

THE SECTION AT USSELO; BRIEF DESCRIPTION, GRAIN-SIZE DISTRIBUTIONS, AND SOME REMARKS ON THE ARCHAEOLOGY

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ABSTRACT: In this paper a concise description is given of the type section at Usselo, based on the drawing and photographs made in 1975 in the course of a reinvestigation (see also van Geel et al., 1989). The grain-size distributions of 34 sand samples, taken in 1975, are presented and discussed. One conclusion is that at Usselo the permafrost disappeared approximately at the beginning of the Bølling Interstadial s.s.

Finally, some preliminary remarks are made on the archaeological finds from Usselo. It is pointed out, among other things, that there may have existed a Late Palaeolithic habitation at this site during the Late Dryas Stadial, i.e. after the main occupation period represented by the large collections from the 'Usselo Horizon', excavated by Hijzeler in the 1940's. It is probable that the archaeological material of Usselo represents repeated occupation of the site.

KEYWORDS: Lateglacial stratigraphy, Late Palaeolithic.

1. INTRODUCTION

During 9-14 October 1975 the classic profile at Usselo (section A in: van der Hammen, 1952) was exposed for the purpose of reinvestigation. This was done notably in order to take new samples for (1) analysis of pollen, fruits, seeds, algae, etc. (Hugo de Vries Laboratory, Amsterdam), (2) analysis of Coleoptera remains (Department of Geology, Birmingham) (see van Geel, de Lange & Wiegers, 1984; van Geel, Coope & van der Hammen, 1989), and (3) analysis of mites (Schelvis & van Geel, 1989).

The Biologisch-Archaeologisch Instituut (B.A.I., Groningen) provided technical assistance in preparing the section, and was responsible for the drawing work and photography. Also four lacquer peels of the section were made (B.A.I. collection, indicated in fig. 3). Finally a series of sand samples was collected for grain-size analysis; this was carried out by the Geological Institute (Groningen).

During the cleaning of the section two archaeological finds were made. In order to place these in their proper context, some remarks on the archaeology are made in the last chapter of this paper.

2. BRIEF DESCRIPTION OF THE SECTION

The section is situated in the former peat-bog area known as the Usselerveen (reclaimed in the 1920's and 1930's), about 5.5 km SW of the centre of the town of Enschede (see figs 1 and 2). The coordinates

of the middle of the section that was investigated in 1975 are approximately 254.725/466.588 on the Topographical Map of the Netherlands (sheet 34F). The site is located on the eastern slope of a long N-S running dune that is at least 100 m in width; the eastern slope is steeper than the western (Hijzeler, 1955). We are concerned here with the type locality of the 'Usselo Horizon' (a fossil soil, containing charcoal particles, dating from the Allerød Interstadial), that was described by van der Hammen (1952: section A). The profile was exposed in the 1940's during archaeological excavations by C.C.W.J. Hijzeler, as a result of which many finds were made belonging to the *Federmesser* (= Tjonger) Tradition. The area is now a protected geological/archaeological monument (Gonggrijp & Boekschoten, 1981: fig. 1, No. 17).

Here we are possibly concerned with a gully that was cut off by coversand deposition before the Bølling Interstadial (s.s.), which later, during the Late Dryas Stadial, became completely filled up with Younger Coversand II. On the old geological map of this region (Tesch, 1929) no stream valleys are indicated in the immediate vicinity, however. Attempts to map the geographical occurrence of the fossil depression by boring have not been performed (it certainly is not a pingo rampart).

The section illustrated in figure 3 is approximately 12 m long, and is only a part of the section studied by van der Hammen (1952: figs 15, 16; see also van Geel et al., 1989).

In 1975 the section was dug almost 1 m deeper



Fig. 1. The location of the section at Usselo on a map of the Netherlands. Drawing J.M. Smit.

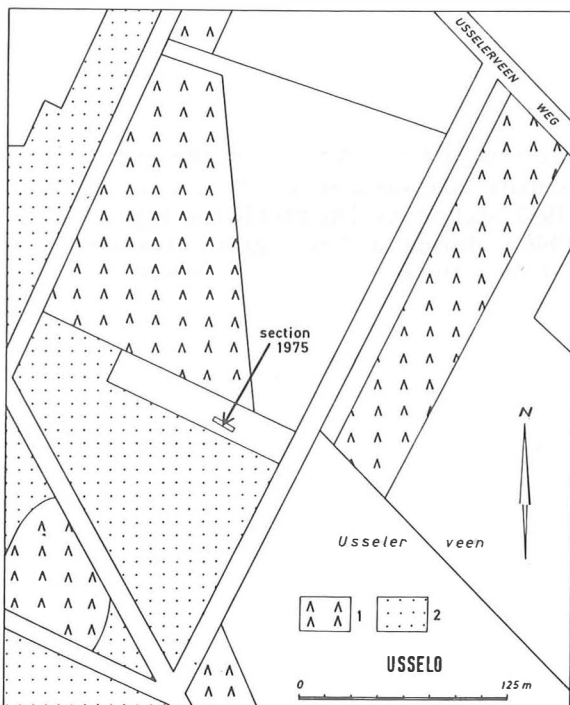


Fig. 2. Situation of the part of the section at Usselo investigated in 1975, after the Topographical Map of the Netherlands 1:25,000 (sheet 34F, 1965). 1. forest; 2. heathland. Drawing J.M. Smit.

than at the time when van der Hammen and Hijszeler carried out their investigations. This led to the discovery of a thin loamy layer (thickness 3 or 4 cm) containing organic material (fig. 3: symbol 5) in the basal part of the section. In the eastern part of the studied section this organic band is present approximately 0.4 m below the Bølling (s.s.) layers (the Bølling Interstadial s.s. is represented by layers 7 and 8 in figure 3) as is evident from the palynological research (van Geel et al., 1989). The organic band runs more or less horizontally in the section drawn by us, implying that during the deposition of this band a brook was not present at the site. Five large samples were taken from this band (labelled A-E in fig. 3). The layer turned out to contain pollen, seeds and insects (van Geel et al., 1989), and is dated by ^{14}C (AMS-dates: sample C: Ua-381, 12.840 ± 200 BP; sample D: Ua-382, 12.930 ± 210 BP). This means that in the Usselo section the whole of the Lateglacial is represented by sediments. Another conclusion is that the uppermost part of the Older Coversands was deposited (at least locally) during the first part of the Bølling Interstadial s.l.: the 'Earliest Dryas Stadial'. As we know that the 'Earliest Dryas Stadial' was relatively warm (van Geel et al., 1989), this illustrates once again that there is not always a strict correlation between coversand deposition and stadials in conventional sense (Stapert, 1986: fig. 2), and this is one of the main problems with 'stratigraphical' dating of Late Palaeolithic findspots embedded in coversand.

In 1975, from the bottom of the trench a few shallow borings were made with a hand-driven auger (B I-IV in fig. 3). Because of problems with the groundwater these observations cannot be counted upon as being very accurate. In all four borings a gravelly layer (fig. 3: symbol 2) was found, 10-20 cm thick, below which presumably fine sand (loamy?) was present. It is possible that this gravelly layer represents the 'Beuningen Gravel Bed' (van der Hammen et al., 1967; van der Hammen & Wijmstra, 1971). In the eastern Netherlands the 'Beuningen Gravel Bed' separates the Older Coversands I and II; it dates from the Upper Pleniglacial (Kolstrup, 1980).

The rest of the section broadly corresponds to the description by van der Hammen (1952). Here we shall briefly discuss a few details, that were conspicuous as a result of the new investigation. The section is documented by a series of photographs (figs 4-9).

The sand layers below the Bølling (s.s.) layers in the eastern part of the profile are greenish to bluish in colour, while in the western part they are more yellowish. As is evident from the results of the grain-size analysis (see 3), this difference is not a result of a higher loam content in the eastern part.

According to van Geel et al. (1989), at least part

of the sediments below the Bølling (s.s.) layers was deposited in aquatic conditions, especially over a thickness of about 20 cm immediately above the organic band.

Also the Bølling (s.s.) layers in the eastern part of the section must have been deposited in a pool, the lower part (fig. 3: symbol 7) consists of a gyttja-like sediment.

In the western part of the section there is no 'Bølling level' visible in the coversand (e.g. in the form of a bleached zone or a loamy layer). There is only a gradual transition from sand with 'loamy bands' in the bottom part of the section to sand in which no distinct 'loamy bands' are visible. As van der Hammen (1952) already remarked, and is also evident from the grain-size distributions (see 3), in fact the 'loamy bands' do not consist of loam, but rather of fine sand. In the western part of the section the sand immediately below the 'Usselo Horizon', over a thickness of 0.5-1 m, is without 'loamy bands', but instead contains a number of bands of fine gravel (fig. 3: symbol 13). Roughly speaking, we can say that the facies of coversand with 'loamy bands' ended here approximately at the beginning of the Bølling Interstadial s.s. This is also the case at other localities in the eastern Netherlands, where in general especially the Older Coversand II shows these 'loamy bands', but not the Younger Coversand I. In the Dinkel valley the Younger Coversand I only locally shows loamy bands in depressions (van der Hammen & Wijmstra, 1971). In the northern Netherlands, i.e. to the north of the valley of the Overijsselse Vecht, however, the Younger Coversand I is characterized by the occurrence of 'loamy bands' (ter Wee, 1966; 1979; Stapert, 1986), while the Older Coversand there is relatively strongly loamy compared with e.g. Usselo. It has been suggested, that this difference in lithology of the Younger Coversand I between the eastern and the northern Netherlands can be explained by assuming that the southern border of a (probably discontinuous) permafrost was located approximately in the valley of the river Vecht during the deposition of Younger Coversand I – that is during the Early Dryas Stadial (Stapert, 1986; see also de Groot, Cleveringa & Klijnstra, 1987). This is apparently in contradiction, however, with the conclusions of Maarleveld (appendix to van Geel et al., 1989), based on geocryological data (see also 3).

In the eastern part of the section, below the Allerød peat layer, there is a fairly thin unit (30-40 cm), consisting of respectively a loamy gyttja-like layer (symbol 7), and a complex of alternating sand layers and thin layers containing organic material (symbol 8). It seems fairly clear that we are concerned with mainly lacustrine sediments. These layers date from the Bølling Interstadial s.s. They have been disturbed by cryoturbation after their

deposition (figs 4-9). Moreover, here and there these layers appear to be 'broken' into pieces, as though periodical desiccation has taken place. Also the Allerød peat layer (fig. 3: symbol 10) shows distortion due to cryoturbation, both the top as well as the base. In addition this layer becomes abruptly thinner in places. Apart from the effects of cryoturbation, it seems clear to us that this phenomenon is at least partially caused by water erosion after the deposition of the peat. This would imply aquatic circumstances in the eastern part of the section during the first part of the Late Dryas Stadial (see also van Geel et al., 1989). The distortions due to cryoturbation can probably be dated in the Late Dryas Stadial. No frost wedges or fissures were observed in this section, but Hijzeler found a few small frost fissures in other places on the site, coming out of the Younger Coversand II, that therefore must date from the Late Dryas Stadial (unpublished drawings). Also elsewhere in the Netherlands frost fissures are known from the Late Dryas Stadial (van der Tak-Schneider, 1968; Stapert, 1982; 1986; Maarleveld, appendix to van Geel et al., 1989); they are not necessarily indicative of the presence of permafrost during that zone.

The 'Usselo Horizon' in the western part of the section only consists of an A2-horizon, a B-horizon being nowhere visible. We suppose that the B-horizon has been secondarily leached out during the Holocene (many infiltration bands are present in the section, also below the 'Usselo Horizon', that can be connected with the strong Holocene podsol that must once have been present at the top of the section). Within the 'Usselo Horizon', in addition to charcoal particles, some greyish-blackish bands are present, mostly at the top. A feature well-known from earlier descriptions is the occurrence of 'finger-like protrusions' of the 'Usselo Horizon', both downwards and upwards (e.g. Hijzeler, 1957: fig. 2). These protrusions have nothing to do with the 'Usselo Horizon' as a fossil soil. They are in fact burrows dug by scarab beetles, dating from the Holocene. They are only conspicuous adjacent to the 'Usselo Horizon' on account of the differently coloured filling – see figures 8 and 9 (we were informed of this by L. Brussaard; see Brussaard, 1983; 1985). Also Hijzeler (1947; 1974) regarded these protrusions as secondary burrows; Stroink (1962) already indicated the possibility of activities by dung beetles. It is interesting to note that the 'Usselo Horizon' is still recognizable from the beginning of the Allerød peat layer (at 7 m on the horizontal scale-bar in fig. 3), going eastwards over a distance of about 1 m, overlying the peat layer. The explanation for this phenomenon is unclear to us (trampling by humans?, erosion by running water?).

The coversand above the Allerød peat layer and

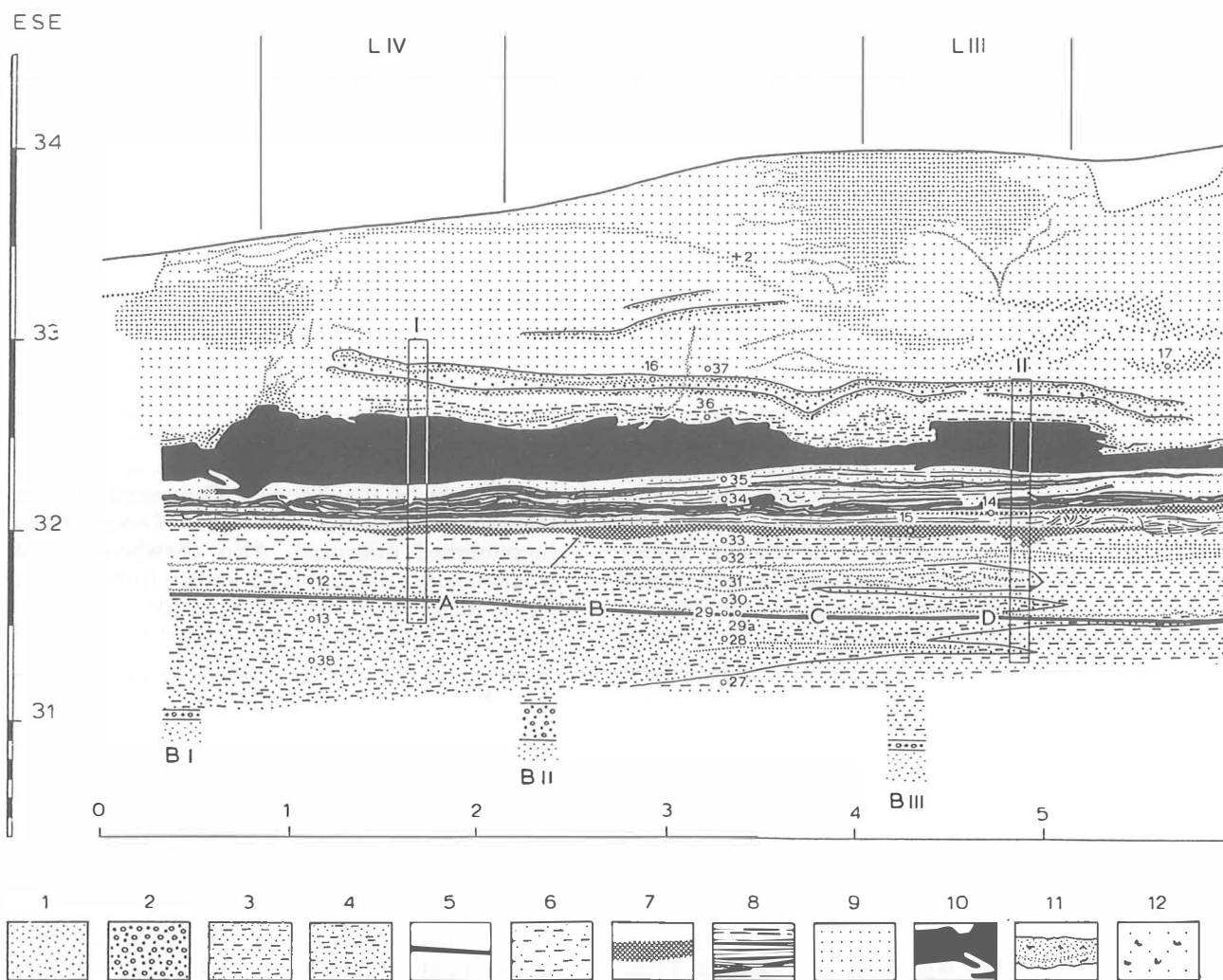
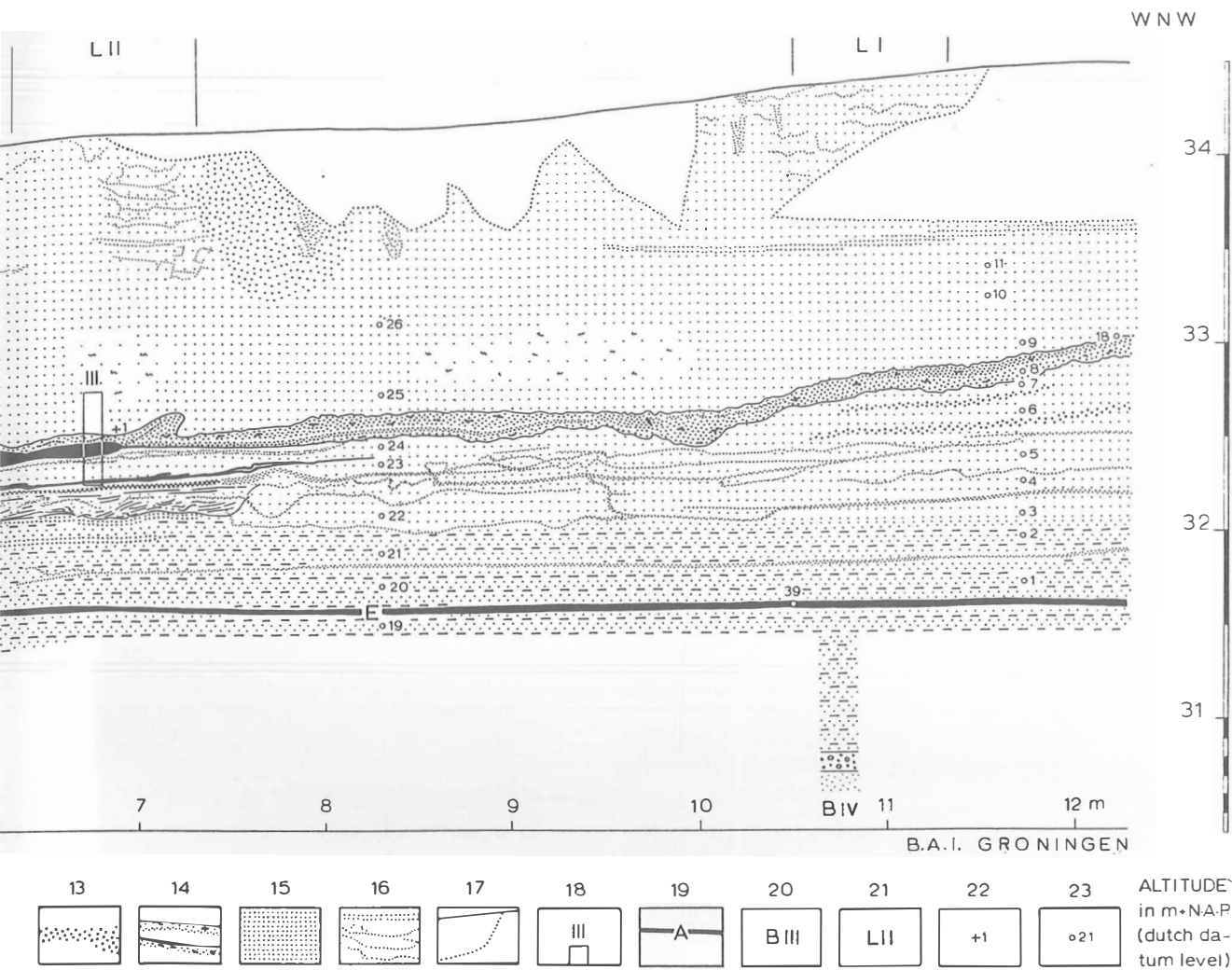


Fig. 3. The part of the section at Usselo investigated in 1975. Key: 1. fine sand; 2. coarse sand with gravel; 3. yellow sand with greyish fine ('loamy') layers; 4. greenish fine sand; 5. brownish loamy layer containing organic material; 6. bluish loamy fine sand; 7. bluish-greyish loamy layer with organic material; 8. yellowish sand with many thin dark organic layers; 9. yellow sand; 10. brown peat; 11. 'Usselo Horizon', bleached zone in sand with charcoal particles and dark-grey bands, showing 'finger-like' protrusions upwards and downwards; 12. diffusely bleached sand with charcoal particles; 13. very coarse sand with fine gravel; 14. thin layers of bleached sand with charcoal particles; 15. iron infiltration band (brown or orange) in sand; 16. iron infiltration bands (brown) in sand; 17. recently disturbed soil; 18. palynological samples; 19. samples from the thin organic band (symbol 5); 20. borings; 21. lacquer peels; 22. archaeological finds made during the preparation of the section; 23. samples for grain-size analysis. Drawing H. Praamstra.

the 'Usselo Horizon', Younger Coversand II, was mainly deposited during the Late Dryas Stadial. In the eastern part of the section within this sand a number of thin pale layers are present containing relatively many charcoal particles (symbol 14 in fig. 3); they were already mentioned by van der Hammen (1952). In the section drawn by us these thin layers do not pass into the 'Usselo Horizon'. At least four such bands could be identified in the eastern part of the section, some of which were

double in places. In our opinion they must be regarded as possibly consisting of material from the 'Usselo Horizon', originating from higher up the slope due to erosion, and having been deposited in aquatic circumstances (this is confirmed by the palynological analysis: van Geel et al., 1989). To what extent secondary seeds, etc. could be present in these layers as a result of erosion, is difficult to ascertain, but this possibility should be taken into account. In this connection it is noteworthy that in a



few cases immediately below these charcoal-bearing layers bands of coarse grains (fine gravel) were present, suggesting washing out by flowing water. Perhaps an earlier observation of Florschütz is of interest here: he found *Pediastrum boryanum* “both in the artefact layer and in the covering sand, this being indicative of sedimentation in water” (Hijsszeler & Florschütz, 1941). Florschütz dated the Allerød peat layer already in the Lateglacial; however, it is not clear what he meant by the ‘artefact layer’, as it must be assumed that the ‘Usselo Horizon’ contains hardly any or no pollen or spores. We suppose therefore that he meant the Allerød peat layer.

In the western part of the section, scattered in the Younger Coversand II, there are a few diffuse

patches of bleached sand with (far fewer) charcoal particles (fig. 3: symbol 12). Again erosion of the ‘Usselo Horizon’, higher up the slope, could be the explanation, but in this case deposition by the wind under dry conditions seems more probable.

In the eastern part of the section, in the coversand above the Allerød peat layer, a conspicuous orange-coloured infiltration band was visible (see fig. 3, between 1 and 5 m on the horizontal scale-bar). This most probably indicates a temporary standstill phase in the deposition of this sand. Considering the form of this band in profile, there must then have been present a small dune in the eastern part of the section, while in the western part of the section till then hardly any sand (less than 0.5 m) had been deposited on top of the ‘Usselo Horizon’. It seems

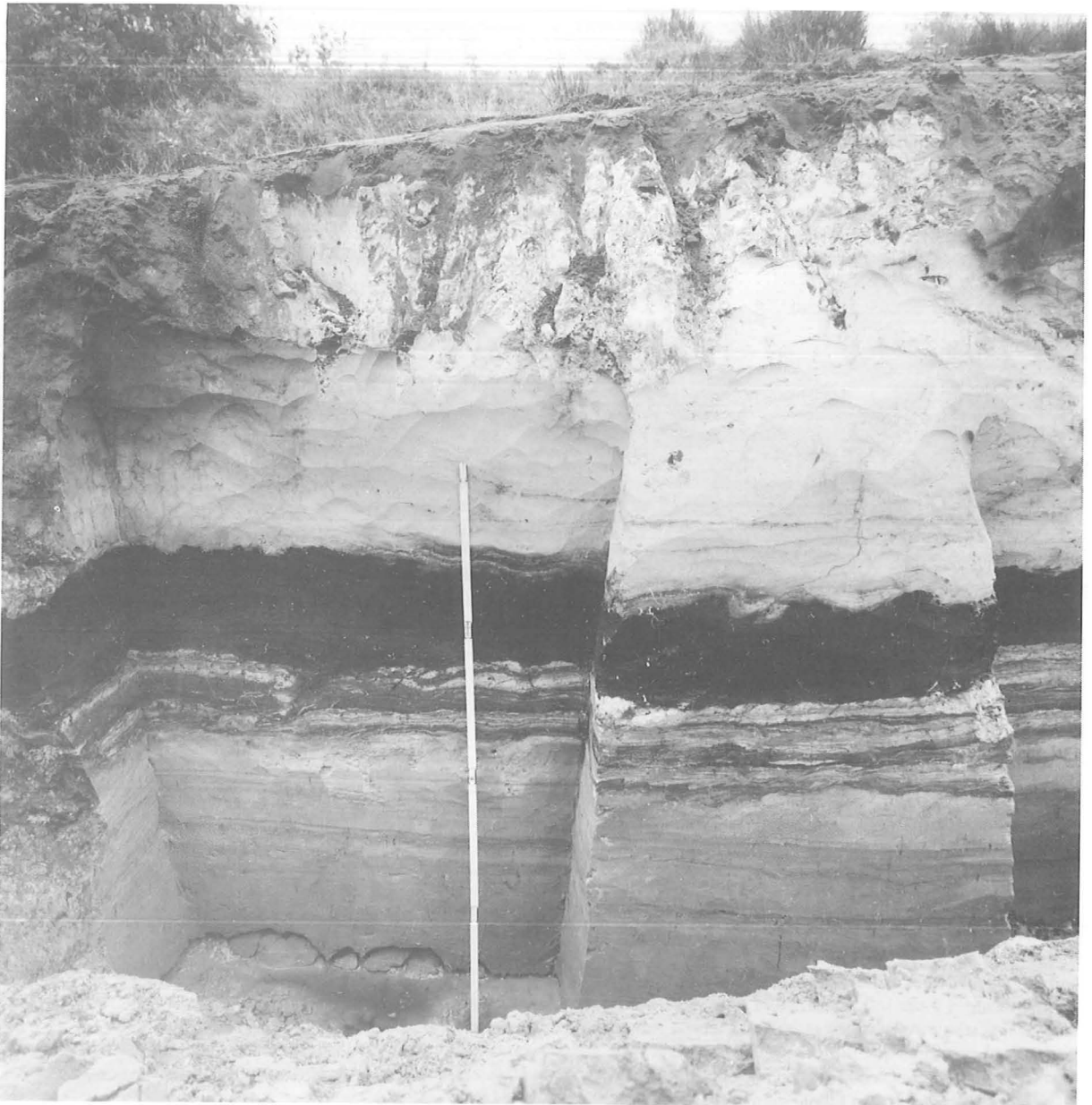


Fig. 4. The eastern most part of the section at Usselo (1975), after samples had been taken for palynological analysis and after the section had been made extra deep. The scale-bar is 2 m long in all the photographs. Photograph F.W.E. Colly.

as if a relief reversal had occurred in the beginning of the Late Dryas Stadial, due to deposition by the wind. This suggests that the first part of the sand above the Allerød peat layer was not only deposited by water, but partly also by the wind. Possibly an alternation of these two modes of sedimentation occurred, perhaps during different seasons. At the level of this infiltration band we found a flint artefact (No. 2, see under 4) while preparing the section. Also in the middle of the section an artefact (No. 1) was found, in the 'Usselo Horizon', at the

point where this horizon passes into the Allerød peat layer (for a further discussion of these finds, see 4).

An interesting detail is the local occurrence of lenses of very coarse sand with fine gravel in the Younger Coversand II (e.g. between 5 and 6 on the horizontal scale-bar in fig. 3: symbol 13). Within these lenses distinct foresets were visible, sloping (downwards) to approximately east (the angle with respect to the horizontal plane usually measured 30-40°). The grain-size distribution of a sample



Fig. 5. Part of the section before it was made extra deep, between approximately 2 and 4.5 m on the horizontal scale-bar in figure 3. The total height of the section in the middle part is about 2 m. Photograph F.W.E. Colly.

from one of these coarse lenses (sample No. 17) was very aberrant (see under 3). We feel certain that these coarse lenses were deposited by flowing water. Also elsewhere in the Younger Coversand II patches with many coarse grains were found (e.g. towards the top of the section, between 7 and 8 m on the horizontal scale-bar in fig. 3), of which the character is less clear.

Towards the top of the section 'sagging' parts of the B-horizon of the Holocene podsol occur here and there. These are presumably connected with

trees that grew there formerly, in view of the many small infiltration bands in these patches. The podsol itself is largely absent, however, which clearly indicates that a part has disappeared from the top of the section, probably approximately 0.5 m. The recent disturbances towards the top of the section were undoubtedly caused by the excavations carried out here in the 1940's by Hijzeler; it was probably in the course of these excavations that the missing uppermost part of the section was removed.

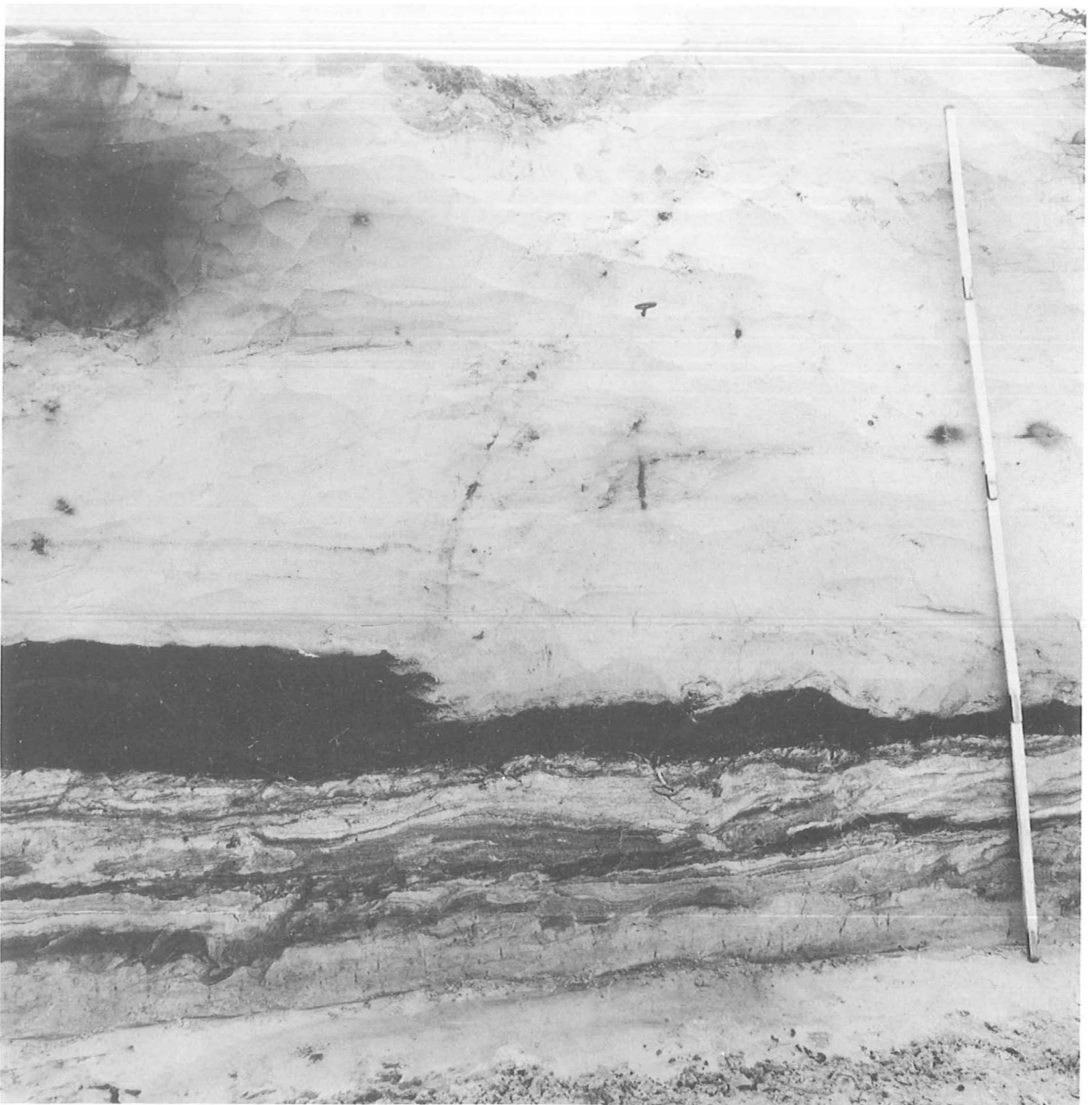


Fig. 6. Part of the section before it was made extra deep, between approximately 4.5 and 6.5 m on the horizontal scale-bar in figure 3. Photograph F.W.E. Colly.

3. GRAIN-SIZE DISTRIBUTIONS

A total of 34 samples were studied with regard to their grain-size distributions (for the sampling sites see fig. 3). The results are shown in the form of histograms (figs 10-14). The sand samples are arbitrarily divided into two groups: (a) relatively fine sands (the sample numbers of which are enclosed in a small circle in figs 10-13); (b) relatively coarse sands (sample numbers enclosed in a small square in figs 10-13).

The variability of the cumulative curves of both groups of samples has been summarized in figure 14, with the exception of that of sample 17, which is represented separately.

On the basis of their research in the Dinkel valley, Wijnstra et al. (1971) give the following characteristics for the different coversands:

Younger Coversands. Principal fraction 150-210 μm ; sometimes there is a secondary maximum in the 1400-2000 μm fraction; in general the distributions are unimodal, however.



Fig. 7. Part of the section before it was made extra deep, between approximately 6.5 and 9 m on the horizontal scale-bar in figure 3. Photograph F.W.E. Colly.

Older Coversand II. Principal fractions 105-150 μm and 150-210 μm ; sometimes a secondary maximum occurs in the 50-75 μm fraction. To some extent these sands are apparently better sorted than the Younger Coversands.

Older Coversand I. Rather variable diagrams; the principal fraction is usually 105-150 μm , but sometimes the fractions between 300 and 2000 μm are the best represented.

From the histograms published by van der Ham-

men (1952) it is evident that the Older Coversand usually shows peaks in the 105-150 μm fraction, while there is often a secondary maximum in the 50-75 μm fraction. The Younger Coversand also usually has a maximum in the 105-150 μm fraction, but sometimes in the 150-210 μm fraction, while also the fractions coarser than 210 μm are well represented. Also from van der Hammen's cumulative curves it is evident that in general the Younger Coversand is coarser than the Older Coversand.

For the section at Usselo van der Hammen (1952)



Fig. 8. Part of the section after it was made extra deep, between approximately 8.5 and 11 m on the horizontal scale-bar in figure 3. The deepest, somewhat darker layer visible in the photograph is the organic band (symbol 5 in fig. 3). Photograph F.W.E. Colly.

gives two histograms (his fig. 42: Nos 20-21): one for the Younger Coversand (maximum 105-150 μm), and one for the Older Coversand (maximum 105-150 μm , with a secondary maximum 50-75 μm). According to van der Hammen, as a general rule the Older Coversand gradually becomes coarser again going downwards.

It was shown by Veenstra and Winkelmoen (1971) that in all kinds of eolian sands the 149-177 μm fraction is generally dominant. On the basis of studies of grain-size distributions, grain orienta-

tions and the directions of foresets, they came to the conclusion that the Younger Coversands were mainly borne by NW winds (see also Maarleveld, 1960).

According to van der Hammen (1952), the Older Coversand in the eastern Netherlands often is characterized by the presence of alternating layers of coarser and finer sand. We have already pointed out (under 2) that in the northern Netherlands this is the case with the Younger Coversand I. In van der Hammen's opinion this type of coversand can best be explained as having been deposited by snow-

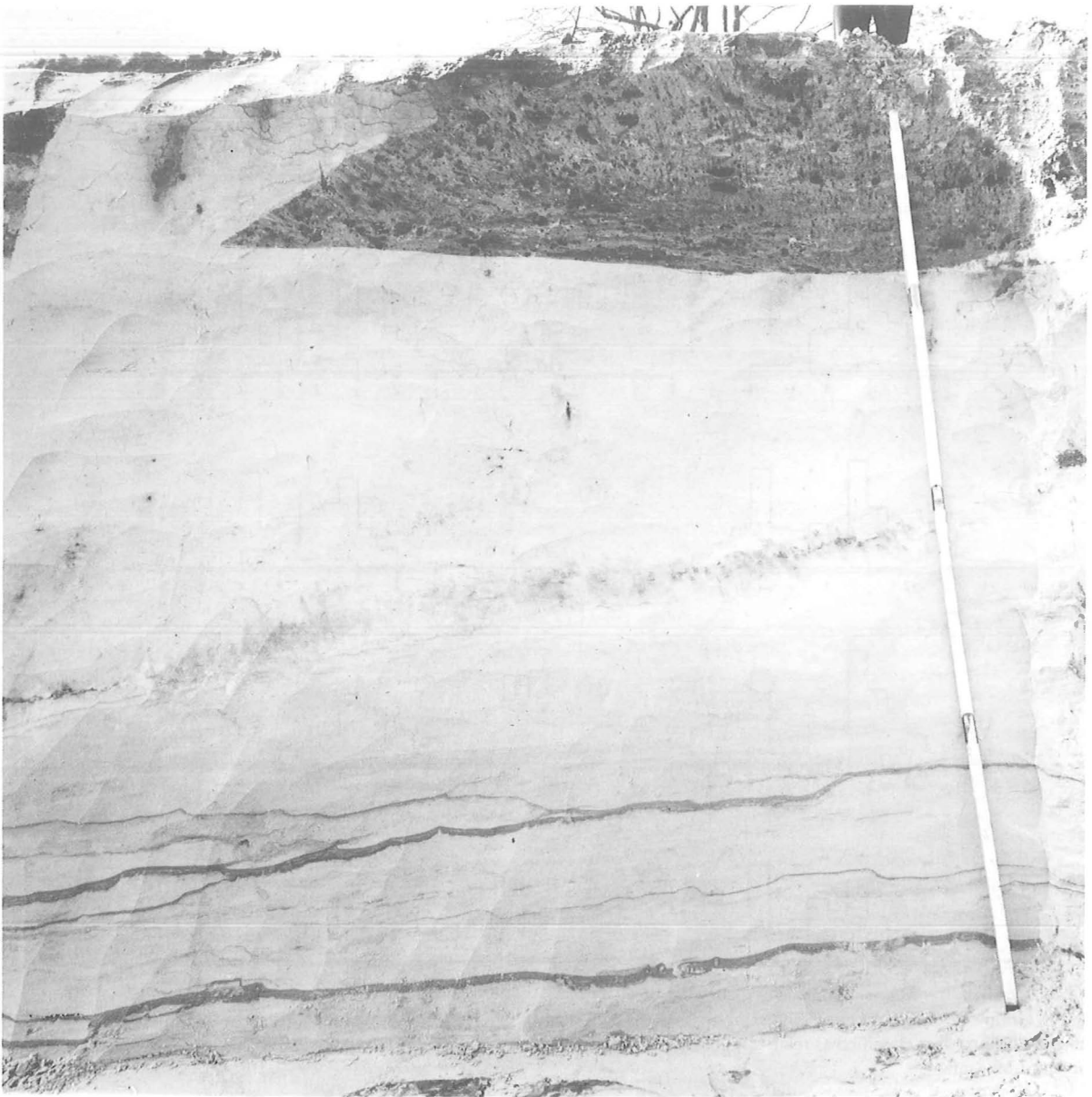


Fig. 9. The westernmost part of the section before it was made extra deep. Photograph F.W.E. Colly.

storms ('niveo-eolian' sedimentation: van der Hammen, 1952: p. 168); this view is shared by Wijmstra et al., 1971 (see also Edelman, 1951).

Ruegg (1983) discusses such laminated coversands, and has a different opinion on the matter (see also Schwan, 1988). He distinguishes two types of eolian sands:

- a. Type A: 'predominantly unimodal well-sorted uniform sands'.
- b. Type B: '... intercalated yellowish and greyish evenly laminated sands ('layer cake' effect); greyish

laminae are more or less silty; minor grain size peaks occur in the coarse silt and/or in the 75-80 μm fractions'.

According to Ruegg the origin of the 'loamy bands' is connected with the occurrence of alternating wet (summer) and dry (winter) 'depositional surfaces' during the sedimentation. The occurrence of wet surfaces during the summers could have been the result of the presence of an impermeable layer in the subsoil, for example a layer of till or a permafrost.

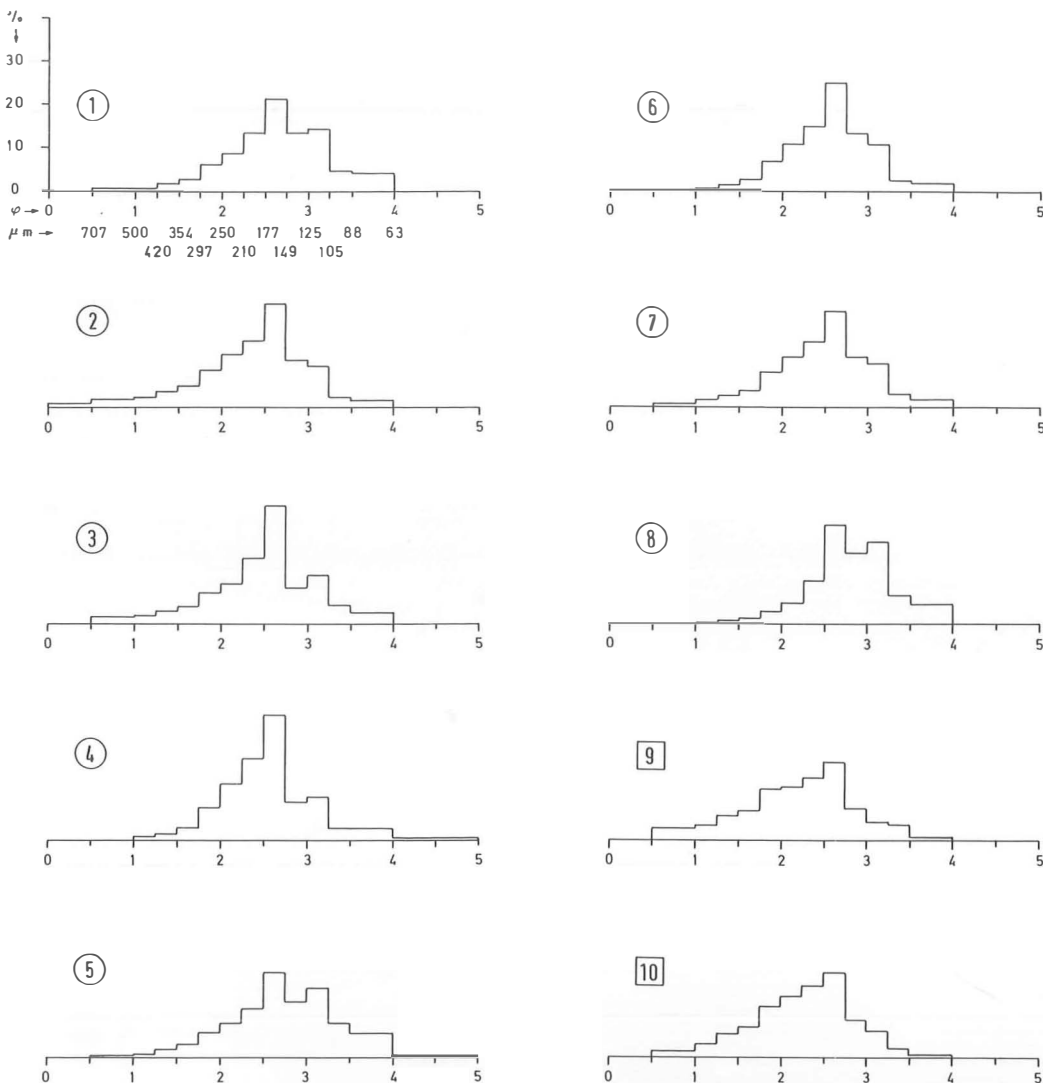


Fig. 10. Grain-size distributions of sand samples from the section at Usselo (1975), shown in the form of histograms. Sample numbers with a small square are classified as relatively coarse samples, those with a small circle as relatively fine (for the sample sites see fig. 3). Drawing J.M. Smit.

He suggests that in general the Younger Coversands have a dry eolian, and the Older Coversands a wet eolian genesis, while in addition for the Older Coversand I locally a fluvial origin can be assumed (pers. comm.). At Usselo the facies with loamy bands ended approximately at the beginning of the Bølling Interstadial s.s. As no boulderclay is present near the surface, we assume that the occurrence of loamy bands is connected to a permafrost, which apparently disappeared here during Bølling times. In the northern Netherlands the facies with loamy bands ended approximately at the beginning of the Allerød Interstadial. The hypothesis of van der Hammen and Wijmstra, i.e. that the loamy bands are the result of 'niveo-eolian'

sedimentation, seems to be improbable. Niveo-eolian sedimentation tends to result in poorly sorted sand with coarse or indistinct lamination or without structure altogether (Schwan, 1988).

As stated above, the 1975 samples from Usselo are arbitrarily divided into two groups: coarser and finer sands, but as is evident from figure 14 there is a considerable overlap. All samples taken above the Allerød peat layer and the 'Usselo Horizon' belong to the group of coarser samples, thus confirming the general observation that on average the Younger Coversands are coarser than the Older Coversands. Of the samples taken below the Allerød peat or the 'Usselo Horizon' 6 belong to the coarser sands, and 20 to the finer ones. The few samples that were

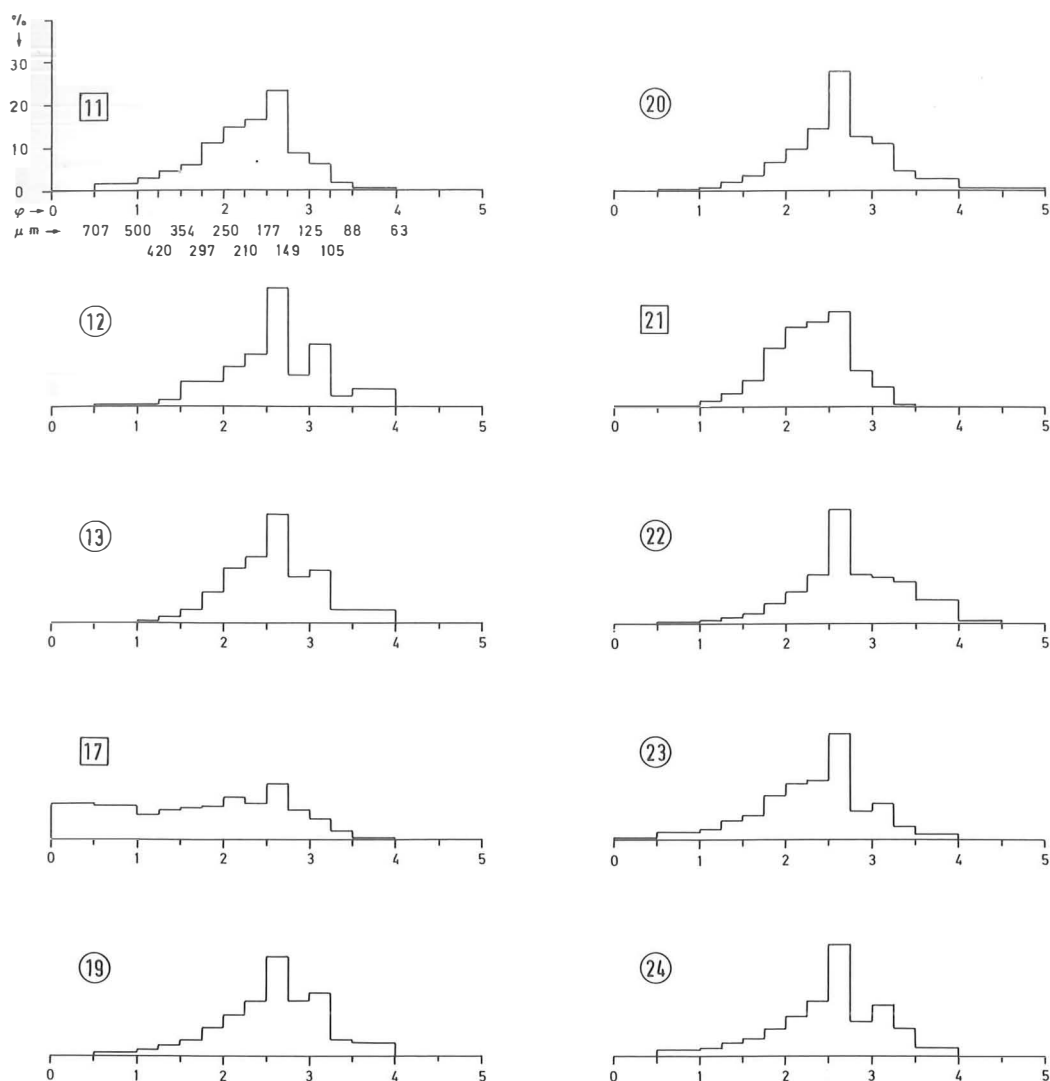


Fig. 11. Grain-size distributions of sand samples from Usselo. Drawing J.M. Smit.

taken in the western part of the section immediately below the 'Usselo Horizon' belong to the fine sands, while below the Bølling (s.s.) layers in the east coarser samples occur again, in addition to finer ones. From top to bottom three zones can thus be distinguished: (1) only coarser samples, (2) only finer samples, (3) coarser and finer samples.

The coarser samples occur also in the sand with 'loamy bands' in the lower half of the section. The deposition of these sands can be suggested as having taken place in a flat sandy area where water was abundant. The analysis by van Geel et al. (1989) has made it clear that at least from the level of the thin organic band (symbol 5 in fig. 3), going upwards, aquatic conditions prevailed most of the time in the eastern part.

Sample 17, taken from one of the lenses of very

coarse sand with gravel, is of aberrant composition, being much coarser than the surrounding material. It is probable that we are concerned here with local formations by running water. As far as the coarser samples from the bottom of the profile are concerned, the 'Beuningen Gravel Bed' can probably be considered as a local source of coarse material.

On the basis of the stratigraphy and the grain-size distributions obtained, compared with the results of van der Hammen (1952) and the data of Wijnstra et al. (1971), it can be deduced that the following coversand layers are present (in the western part of the section the boundary between the two lowermost layers is somewhat arbitrary):

Younger Coversand II: samples 9-11, 17, 25, 26, 36, 37.

Younger Coversand I: samples 4-8, 22-24, 35.

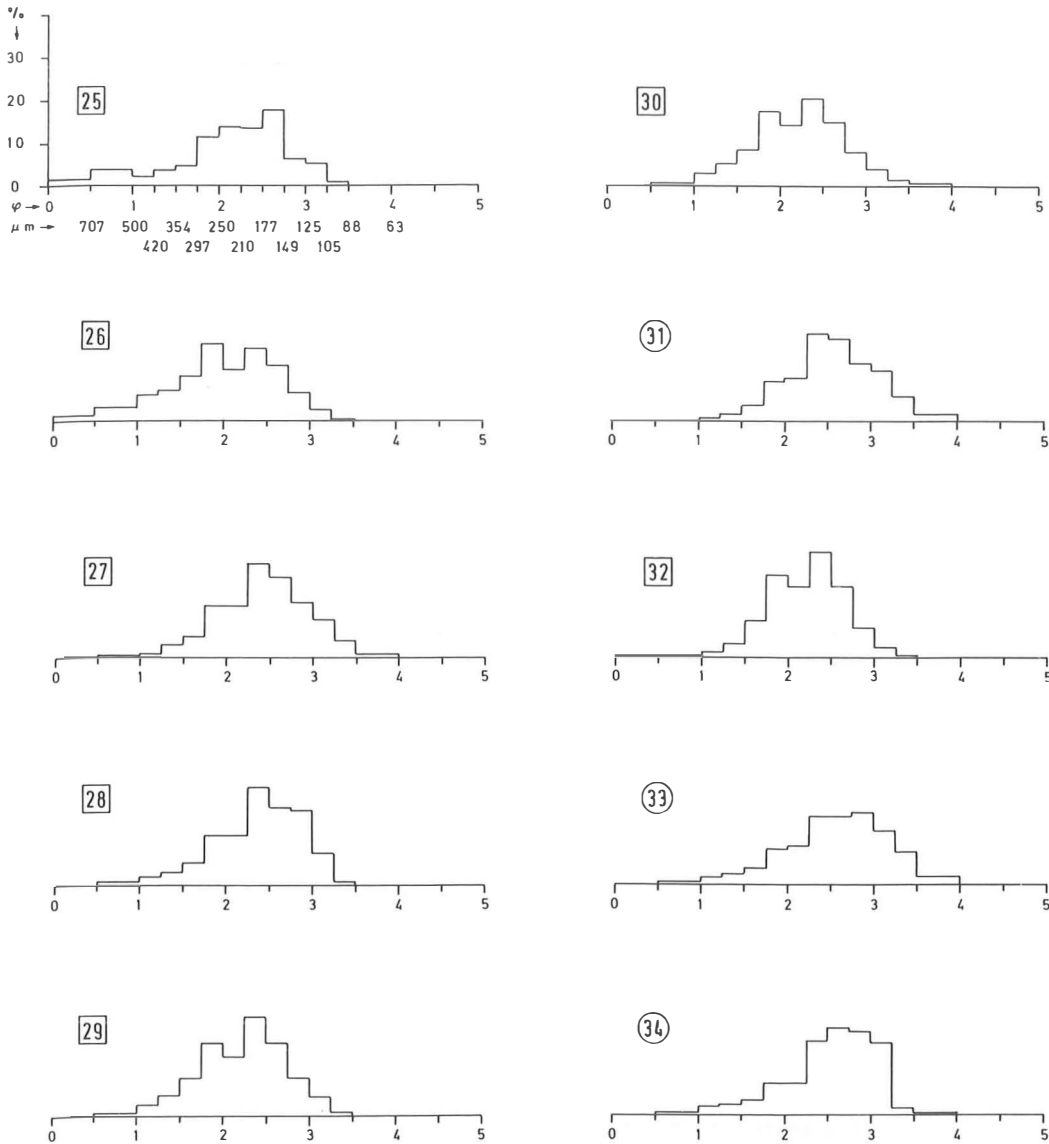


Fig. 12. Grain-size distributions of sand samples from Usselo. Drawing J.M. Smit.

Older Coversand II: samples 1-3, 12, 13, 19-21, 27-33, 38.

The range of median values of grain sizes and the calcium carbonate contents are thus as follows (sample 17 is not included here):

Younger Coversand II – Med. 197-251 μm ; CaCO_3 0.4-1.1%;

Younger Coversand I – Med. 141-186 μm ; CaCO_3 0.4-1.9%;

Older Coversand II – Med. 157-213 μm ; CaCO_3 0.3-1.0%.

From this it follows that the sands in the middle layers of the section contain the highest amount of CaCO_3 . Possibly this may be explained by the CaCO_3 production of the Characeae which are

abundant in the Bølling (s.s.) layers (van Geel, pers. comm.).

From the data presented here it follows once again that the youngest coversand is the coarsest. On the other hand the Older Coversand II is here somewhat coarser than the Younger Coversand I. Sample 17 from the Younger Coversand II is highly aberrant, with its median grain-size value of 294 μm . The median grain-size values and CaCO_3 contents of all samples investigated are given in table 1.

Within our histograms of the finer samples no secondary peaks in the 63-88 μm fraction can be seen. As stated above, both Wijmstra et al. (1971) and van der Hammen (1952) found secondary peaks

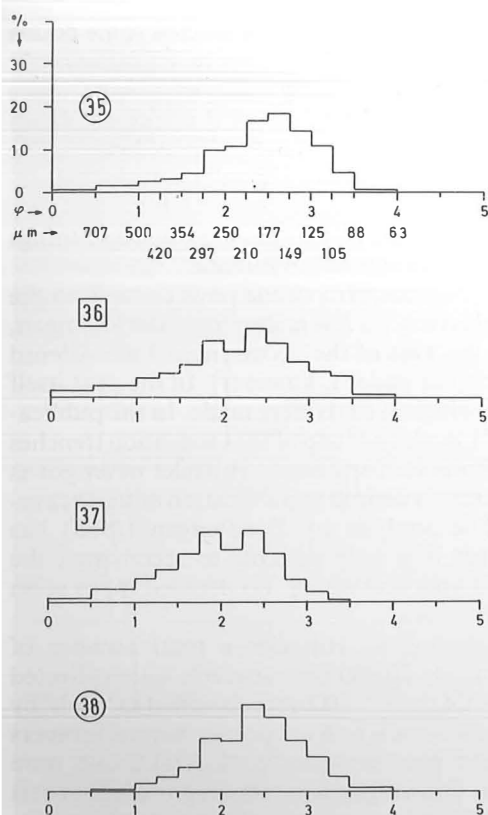


Fig. 13. Grain-size distributions of sand samples from Usselo. Drawing J.M. Smit.

in the 50-75 μm fraction within the Older Coversand, while Ruegg (1983) mentions secondary peaks for his type B coversands in the "coarse silt and/or in the 75-88 μm fractions".

With our histograms of Usselo it is conspicuous that in addition to the usually dominant fraction of 149-177 μm , in the finer sands a secondary peak is often present in the 105-125 μm fraction, but never in the 63-88 μm fraction. We must emphatically point out, however, that some differences with respect to previous data may also be the result of the fact that we measured fractions obtained by sieving that were different from those measured by van der Hammen et al. and Ruegg.

4. SOME REMARKS ON THE ARCHAEOLOGICAL FINDS

The site of Usselo is well-known in archaeology, and in fact all investigations carried out at this locality are a result of the discovery of flint artefacts in June 1937 by Mr. and Mrs. G.C.M. Ballintijn-Wijger. Archaeological excavations were carried out in the years 1940, 1941, 1946 and 1949 under the direction of C.C.W.J. Hijzeler (then head of the archaeological department of the Rijksmuseum Twente in Enschede; deceased in 1982). In a series of articles Hijzeler reported on his finds (Hijzeler, 1947; 1949; 1950; 1955; 1957; 1970; 1974; see also

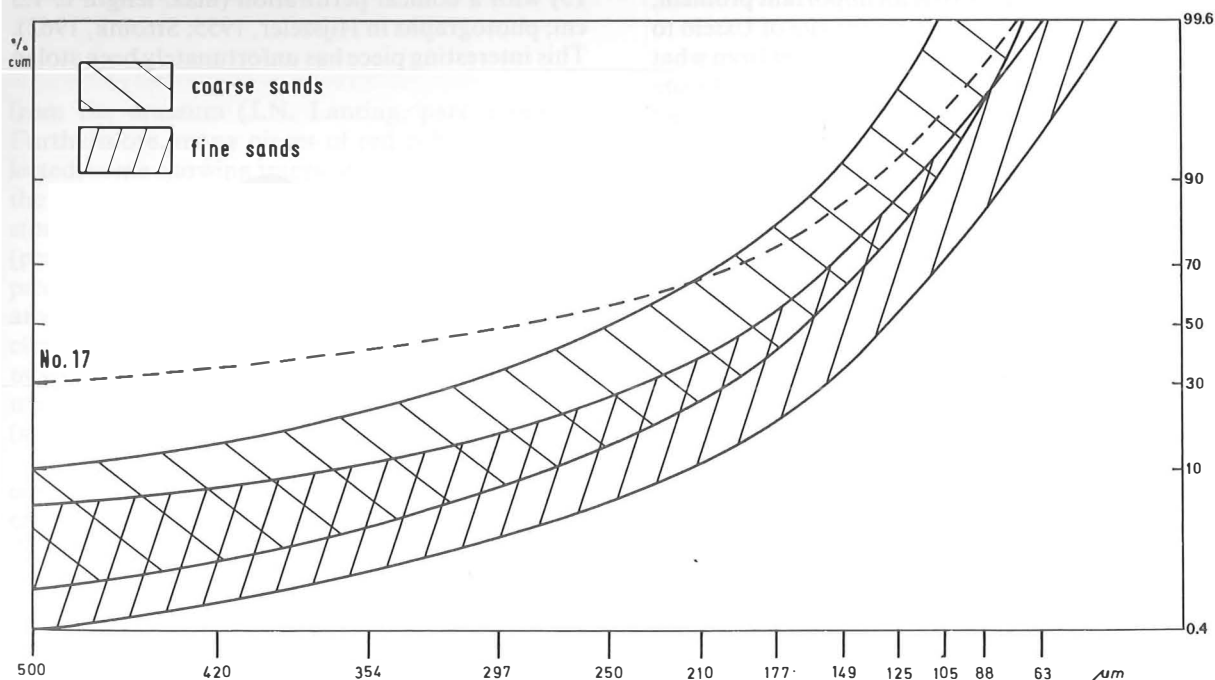


Fig. 14. Schematic diagram of the variability of the cumulative curves of grain-size distributions, in which all sand samples from Usselo (except for No. 17 that is indicated separately) are combined, divided into relatively coarse and relatively fine sands. Drawing J.M. Smit.

Table 1. Median grain-size values and CaCO₃ weight percentages.

| No. | Md | CaCO ₃ | No. | Md | CaCO ₃ |
|-----|-------------------|-------------------|-----|-------------------|-------------------|
| 1 | 157 μm | 0.65 % | 22 | 154 μm | 0.56 % |
| 2 | 181 | 0.40 | 23 | 186 | 0.61 |
| 3 | 170 | 0.45 | 24 | 169 | 0.65 |
| 4 | 172 | 0.35 | 25 | 228 | 0.36 |
| 5 | 149 | 0.47 | 26 | 249 | 0.54 |
| 6 | 168 | 0.41 | 27 | 188 | 0.57 |
| 7 | 172 | 0.45 | 28 | 190 | 0.53 |
| 8 | 141 | 0.54 | 29 | 209 | 1.02 |
| 9 | 210 | 0.44 | 30 | 213 | 0.84 |
| 10 | 201 | 1.09 | 31 | 176 | 1.00 |
| 11 | 197 | 0.56 | 32 | 211 | 0.52 |
| 12 | 164 | 0.73 | 33 | 168 | 0.88 |
| 13 | 166 | 0.58 | 34 | 167 | 1.61 |
| 17 | 294 | 0.79 | 35 | 182 | 1.94 |
| 19 | 162 | 0.62 | 36 | 212 | 0.96 |
| 20 | 165 | 0.57 | 37 | 251 | 0.72 |
| 21 | 200 | 0.34 | 38 | 192 | 0.57 |

Anon., 1940; n.d. – both probably written by Hijzeler –, and Hijzeler & Florschütz, 1941). The site has always been ascribed to the *Federmesser* Tradition (Schwabedissen, 1954), which in the Netherlands and in Belgium is called the Tjonger Tradition (Bohmers, 1947; Paddayya, 1971). The *Federmesser* Tradition is closely related to the Azilian Tradition in France, and at least partially contemporaneous with the Brommian and Creswellian Traditions. There exists an important problem, however, with simply ascribing the site of Usselo to the Tjonger Tradition. As will be evident from what follows, it seems to be highly probable that the site represents multiple occupations, perhaps spread over a time range of more than 1000 years. Though it seems reasonable to suppose that an important proportion of these occupations can be placed in the *Federmesser* Tradition, it is not impossible that also other traditions are represented. It has been argued that in general one should be very cautious in ascribing multiple occupation sites to specific traditions (Stapert, in press a). Usselo belongs to a group of very large sites placed in the *Federmesser* Tradition, and it is of interest to note that such very large sites are virtually unknown from other Lateglacial traditions in the Netherlands. We suppose that the main reason for this phenomenon is of a geological nature. Most sites of this tradition can be dated in the Allerød Interstadial, a period of non-deposition (outside depressions), and multiple occupations would not be separated by sterile deposits. Therefore, favourable habitation spots, for example located on lake borders, could have been used over and over again, resulting in huge accumulations of artefacts.

In the following we will first discuss some points emerging from the publications by Hijzeler, after which some summarizing remarks will be made based on the recent analysis of the finds by Zandbergen (1985). Finally the two finds made while preparing the section in 1975 will be described.

From the papers by Hijzeler among other things the following points are of interest.

a. The great majority of the finds come from the 'Usselo Horizon', 'a few meters' (van der Hammen, 1957) to the west of the occurrence of the Allerød peat layer (see under f, however). In the peat itself no archaeological finds were made. In the publications by Hijzeler no map of the excavation trenches is to be found (unfortunately Hijzeler never got as far as making a definitive publication of his excavations). The analysis by Zandbergen (1985) has shown that it is only possible to reconstruct the excavated area tentatively, no detailed maps seem to have survived.

b. According to Hijzeler a total number of approximately 20,000 flint artefacts were collected in Usselo. Of these c. 800 were classified as 'tools' by Hijzeler, among which are points, borers, scrapers and burins. Numbers per typological group were not given. Drawings and photographs of flint tools are to be found in several publications (Hijzeler, 1950; 1955; 1974; see also Anon., 1940; n.d.; Stroink, 1962). Furthermore, in the Rijksmuseum Twente some unpublished drawings of artefacts from Usselo are kept. Also mentioned is a stone 'pendant' (fig. 15) with a conical perforation (max. length c. 1.5 cm; photographs in Hijzeler, 1955; Stroink, 1962). This interesting piece has unfortunately been stolen

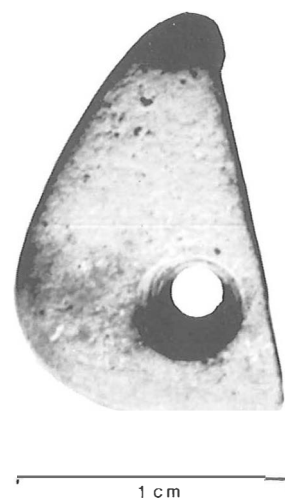


Fig. 15. The stone pendant from Usselo, fine quartzite. Photo Rijksmuseum Twente, Enschede.



Fig. 16. One of the 'pits' at Usselo, excavated by Hjijszeler. These pits most probably originated as a result of ancient treefalls. Photo Rijksmuseum Twente, Enschede.

from the museum (J.N. Lanting, pers. comm.). Furthermore, many pieces of red ochre were collected, some showing traces of rubbing (fig. 20). In the Rijksmuseum Twente, moreover, a 'rubbing-stone' is on display (fig. 20: No. 9). Finally, in Anon. (probably Hjijszeler, 1940) are mentioned "a few pieces of flat stones, that could originate from small anvils". The analysis of Zandbergen has made it clear that many of the original finds are now missing, with the effect that a description of the material from this site cannot be very satisfactory (see below).

c. According to Hjijszeler, many finds occurred in concentrations ('workshops', 'ateliers'). These concentrations were sometimes limited, in terms of depth, to the 'Usselo Horizon', but also occurred in 'pits', the top of which was formed by the 'Usselo Horizon'. These pits were more or less round in a horizontal plane, with a diameter of 1.3-1.5 m, and an average depth of 0.75 m (Hjijszeler, 1974); elsewhere (Hjijszeler, 1957) the diameter of these pits is given as 'about 1 m' and their depth as 'about 0.9

m'. In one of these pits Hjijszeler observed two 'post-holes', that he interpreted as the remains of a tent (i.a. Hjijszeler, 1957). In another article it is stated that 14 such pits were present (Hjijszeler, 1947). The contours of these pits were as a general rule fairly regular on one side, but on the other side irregular. It was striking that the flint artefacts were always present only in the western half of these pits, distributed from top to bottom. Moreover, in the western part of these pits relatively large fragments of charcoal were often present, while in the eastern part 'pulverized' charcoal was found (Hjijszeler, 1947). Another interesting observation by Hjijszeler is that in these pits relatively more burnt flints (*craquelé*) occurred than outside them (Hjijszeler, 1947). Drawings of a few cross-sections through one of these pits are to be found in Hjijszeler (1950: fig. 57). From these drawings it is clearly evident that these pits are asymmetrical in cross-section, the steepest and the most clearly delineated side being the eastern one. All the observations described by Hjijszeler make it most probable in our opinion that

we are concerned here with traces left by trees that were blown down during westerly gales (Kooi, 1974). Photographs that are present in the Rijksmuseum Twente in Enschede confirm this interpretation (fig. 16). Here we are most probably concerned with (dead?) pine trees, that evidently became burnt only afterwards (in view of the relatively larger quantities of burnt flints in these pits, because burnt trees are less likely blown down). If this is true it cannot be concluded that "the bulk of the charcoal from the fossil surface layer [the 'Usselo Horizon'] was present at the time when prehistoric man was living at the site, and thus [that] the culture cannot be older than c. 10,800±160 years B.P." (i.e. not older than the end of the Allerød Interstadial) (van der Hammen, 1957). Evidently at least some of the finds were already present before some of the forest fires happened at this spot, and also before at least some of the treefalls (because of the distribution of the flints within the pits: from top to bottom in the western half), thus before the end of the Allerød Interstadial.

Hijzeler (e.g. 1974) mentions that these 'concentrations' of flints ('ateliers', whether or not present in pits) differed from one another with respect to typology. Thus, some 'ateliers' occurred with the only tools present being scrapers, while others included only burins. This observation potentially is of great interest from an archaeological point of view, but it cannot be substantiated anymore, unfortunately, because we found that the documentation of the excavation is very poor. For example, the finds are not numbered in any systematic way, and cannot be plotted in distribution maps.

d. Apart from the 'concentrations' mentioned under c Hijzeler found at least one concentration

of another type: "At a spot about 10 cm in diameter and 15 cm deep, we found 126 objects, consisting of cores, blades, etc. and of many small flakes". Such small compact concentrations of predominantly flint waste can be interpreted as 'dumps' of seated flintworkers, and are also known from other Late Palaeolithic sites (e.g. the Hamburgian site of Oldeholtwolde: Stapert, 1982; see also Karlin & Newcomer, 1982).

e. In various articles by Hijzeler hearths are mentioned, that were clearly described as lying outside the flint concentrations. The charcoal in these hearths apparently consisted (mainly) of *Pinus*, as is also the case with the natural charcoal in the 'Usselo Horizon'. In Hijzeler (1947) there is mention of 6 hearths, in association with which there were 'hardly any flints'. In a later publication (1955), dating from after the last excavation in 1949, 8 hearths are mentioned. Van der Hammen (1957) considers it not impossible that (some of) the forest fires occurring at the end of the Allerød Interstadial or in the beginning of the Late Dryas Stadial were the result of human activities. There are no drawings or photographs of the hearths included in the articles by Hijzeler. In general hearths at Late Palaeolithic sites in the Netherlands are scarce, possibly i.a. because the charcoal eventually blew away.

From the Hamburgian site of Oldeholtwolde (dating from the end of the Early Dryas Stadial or the beginning of the Allerød Interstadial) a large constructed hearth is known, formed by close-set flat stones in a shallow pit, beneath which charcoal was present (Stapert, 1982). Evidently we are not dealing with this kind of hearth in Usselo, although Hijzeler does mention a few flat stones (see under b). According to Zandbergen (1985), however, only 51 stones are (still) present in the Usselo collection (apart from the 'rubbing-stone') that are in general very small (the mean maximum diameter is only c. 3 cm; not more than 6 stones are between 6 and 8 cm in any diameter). Especially sandstones and quartzites are present. These stones are not at all comparable with the hearth stones of Oldeholtwolde and other Late or Upper Palaeolithic sites. We have to face the possibility, however, that more stones have been present originally that are now lost. Lanting and Mook (1977) point to the danger that an "incidental concentration of charcoal, connected with the forest fires of the Late Allerød" may be interpreted as a hearth. As an indication of this might serve at Usselo the fact that according to Hijzeler hardly any flints were found in the vicinity of the hearths, this being not totally impossible but certainly unusual. Often the Late Palaeolithic hearths were precisely centres of human activity (Stapert, 1989; in press a). Thus around the hearth of Oldeholtwolde there lie thousands of flints (see

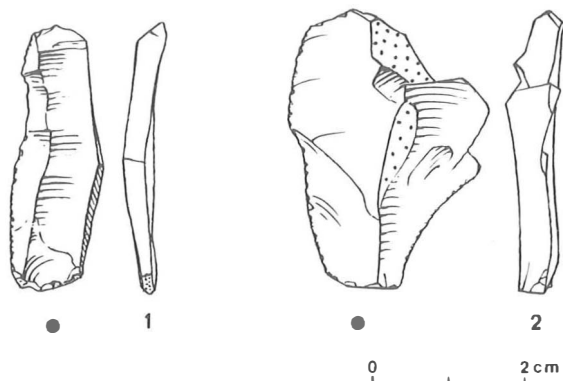


Fig. 17. Two flint artefacts, found during the preparation of the section in 1975 (for the findspots see fig. 3). The regular stippling indicates old frost-split faces; the solid circle indicates the location of the point of percussion. Drawing J.M. Smit.

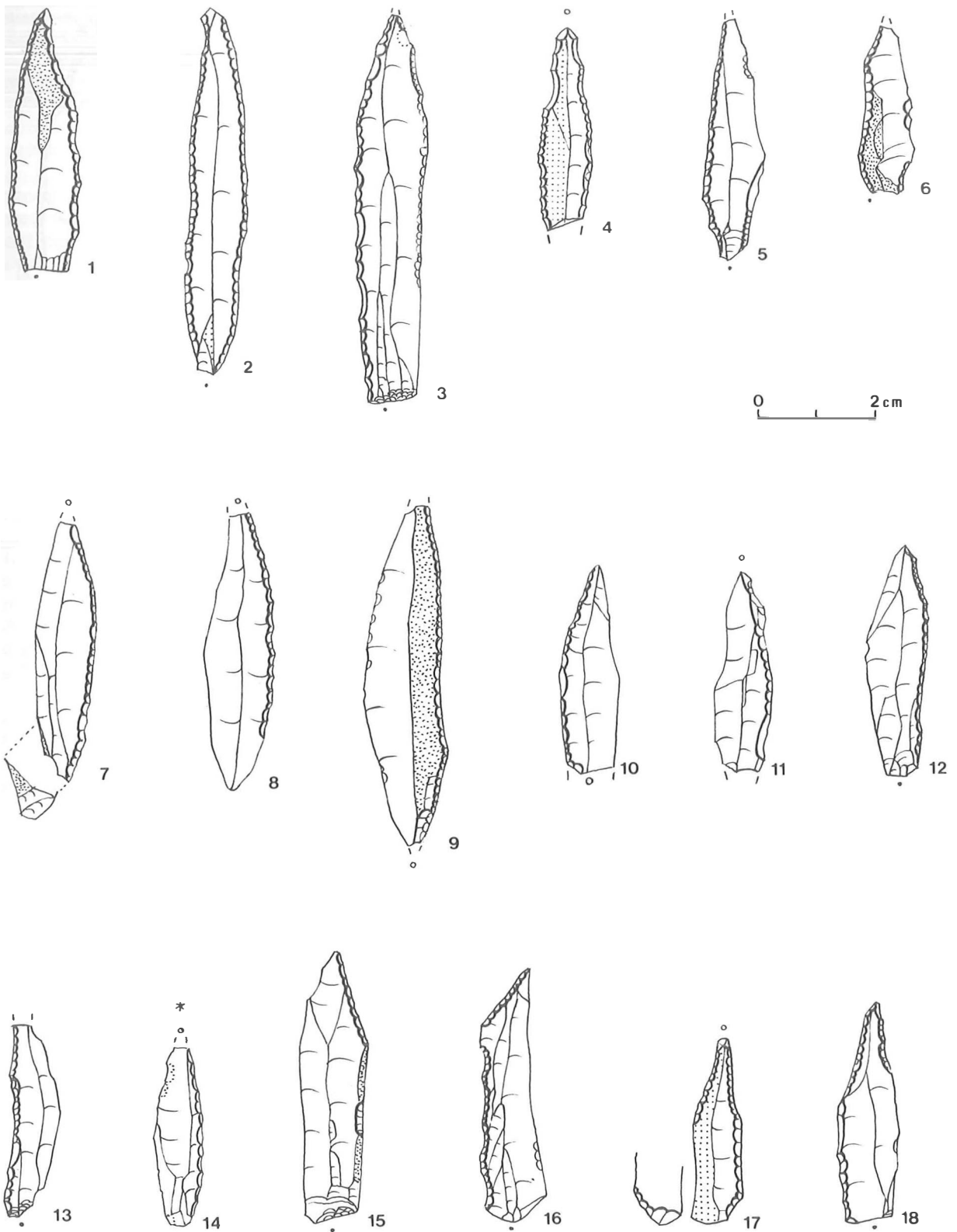


Fig. 18. Some points from the Usselo collection, Rijksmuseum Twente (Enschede). Tjonger/Gravette points: Nos 3, 5, 6-14; Kremser points: Nos 1, 2, 4, 17, 18; Creswell points: Nos 15, 16. No. 2 is probably manufactured from Meuse flint. Drawing H.R. Roelink.

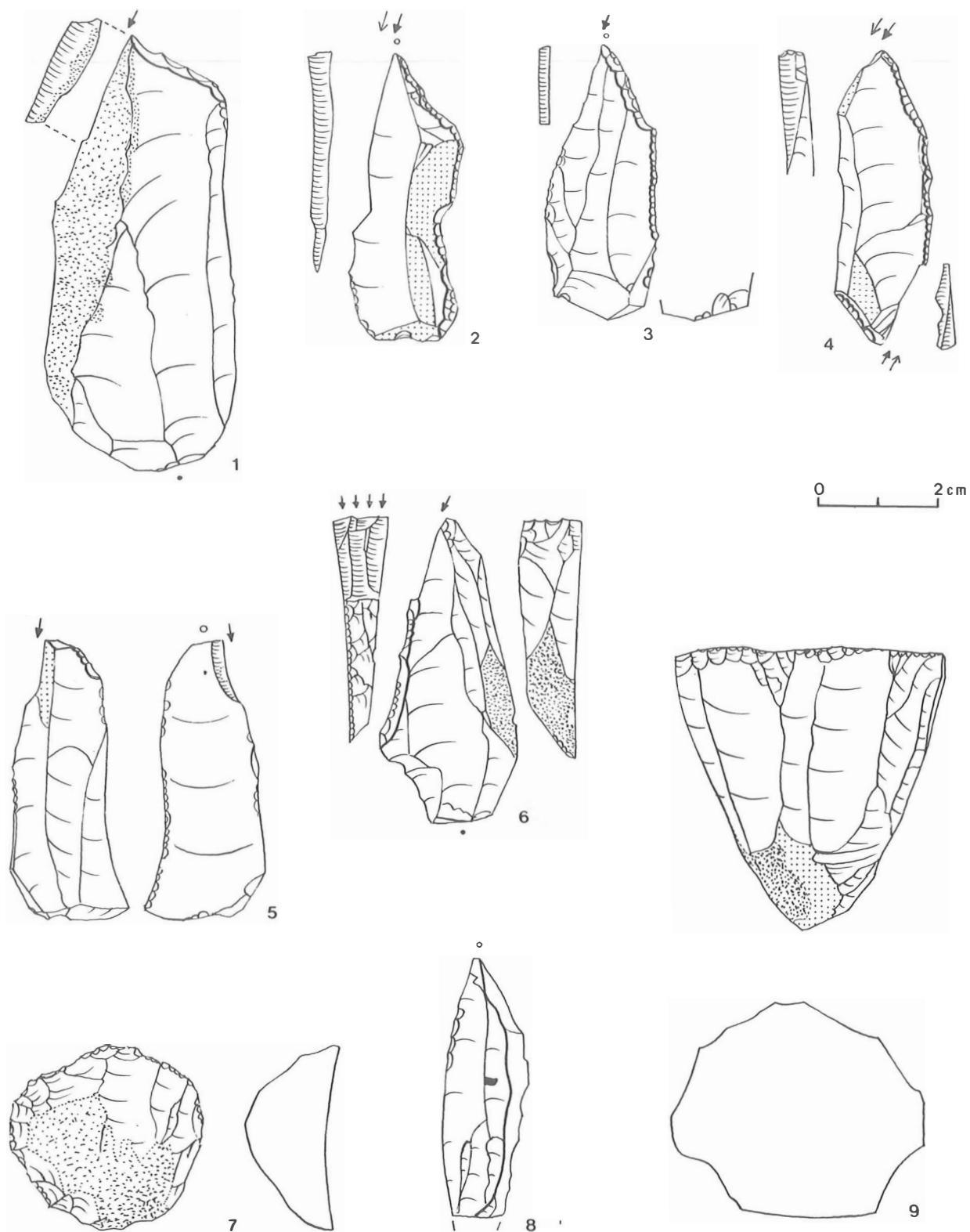


Fig. 19. Some artefacts from the Usselo collection, Rijksmuseum Twente (Enschede). Burins: Nos 1-6; scraper: No. 7; blade: No. 8; conical core: No. 9. No. 1 is probably manufactured from Meuse flint. Drawing H.R. Roelink.

also i.a. the Late Magdalenian site of Pincevent: Leroi-Gourhan & Brézillon, 1972).

f. In two publications of Hijszeler mention is made of finds coming from the coversand above the Allerød peat layer or the 'Usselo Horizont': "In this eolian sand, that is thus younger than the old culture layer ['Usselo Horizon'], we found two more flint-working areas, so-called ateliers. Although on the basis of stratigraphy these ateliers were clearly younger than the ateliers lying in the old culture layer, this difference in age was also evident from the objects themselves. [...] The two other ateliers are younger, and date from the Middle Stone Age" [= Mesolithic] (Both citations from: Anon. – probably Hijszeler –, 1940). "In the [deposits representing the] younger part of the dune [above the Allerød peat and the 'Usselo Horizont'] two flint-working areas were found, that could be dated in the Middle Stone Age" (Hijszeler & Florschütz, 1941). No drawings have been published of these flints, or of their precise stratigraphical position, and in later publications of Hijszeler they are not mentioned.

In 1985 A.L. Zandbergen (then a B.A.I. student) studied the finds from Usselo present in the Rijksmuseum Twente in Enschede (Zandbergen, 1985). All the finds were individually numbered by him, and he counted in total 12,924 flint artefacts (in addition to 52 stones of other material, 17 pieces of red ochre, 1 fragment of pottery, and some particles of charcoal). This is about 7000 less than the total number of flints mentioned by Hijszeler: c. 20,000. It seems therefore evident that a large part of the original material is missing (in this connection we should point again to the 'pendant' which has been stolen, see under b). Since it is possible that the number given by Hijszeler is only a guess, it was decided to test the idea that many artefacts are missing by another method. All drawings and photographs (whether published or not) of artefacts from Usselo were collected, and it was then attempted to find the objects themselves. Of the artefacts represented in the figures 39% (67 cases) could not be found, which clearly means that indeed many finds from Usselo are lost meanwhile.¹

It was furthermore concluded that the excavation was not documented satisfactorily. Detailed distribution maps are not available, the finds have not systematically been numbered, and notes on their stratigraphical occurrence are not available. This means, for example, that the finds presumably made in the Younger Coversand II cannot be isolated from the rest, if they are indeed still present in the museum collection as it exists today. It also means that, archaeologically speaking, the Usselo collection cannot play any important role in discussions of the Late Palaeolithic of the Netherlands:

it is now merely a collection of artefacts from one known location.

Of the 12,924 flint artefacts counted by Zandbergen, 2860 are 'chips': pieces smaller than 1.5 cm in any dimension (of which 39 show retouches – this does not necessarily imply that they are fragments of tools). Of the remaining artefacts larger than 1.5 cm (in total 10,064), 1289 were classified as tools by Zandbergen, this is c. 13%.

The tools (fragments and complete tools all counted as 1) comprise, according to the counts by Zandbergen (in 1986 more tools came to light¹): scrapers 607 (47%), burins 253 (20%), points and 'knives' 138 (11%), borers 47 (4%), combination tools 32 (2%), obliquely truncated blades 13 (1%), notched pieces 11 (1%), rest (retouched blades, flakes, etc.) 188 (15%). For some drawings of archaeological material from Usselo, see figures 18-22. Among the points (figs 18, 21) the following types were noted: Tjonger/Gravette points 47, Creswell points 13, Cheddar point 1, B-points 6, obliquely blunted points ('long B-points') 3, Kremen points 6, pen-knife points 3, Azilian points 2, Zonhoven point 1, small shouldered point 1, Bronze Age point 1, Mesolithic point 1, point-fragments 27, backed blades 3, fragments of points or backed blades 23. Most of the scrapers are short flake scrapers, though blade scrapers also occur. Several scrapers (fig. 22) are tanged (like the ones from the Creswellian site of Siegerswoude: Kramer et al., 1985). Among the non-tools 3154 blades or blade-fragments are present, and 431 cores or core-fragments. Most of the cores are irregular, or only worked ephemerally, but there is one regular conical core (fig. 19: No. 9). Among the blades there is one with a somewhat rounded proximal end; such pieces have presumably been used as fire-lighters (Stapert et al., 1986). In Usselo 17 pieces of red ochre have been found, of which 7 have one or a few rubbed faces (fig. 20: Nos 1-8). It is of interest to note that a few artefacts belonging to the Mesolithic (needle-shaped point) and the Bronze Age have been found; in fact several of the B-points and the short scrapers could perhaps also belong to the Mesolithic. These finds must come from the surface.

The variety of point types is striking. Together with the fact that the total amount of flint artefacts is relatively high, this forms a good indication for the hypothesis that we are dealing here with a multiple occupation site. Though it seems clear that the majority of the finds can be placed in the Tjonger Tradition, it cannot be excluded that other traditions are also represented with smaller numbers of artefacts. For example, the Creswellian Tradition could very well be represented, in view of the presence of several Creswell points, 1 Cheddar point, obliquely blunted points, tanged scrapers and blade end scrapers.¹ Also, we should envisage

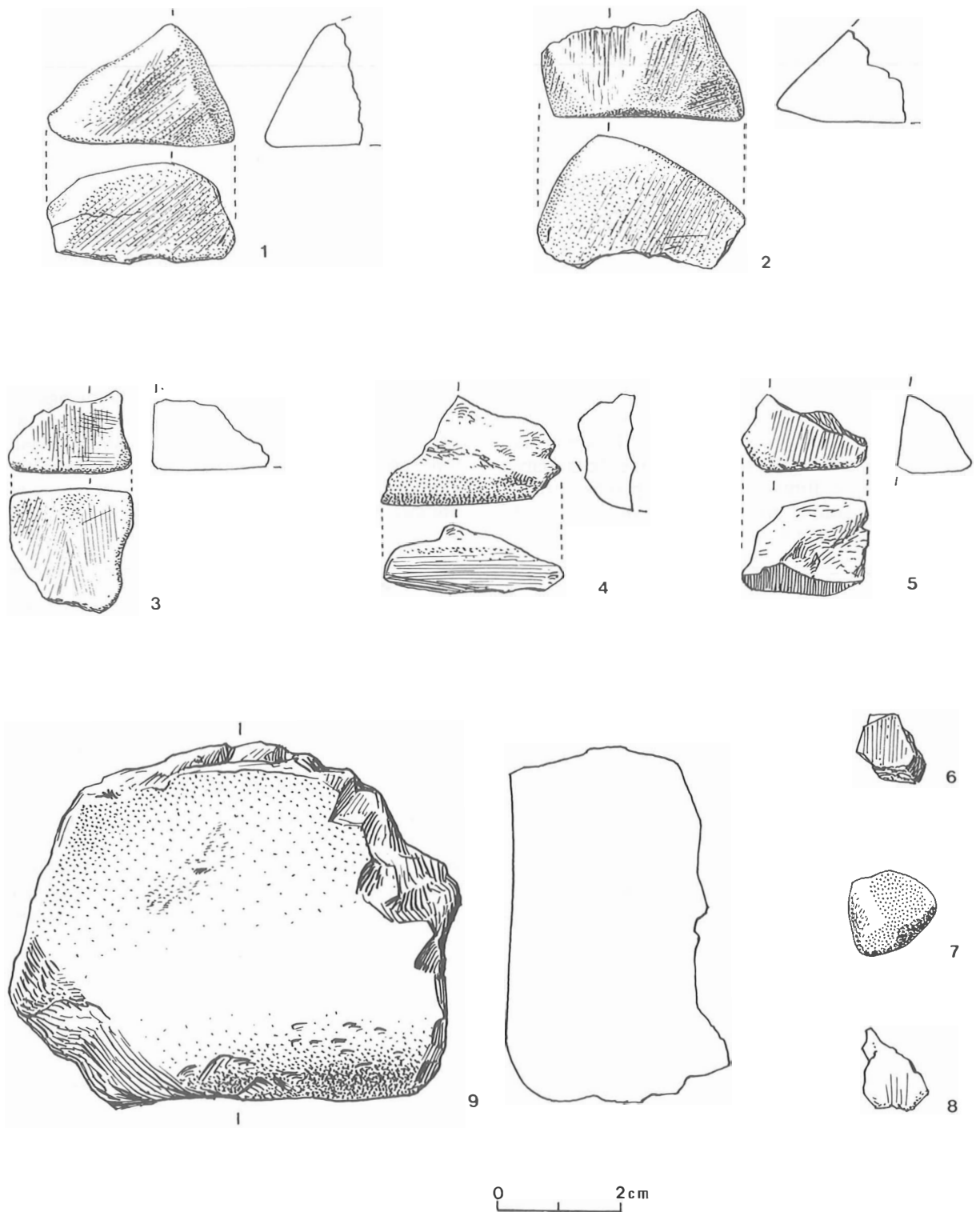


Fig. 20. Some artefacts from the Usselo collection, Rijksmuseum Twente (Enschede). Red ochre: Nos 1-8; 'rubbing stone' (sandstone): No. 9. Drawing H.R. Roelink.

that the Tjonger finds do not all derive from one occupation phase but probably from many habitation events.

While the section was being cleaned, two flint artefacts were found (fig. 17); the sites at which they were found are indicated in the drawing of the section (fig. 3: symbol 22).

Find 1. This is a complete blade, with a maximum length of 3.4 cm. The right edge consists of an almost transversely oriented face, partly formed by a remnant of an old frost-split face. The left edge shows edge-damage, that is probably a result of use. The striking platform remnant consists of cortex (white). The blade is made of brownish-greyish fine-grained moraine flint, and displays a slight gloss patina.

Find 2. This is a complete flake, with a maximum length of 3.6 cm. Dorsally a few remnants of old frost-split faces have been preserved (indicated by stippling in the figure), while the striking platform remnant also consists of an old frost-split face. Along the edges there are traces of edge damage, perhaps the result of use. The flake is made of moderately fine-grained light-grey moraine flint, and its surface shows distinct gloss patina.

Find 1 came to light precisely at the spot where the 'Usselo Horizon' passes into the Allerød peat layer, actually on top of the 'Usselo Horizon', that is recognizable from this point over a distance of approximately 1 m towards the east, lying on top of the peat layer (perhaps because of erosion). The stratigraphical location of the find makes it probable that this find is younger than at least the middle of the Allerød Interstadial (van Geel et al., 1989). The find undoubtedly belongs to the Tjonger finds excavated by Hipszeler from the 'Usselo Horizon' to the west of the peat layer; evidently this occupation extended eastwards as far as the lateral extremity of the peat layer, and is at least partially younger than the period in which the peat formed.

The stratigraphical position of the second find is more difficult to comprehend. This find came from between meters 3 and 4 on the horizontal scale-bar in figure 3, approximately 85 cm above the top of the Allerød peat layer. It lay in a fairly thick infiltration band (orange coloured), that most probably marks the top of a small dune at this spot, that must have formed in the first part of the Late Dryas Stadial. In view of the course of this infiltration band, it is probable that in the western part of the section hardly any coversand was deposited during the first part of the Late Dryas Stadial. In that case flint artefacts from the 'Usselo Horizon' could very well date from the first part of the Late Dryas Stadial (see in this connection also van der Hammen, 1952: fig. 34). Above the spot where the flake

was found there is still c. 0.5 m of coversand left, though originally there must have existed a thicker layer of sand here, as part of the top of the section has disappeared (in view of the absence of the Holocene podsol at the top). It is therefore clear that the findspot lies approximately halfway through the layer of Younger Coversand II, that was deposited mainly during the Late Dryas Stadial. Unfortunately the specimen itself gives no clue as to its cultural affinity. Of course we are only concerned here with a single find, and caution is indeed always necessary in interpreting finds made during the preparation of a section. Moreover, traces of roots were present close to the findspot. In the field, however, we were convinced that we were dealing with an *in situ* find.

As mentioned previously (under f), Hipszeler found two 'flint-working areas' in the sand above either the Allerød peat layer or the 'Usselo Horizon'. From his description we must deduce that these finds were embedded in coversand, not located on top of it. Hipszeler places these finds in the Mesolithic, but gives no typological arguments to support his view.

It is our conviction that Mesolithic finds cannot be expected from the middle of the Younger Coversand II. Mesolithic finds could possibly occur at the top of the Younger Coversand II. In that case it is very well possible that they could have become displaced downwards to some extent as a result of bioturbation, but not so far as to end up in a position distinctly below the Holocene podsol, in the yellow sand, which is where our find 2 occurred. Also the presence of distinct gloss patina on find 2 is indicative rather of an age greater than Mesolithic.

In the southern half of the Netherlands we know Ahrensburgian sites dating from the Late Dryas Stadial (for example Geldrop). In the nearer surroundings of Enschede we know the Late Ahrensburgian ('Epi-Ahrensburgian') site of Gramsbergen (Goutbeek, 1974; Stapert, 1979); this site yielded all the tool types that are characteristic for the Ahrensburgian Tradition, except for tanged points. In terms of stratigraphy the finds of Gramsbergen occurred at the top of the Younger Coversand II; at some depth gyttja was found dating from the Allerød Interstadial. A ¹⁴C dating of charcoal from a pit (the character of which is not clear) pointed to the Preboreal (GrN-7793: 9320±60 BP), but the dating probably is too young, because of insufficient pretreatment (J.N. Lanting, pers. comm.). We must assume that during the Late Dryas Stadial, too, it was very well possible for people of the Ahrensburgian Tradition to maintain themselves in the eastern Netherlands, also in view of the finds made by Rust in the surroundings of Hamburg (e.g. Stellmoor: Rust, 1943), and because we now know one Ahrensburgian findspot in Friesland, near

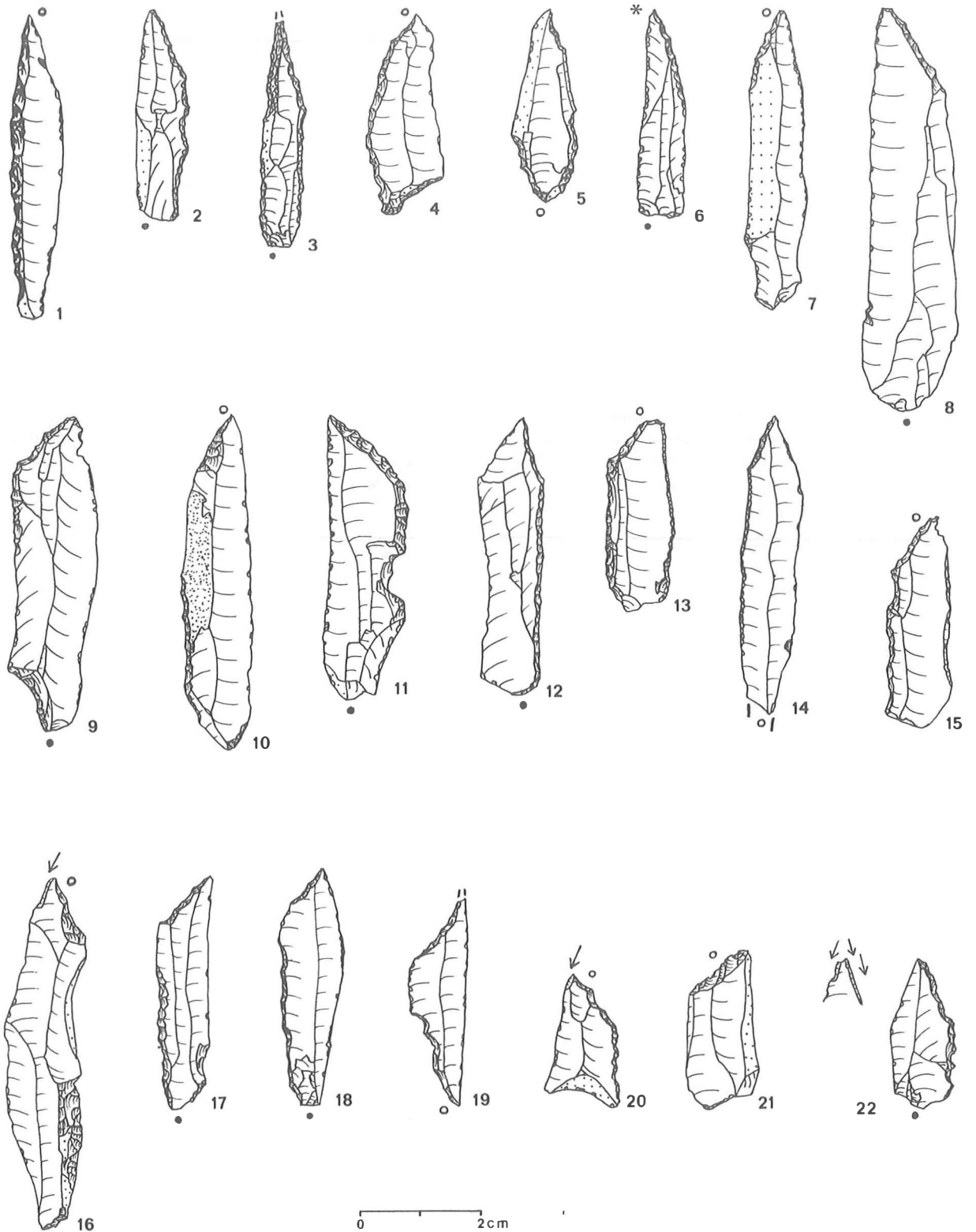


Fig. 21. Some points from the Usselo collection, Rijksmuseum Twente, Enschede. 1, 2. Tjonger/Gravette points; 3. Kremser point; 4, 5. Penknife points; 6-8. obliquely blunted points; 9. atypical Cheddar point; 10-18. Creswell points; 19. small shouldered point; 20-22. microlithic points. Nos 8, 10 and 16 are manufactured from Meuse flint. Drawing F. de Vries, Groningen.

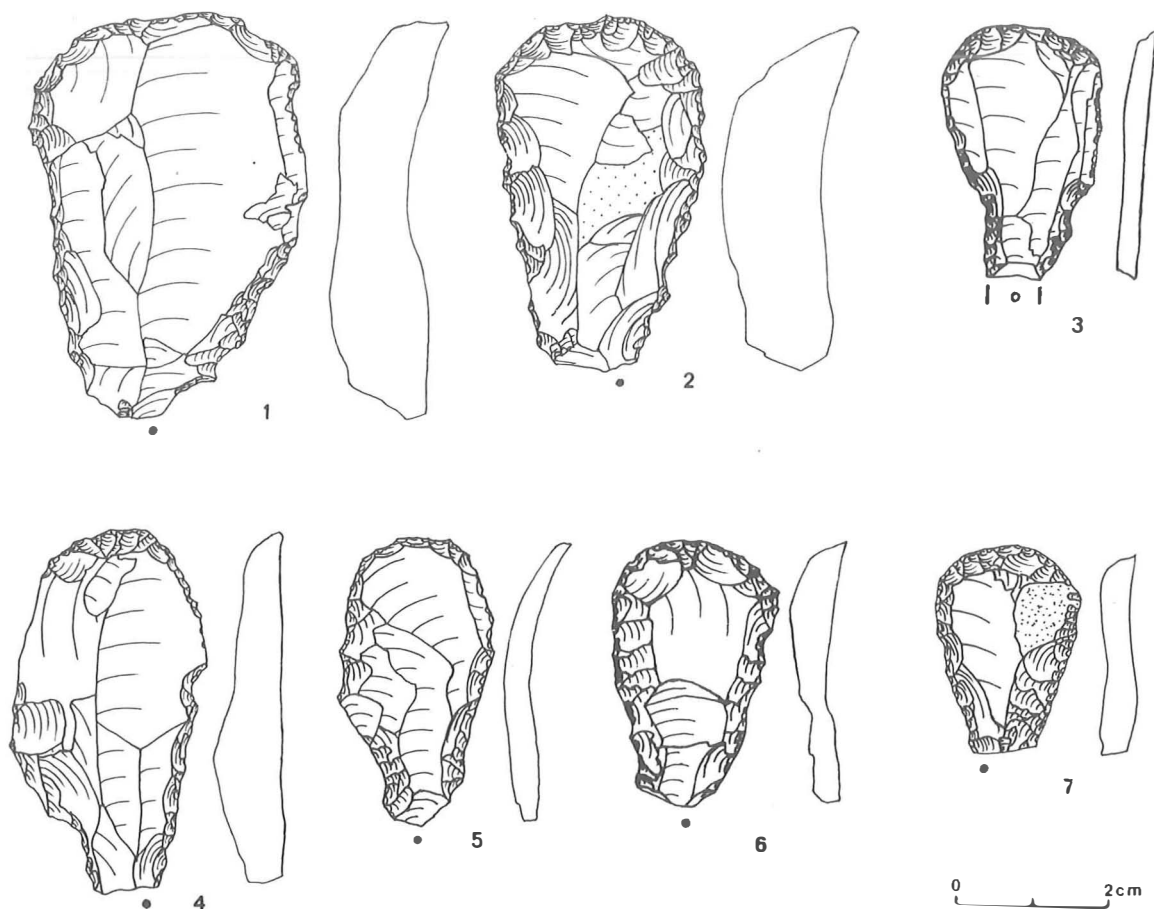


Fig. 22. Some 'tanged' scrapers from the Usselo collection, Rijksmuseum Twente, Enschede. Drawing F. de Vries, Groningen.

Oudehaske (Stapert, in press b). Among the points of the Usselo collection in the Rijksmuseum Twente, however, there are no typical Ahrensburgian tanged points present. We do have a few B-points and one Zonhoven point, types occurring both in the Ahrensburgian and the Mesolithic. Large blades, which mostly occur in Ahrensburgian assemblages, are however missing in Usselo (except perhaps for one fragment). Thus, it seems improbable that the finds, recovered in Usselo from the Younger Coversand II, can be placed in the Ahrensburgian Tradition, though this cannot be excluded completely.

Another possibility is that we are concerned here with people who still 'belonged' to the Tjonger Tradition. There are various indications which suggest that the Tjonger Tradition was still in existence during the Late Dryas Stadial. In the first place we can point to the site of Meer in northern Belgium (van Noten, 1978; Cahen et al., 1979). From hearths found there a number of ^{14}C datings is available, indicating that the Tjonger Tradition

may have been present there even during the entire Preboreal (Lanting & Mook, 1977). However, it is not proven that all the hearths at that site really belong to the Tjonger occupation; the possibility that mixing has occurred with Mesolithic material cannot be excluded, and in fact seems very probable. A second example is the site of Een-Schipsloot in the northern Netherlands (Houtsma et al., 1981). Here natural pits were present, which were formed by a 'periglacial' mechanism (Casparie & ter Wee, 1981; see also de Groot, Cleveringa & Klijnstra, 1987), and that can be dated in the Late Dryas Stadial. Some of the Tjonger finds date from before the formation of these pits, and may therefore very well date from the Allerød Interstadial, but others date from after the formation of the pits, and must therefore date from the Late Dryas Stadial. Consequently there are good indications of repeated habitation at this spot, so the horizontal distribution patterns of the finds can provide hardly any useful information as to the spatial distribution of various human activities at the site. As we have

seen, in the case of Usselo, too, we have good reason to believe that we are dealing with a multiple occupation site. Perhaps in Usselo too we should envisage Tjongerian habitation during the Late Dryas Stadial, to account for the finds of Hijzeler and of us in the Younger Coversand II.

It may even be possible that find No. 2 is more or less contemporaneous with many of the finds from the 'Usselo Horizon' (see under 2). In that case at least some Tjongerian visitors of the site did not live here when the pool, in which the peat formed, was still in existence, but only after the formation of the small dune in the eastern part of the section. Even in that case, however, running water was locally present in the immediate vicinity during at least parts of the first half of the Late Dryas Stadial (see under 2 and van Geel et al., 1989).

Finally, it should be mentioned here that locally in the western part of the section, in and just above the 'Usselo Horizon', some red patches were observed in the sand. These patches of red coloration can presumably be attributed to the presence of red ochre brought here by prehistoric people, as we know that quite a lot of ochre was used at the site. In this connection it is interesting to note that scrapers are the most numerous type-class in Usselo. It is known that scrapers mostly served to work hides, and it is possible that ochre was rubbed into hides to improve their preservation (e.g. van Noten, 1978).

If we accept the possibility that some of the Tjongerian finds at Usselo date from the first half of the Late Dryas Stadial, this would imply quite a long period of occupation at the site. We have good reasons for believing that occupation started in any case before the end of the Allerød Interstadial and we cannot exclude occupation during the first half of this interstadial, for example by people of the Creswellian Tradition. Thus, occupation took probably place here many times during a rather long period that can summarizing be described as: parts of the Allerød Interstadial and parts of the first half of the Late Dryas Stadial.

5. ACKNOWLEDGEMENTS

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6. NOTE

1. In 1986 a number of finds (46 flint artefacts) came to light that were hitherto unknown to us (they were kindly brought to our attention by A.D. Verlinde of the R.O.B.). These include: 2 Tjonger/Gravette points, 2 Creswell points (one of which is manufactured from Meuse flint), one 'obliquely blunted point' (or 'long B-point', this point is made of Meuse flint), one obliquely truncated blade, 4 blade end scrapers (one of which has one retouched side), 3 double flake scrapers, 5 tanged scrapers, 10 flake scrapers (one of which is made of flint containing bryozoa, and another of Meuse flint), one retouched nodule, and 3 cores (two of which have two opposite striking platforms, one has only one platform; one of the cores is burnt). Most of these flints were manufactured from northern moraine flint, but three are clearly made of Meuse flint (grey-coloured with small light and dark spots, rather coarse-grained). A subsequent inspection of the whole Usselo collection (as it exists today) indicated that the following artefacts are certainly or probably manufactured from Meuse flint: 2 Creswell points (fig. 21: Nos 10, 16), 2 obliquely blunted points (one is illustrated: fig. 21: No. 8), 2 retouched bladelets, 21 blades or blade-fragments, 1 borer, 2 flake scrapers, 3 burins. The technical quality of these pieces is high, and it is of interest to note that the three points of Meuse flint are typical for assemblages of the Creswell Tradition. As noted before, tanged scrapers are also well-known from several Creswellian assemblages in the northern Netherlands (Siegerswoude, Zeijen). Therefore, the possibility exists that at least one of the occupation phases at Usselo could be placed in that tradition. The occurrence of artefacts made of Meuse flint does not necessarily imply that they were imported from the southern Netherlands. In the eastern Netherlands locally Pleistocene river gravels are present (in terrace remnants), containing Meuse flints (A.E. van de Meene, Geological Survey of the Netherlands, pers. comm.). Therefore, Meuse flints could have been collected in the not too far surroundings of Usselo.

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