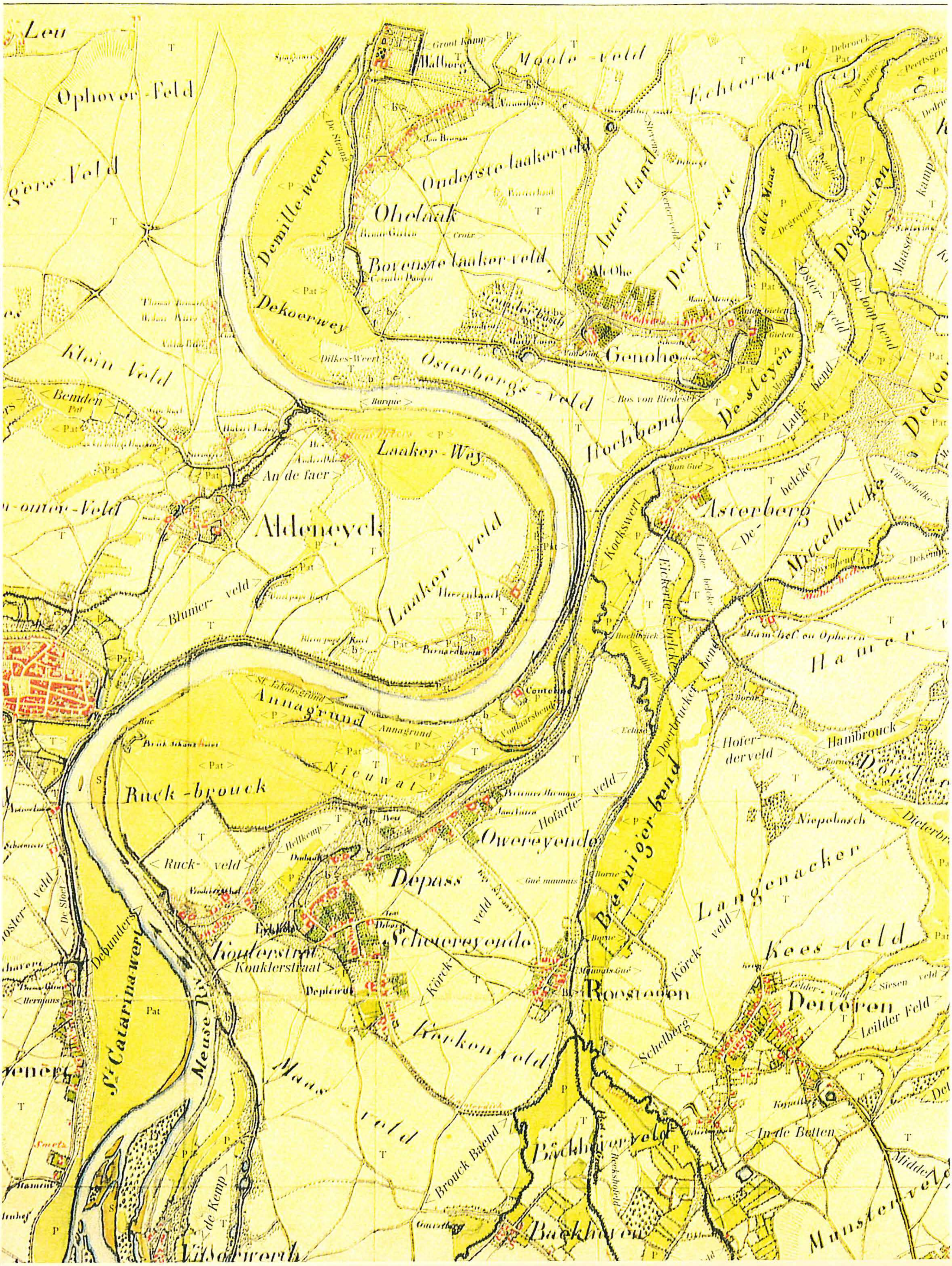
EXCURSION GUIDE TO THE FLAG MEETING

ARCEN, LIMBURG, THE NETHERLANDS (9-10 September 1997)



EXCURSION GUIDE

TO THE FLUVIAL ARCHIVES GROUP (FLAG) MEETING

ARCEN, LIMBURG, THE NETHERLANDS (9-10 September 1997)

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Excursion stops FLAG-meeting 10 September 1997

Stop Oude Maas exposure: Holocene gravel and loam deposits of the Maas.

Stop Oevereind: Late Holocene floodplain morphology.

Stop Rasberg: Morphology of the Quaternary Maas terraces.

Stop Houben/Spaubeek exposure: Sedimentary sequence of the Geertruid 2 terrace.

Stop Meers exposure.

Stop Hochter Bampd.

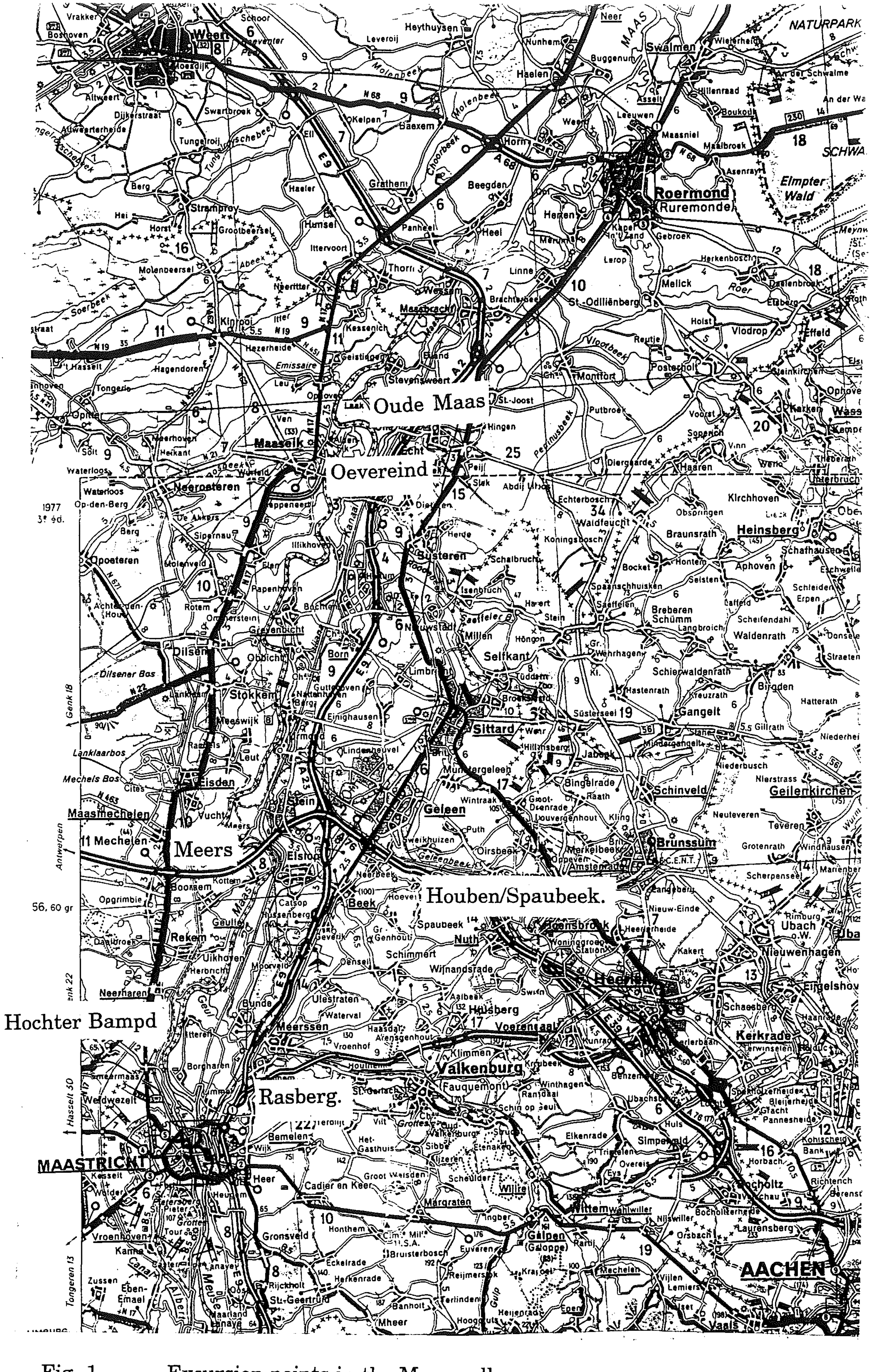


Fig. 1 Excursion points in the Maas valley.

EXCURSION STOP OUDE MAAS: HOLOCENE GRAVELS AND LOAMS

This point is situated near the village of Ohé en Laak in the Holocene floodplain of the Maas. At this point an old branch of the Maas river (so-called Oude Maas/Old Maas) is still visible in the field. During high water levels this old channel discharges part of the flood water. On the oldest topographical maps of this area (So-called Tranchot Map of 1804-1805) this old course is already present which indicates that this channel was already abandoned as the main river course (long) before the start of the 19th century.
At this stop two sedimentological aspects of the Holocene Maas deposits will be demonstrated.

I. The lateral accretion gravels

In the gravel extraction pit c. 3 m of gravel is exposed above the water level, which is overlain by c. 2 m alluvial loams. The gravels exhibit well-developed lateral accretion surfaces dipping towards the southwest. They are interpreted as gravelly pointbar deposits formed by the lateral migration of a meandering river. Underlying the lateral accretion deposits, almost at the water level of the pit, the gravel size increases strongly upto 30 cm. It is supposed that this coarse gravel represents the gravel lag of the former Holocene channel.

During the gravel extraction in the pit several fossil oaks have been dredged up. Some of the fossil trees can be seen in the gravel exposure, c. 1 m above the water line. Dendrochronological research of the fossil oaks at the Dutch Centre for Dendrochronology at the R.O.B. (Rijksdienst voor Oudheidkundig Bodemonderzoek) has revealed that most of the trees started to germinate at around 300 AD and died at around 600 AD.

II. The alluvial loams of the Oude Maas

In the undercut bank of the former course of the Maas (Oude Maas) the alluvial loams overlying the gravels can be studied. In the exposure two distinct loam units can be seen. The lower one has a brown colour due to oxidation and it overlies the gravel normally with an abrupt facies contact. These loams can be interpreted as vertical accretion deposits overlying the lateral accretion gravel unit. They were deposited from suspension during floods. Locally, in former depressions on the gravel surface (e.g. pointbar swales or abandoned channels, the loams are reduced and have a gray colour. Pollen analysis (see fig. 5) of these reduced loams indicates the strong presence of antropogenic plants. Especially the presence of *Zea mais*, a species that was cultivated in the Netherlands from the end of the last century onwards, demonstrates that the floodplain loams are very young and sedimentation rate has been very high during the last centuries. However, it cannot be excluded that part of the floodplain loams are older, because of the Post Roman age of the underlying fossil trees in the gravels. Due to the lateral migration and erosion loams of different periods may occur adjacent to each other, but because of lithological similarities they are difficult to distinguish.

The youngest loam unit in the erosional bank of the Oude Maas is clearly different from the older brown one by its dark gray to black colour. In the section this dark loam erosively overlies the older brown loam and it fills part of the Oude Maas channel. The black color is caused by silt-sized coal particles in the alluvial deposits, generally attributed to the mining industry in southern Limburg. These mines were established during the first decades of this century and the base of the coal-rich alluvium can therefore be used as a time line in the Maas valley.

lll. The pollenrecord Oude Maas

The analysed section (fig. 5) derives from a grey silty clay that filled in an abandoned gully of the Oude Maas and that has incised in the gravelly deposits, that form the basal unit at the exposure near Ohé en Laak (unit lll, north side of the profile, fig. 4). Due to the fact that the former gully forms a deeper lying part, the sediment were not oxidised and hence were suitable for pollenanalyses. Besides the gully of which the sediments were sampled is visible on the old Tranchot topographic map (1804-1805). The diagram is a selection of curves and only the tree taxa and anthropogenic herbs are depicted.

The bulk of the tree pollen are formed by *Alnus* and *Fagus*. *Alnus* formed a dominant species on the flood-plain. The *Fagus* pollen for a large part probably derived from the Belgium Ardennes, where it formed an important species on the hill sides. Its pollen must have been transported down stream by (the tributaries) of the Maas and deposited from suspension in abandoned gullies.

The curve of *Quercus* is fairly low, underlining the fact that these sediments were deposited after the removal of Oak from the alluvial plain c. 600 AD.
The curve of *Pinus* shows a gradual increase, which is interpreted as reflecting the afforestation of the area with pine. A large need for timber became essential when the mining industry started at the beginning of this century.
Of the anthropogenic herbs the occurrence of *Zea mais* needs to be mentioned. *Zea mais* may possibly have been cultivated on a small scale from the end of the last century (oral comm. K.E. Behre). Resuming the pollendiagram and hence the infill of the gully possibly reflects deposition from the end of the last century beginning of the 20th century.

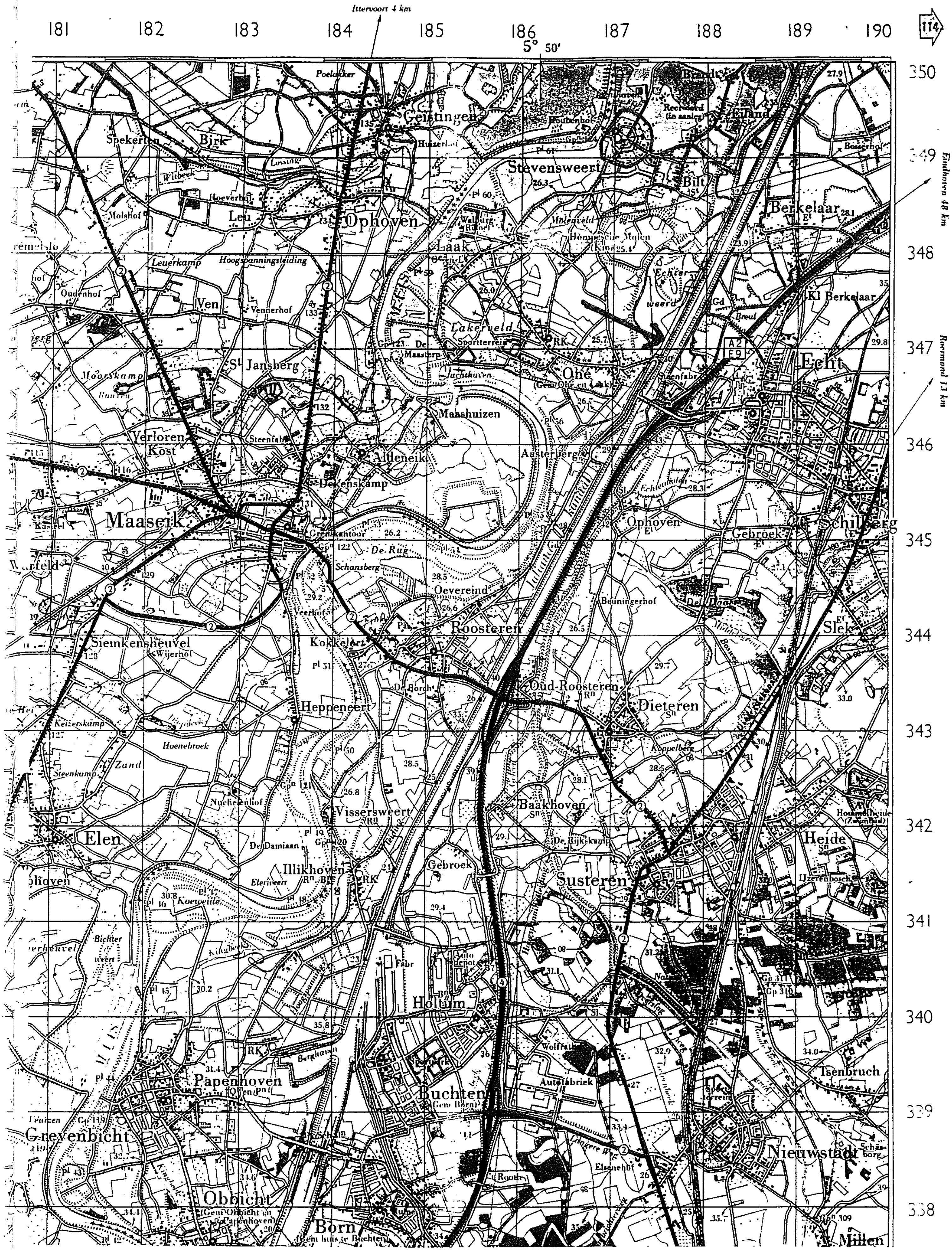
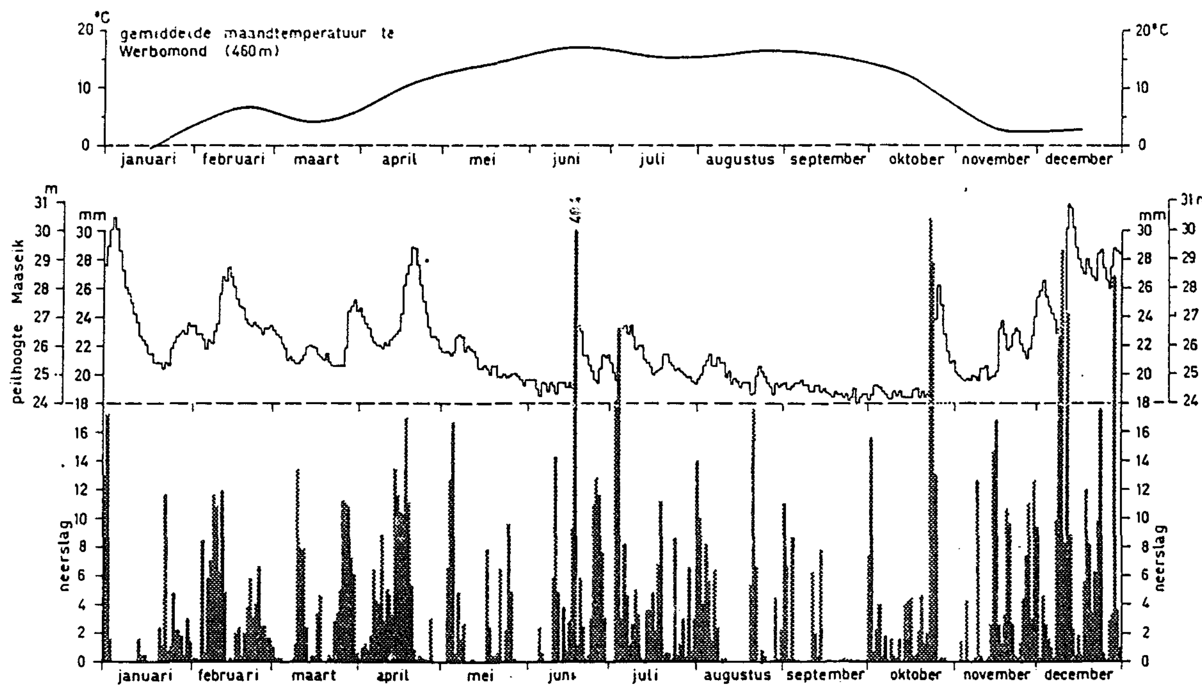


Fig. 2 Location map (1:50.000) of excursion point Oude Maas (OM) near Ohé.

	Jaarlijks gem. debiet	Gem. winterdebiet	Gem. zomerdebiet
1911-1920	317	476	159
1921-1930	307	429	186
1931-1940	272	401	144
1941-1948	195	355	120

Gemiddelde debieten (m³/sec) per decennium.

Mean discharges (m³/sec) per decennium.



De dagelijkse waterhoogte te Maaseik vergeleken met de dagelijkse neerslag in het Ardens bekken voor 1966.

The daily water level at Maaseik compared with the daily precipitation on the Ardennes basin for 1966.

Fig. 3 Hydraulic properties of the Maas (after Paulissen, 1973).

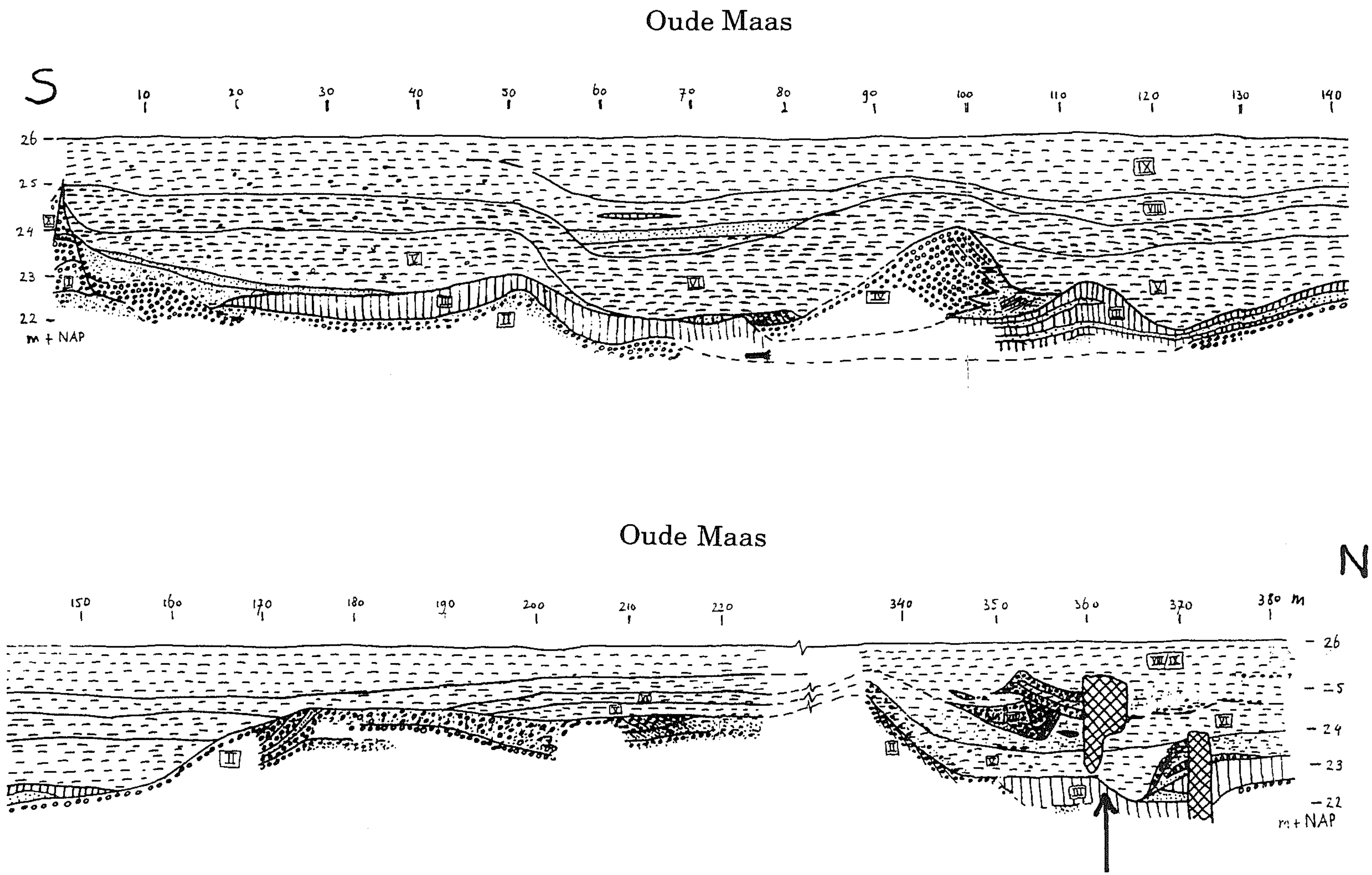
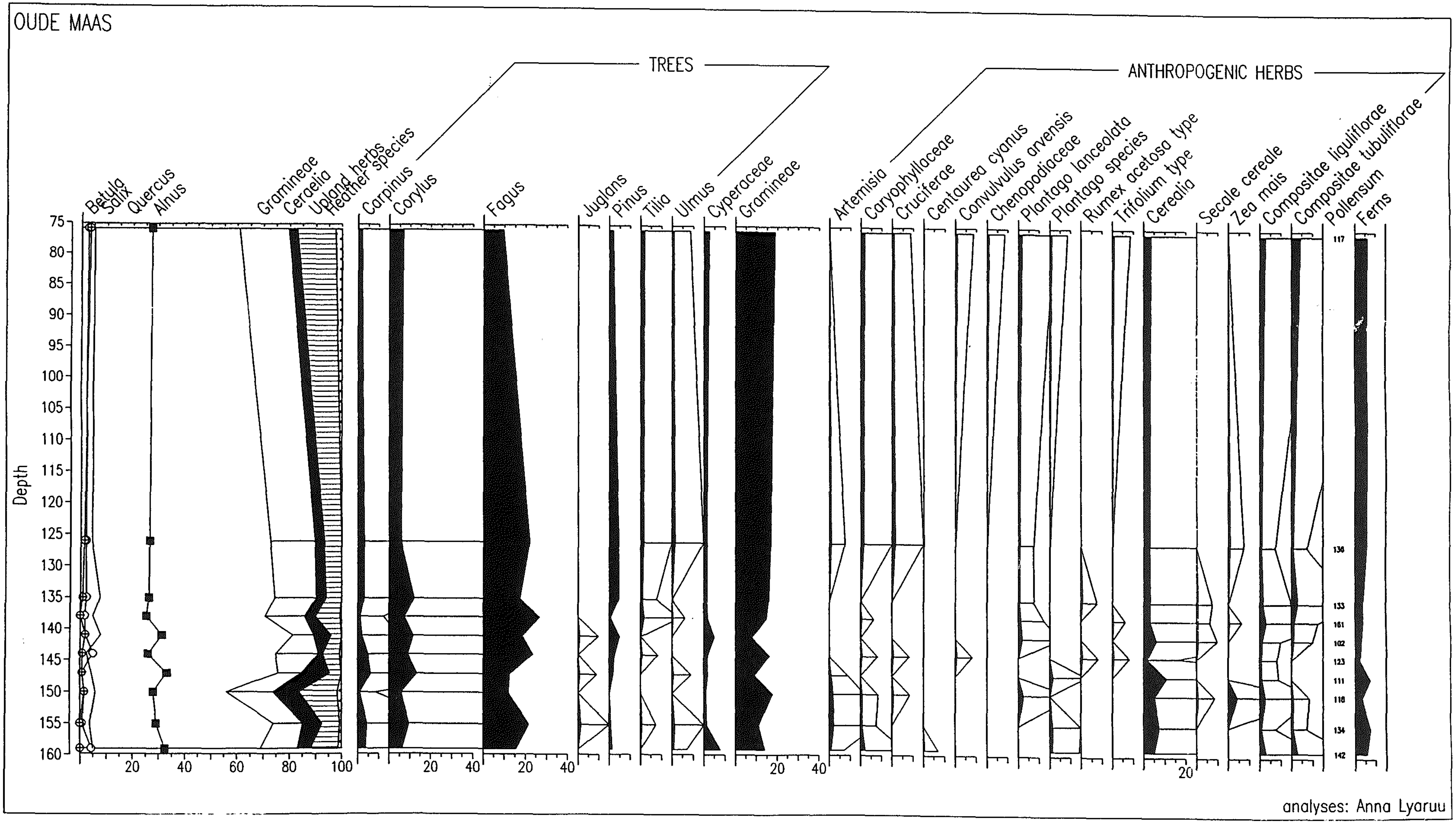


Fig. 4 Drawing of previously exposed section at location Oude Maas. Arrow indicates position of pollen record at 360 m.

Fig. 5 Pollen diagram Oude Maas (selection of curves only).



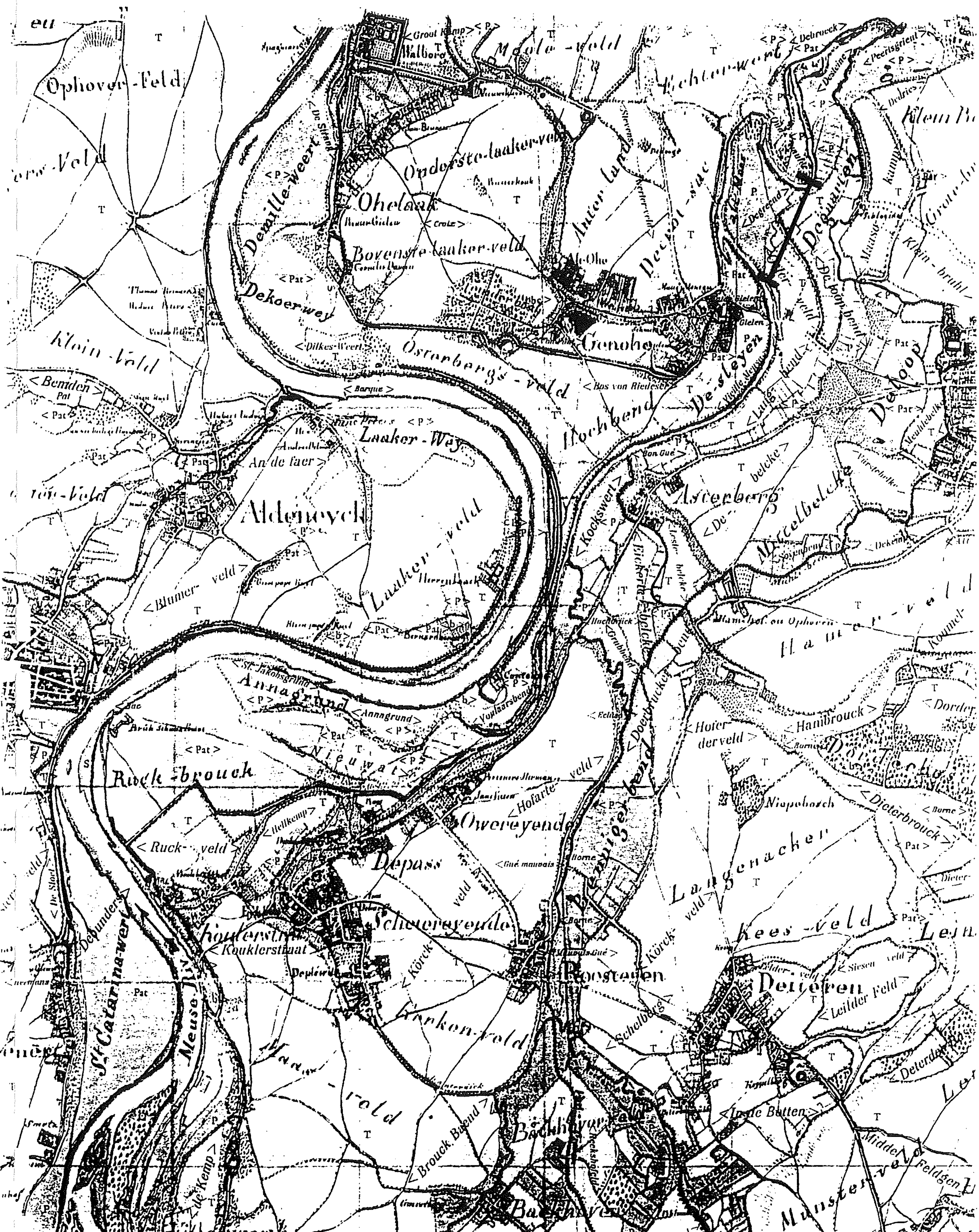


Fig. 6 Topographic map (so-called Tranchot map) of 1804/1805 (1:25.000).

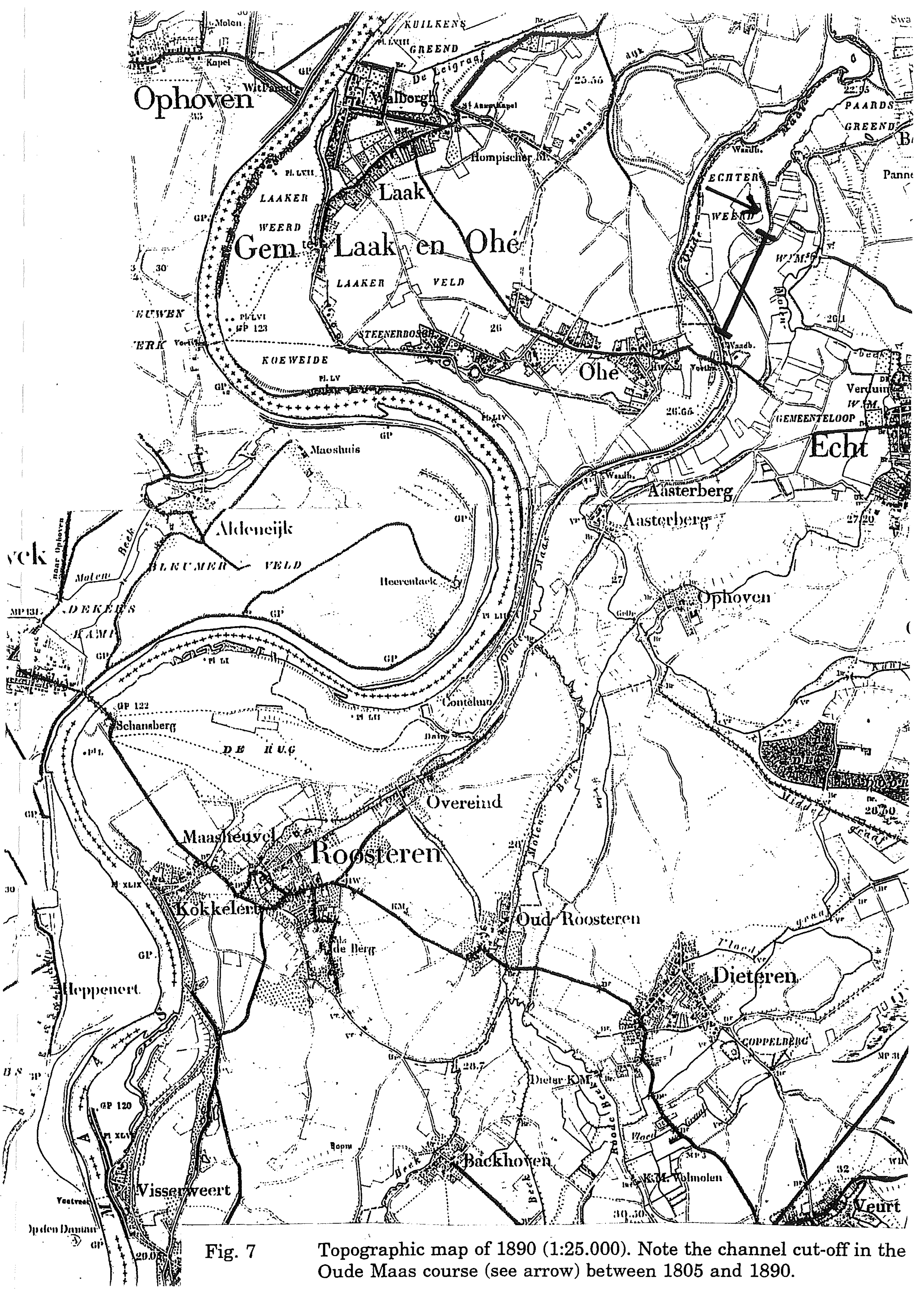


Fig. 7 Topographic map of 1890 (1:25.000). Note the channel cut-off in the Oude Maas course (see arrow) between 1805 and 1890.

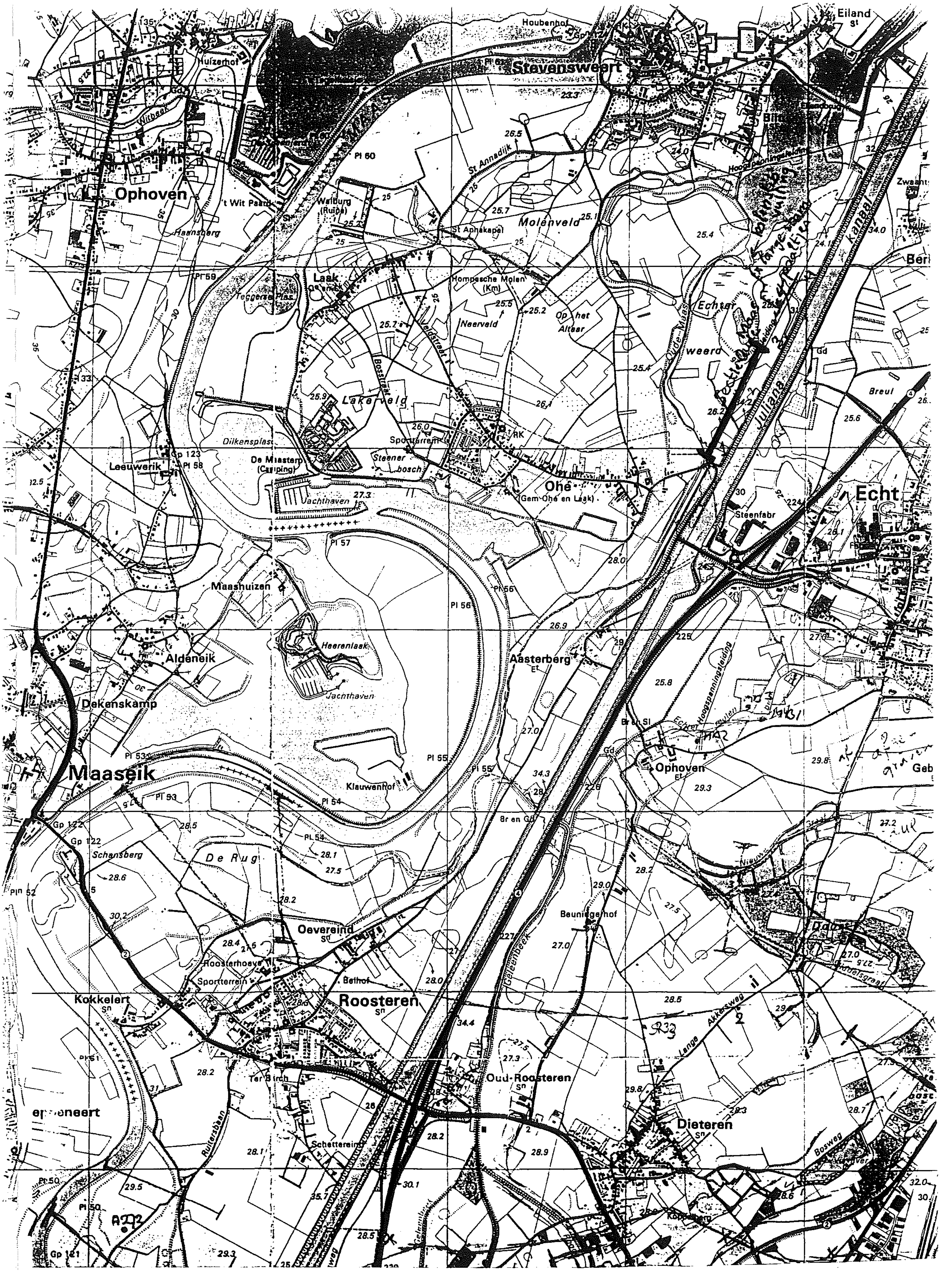


Fig. 8 Topographic map of 1988 (1:25.000).

EXCURSION STOP OEVEREIND: YOUNG HOLOCENE MORPHOLOGY

This point is situated north of the village of Roosteren in the recent Holocene floodplain. The morphology is characterized by several elongated higher bars separated by low-lying depressions, more or less parallel to the actual river course. At first sight the morphology can be interpreted as pointbar and swale topography, formed by the northward migration of the river. Detailed bore hole cross-sections (fig. 11) show that in general the top of the gravel in the subsurface follows the present-day morphology. This can be explained by the presence of gravelly pointbars, later covered by vertical accretion loams. Locally, however, beneath a bar the gravel top is situated at a deeper level (see fig. 11). Furthermore some of the swales are rather deep and broad and give the impression of former channel courses. This mismatch of the surface and subsurface morphology can be explained by channel or chute erosion and later infilling in an already existing pointbar surface (see also excursion point Meers for a recent analogue). It is supposed that in general the morphology was formed by northward channel migration and pointbar formation in subrecent times. During exceptional floods the pointbars surfaces were flooded at locally deep erosion occurred of the former pointbar relief and new channel or chutes were formed, which were later rapidly filled with loams during lower stage floods. The age of the sediments has been derived by pollen analysis and the analysis of old topographic maps. The oldest topographic map of this area is the so-called Tranchot map of 1804/1805. Comparison with recent topographic maps shows that the Maas has migrated c. 90 m to the north since 1804/1805. The 1804/1805 river bank was approximately at the position of stone pole 54. These poles have been erected along the river every kilometer, but, unfortunately the exact date of erection has not yet been found. In any case the floodplain morphology was formed during the past two centuries at the most. This young age is supported by the fact that pollen of *Zea mais* is present at a depth of 3.50 m. Since this species was introduced a century ago, high sedimentation rates have to be assumed. In addition, the bore hole cross-section shows that the upper floodplain loam (c.1 m thick) has a darker gray colour associated with the mining industry in South Limburg that started at the beginning of this century. From these data a high sedimentation rate can be established.

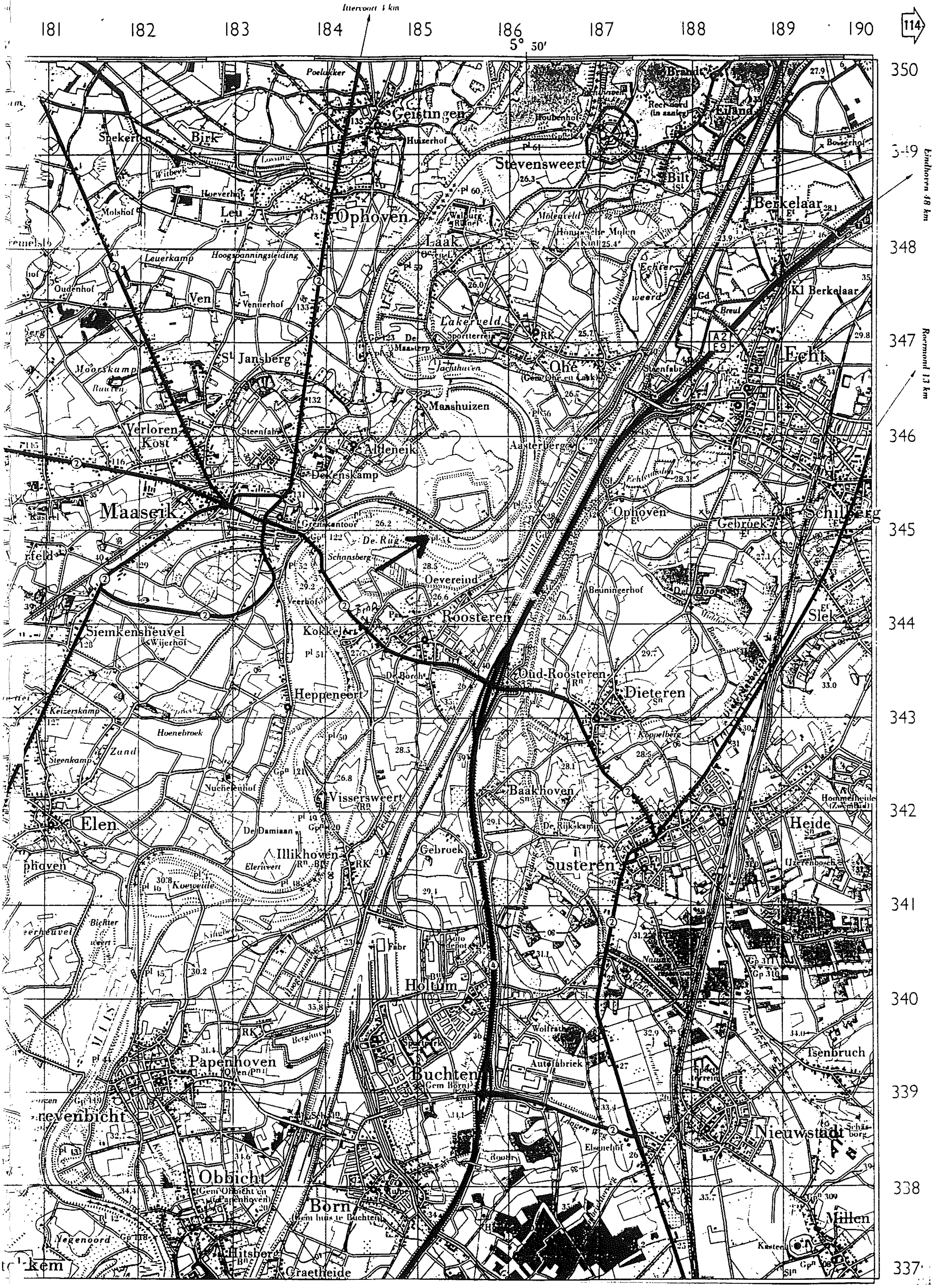


Fig. 9 Location map (1:50.000) of excursion point Oevereind (OE) north of Roosteren.

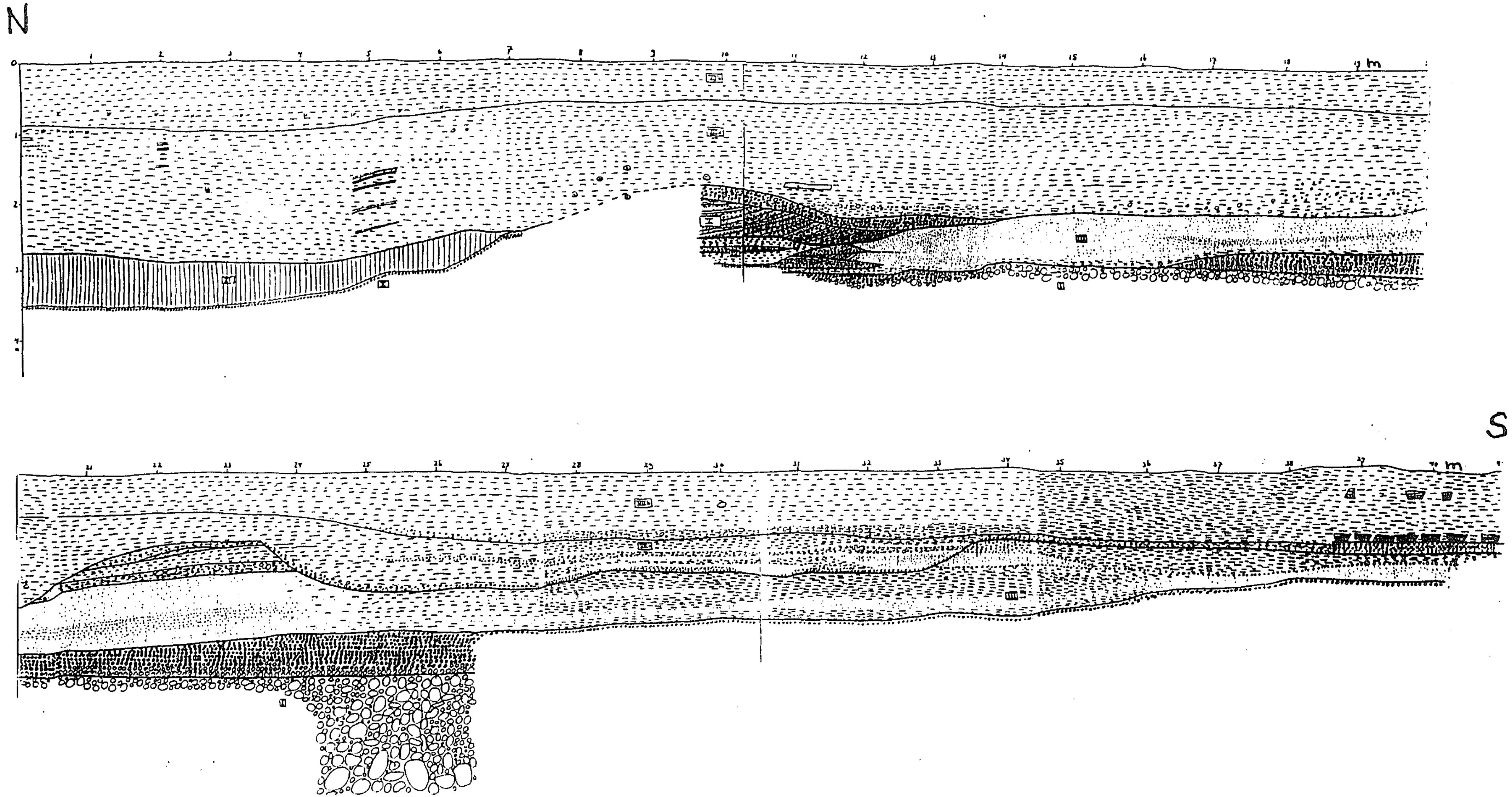


Fig. 10 Drawing of the undercut bank of the Maas at Oevereind. The northerly dip of the sediment units can be interpreted as lateral pointbar accretion. The upper c. 1 m thick unit (VIIb) has been deposited since the beginning of the mining industry (c. 1900 AD).

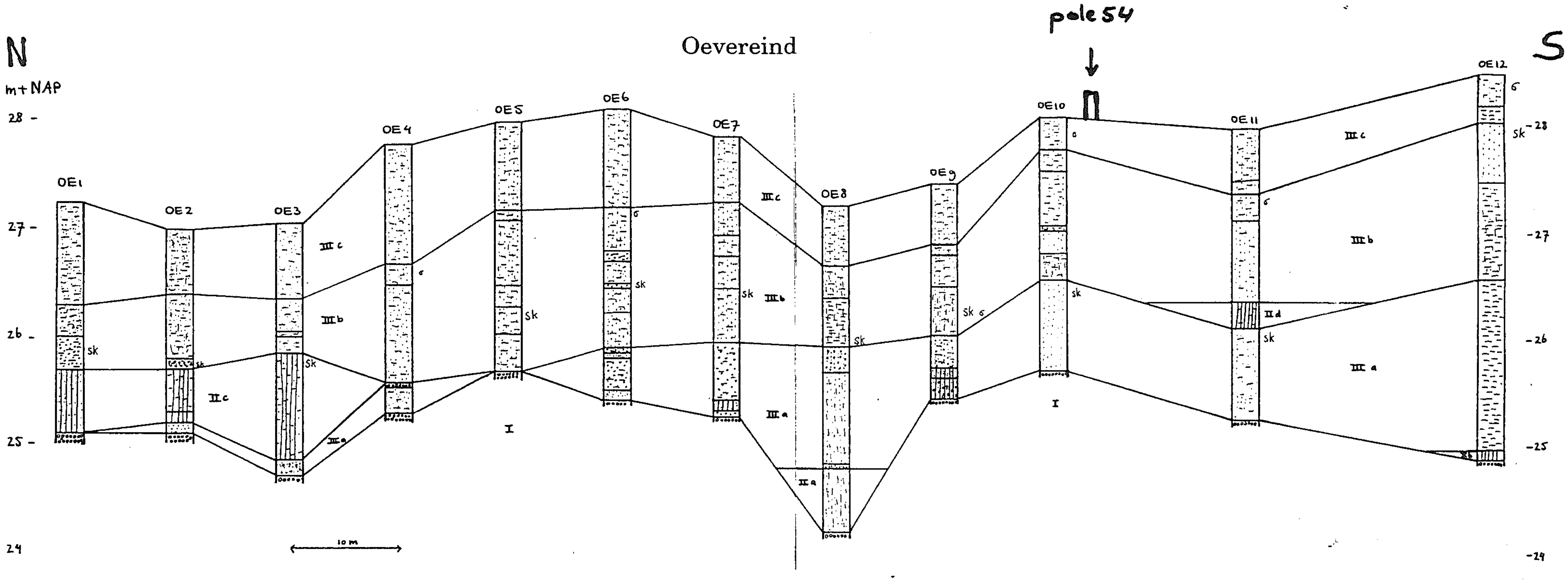
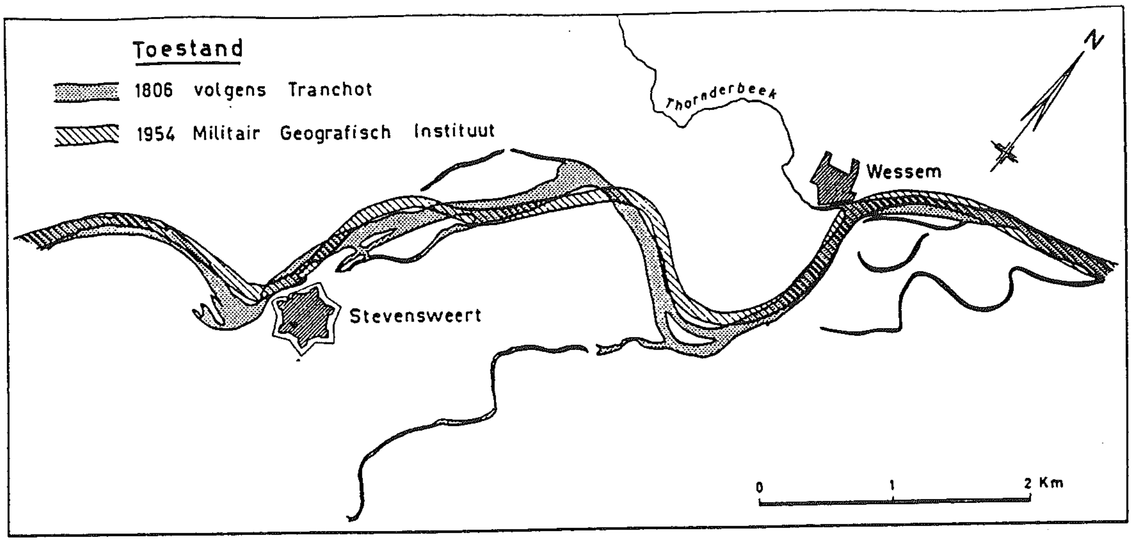
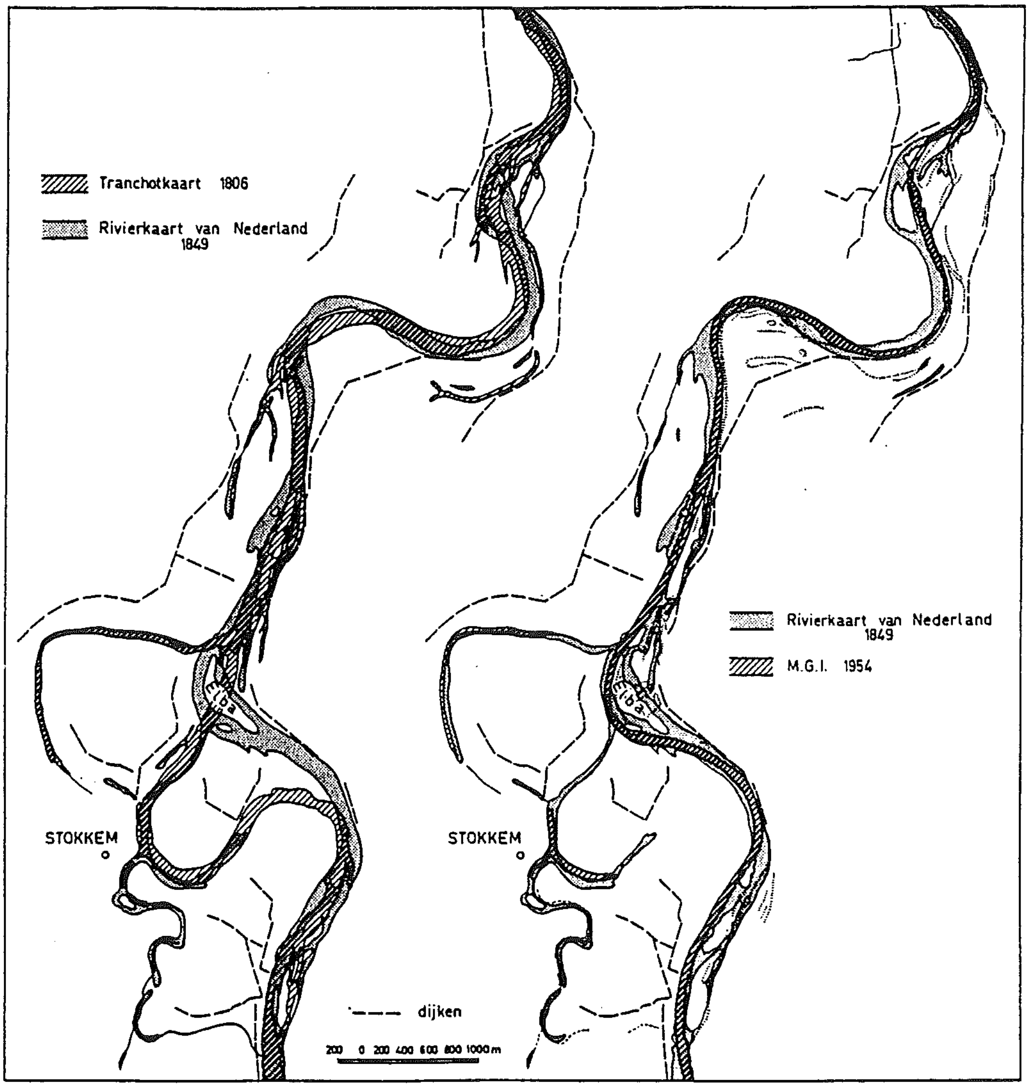


Fig. 11 Bore-hole cross-section perpendicular to the actual Maas over the pointbar-swale morphology. Pollen analysis is from the base of the alluvial loams in bore hole 12.



Planimetrische evolutie van de Maas bij Stevensweert-Wessem.
Planimetric evolution of the Meuse near Stevensweert-Wessem.



Evolutie van de Maas bij Stokkem op basis van topografische kaarten.
Evolution of the Meuse near Stokkem based on topographical maps.

Fig. 12 Evolution of the Maas channel between 1806 and 1954 (after Paulissen, 1973).

EXCURSION STOP RASBERG

demonstrated by: Dr. M.W. Van den Berg, Nederlands Instituut voor Toegepaste Geowetenschappen TNO, P.O. Box 511, 8000 AM Zwolle.

This point, on the shoulder of the Middle terraces, offers a west view over the lower Maas valley near Maastricht. The formation of the terrace stair case will be explained. Discussion on the significance of this general valley shape, which is at least at a northwest European scale a common morpho-stratigraphic feature.

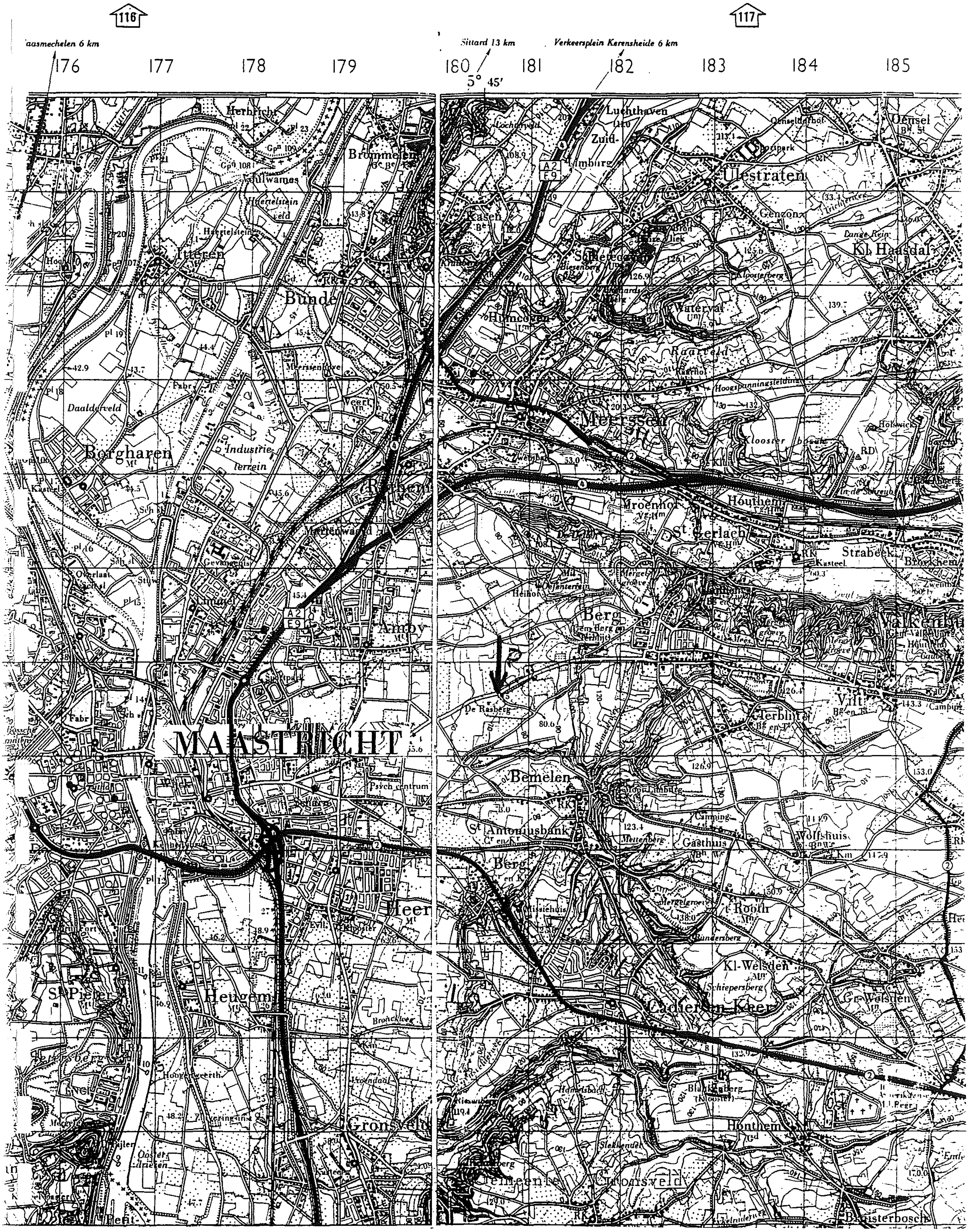
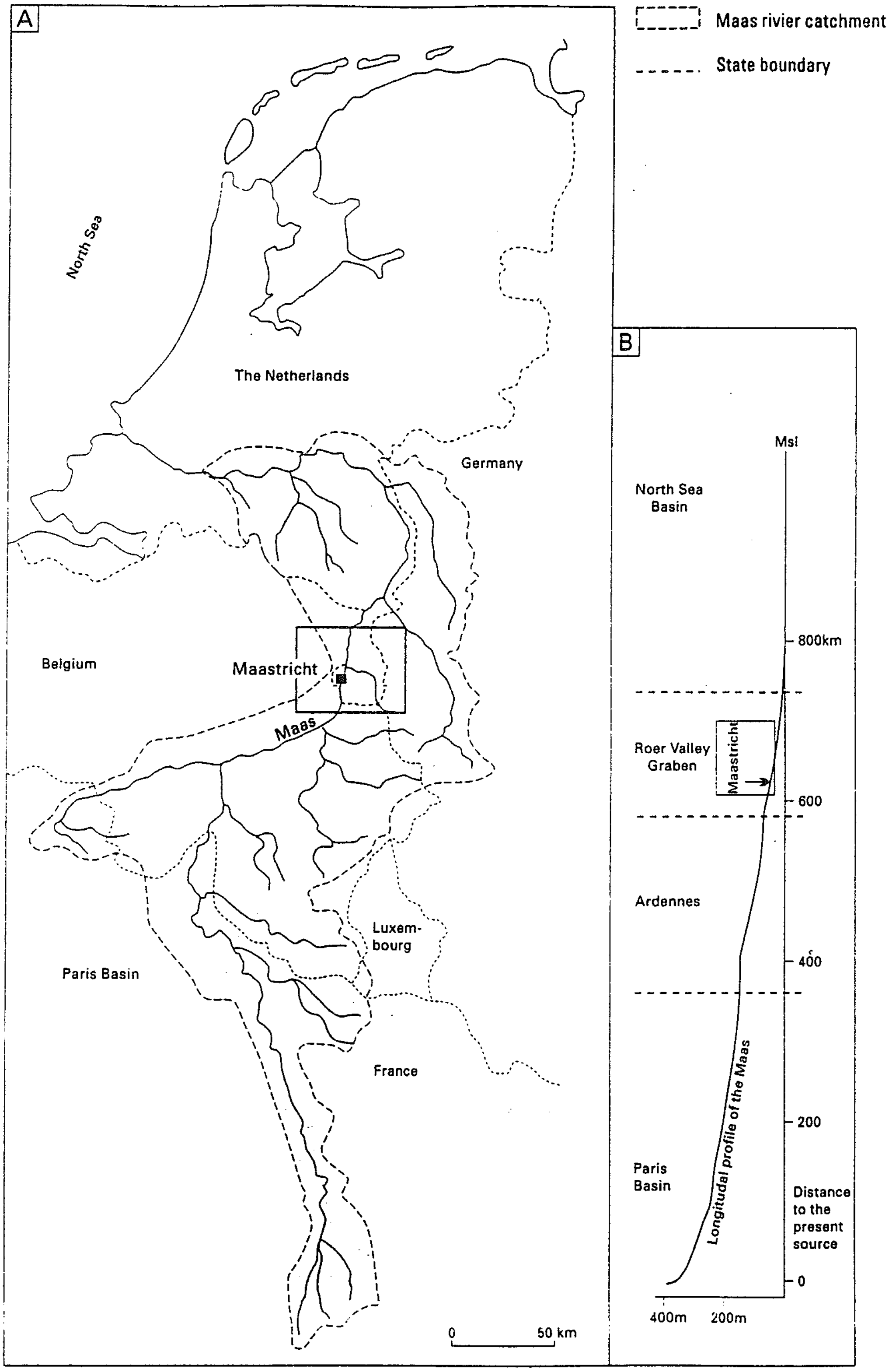


Fig. 13 Location map (1:50.000) with excursion/view point Rasberg.



Setting of the study area within the catchment of the Maas river.

Fig. 14 (after Van den Berg, 1996).

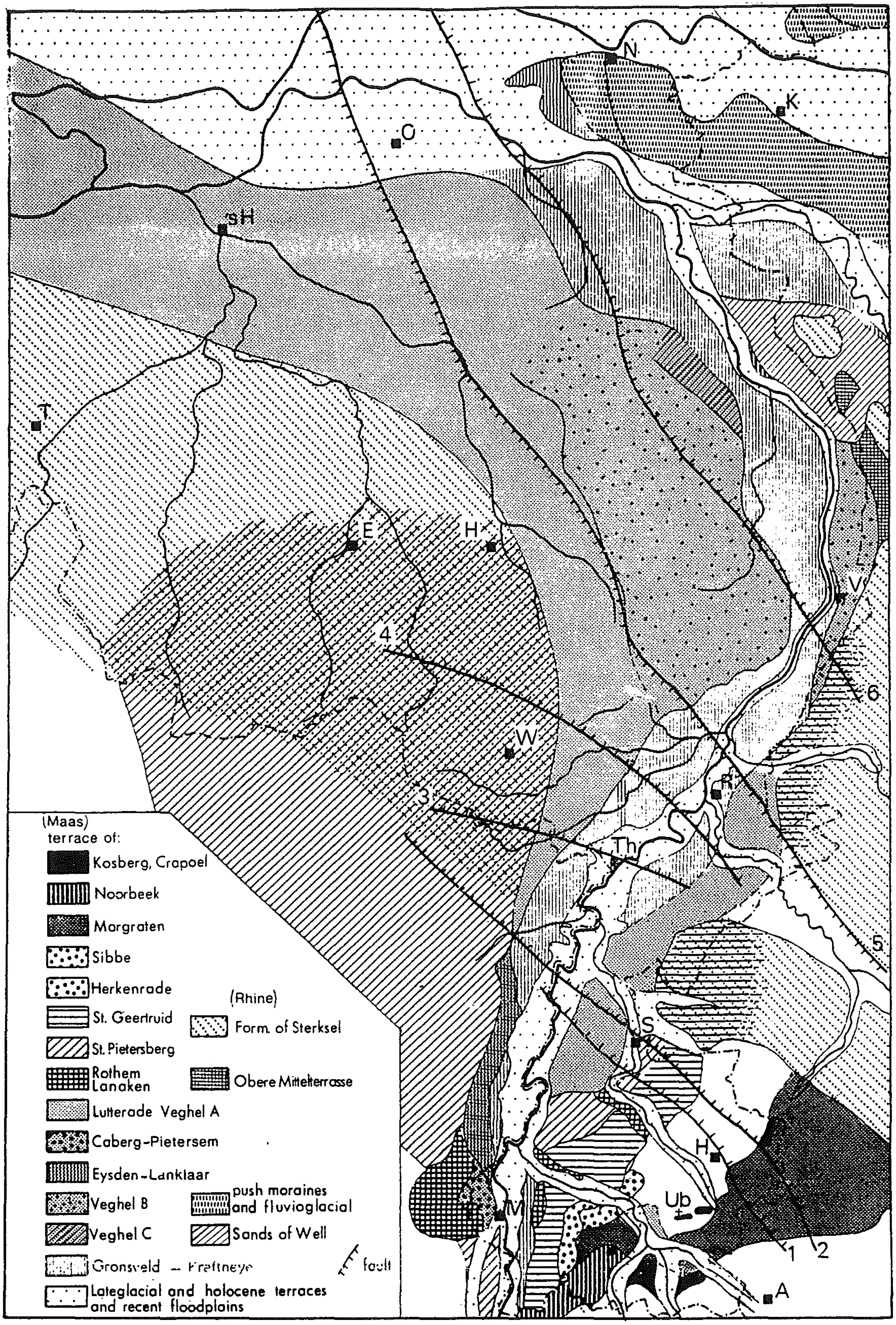


Fig. 15 - *The terraces of the Maas and the Rhine in SE Netherlands. 1, Fault of Heerlerheide; 2, Feldbiss; 3, Fault of Montfoort; 4, Fault of Beegden; 5, Peel Boundary Fault; 6, Fault of Tegelen; N, Nijmegen; K, Kleve; O, Oss; 's H, 's Hertogenbosch; T, Tilburg; E, Eindhoven; H, Helmond; Th, Thorn; V, Venlo; W, Weert; R, Roermond; S, Sittard; H, Heerlen; M, Maastricht; Ub, Ubachsberg; A, Aachen. Read: "Kreftenheye" instead of "Kreftheye".*

(after Zonneveld, 1974)

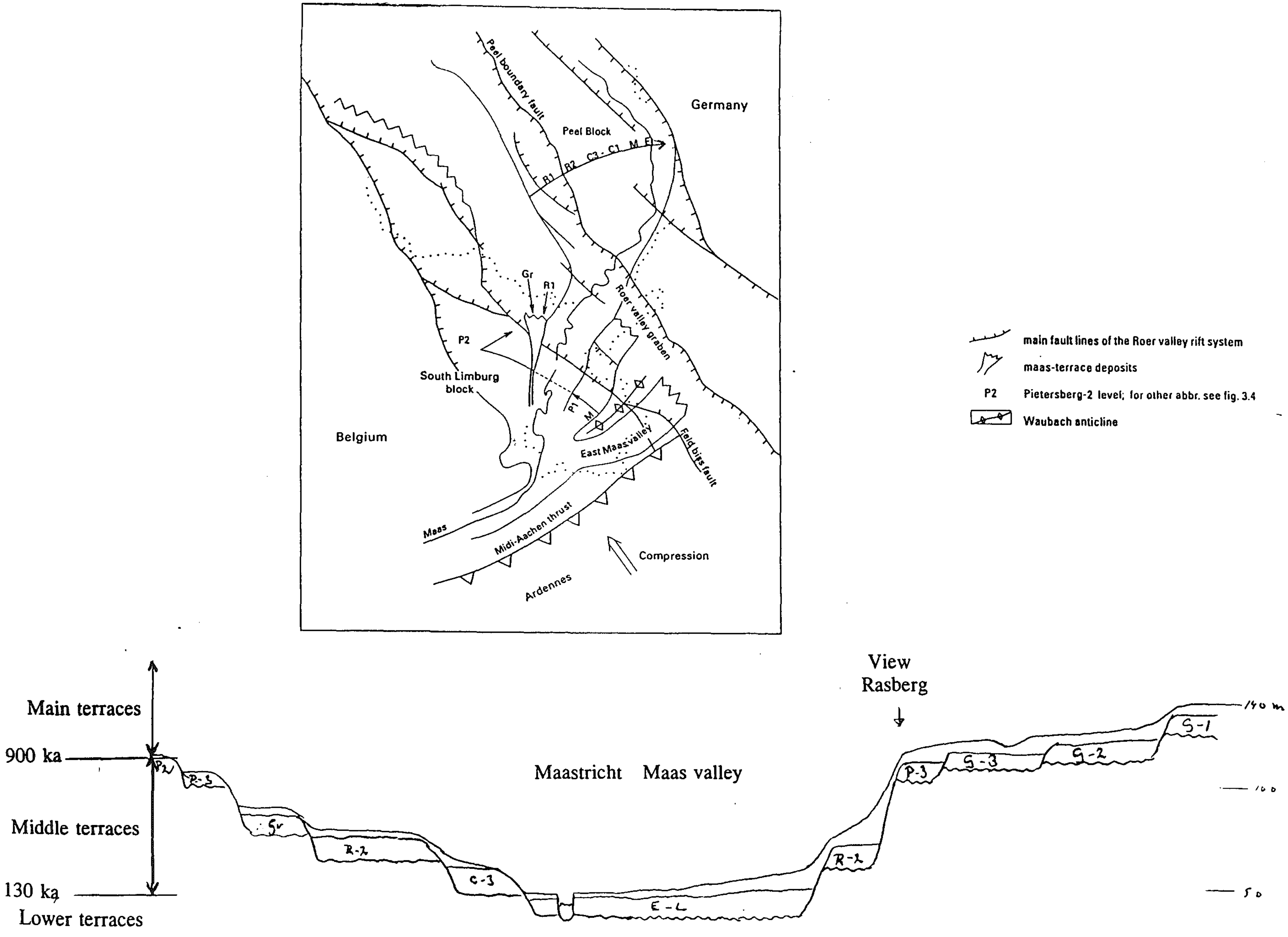


Fig. 16 Tectonic setting and E-W cross section over the Maas valley (after Van den Berg)

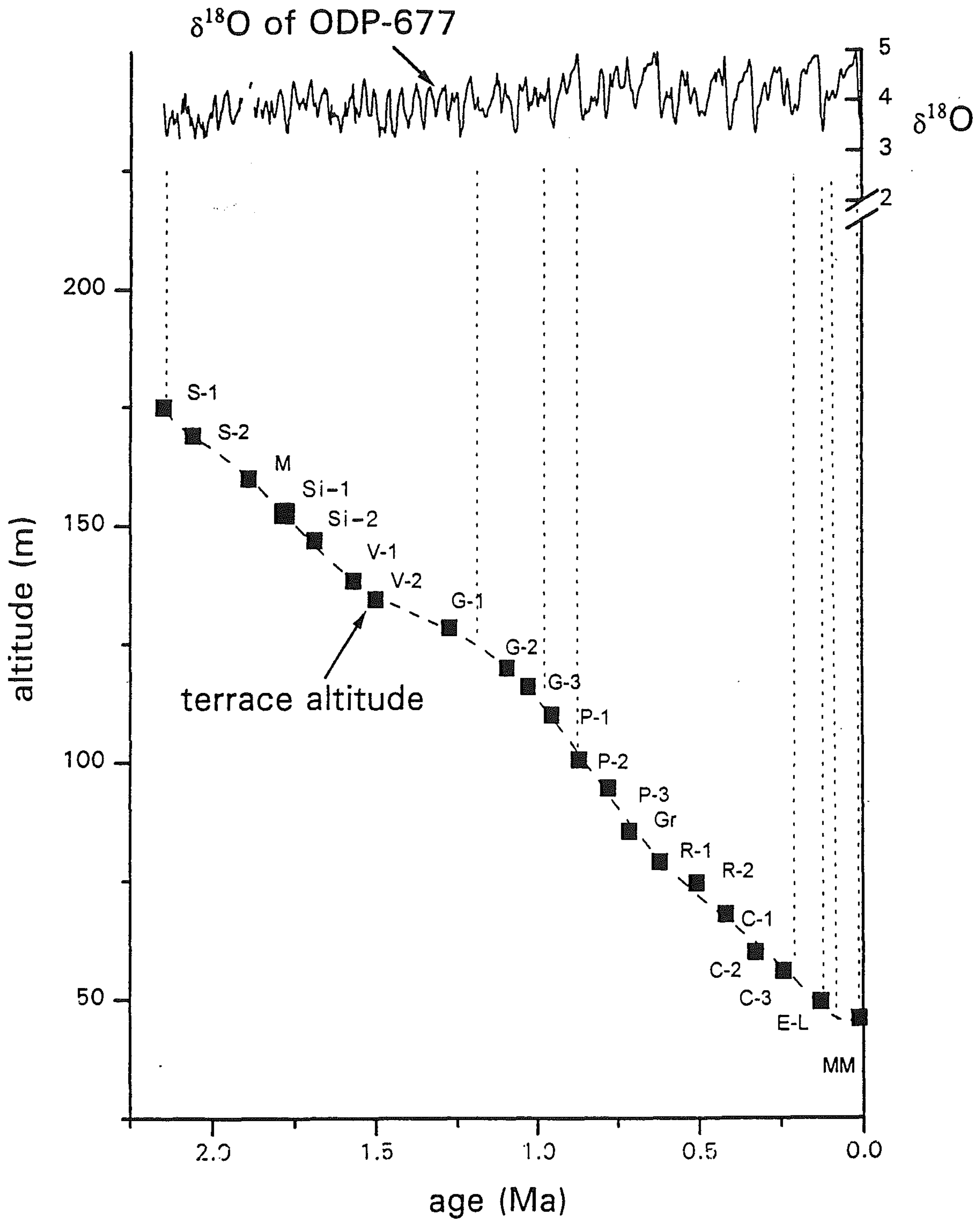


Fig. 20 Altitude-age plot of the youngest 21 terrace levels considering sequence stratigraphic arguments and age determinations mentioned in text.

(after Van den Berg, 1996).

EXCURSION STOP HOUBEN/SPAUBEEK

demonstrated by: M.W. Van den Berg, Nederlands Instituut voor Toegepaste Geowetenschappen TNO, P.O. Box 511, 8000 AM Zwolle.

In this quarry gravels and sands of the Geertruid 2 terrace occur between the Miocene marine white sands and the overlying loess mantle. This setting is illustrative for the sedimentary architecture of Maas terraces. Notice the rithmic stacking of fining-upward sequences together composing this terrace (Fig. 23). It is interpreted as the sedimentary response to stadial-interstadial climatic cycles. The paleomagnetic and pollen data assign this level to an Early Pleistocene Menapian age, the equivalent of deep sea stages 36 through 33.

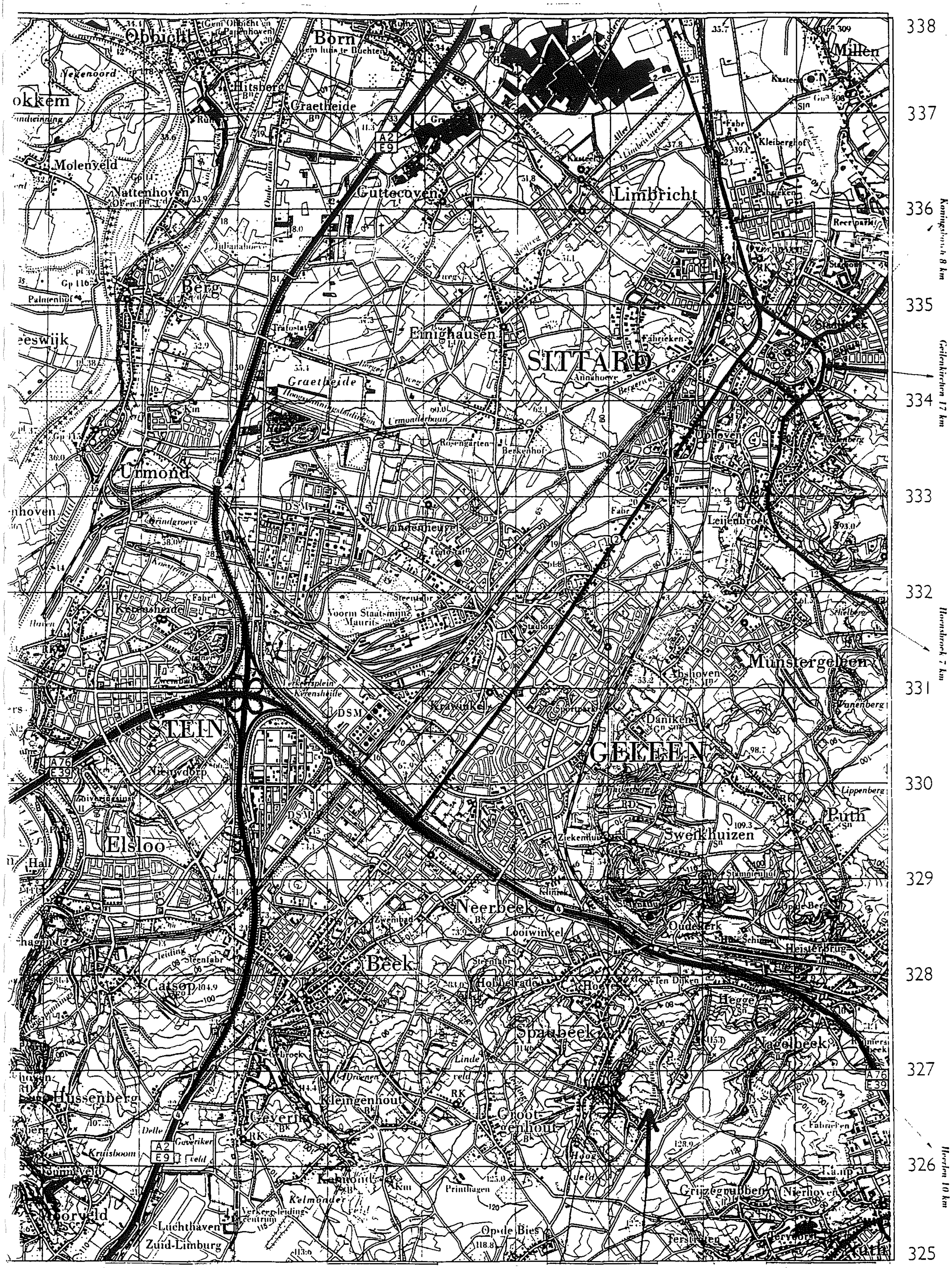


Fig. 21 Location map of excursion point quarry Houben/Spaubeek.

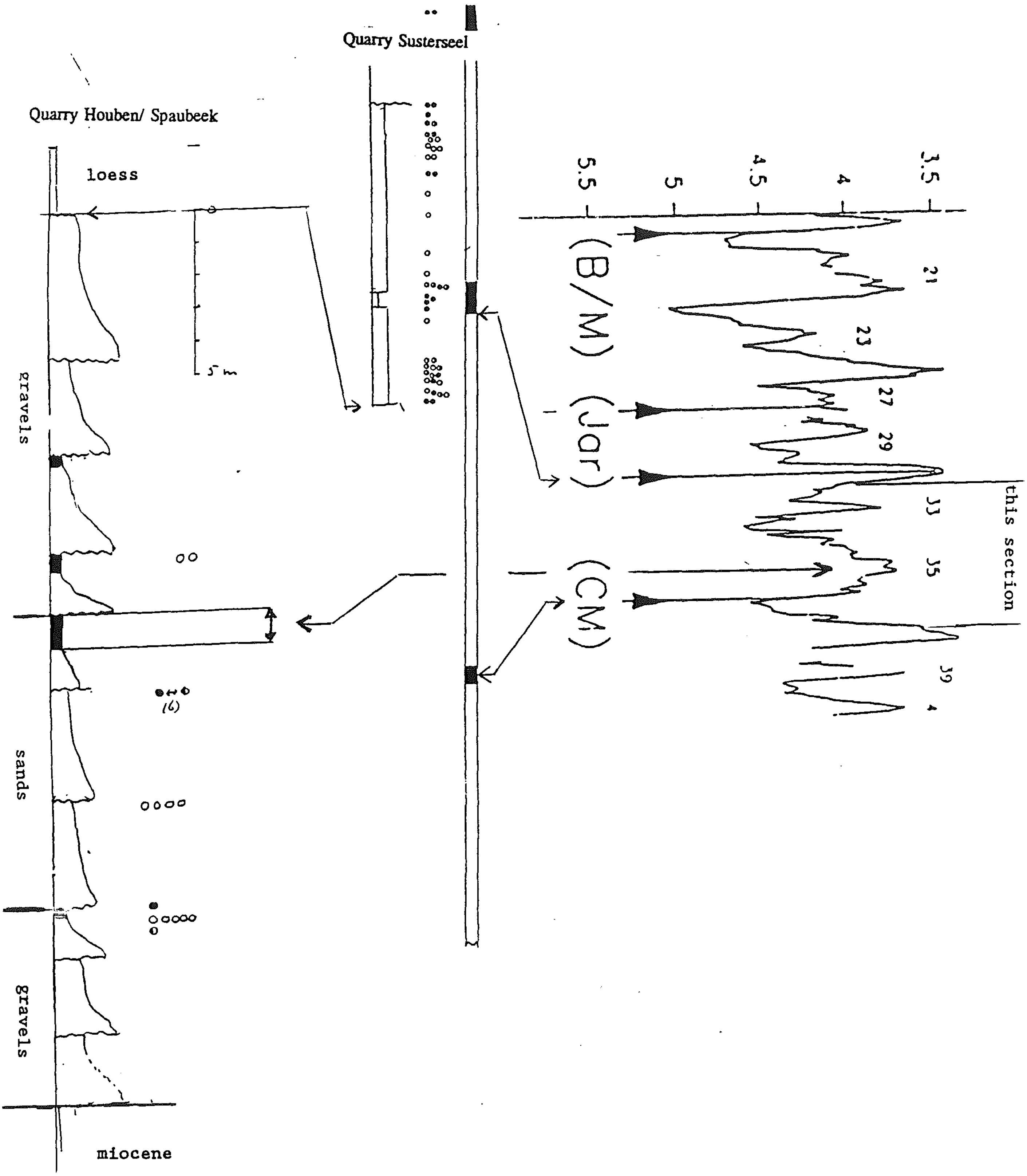


Fig. 22 Lithological log of quarry Houben/Spaubeek and paleomagnetic correlation with oxygen isotope stages (after Van den Berg).

Fig. 23 Part of the Geertruid -2 terrace sequence showing the braided stream alluvium (Scott-type) with typical planar erosion surfaces delineating (four) reactivation phases. The height of the gravelly sands approximately amounts 12 m. The alluvium is overlain by a loess mantle and underlain by Miocene marine sands.

(after Van den Berg, 1996).

EXCURSION STOPS MEERS AND HOCHTER BAMPD

These excursion points will be demonstrated by drs. F.J. Offerein, project manager Grensmaas (De Maaswerken), P.O. Box 1593, 6201 BN Maastricht.