't Rooth (weakly cryoturbated).

5A: Detailed profile containing the Eltville tuff layer.

5B: Complete loess section with the Eltville tuff.

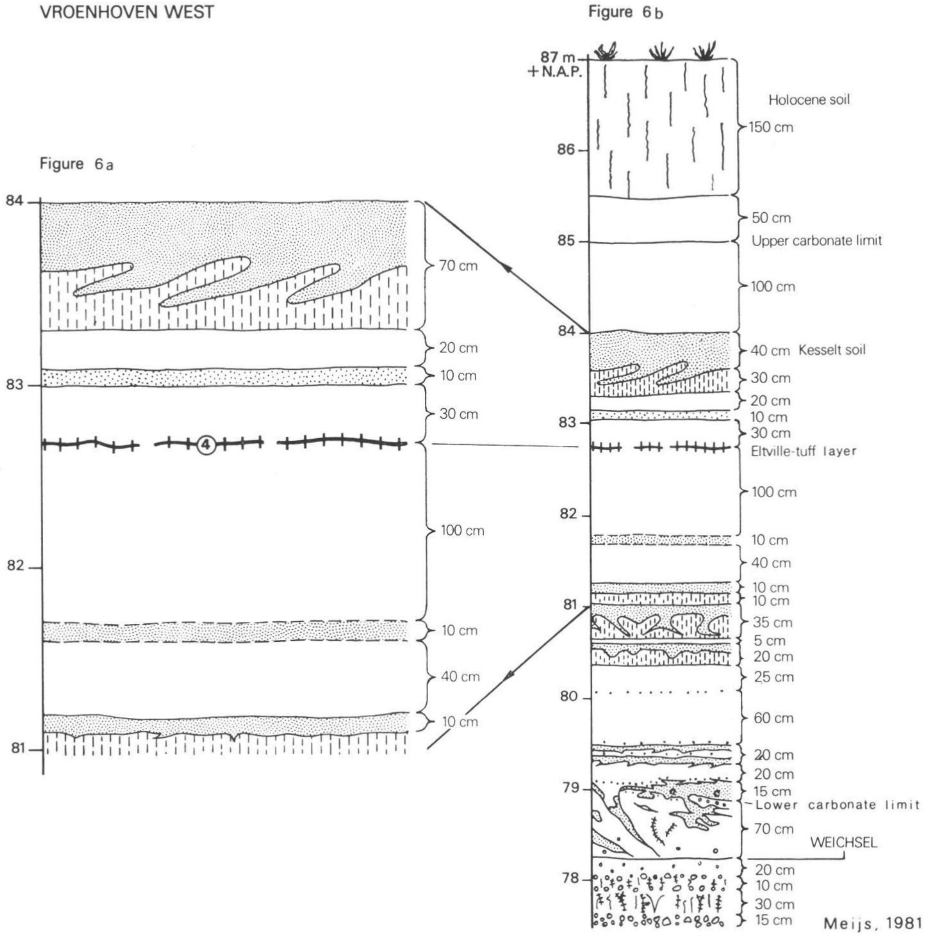


Figure 6: Position of the almost undisturbed Eltville tuff layer in the Western wall of the Albert canal near Vroenhoven.

6A: Detailed section containing the Eltville tuff layer.

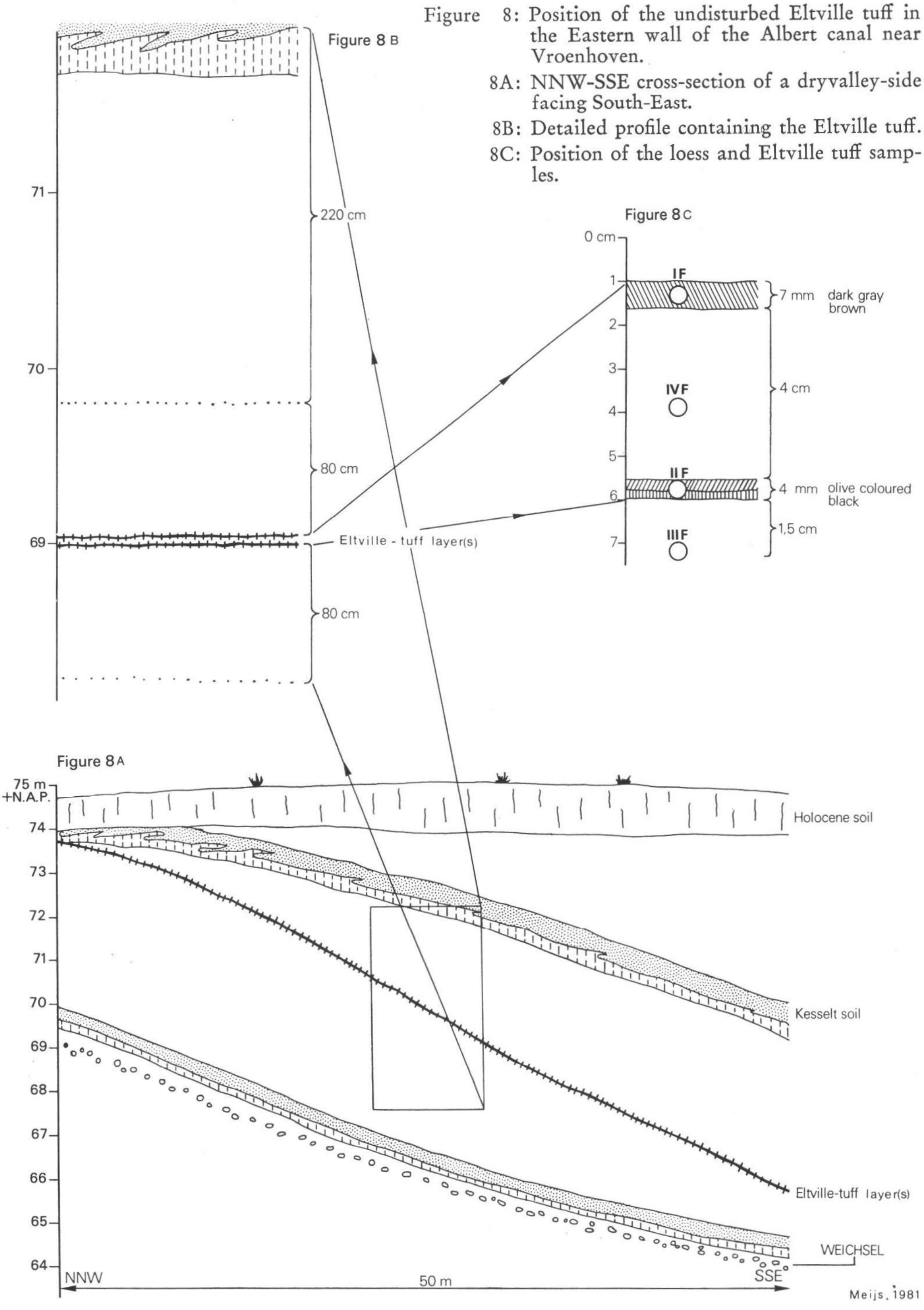
6B: Complete loess profile with the Eltville tuff.

Figure 8: Position of the undisturbed Eltville tuff in the Eastern wall of the Albert canal near Vroenhoven.

8A: NNW-SSE cross-section of a dryvalley-side facing South-East.

8B: Detailed profile containing the Eltville tuff.

8C: Position of the loess and Eltville tuff samples.



2.1. Field observations

During the fieldwork attention was given to paleosols, periglacial features and sedimentological characteristics, as well as to the macroscopic appearance of the tephra layer. The presence of calcium carbonate and manganese compounds in the loess profile was demonstrated by the use of 5 % HCL and 15 % H_2O_2 resp.

In the vicinity of Maastricht the lower part of the thin tephra layer is generally dark grey to dark greyish black and the upper part olive-green to greyish green¹). On the average the tephra layer has a thickness of 2 mm.

In those cases where the tephra layer was influenced by cryoturbation and/or solifluction processes, it may consist of several layers (see figure 7C and 7D). The undisturbed and almost undisturbed appearance of the tephra layer occurs only in strongly to moderately stratified loess resp. (see figure 6A, 7B and 8B). In the vicinity of Maastricht, the loess section depicted in figure 8, is the only one containing the tephra layer with a split appearance which is not due to solifluction and/or cryoturbation.

2.2. Heavy mineral composition and grain-size distribution

The samples taken for heavy mineral analysis were pre-treated with Na-dithionite (heated to 90° C) in order to preserve all the heavy minerals. Bromoform was used to separate the different grain-size fractions into light and heavy mineral sections. To do this narrow Edelman separatory funnels were used. Only the fraction 32—50 μm was separated by using a laboratory overflow centrifuge (IJLST 1973). From each sample 200 to 300 transparent grains were counted, using the line-counting method.

The grain-size distribution of material smaller than 2 mm was established by sedimentation ($<$ 50 μm) and sieving (50—2000 μm), following H_2O_2 and HCL pre-treatment and dispersion with $Na_4P_2O_7$.

The volcanic character of the discovered thin blackish layer, represented in figures 3 to 8, is demonstrated by the presence of the transparent volcanic heavy minerals clinopyroxene, olivine, brown hornblende, titanite and apatite. Some clinopyroxenes (especially in the large grain-size fractions) show an outer zone of a kind of converted volcanic glass.

Of interest are the varying volcanic heavy mineral percentages in the different grain-size fractions (see figure 9B). This variation is probably due to the greater initial size of the olivine and brown hornblende grains in relation to those of clinopyroxene, apatite and titanite. These results are in accordance with the findings of FRECHEN & ROSAUER (1959), who also determined higher percentages of olivine and brown hornblende in the large grain-size fractions of the loess deposits near Kärlich (Germany).

In the loess fraction of the newly discovered tephra layer (32—50 μm), the percentage of transparent non-volcanic heavy minerals is rather high (see figure 9C). The non-volcanic heavy mineral composition of this fraction does not differ from the heavy mineral composition of the loess samples 101, III F and IV F (shown in figures 3 and 8C) and can be considered as the characteristic heavy mineral composition of Weichselian loess (MÜCHER 1973; JUVIGNÉ 1978). The contamination of the tephra layer by loess material may be due to the inaccuracy of the sampling, the grain-size distribution of the volcanic minerals emitted and/or to the kind of sedimentation of the tephra layer.

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¹) Not all blackish and grey-greenish thin layers in the loess profile (especially in stratified loess) are tephra layers! Most of them consist of Mn- and Fe-oxides and hydroxides and/or opaque minerals (MÜCHER et al. 1981).

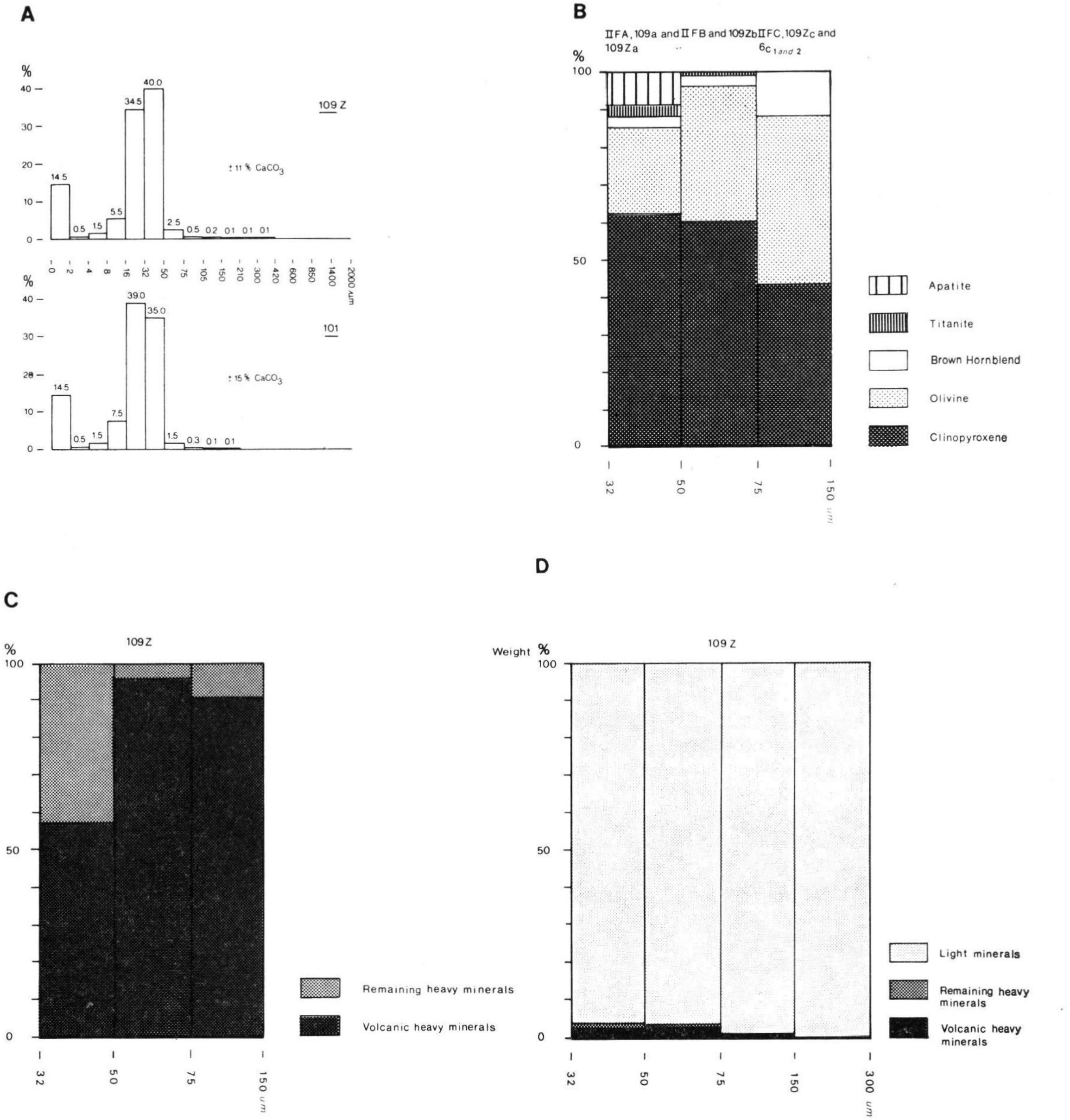
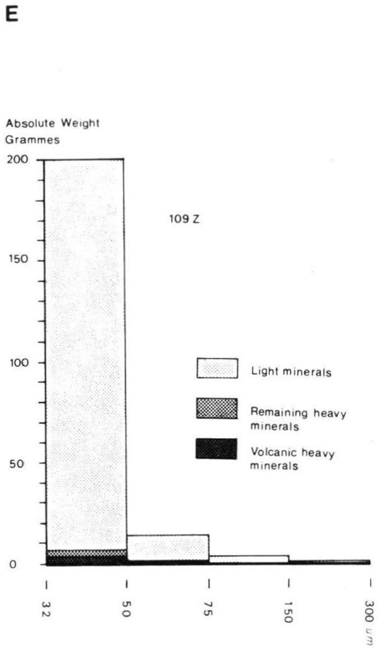


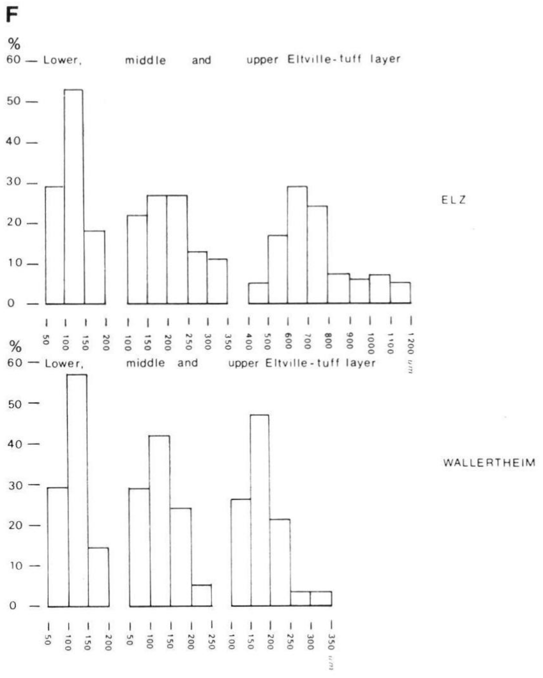
Figure 9A: Grain-size distribution of the pure Eltville tuff sample 109Z and the underlying calcareous loess sample 101, as indicated in figure 3.

9B: Average volcanic heavy mineral percentages in the grain-size fractions 32—50, 50—75 and 75—150 μm of the Eltville tuff, found in the vicinity of Maastricht.

9C: Percentages of the volcanic heavy minerals in relation to percentages of the non-volcanic heavy minerals in the fractions 32—50, 50—75 and 75—150 μm of sample 109Z.

9D: Percentages of the volcanic and non-volcanic heavy minerals in relation to percentages of the light minerals in the fractions 32—50, 50—75, 75—150 and 150—300 μm of sample 109Z.





9E: Absolute weights of the volcanic and non-volcanic heavy minerals in relation to the absolute weights of the light minerals in the fractions 32—50, 50—75, 75—150 and 150—300 µm of 500 grammes of dried and decalcified, pure Eltville tuff (sample 109Z).

9F: Grain-size distribution of the clinopyroxenes present in the separate Eltville tuff layers in Elz and Wallertheim (Germany), according to Frechen (1959; the locations are indicated in fig. 2).

It should be borne in mind the tephra layer consists mainly of light minerals (see figure 9D) and its grain-size distribution almost resembles that of loess (see figure 9A).

Figure 9E shows that the grain-size fraction 32—50 µm contains the most heavy minerals of volcanic origin.

2.3. X-ray diffraction

X-ray diffraction analyses of powder specimens were carried out with a Philips X-ray diffraction camera (debeye-Scherrer powder camera, diameter 114.83 mm, K∝ $_{\text{Co}}$-radiation with Fe-filter), using a Philips 3 kW-generator, type PW 1120/00.

The light minerals were pre-treated at 20° C with 5 % HCL for 3 minutes in order to dissolve the calcium carbonate.

In addition to the data obtained by heavy mineral analysis, x-ray diffraction has revealed the presence of traces of phlogopite, prehnite and haüyne in the heavy mineral section and biotite, ∝-tridimite, "high" sanidine, nepheline, "high" orthoclase and anorthoclase in the light mineral section of the tephra layer.

2.4. Micromorphological description

For micromorphological investigation undisturbed samples were collected in the field in tins measuring 8x6x4 cm. The thin sections 20 μm thick, were described using the terminology of BREWER (1976).

According to the data obtained by micromorphological investigation of the tephra layer, it seems that the tephra material was first deposited in situ in the shape of microlapilli or pisolite aggregates (50—500 μm), consisting of greyish brown fine material ($<10\ \mu$m) and some scattered mineral grains (10—40 μm). This was followed by a slight precipitation of individual volcanic minerals (16—110 μm). During and after the sedimentation of tephra material, loess was deposited between the aggregates. Next, owing to disintegration, probably as a result of raindrop impact (splash), part of the aggregates was destroyed; as a result the tephra layer now consists of aggregates and an amorphous mass, which are slightly intermingled with calcareous loess material. Finally the tephra layer was burried by a secondary laminated loess deposit due to rainwash.

The in situ position of the tephra layer can be concluded from the fact that it is only slightly intermingled with loess.

3. Interpretation and discussion

In interpreting the data mentioned in section 2, and in comparing them with data for Germany, we shall give special attention to the mineralogical composition, the stratigraphical position and the macroscopic appearance of the discovered tephra layer near Maastricht and the Eltville tuff in Germany.

3.1. Mineralogical composition

With regard to the mineralogical content, the found tephra layer can be correlated only with the Eltville tuff (because of the presence of „high“ sanidine and anorthoclase).

It should be added, that the percentages of the heavy minerals clinopyroxene, olivine and brown hornblende of Eltville tuff samples, mentioned by JUVIGNÉ (in JUVIGNÉ & SEMMEL 1981), by FRECHEN (1959 and in BIBUS 1973) and in this publication, sometimes show rather large differences. This aspect will be dealt with extensively elsewhere (MEIJS, in prep.). One of the reasons for such differences is for instance the different heavy mineral content of the separate Eltville tuff layers. This was first noticed by FRECHEN (1959), after he had examined the individual Eltville tuff layers in Elz and Wallertheim (Germany; for the locations see figure 2). He found that the lower two grey-blackish and brownish tephra layers show a higher percentage of olivine than the upper blackish layer.

In this connection a study was done by the authors on the heavy mineral content of three Eltville tuff layers sampled in the former „Klüter“ brickyard at Am Bingert near Wiesbaden (Germany; see fig. 10). The lower dark grey-greenish tephra layer (thickness 2 mm) shows a close resemblance in colour and in heavy mineral composition to the tephra layer discovered near Maastricht (31,1 % olivine, 65,6 % clinopyroxene and 3,3 % brown hornblende in the fraction $>75\ \mu$m). The upper two dark brown and black tephra layers, which were sampled together (thickness 28 mm; see fig. 10), show a considerably lower percentage of olivine (14,5 % olivine, 81,8 % clinopyroxene, 2,5 % brown hornblende and 1,2 % titanite in the fraction $> 75\ \mu$m). Probably the percentage of olivine in the black tephra layer (so not sampled together with the dark brown one) will be even lower!

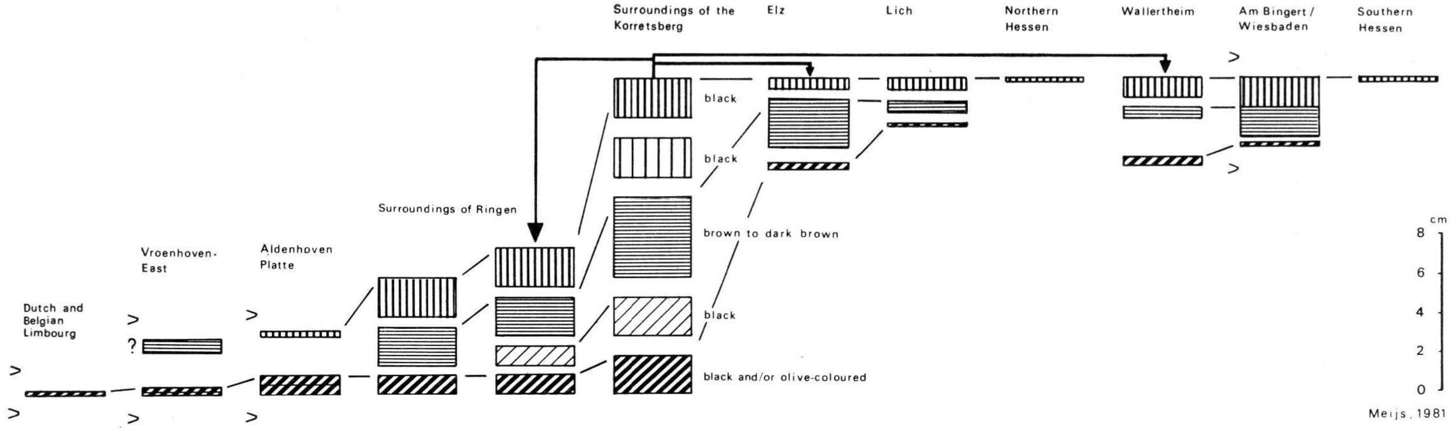


Figure 10: Thickness and macroscopic appearance of the Eltville tuff layers, going from the centre of Germany (Hessen) to the Southern part of The Netherlands (Southern Limbourg) and to the North-Eastern part of Belgium (Limbourg) (German area according to BIBUS 1973, 1980; BIBUS & SEMMEL 1977; FRECHEN 1959; LÖHR & BRUNNACKER 1974 and SCHÖNHALS 1959).

Comparison of these data with those for Dutch and Belgian Limbourg suggests that the heavy mineral content of the tephra layer near Maastricht corresponds only to that of the lowest Eltville tuff layer in Germany (see figure 10).

3.2. Macroscopic appearance and morphometric composition

So far the Eltville tuff has been observed in a split form by several German loess explorers (see figure 2 and 10).

Near Maastricht such a split form could only be found at one location (Vroenhoven East; see figure 8). At this location the 4 mm thick lower tephra layer, which is normally present in this region, has a slightly rusty and hardened, black lower part, and a looser, olive-coloured upper part. Four cm above this tephra layer a dark greyish brown, 7 mm thick layer is present, containing volcanic heavy minerals only in the grain-size fraction 75—150 μm (see fig. 8c).

With regard to the morphometric composition FRECHEN (1959) revealed that the clinopyroxenes in the upper Eltville tuff layers have a higher average grain-size than those in the lower layers (see fig. 9F). LÖHR & BRUNNACKER (1974) observed that at many locations in Germany, the lowest Eltville tuff layer is divided into a black lower part and an olive-coloured upper part.

Concluding it can be said that at the Vroenhoven East location near Maastricht, as well as in Germany, the lowest tephra layer is divided into a blackish and an olive-coloured part, while the upper layer is showing a higher average grain-size than the lower one.

3.3. Stratigraphical position

3.3.1. Paleosols

The tundragleys, present in the Upper-Pleniglacial loess deposits of Western Europe, are very weakly developed arctic or subarctic soils, tending towards Rankers. In addition to humification and clay formation, there were also particular podzolic and gley processes. This has caused the often visible rustiness in these paleosols and the rust coloured horizon beneath them (ROHDENBURG & MEYER 1966, SEMMEL 1968).

In the middle part of Germany the E_4 (= Erbenheim-4) tundragley (according to SCHÖNHALS et al. 1964) differs in a typological way from the other tundragleys, in that it shows practically no rustyness and displays more Para-Rendzina properties (SEMMEL 1968; fig. 1). There is a clear resemblance between the E_4 tundragley and the Kesselt paleosol (= Horizon of Nagelbeek, according to HAESAERTS et al. 1981) in the vicinity of Maastricht. Here too the Kesselt paleosol shows the differences mentioned above with respect to the under- and overlying tundragleys [2]).

On top of the Middle-Pleniglacial loess in Germany one often finds a characteristic, subarctic Brown-Podzolic paleosol (the so-called Lohne or Hainerberg paleosol; see fig. 1). It represents the strongest soil-formation period during Weichselian time. This paleosol consists of dark grey-brownish to red-brownish, decalcified loess material, with a subangular to platy structure and thin clay skins and iron and manganese coatings on the peds (SEMMEL 1968). In their publication BIBUS & SEMMEL (1977) report the discovery of

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[2]) According to soil-micromorphological research, the rusty yellowish coloured Kesselt "paleosol" sensu stricto (GULLENTOPS 1954), unlike the Kesselt paleosol (= Horizon of Nagelbeek), does not show any signs of soil-formation (MÜCHER in HAESAERTS et al. 1981; see fig. 3).

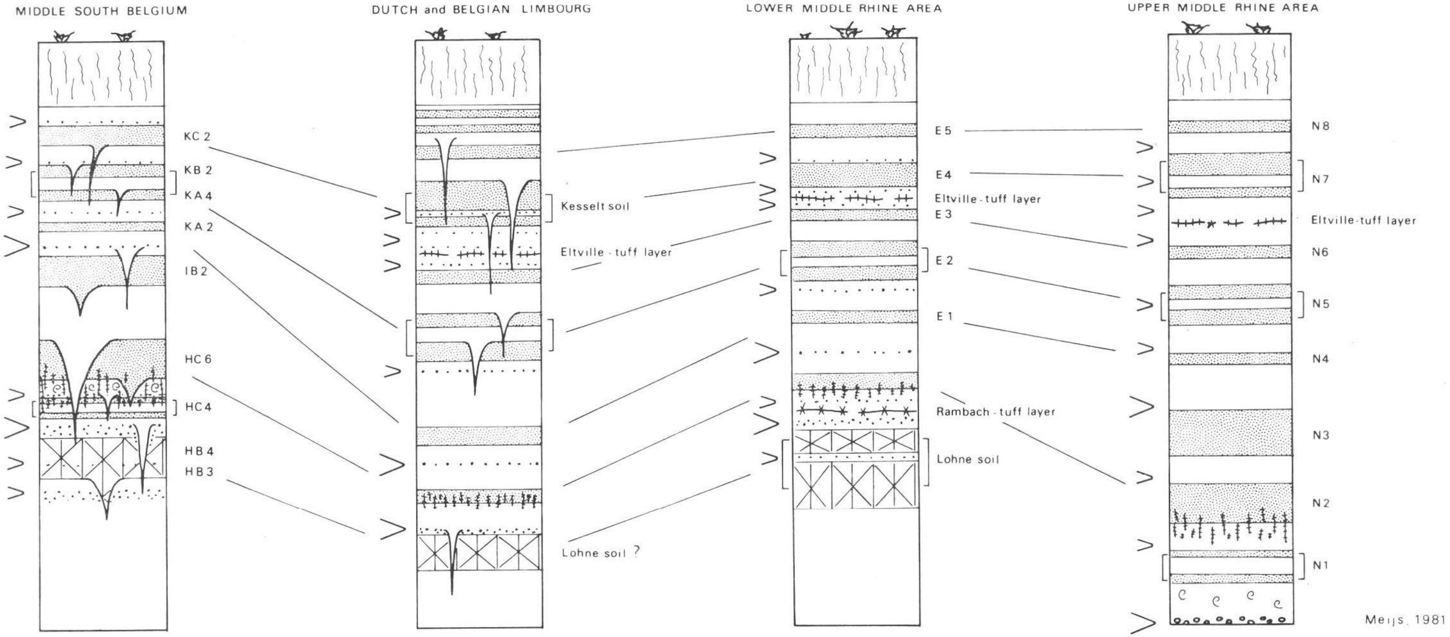

Figure 11: Correlation model of some idealized Upper-Pleniglacial loess sections in Belgium (slightly modified Harmignies section, as represented in HAESAERTS & VAN VLIET 1974, 1981), in The Netherlands and in Germany (lower and upper middle Rhine area according to BIBUS 1980 and SABELBERG & LÖSCHER 1978 resp.), in relation to the stratigraphical position of the Eltville tuff (for abbreviations see text).

a typological equivalent of the Lohne paleosol in the vicinity of Mons (Belgium). After examining some loess sections in the neighbourhood of Wiesbaden (Germany) and Mons (Belgium), we were able to locate the presence of the Lohne paleosol in Belgium in the Harmignies quarry, about 5 km to the South of Mons. In this pit, containing one of the most complete Weichselian loess sections of Western Europe, we were also able to establish the typological and stratigraphical equivalence of the KC_2 tundragley to the Kesselt paleosol (Horizon of Nagelbeek) in the vicinity of Maastricht and to the E_4 tundragley near Wiesbaden (see figure 11). The possibility exists however, the equivalent of the Lohne paleosol in Harmignies is representing the B_3 horizon of the truncated Eemian Grey Brown Podzolic paleosol. But on the basis of heavy mineral data of the fraction 30—63 μm of loess material present beneath this paleosol, showing a typical Weichselian heavy mineral composition (see JUVIGNÉ 1978), this possibility can be precluded.

In The Netherlands, the Nagelbeek pit is the only location where a typological equivalent of the Lohne paleosol could be recognised. Unfortunately its stratigraphical position does not offer enough support to a positive correlation with the Lohne paleosol.

So at this location the discovered tephra layer lies between the typological equivalent of the Lohne paleosol and the Horizon of Nagelbeek (Kesselt paleosol), which is in complete accordance with the stratigraphical position of the Eltville tuff in Germany.

3.3.2. Sedimentological characteristics

In the Western part of Germany the typical unstratified loess generally appears for the first time above the E_4 tundragley (LÖHR & BRUNNACKER 1974; ROHDENBURG & SEMMEL 1971, and SABELBERG & LÖSCHER 1978).

In the lower middle Rhine area the Eltville tuff is often situated within very clearly stratified loess. In general this loess contains some gravelly layers situated both below and above the tephra layer (BARTELS & HARD 1973). LÖHR & BRUNNACKER (1974) also found gravelly and/or sandy sediment layers below and above the Eltville tuff in many loess profiles (some of them only at a distance of 20 km from Southern Limbourg).

These data closely resemble those for the sediment strata under- and overlying the tephra layer under consideration near Maastricht (see figure 5, 6, 7A, 7B and 8B).

3.3.3. Periglacial features

In Hessen ROHDENBURG (1966) discovered in the Upper-Pleniglacial loess deposits 6 distinct fossil ice-wedge generations (see fig. 1). In the lower middle Rhine area a generation of big fossil ice-wedges lies directly below the E_4 tundragley. These wedges are filled with E_4 soil material. Directly above this paleosol there is an extensive system of big fossil ice-wedges, filled with typical unstratified loess (LÖHR & BRUNNACKER 1974; see figure 1).

In the vicinity of Maastricht there is a clear similarity between the fossil ice-wedge generations lying below and above the Kesselt paleosol (Horizon of Nagelbeek) and the upper three fossil ice-wedge generations in Germany (see figure 1, 3 and 4).

4. Conclusions

Up till now the Kesselt paleosol (Horizon of Nagelbeek) present in Belgium and The Netherlands has been correlated with the Stillfried-B paleosol (see e. g. ZAGWIJN & PAEPE 1968), which was formed during the Denekamp interstadial (± 32,000—29,000 BP; VOGEL & VAN DER HAMMEN 1967). Because there is now clear evidence of the presence of the Eltville tuff in this region right beneath the Kesselt paleosol (Horizon of Nagelbeek), this paleosol appears to be equivalent to the E_4 tundragley in Germany, which is about 10,000 years younger than the Stillfried-B paleosol (SEMMEL 1967).

As a result the division between the Upper- and Middle-Pleniglacial in Belgium and The Netherlands must come much lower in the loess profile, just on top of the equivalent of the Stillfried-B paleosol (in Germany the so-called Lohne paleosol).

A correlation model, containing some idealized Upper-Pleniglacial loess sections has been constructed in order to demonstrate the stratigraphical position of the various Upper-Pleniglacial paleosol horizons in relation to the position of the Eltville tuff in Germany, Belgium and The Netherlands (figure 11).

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