

SWIFTERBANT, OOST FLEVOLAND, NETHERLANDS:
EXCAVATIONS AT THE RIVER DUNE SITES, S21-S24, 1976
Final reports on Swifterbant III

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CONTENTS

1. INTRODUCTION
2. GEOLOGY
3. PREVIOUS WORK AT PARCEL H46
4. THE 1976 INVESTIGATIONS
 - 4.1. Mapping and borings
 - 4.2. Excavations at S22
 - 4.3. Excavation of S21, Grave XI
 - 4.4. Excavation at S23
 - 4.4.1. *Features*
 - 4.4.2. *Artifacts*
 - 4.5. Sondage at S24
 - 4.6. Dating
 - 4.6.1. *Isotopic*
 - 4.6.2. *Artifactual*
 - 4.7. Depositional Processes
5. SUMMARY AND CONCLUSIONS
6. ACKNOWLEDGEMENTS
7. BIBLIOGRAPHY

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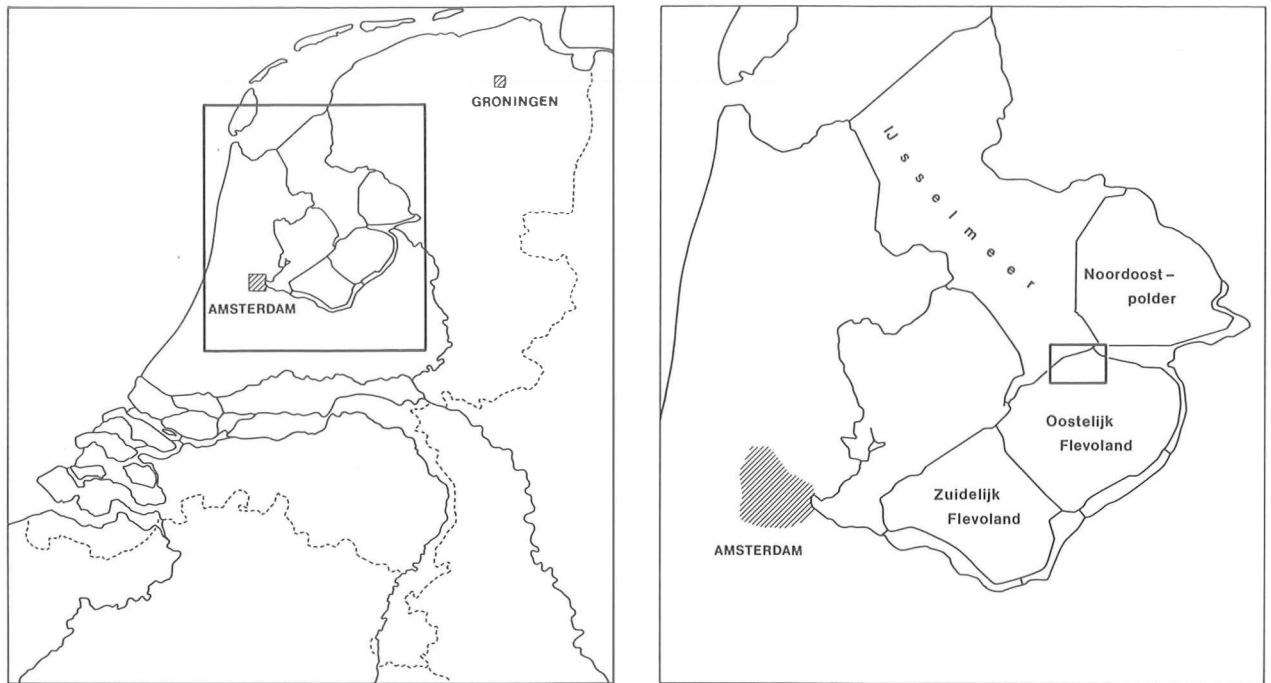


Fig. 1 a. The Netherlands at the present time, showing the location of the Swifterbant area.

1. INTRODUCTION

The region around the town of Swifterbant on the polder (reclaimed land) of Oost Flevoland in the Netherlands (fig. 1 a) offers rare opportunities to the archaeologist. Until roughly 3000 B.C.,* this area was part of a larger landscape that at one time extended across the dry bed of the English Channel. The gradual rise of sea level during the early Postglacial epoch transformed the region into a freshwater tidal delta at the mouth of the Old IJssel River, just prior to complete inundation. After 3000 B.C. this submerged surface was slowly covered with marine and freshwater deposits. Reclamation of the polder of Oost Flevoland, beginning with the closing of the dikes in A.D. 1956, once again has exposed the surface to the open air. Thus, beneath roughly one meter of sediments, at a depth of approximately five meters below modern sea level (Dutch N.A.P.: Nieuw

Amsterdams Peil), an intact land surface dating from prior to 3000 B.C. is preserved and accessible to the prehistorian.

The remains of Mesolithic and Neolithic materials were discovered on this buried surface initially in the 1960's in two distinct geomorphological situations: clay levees along the former stream channels and sand dunes along the former river banks. The investigation of the prehistoric human occupation of the area continued in the 1970's as a major research project under the overall direction of the Biologisch-Archaeologisch Instituut of the State University of Groningen.

This report details one portion of the larger research project, the excavations at one of the river bank dunes, located in the parcel designated as H46 on the polder of Oost Flevoland, to the north of the present town of Swifterbant (fig. 1 b). The excavation sites in this parcel are designated as S21, S22, S23, and S24 (fig. 2). These investigations were conducted by the University of Wisconsin-Madison in 1976. Geological investigations at the dune in

* In this paper, all radiocarbon dates cited are uncalibrated; therefore B.C. should be read as b.c.

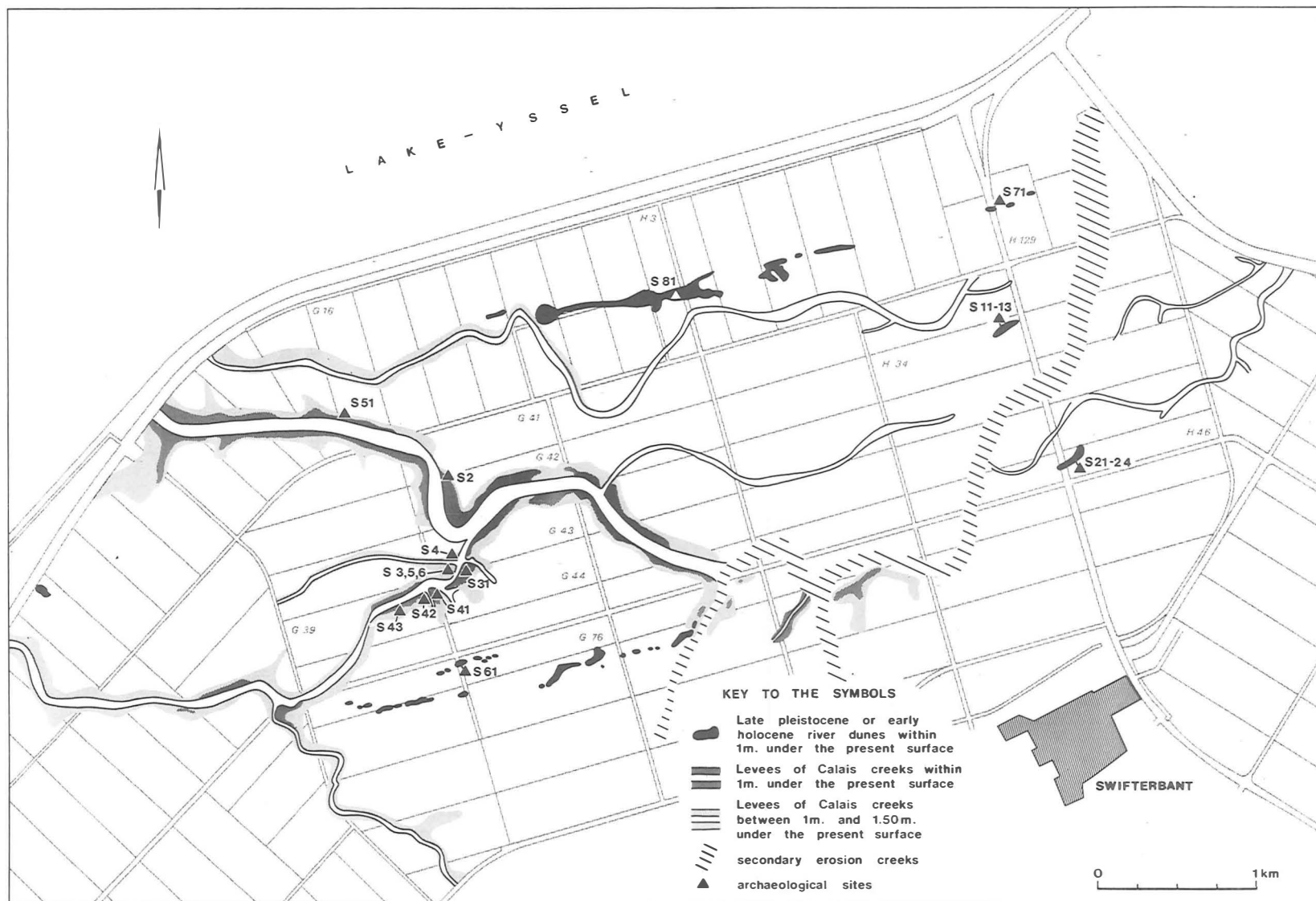


Fig. 1 b. Polder Oost-Flevoland, Swifterbant area. Location of sites on river dunes and on natural clay levees (Courtesy of the BAI).

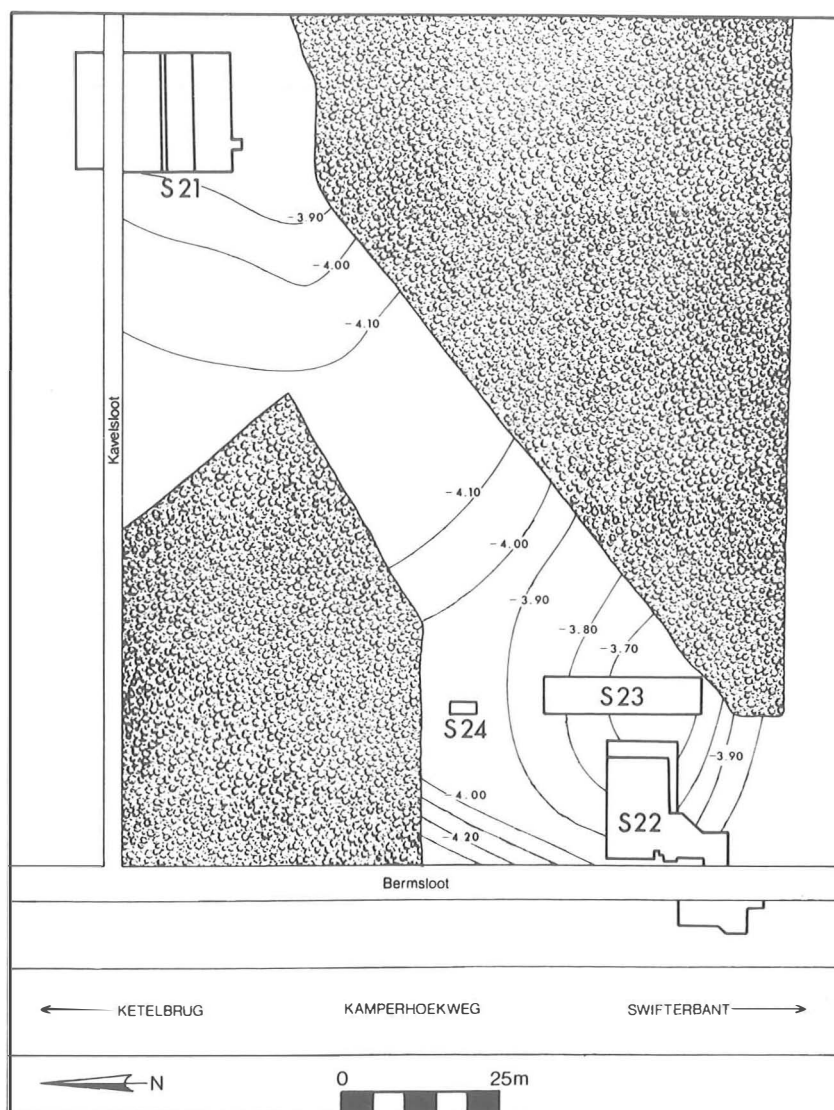


Fig. 2. Excavation units S21-S24 in parcel H46 at Swifterbant. Modern ground surface contours at 10 cm intervals. Areas of vegetation are woods and heavy undergrowth.

H46 are described by Enté (1971, 1976). A general discussion of the entire project appeared in Van der Waals and Waterbolk (1976). A list of all the publications of the Swifterbant project can be found in the bibliography.

2. GEOLOGY

Development of the land surface in the Swifterbant area in the Postglacial was primarily determined by the former Pleistocene land surface

and the presence of the Old IJssel River (Ente, 1976). Under the periglacial conditions prevalent at the close of the Pleistocene, broad areas of northwest Europe were subjected to eolian erosion and redeposition, creating the coversand topography that characterizes much of the northern Netherlands. During this same period, dunes were forming over vegetation along the banks of the Old IJssel River as it flowed through the Swifterbant area.

In the early Postglacial epoch, a relatively stable, wooded landscape developed along the

channels and tributary streams of the river system. During the Atlantic period, after 5500 B.C., gradually rising sea levels transformed the area into a freshwater tidal delta, resulting in the deposition of clays and peats. After 3000 B.C. the region was completely submerged and the accumulation of sediments on top of the former land surface began.

Profiles from drainage canal cutting (Ente, 1976, fig. 7) and archaeological excavation (fig. 3) reveal portions of this depositional sequence in the stratigraphy. The profile of the dune can readily be seen in the section, marked by a slightly steeper slope to the south and a more gradual incline to the north toward the nearest stream channel. Soil development in the dune sand is seen in a weakly developed A and B horizon, more pronounced along the slopes of the dune. The grey A horizon grades quickly into a light-brown B horizon. On the higher portions of the dune, this soil profile is truncated with the disappearance of the A horizon and, on the highest parts of the dune, the disappearance of much of the B horizon. This problem will be considered in more detail below.

Directly above the surface of the dune, a layer of fen peat appears, formed during the higher water levels of the Atlantic period. The base of this peat, at a depth of -6.16 m N.A.P., has been radiocarbon-dated to 5610 ± 60 B.P. (GrN-5607) and correlated with the mean sea level at that time (Ente, 1976, p. 29). This peat layer is observed on both sides of the dune and may originally have covered the dune completely.

Analysis of the pollen in this peat horizon has indicated that during the second half of the Atlantic period the dune supported a mixed forest of oak, ash, and lime (Casparie et al., 1977, pp. 30; 33). Beneath the forest canopy, undergrowth was minimal with only small amounts of hazel growing. In the marshy areas surrounding the dunes, alder would have been the predominant species. Shortly after 3650 B.C., the influence of the sea and rising water levels were felt in this area and a fresh water tidal delta environment developed. Salt water

did not reach the dune, however, but open water stood in the nearby stream channels.

The final transgression of the sea over this area is noted clearly in the profiles by the presence of a thin layer of coarse, yellow, water-laid sands, designated as the erosion layer. This lens, only a few centimeters in thickness, marks the last erosive activity of the sea. This wave erosion removed the top of the peat deposits and the crest of many of the river dunes. Above the erosion layer, several deposits are noted, designated as sediments of the Almere, Zuiderzee, and IJsselmeer phases of water levels in this area. These deposits are discussed in greater detail in Ente (1976) and will not be considered again here as they post-date the period of human occupation in the area.

The focus of archaeological interest lies in the sand deposits of the dune. Artifacts were found on the surface of the dune and throughout the A horizon where it appears. Cultural features, including hearths and graves, are found primarily in the B horizon along the crest of the dune where the A horizon has disappeared.

3. PREVIOUS WORK AT PARCEL H46

Shortly after the polder of Oost Flevoland was drained, archaeological remains in the form of stone tools, bone, and charcoal were discovered in the course of canal cutting and the subsequent geological inspection of these exposures (Ente, 1976). Because of its potential scientific value, a portion of parcel H46 was set aside as a reserve by the state, along with several other locales on the polder. The surface of the dune, as determined from preliminary borings, was planted in grass and the peat deposits along the margins of the dune were marked with shrubs and trees (fig. 2).

Preliminary archaeological excavations were undertaken in 1962 and 1966 at parcel H46 by the Research Division of the Polder Development Authority (= Rijksdienst voor de IJsselmeerpolders) (Van der Heide, 1966a; 1966b) to horizontally expose the areas originally ob-

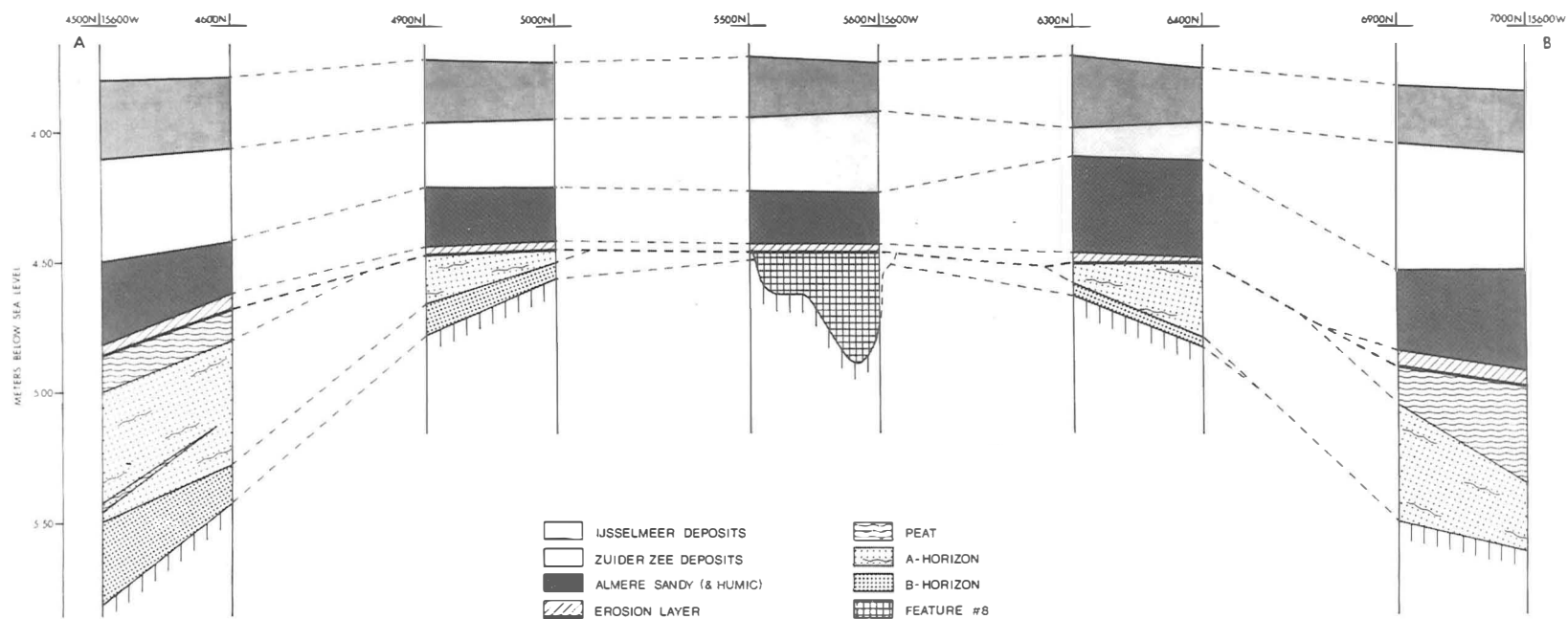


Fig. 3. Schematic profile of longitudinal section of west wall in excavation unit S 23. Note that the vertical scale is exaggerated. The location of the section is indicated in figure 10.

served in the profiles of the drainage ditches. Two excavation units were opened at either end of the dune in parcel H46. These areas are now designated as S21: Working Floor 1 and S22: Working Floors 4 and 5 (fig. 4). The excavated remains included pottery sherds, flint artifacts, a number of hearths, and several graves.

Investigation of the river dune as a part of the larger Swifterbant research project of the Institute in Groningen began in 1971 and continued in 1973 (Van der Waals & Waterbolk, 1976; de Roever, 1976). The preliminary excavations of Van der Heide were re-opened and expanded at both S21 as Working Floors 2 and 3 and at S22 as Working Floors 6a, 6b, and 6c (fig. 4). Additional artifacts were collected and a larger number of hearths and several more graves were revealed. A much clearer impression of the situation of the dune and the nature of soils was gained through these studies, as well as a more representative collection of archaeological remains. This fieldwork was not completed in two areas: one section in S22, designated as Working Floor 6c, and a burial in the south end of S21 (Grave XI).

4. THE 1976 INVESTIGATIONS

In 1974 the University of Michigan Museum of Anthropology began a series of investigations at a river dune in parcel H34 in the Swifterbant area (Whallon & Price, 1976). Excavation units in this parcel were designated as S11, S12, and S13 (fig. 1b). Borings and preliminary excavations uncovered a cultural horizon at S11 with both Mesolithic and Neolithic elements present. Radiocarbon dates of 4335 ± 45 B.C. (GrN-7214) and 4380 ± 45 B.C. (GrN-7215) argued that this site might also represent an occupation transitional between the Mesolithic and Neolithic periods. The 1974 project was under the direction of T. Douglas Price and Robert Whallon, Jr., and supported by a grant from the National Science Foundation (GS-42656).

One of the goals of the 1974 project had been to locate an intact occupation surface

dating from the Mesolithic period. Such information would help to document human adaptation in the Swifterbant area prior to the advent of farming cultures and provide additional data on Mesolithic occupation in the northern Netherlands — an extension of earlier work in the province of Drenthe (Price, Whallon & Chappell, 1974). Because of the absence of a demonstrably Mesolithic occupation at H34, Price, now at the University of Wisconsin-Madison, moved to a new locale in the Swifterbant area while Whallon continued work at the important site of S11.

The 1976 University of Wisconsin project was focused on another river dune located in parcel H46 (fig. 1b). Previous work at H46 had demonstrated that the dune contained both Mesolithic and Neolithic components. A radiocarbon date of 7775 ± 40 B.P. suggested that a pure Mesolithic occupation might be found at the site. Reasonably good bone preservation at H46 was indicated by the presence of several human skeletons and some animal bones from the earlier excavations at S21 and S22. These considerations directed our investigations to H46 as a potential site for the excavation of an intact Mesolithic settlement.

Beyond the recovery of a Mesolithic site, the 1976 project had additional goals. Some of the earlier excavations opened in 1973 by the Biologisch-Archaeologisch Instituut had not been completed and required termination. In addition, development of the stratigraphy of the dunes and the deposition of cultural materials remained problematical and we hoped to obtain more information on these questions.

Excavation units in the Swifterbant project are designated with the initial letter *S* (for Swifterbant) and then a sequential number appropriate to a new excavation. Thus, the original excavations at parcel H46, begun by Van der Heide and continued by the Biologisch-Archaeologisch Instituut, were designated as S21 and S22 (fig. 2). The new excavations opened in 1976 were designated as S23 and S24. These excavation unit abbreviations do not necessarily indicate separate sites or cultural components.

The 1976 field season began on 21 June and ended on 27 August. Several of the project goals were achieved but we were unable to locate an uncontaminated Mesolithic horizon and additional work at the site, planned for future seasons, was not undertaken. The project was supported by the National Science Foundation (grant BNS-11304).

4.1. Mapping and borings

A vertical datum for the site area in parcel H46 was established near the southwest corner of the field at an elevation of -3.94 m N.A.P. The horizontal grid for the area was set up incorporating the excavation units from the previous seasons in 1971 and 1973. These excavation units had been laid out along the network of drainage pipe ditches that cut through the parcel at roughly ten meter intervals on a north-south axis. An arbitrary point to the southeast of the reserve was set as the zero-zero datum point. Any spot in the area of investigation would then be designated by distance in centimeters to the north and west of this datum. Grid north for the excavations was set along the line of the drainage pipes in accordance with the earlier excavations. True north is approximately fourteen degrees east of grid north. A grid of ten meter squares was then set out over the entire field of the study area with the exception of the wooded margins. Vegetation was too dense in these areas for mapping or boring.

The field was mapped and ground surface elevations recorded using the established grid. Although the seabed of the former Zuiderzee was extremely flat, compaction of sediments subsequent to the drainage of this area has resulted in some slight relief. In the case of parcel H46, drying and compaction of the peat and lacustrine deposits surrounding the dune sand has left the top of the dune somewhat higher than the surrounding area. The map of the present ground surface thus reflects the contours of the buried dune (fig. 2).

Two distinct sections of the dune, or perhaps two distinct dunes, can be recognized at

the east and west ends of the site area from the map of the ground surface contours. Although the longitudinal orientation of the two areas appears to be at right angles, the two ends of the field may simply represent two high portions of the same dune.

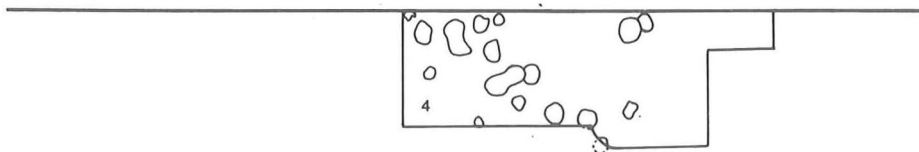
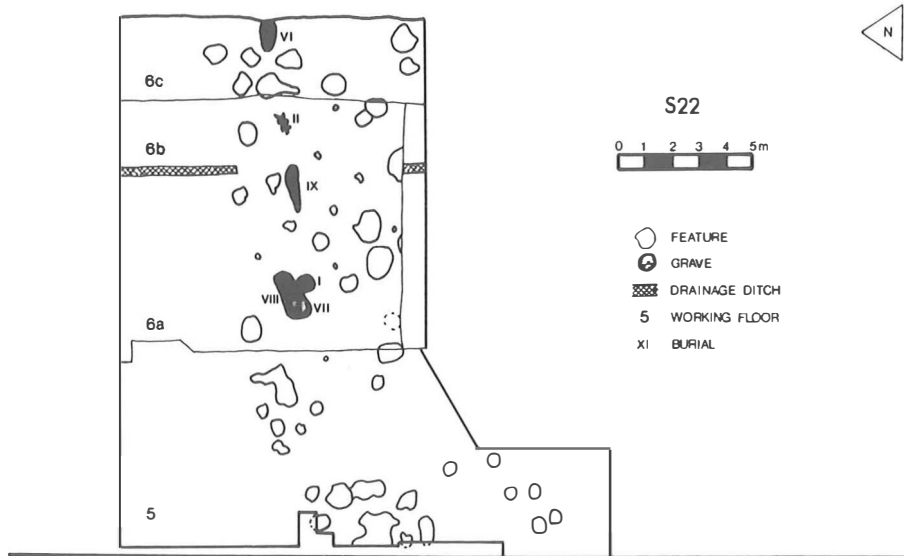
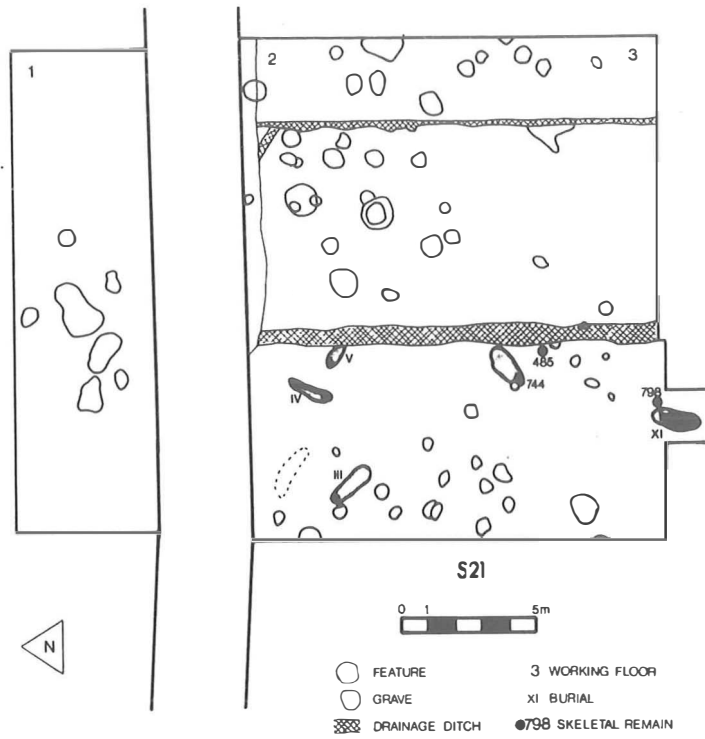
In order to verify the ground surface contour indications of the shape and extent of the dune and to map the sub-surface sediments, a series of borings were made following the site grid. In these borings, the depths below the surface of the peat and the dune sand were recorded and this information was used to construct a contour map of these major units of sediment beneath the more recent marine deposits. The results of the boring program confirmed the presence of two distinct areas of the dune, at the opposite ends of the site area. The borings also revealed a layer of peat in the middle of the site area between the two ends. On the basis of the ground surface contour map and the results of the borings, it was clear that the dune curved sharply through the wooded area to the south and that the vegetation, intended to mark the course of the dune, was partially misplaced (fig. 2).

4.2. Excavations at S22

The eastern portion of unit S22, designated as 6c (fig. 4), had been opened in 1971 but not completed. In this eleven by three meter area, the overburden of marine deposits had been removed and approximately fifteen centimeters of the top of the dune had been excavated. Some artifacts, a few hearths, and a portion of one grave were uncovered but time did not permit the remainder of the artifact horizon or the hearths to be excavated. The burial (number VI) was removed from the grave and the entire area was covered with heavy plastic and buried underneath twenty centimeters of backdirt.

In 1976, this backdirt and the plastic were

Fig. 4. Excavation units S21 and S22: floor plans (cf., de Roever, 1976, Figs. 2, 3 & 5).



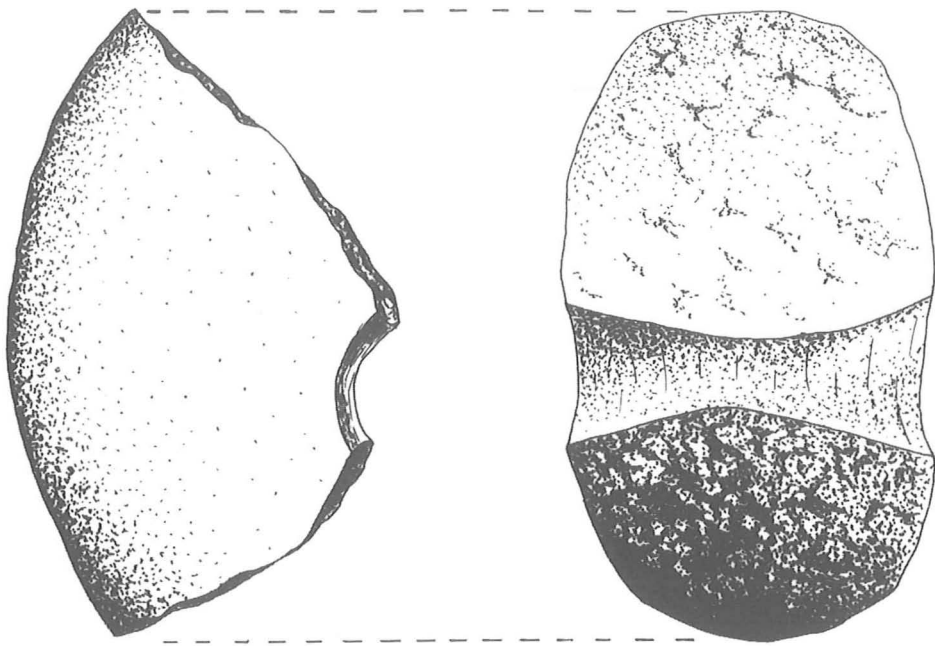


Fig. 5. "Macehead" fragment from S22: Feature 4. Full size.

removed and the excavation floor once again exposed. The profile of the east wall of the excavation unit indicated that the A horizon of the soil had originally extended across most of the dune at this point, truncated only in the north-central portion of the excavation. The 1971 excavations in Working Floor 6c had removed much of the A horizon.

On the floor of this excavation unit the B horizon was exposed with the exception of two areas. At the north end of the unit, a compact, light-grey A horizon was intact where the dune began to slope down to the north. In the south-central portion of the unit, a second pocket of grey sand was observed with remnants of the B horizon on either side. This pocket of grey sand was unusual in several respects. It was clearly intrusive through the B horizon in this area of the excavation; the base of the grey sand pocket rested directly on the sterile dune sands without an intervening B horizon. This base of the grey sand pocket was irregular but occurred at a maximum depth of 30 cm below the A horizon. Many of the artifacts from S22 and a hearth

were found within this pocket. Numerous charcoal flecks were observed throughout the fill of this depression. This pocket clearly represents a former depression in the surface of the dune, natural or man-made, that filled with grey sand. The cause of the depression and the means by which it was filled are unclear.

The majority of the features in S22:6c were hearths and appeared clearly as black concentrations in the lighter surrounding sands of the B horizon. Charcoal and burned artifacts were encountered in the fill of these features. The location and outline of these features are shown in figure 4.

During the course of the 1976 work at S22, exact provenience coordinates were recorded for a total of 492 items, including 428 flaked stone artifacts (86.3%), six small pebbles (1.2%), five pieces of rock (1.0%), and fifty-four large pieces of charcoal (10.5%). Virtually all of the artifacts were found within the grey sand of the A horizon or in the central depression. Only a very few items were encountered in the B horizon.

All but one of the rocks from the excavation were small fire-cracked fragments. The exception was a segment of a "macehead" found in the bottom of a hearth (Feature 4). The macehead fragment is not quite one-quarter of the complete object, broken vertically through the shaft hole (fig. 5). This hole is an hourglass perforation with an estimated complete diameter of three centimeters. The object is made of metamorphic sandstone and the entire surface is pecked and ground to a smooth finish. The shape of the macehead would have been almost spherical with a flattened base. The weight of the fragment was 415 grams. This object is similar to those reported by Hulst and Verlinde (1976).

Flint artifacts were by far the most common remains encountered in the excavations at S22 in 1976. Table 1 presents the counts and percentages of the various production stages observed among the 428 lithic artifacts. Of the identifiable flint materials, fifty-six (13.1 %) showed evidence of deliberate retouch or utilization. The counts and percentages for the various categories of retouched and utilized pieces are given in table 2.

4.3. Excavation of S21, Grave XI

Attention was turned next to the grave that had originally been encountered in 1973 in unit S21. A portion of this grave had been observed in plan and profile at the south end of the excavation unit (de Roever, 1976, Figs 2 & 4). Roughly half of the grave was excavated to the level of the burial. The remainder of the grave (and the burial) continued under the profile and could not be recovered during the 1973 season. The exposed portion of the grave and skeleton were covered with heavy plastic and partially re-buried.

Knowing the exact location of the grave, it was possible in 1976 to remove the overlying deposits directly above the remainder of the grave. A 1.5 by 1.5 meter extension was added at the south end of S21 (fig. 4) to uncover the remainder of the grave. The southern half of the grave was clearly visible in the A horizon

present on this portion of the dune at a depth of -4.46 m N.A.P. At this level the outline of the grave was an elongated oval, approximately 200 cm in length and 80 cm in width (fig. 6). The fill was light grey sand. This grey sand was distinct in the A horizon, and continued through the B horizon and into the sterile dune sands. The grave had been dug after the soil had formed on the dune. In all probability, the fill of the grave is simply the result of the mixing of the soil and sterile sand removed during the original excavation of the basin-shaped pit. A number of artifacts were encountered during the excavation of the grave but none were in direct association with the burial. These artifacts were apparently simply incorporated in the fill.

The grave extended to a depth of -5.08 m N.A.P., some 62 cm below the present surface of the dune. A single extended burial was found in the grave, oriented north-south along the long axis of the dune (fig. 6). This burial was of an adult female and only the major bones were preserved. The burial consists of a skull with the apex of the vault and the right side of the face missing, together with the partial post-cranial skeleton. The burial was removed to the Instituut voor Anthropobiologie of the State University Utrecht for further cleaning and analysis. This material is reported along with the remainder of the human skeletal material from the Swifterbant project in Meiklejohn and Constandse-Westermann (1978) and Constandse-Westermann and Meiklejohn (1979).

4.4. Excavations at S23

One of the major goals of the 1976 season was to open a new area for investigation completely across the top of the dune and along its slopes. Earlier work at H46 had focused on the crest of the dune where erosional activities had removed much of the soil horizon and the artifacts. It was possible that *in situ* occupation floors would be preserved on the slopes of the dune, buried beneath peat and other deposits. On the basis of the results of the mapping and

borings, a large trench was established in the western section of the dune. This 25 x 6 meter unit, designated as S23, crossed the longitudinal axis of the dune at a right angle and included both the north and the south slopes of the dune (fig. 2).

The overburden of deposits was removed mechanically above the erosion layer. The remaining sediments, directly above the erosion layer, were removed by hand. We began by cleaning an area three meters in width, running the length of the excavation unit. The remaining three meter wide area of the trench was removed as time permitted. The north and south ends of this latter area were not excavated during the field season (fig. 7). A total of 126 square meters were excavated at S23.

The erosion layer of coarse yellow, water-lain sand is three to five centimeters thick across the dune and contains a number of artifacts. These materials are in secondary position, having been removed from the surface of the dune by wave erosion. The erosion layer was shovel-skimmed and screened for artifacts and other materials. Counts of the lithic artifacts from the erosion layer at S23 are presented in tables 1 and 2. No ceramic fragments were encountered in this layer and these were likely destroyed by the erosive activity of the sea. A number of pieces of bone, primarily of fish, and a few scales were found in the screening of the erosion layer. These almost certainly date from the period of erosion and are not associated with the occupation of the dune. A few acorn shells were also found in the erosion layer and may belong to the period of prehistoric occupation. No nutshell was found during the excavation of the dune at S23 but similar materials have appeared in the excavations at S11 in parcel H34 (Whallon & Price, 1976).

Excavations on the dune itself, beneath the erosion layer, were done by shovel-skimming and trowelling in areas of higher artifact density. All artifacts were plotted in three dimensions to provide exact provenience data for the location of these materials. Cultural features — non-portable human remains such

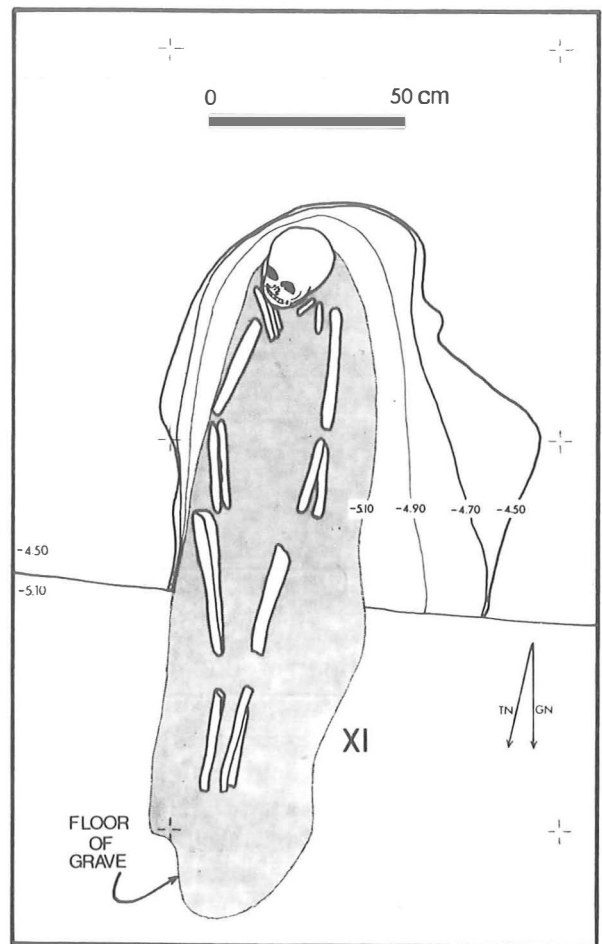


Fig. 6 a. S21: Grave XI. Plan view. East-west line in the drawing marks the south wall of S21 from 1973.

as hearths and pits — were mapped, photographed, and then removed in quarter sections. Two cross-sections of each feature were drawn when possible. Fill from the features was saved for flotation and charcoal was collected when available.

4.4.1. Features

In the central portion of S23, all of the A horizon and most of the B horizon was absent due to the erosion of the dune crest. Very few artifacts were present in this area but the majority of the features were found here

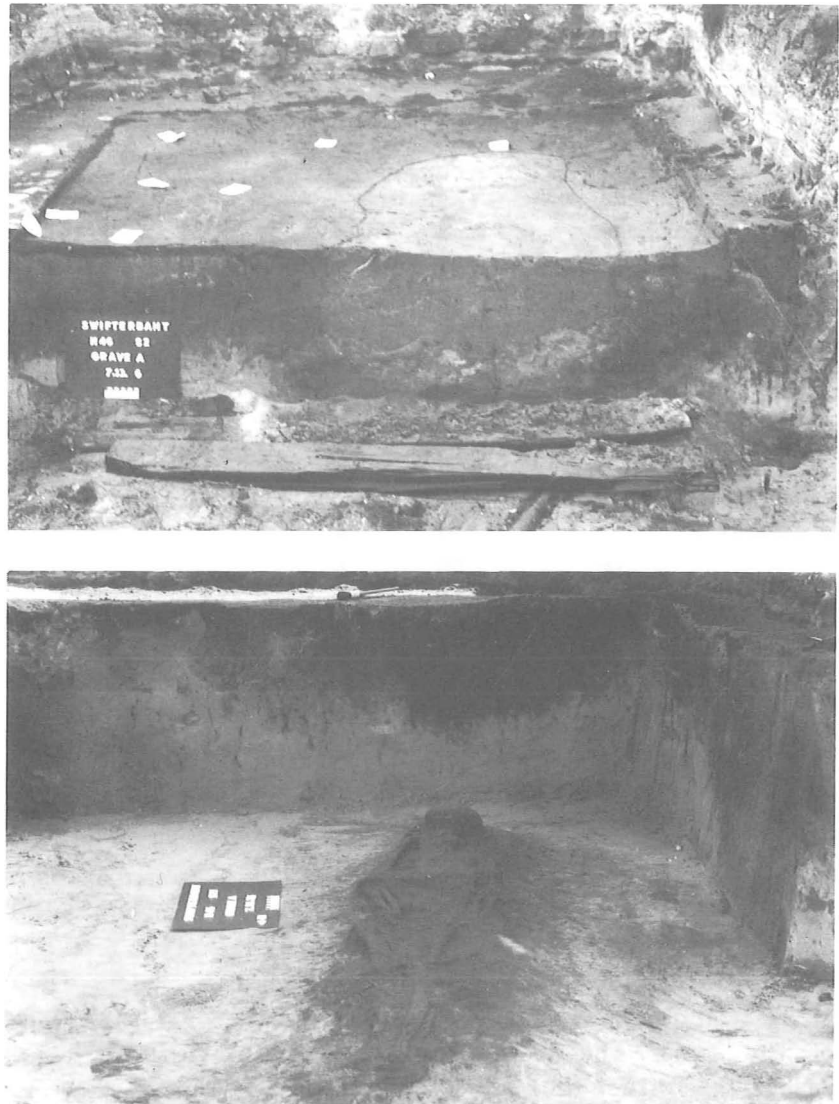


Fig. 6 b-c. S21: Grave XI. (b) Photograph of the grave in section and plan. (c) Photograph of the burial in the bottom of the grave.

(fig. 7). The features were observed as black, or dark grey, sandy concentrations in the dune sand.

A total of thirty-nine cultural features were recorded at S23. Summary information on these features is presented in table 3. The large majority of these features are hearths. Hearths were distinguished from pits by the relative absence of charcoal in the pits. Three features (numbers 14, 15, and 22) appeared as dark stains on the surface of the dune. Cross-sections of these stains, however, revealed

led them to be the result of animal burrowing in the dune – probably foxes or moles. Two of the features (20 and 24) were not excavated because such small portions were intact within the excavation. Feature 36 may be a grave; it is a linear feature and a single unidentifiable bone was found in the feature fill. However, because the feature continued under the profile it was impossible to determine its exact nature.

Many of the features were relatively shallow and it should be noted that these features,

Table 1. Counts and percentages of production stages for lithic artifacts from the 1976 excavations, S22, S23. EL = erosion layer. DS = dune sand.

<i>Stage</i>	<i>S22:DS</i>		<i>S23:EL</i>		<i>S23:DS</i>	
	Count	Percent	Count	Percent	Count	Percent
Nodule	2	0.4	9	0.3	3	0.1
Decortication flake	23	5.4	142	4.9	107	4.5
Decortication flake	11	2.6	91	3.1	76	3.2
Block	15	3.5	87	3.0	86	3.6
Core rejuvenation flake	8	1.9	58	2.0	30	1.3
Flake core	4	0.9	3	0.1	3	0.1
Blade core	20	4.7	62	2.1	43	1.8
Flake	91	21.3	421	14.5	262	11.1
Blade	72	16.8	477	16.5	391	16.5
Microburin	0	0	0	0.0	1	0.1
Sharpening removal	0	0	0	0.0	3	0.1
Shatter	182	42.5	1545	53.4	1362	57.6
	428	100.0	2895	99.9	2367	100.0

like the dune crest, have been truncated by the erosive activity of the sea. The features observed along the crest of the dune in S23 are in effect only the remnants of the deeper pits that at one time reached the higher surface of the dune. The features are noticeably deeper the further they are located from the highest part of the dune and the major zone of erosion.

There was some suggestion of slight vertical separation among the features, although it was difficult to document because of the slope of the dune. A few features were not observed immediately beneath the erosion layer but only after some of the soil horizon had been removed. Feature 16, for example, on the south slope of the dune was recorded initially at a depth of -4.78 m N.A.P. The surface of the dune above this feature was located at approximately -4.65 m N.A.P.

Feature 6 at S23 is a typical example of the features of this site (fig. 8). This roughly

circular, basin-shaped pit is located at approximately 5400N and 15300W on the site grid. The feature has an outer diameter of 80 centimeters. The compact, dark core of the feature is surrounded by a lighter grey sandy zone that is less compact. Large quantities of charcoal were found in the feature, primarily in the dark central core. A "log" of charcoal was observed at the surface of the feature (indicated by the black object in fig. 8). This feature is almost certainly a hearth. The lighter grey zone surrounding the core of the feature is the result of the mixing of the actual hearth fill (the central core) with the surrounding dune sand.

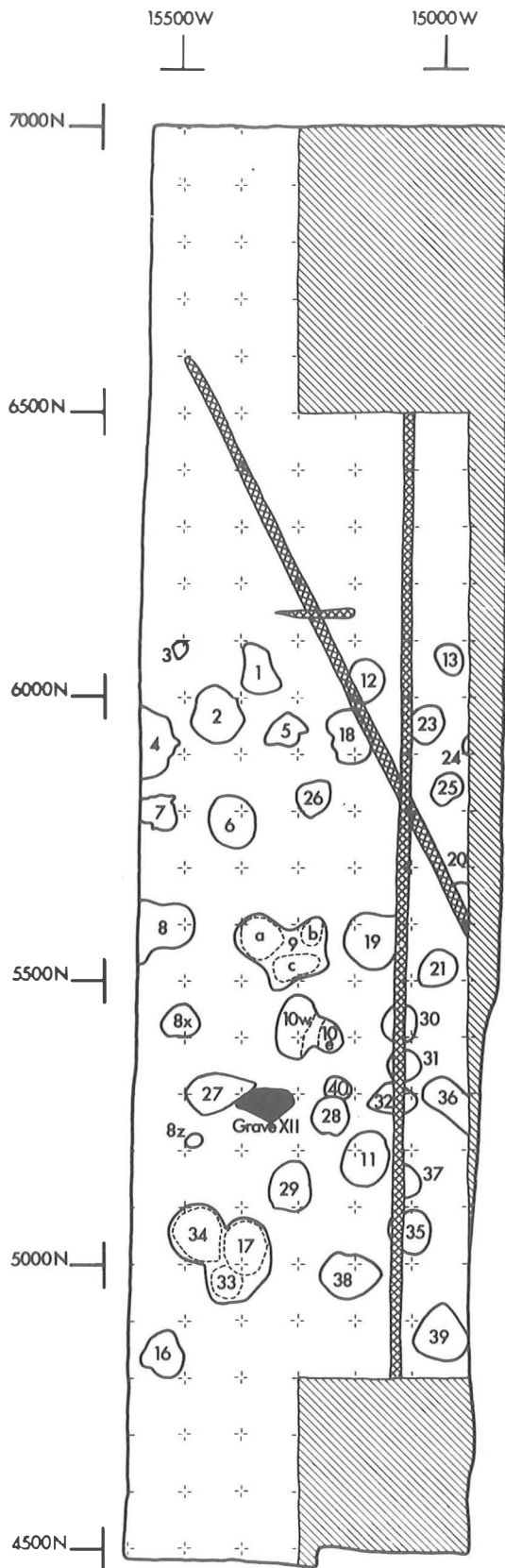
One definite grave (XII) was also recorded as S23 (fig. 9). The grave was directly underlain by a hearth (Feature 27). The outline of the grave was indistinct and roughly elliptical. The maximum dimensions of the grave at a depth of -4.49 m N.A.P. were approximately 1.30 m in length and 0.65 m in width. The

Table 2. Counts and percentages of retouched and utilized artifacts from the 1976 excavations, S22, S23. EL = erosion layer. DS = dune sand.

Type	S22:DS		S23:EL		S23:DS	
	Count	Percent	Count	Percent	Count	Percent
A point			1	0.4		
B point			1	0.4		
C point			1	0.4		
Needle-shaped point			1	0.4		
Lancette point	1	1.8				
Double point			1	0.4		
Surface Retouched point			1	0.4		
Broken point	1	1.8	2	0.9	10	4.0
Isoceles triangle			1	0.4		
Short Scalene triangle	1	1.8			3	1.2
Broad symmetric trapeze			3	1.3		
Right-angle trapeze			1	0.4		
Broken trapeze			2	0.9		
Backed Blade			20	8	13	5.1
Triangular backed blade			3	1.3	1	0.4
Short Blade borer			1	0.4	2	0.8
Long Blade borer			3	1.3	2	0.8
Short flake borer	1	1.8	5	2.2	7	2.8
Burin					2	0.8
Simple flake scraper	6	10.7	50	22.1	10	4.0
Short convex end scraper					1	0.4
Short straight end scraper					2	0.8
Long convex end scraper					1	0.4
Convex Side scraper	1	1.8	1	0.4		
Blade knife					1	0.4
Retouched flake	7	12.5	34	15.0	80	31.6
Notched flake	2	3.6	13	5.7	5	2.0
Retouched blade	4	7.1	11	4.9	29	11.5
Notched blade	1	1.8	1	0.4		
Truncated blade	4	7.1	4	1.8	3	1.2
Piece Esquillee					4	1.6
Utilized flake	14	25.0	49	21.7	33	13.0
Utilized blade	13	23.2	16	7.1	44	17.4
Total Tools	56	100.0	226	99.4	253	100.2
Total Tools	56		226		253	
Total Lithics	428	= 13.1 %	2895	= 7.8 %	2369	= 10.7 %

Table 3. S23: Feature attributes.

Feature number	Coordinates			Shape	Dimensions (cm)			Number of artifacts	Interpretation
	North	West	Surface		Max.	Min.	Depth		
1	6000	15300	-4.59 NAP	Irregular oval	89	75	26	12	Hearth
2	5900	15400	-4.59	Circular	97	94	23	36	Hearth
3	6000	15400	-4.59	Teardrop	32	23	10	2	Small hearth
4	5800	15500	-4.59	Circular?	128	65	22	4	Hearth
5	5900	15200	-4.49	Circular	69	60	9	6	Hearth / Pit
6	5700	15300	-4.48	Circular	82	79	17	0	Hearth
7	5700	15500	-4.50	Irregular	76	65	12	0	Hearth
8	5500	15500	-4.49	Oval	99	113	43	16	Hearth
8x	5400	15400	-4.49	Circular	65	59	37	0	Hearth
8z	5200	15400	-4.49	Circular	32	23	20	6	Hearth / Pit
9	5500	15200	-4.45	Irregular	176	151	16	9	3 Hearths / Pits
10	5300	15200	-4.46	Irregular	134	120	39	9	2 Hearths
11	5100	15100	-4.51	Oval	98	85	30	56	Hearth
12	6000	15100	-4.49	Circular	72	68	17	9	Hearth
13	6000	15000	-4.49	Oval	58	47	25	14	Hearth
14	Animal burrow							0	
15	Animal burrow							0	
16	4800	15500	-4.78	Circular	79	76	16	12	Pit?
17	5000	15300	-4.55	Circular	80	75	18	5	Hearth
18	5800	15100	-4.49	Oval	109	68	23	19	Hearth
19	5500	15100	-4.48	Circular	100	91	34	3	Hearth
20	Not excavated							0	
21	5500	15000	-4.50	Teardrop	77	61	10	3	Pit
22	Animal burrow							0	
23	5900	15000	-4.48	Circular	68	62	24	8	Hearth
24	Not excavated							0	
25	5800	15000	-4.50	Oval	63	55	12	6	Hearth
26	5800	15200	-4.49	Teardrop	65	62	22	4	Hearth
27	5200	15400	-4.49	Teardrop	135	94	34	31	Hearth
28	5200	15200	-4.48	Circular	65	60	30	59	Hearth
29	5100	15300	-4.51	Circular	92	87	37	41	Hearth
30	5400	15100	-4.53	Circular	61	58	13	4	Hearth
31	5300	15100	-4.51	Circular	53	53	24	1	Hearth
32	5200	15100	-4.51	Oval	92	55	26	19	Hearth
33	4900	15400	-4.61	Circular	56	55	12	3	Hearth
34	5000	15400	-4.55	Oval	101	70	14	12	Hearth
35	5000	15000	-4.68	Circular	77	74	19	3	Hearth
36	5200	15000	-4.51	Elongated oval	115	55	31	60	Pit / Grave?
37	5100	15100	-4.51	Circular	55	30?	21	2	Hearth
38	4900	15100	-4.70	Oval	111	77	32	31	Hearth
39	4800	15000	-4.83	Teardrop	101	103	60	25	Hearth
40	5300	15200	-4.48	Circular	48	41	20	37	Hearth



grave had clearly been truncated by the erosion of the top of the dune and only the lower portion of the pit was intact. The orientation of the long axis of the grave was east-west, approximately eighty-eight degrees east of magnetic north. This orientation parallels the main axis of the dune. The fill of the grave was light grey sand, the result of the mixing of the soil horizon and the sterile dune sand when the grave was originally excavated and filled. A number of flint artifacts were incorporated in the fill of the grave but were not in direct association with the burial. The portion of the grave that had not disappeared due to erosion was relatively shallow, only 35 cm in depth.

The burial was very fragmentary; only a few bones were encountered and these were badly preserved. Some of these pieces of bone appeared to be calcined. The only identifiable fragments were a segment of long bone diaphysis and a radial diaphysis. The size of the remains suggests either an older adolescent or an adult (Meiklejohn & Constandse-Westermann, 1978).

Disturbances in the excavation were also mapped (fig. 7). The narrow linear disturbance running north-south on the east side of excavation unit S23 is a drainage pipe ditch. These ditches cross parcel H46 at ten meter intervals. The long, diagonal disturbance and the smaller one that intersects it are tracks from anchors or boat keels on the former sea bed. These were not immediately identifiable as evidence of shipping activities. It is difficult to remember, while standing in the field, that at one time five meters of sea water stood above the excavations.

4.4.2. Artifacts

Four major classes of materials were recorded in the excavation of the dune at S23: flint, stone, pottery and bone. The counts and per-

Fig. 7. S23: Distribution of features and disturbances. Diagonal hatching indicates unexcavated areas. Cross-hatching indicates disturbances.

centages of these classes are presented in table 4. These data do not include the material from the erosion layer.

The horizontal distribution of these materials at S23 points out the effects of erosion on the dune crest (fig. 10). Very few artifacts occur *in situ* in the central area of S23 where the highest remaining portion of the dune is located. Most artifacts are found along the north and south slopes of the dune. Artifact density per square meter (fig. 11) indicates those areas of the dune that have not been eroded and where at least a portion of the A horizon is still intact. The erosion of the dune removed the surface from roughly 5000 north to 6400 north on the grid plan.

These classes of material are relatively equally distributed on both sides of the dune but some differences can be noted. Pottery fragments are more abundant on the north slope while rock is somewhat more common on the south. These differences may be due to the nature of the mechanical processes of erosion on the dune, the larger area of intact A horizon to the north, or actual differences in the location of prehistoric occupations.

The vertical distribution of artifacts in the dune sand was variable, depending upon location. Artifacts further from the crest of the dune, and further down the slope, tended to show greater vertical dispersion. At a maximum, artifacts were distributed through a horizon over 70 cm in thickness. The vertical dispersal of materials at the site will be considered in more detail below.

A total of 2369 flint artifacts were recorded in the excavations of the dune sand at S23. Production stages represented in these materials are presented in table 1. The percentages of these stages are very similar to the materials from the erosion layer. Shatter, created by heat, frost, or flaking, is by far the most common category. Blades and flakes comprise the next larger categories of production stages. The remaining categories are represented in relatively small number.

The counts and percentages of retouched and utilized pieces of flint are given in table 2.

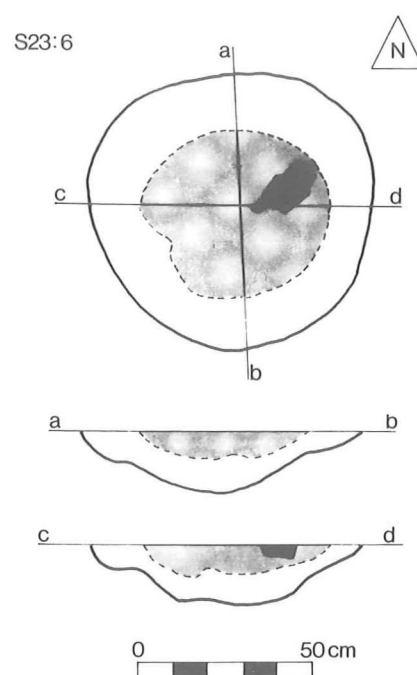


Fig. 8 a. S23: Feature 6. Plan view.

Some differences can be noted between the erosion layer and the dune sand for these types. Scrapers and utilized flakes are more common in the erosion layer, a total of 44.2%, while in the dune sand these two categories comprise only 18.6% of the total retouched and utilized pieces. Retouched flakes are more common in the dune excavations. Intriguing

Table 4. Counts and percentages of major material classes at S23. Erosion layer not included.

Material	Count	%
Flint	2369	96.5%
Rock	39	1.6
Bone	6	0.2
Pottery	41	1.7

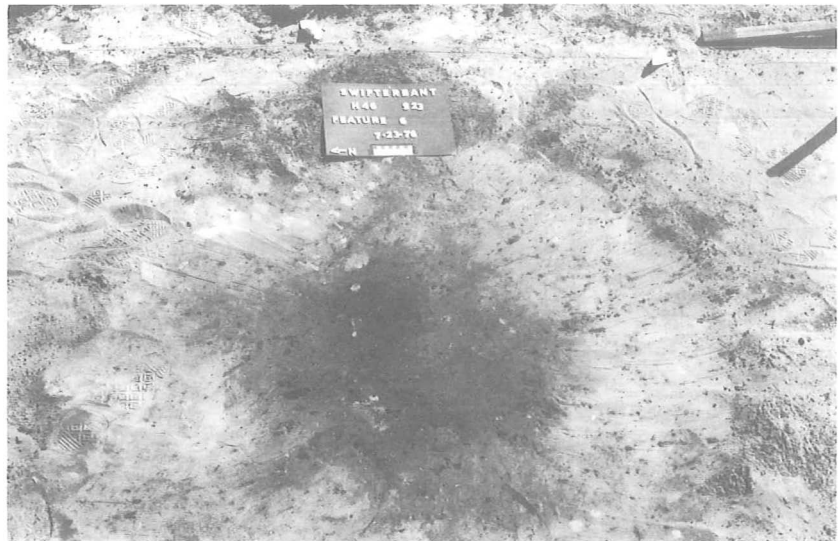


Fig. 8 b-c. S23: Feature 6. (b) Photograph of plan view. (c) Photograph of profile.

also are the absence of trapezes, the smaller number of backed blades, and the abundance of utilized blades in the dune sand. No clear patterning in these differences could be discerned.

Ceramic materials in the dune sand comprised only 1.7% of the major material classes. Forty-one pieces of pottery were recovered and analyzed by J.P. de Roever (1979). The following is a summary of her description of this material. The majority of the sherds are

quite small (less than 3 cm in diameter) and the surfaces are often heavily weathered or absent. There is only one large fragment of a flaring, concave neck of a vessel – the upper section of an S-shaped profile. Five of the sherds are slightly convex and the remainder are too small to be indicative of vessel shape.

Only twenty of the sherds are well preserved and none show any decoration. The sherds are brown to grey/black in color and are tempered with sand, grit, and some fine organic

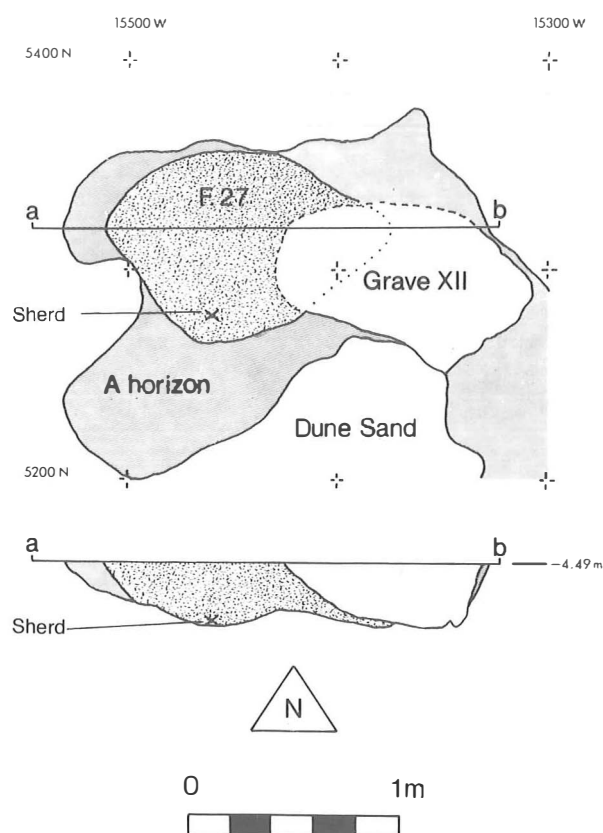


Fig. 9. S23: Feature 27 and Grave XII. Plan view and cross-section.

material. The pottery is coil-made and has heavily-smoothed surfaces. Wall thickness of the sherds ranges between 6 and 11 mm with a mean of 8 mm. The neck fragment and eight other sherds have cooking residues present.

Of the thirty-nine rocks encountered in the dune sand at S23, the majority were small fragments without indications of use. Only six showed any sign of modification (table 5). Of these six, one was a hammer-stone, one a fragment of a "pick", and four had smoothed or polished surfaces. These rocks are of local origin available from ground moraine which outcrops at the ridges of Urk and Schokland, a few kilometers to the north and east of the site respectively.

Six pieces of bone were recovered in the excavations, not including the material from

Grave XII. All of the bones were small, heavily eroded, and unidentifiable.

4.5. Sondage at S24

Following the completion of the work at S23, a final excavation unit was opened in an area fifteen meters to the north of S23 at 15600 west and 8500 north on the grid plan (fig. 2). This unit was designated as S24 and intended to expose the north slope of the dune at a deeper level. Several questions were under investigation: (1) how far to the north did the slope of the dune extend, (2) did the occupation debris continue along the slope of the dune or was it confined to the area around the crest, (3) would the occupational layer at some point be found within the peat horizon, and (4) would the conditions of organic preservation improve in the lower areas of the dune where peat deposits were deeper?

A sondage of approximately four by two meters was excavated by machine through the deposits of peat and clay to the surface of the dune at a depth of -8.40 m N.A.P. The lower peat and the dune sand were brought up in block and spread on the surface of the meadow. This material was handpicked and a number of lithic artifacts were found in the sand. No organic remains were observed. Clearly the occupation of the dune extended for some distance along the slope and away from the crest. No cultural material was observed in the peat deposits above the dune sand in S24.

4.6. Dating

4.6.1. *Isotopic*

Following the formation of the river dunes at the close of the Pleistocene, the Swifterbant area was inhabited by Mesolithic and, later, Neolithic occupants. Materials recovered in the pre-1976 excavations documented the presence of both time periods at H46 in the form of Mesolithic projectile points and "Neolithic" sherds. Three radiocarbon dates were obtained from charcoal found in hearths which cor-

roborated this picture (de Roever, 1976, pp. 2 & 7):

GrN-6709	7745±40 B.P.	S21 Hearth
GrN-6710	6875±45 B.P.	S22 Hearth
GrN-6708	6670±35 B.P.	S21 Hearth

These determinations should date Mesolithic features at the dune.

An additional radiocarbon date has been obtained from S23:

GrN-8248	6240±50 B.P.	S23 Hearth
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The charcoal sample for this determination was taken from a hearth (Feature 27) in which a potsherd was found. Although the possibility of intrusion cannot be ruled out, there was no visible disturbance in the hearth. The sherd was found at the bottom of the hearth at a depth of approximately -4.80 m N.A.P. The hearth itself directly underlies a grave (XII) in profile (fig. 9). The radiocarbon date thus provides a minimum date for the sherd as well as a *terminus post quem* for the grave.

The date is earlier than expected. Neolithic occupation on the clay levees in parcel G43 at Swifterbant is dated to around 5300 B.P.

(Van der Waals, 1977). The date from Feature 27 corresponds more closely to the dates from another dune site, S11, in parcel H34. Two dates from two separate features at S11 (GrN-7214 6285±45 B.P. and GrN-7215 6330±45 B.P.; Whallon & Price, 1976, p. 226) are approximately 1000 years earlier than the dates from the Neolithic levee sites and only slightly younger than Bandkeramik dates from Limburg in the southern Netherlands. These dates from S11 and the date from S23 may belong to the very end of the Mesolithic or to a period transitional between the Mesolithic and the Neolithic. This question will be discussed in more detail in the conclusion of this report.

4.6.2. *Artifactual*

The artifacts from S23, and from S21-22, are also suggestive of both Mesolithic and early "Neolithic" occupations. Projectile points are generally the best temporal markers for the early Postglacial in north west Europe. Traditional Mesolithic point types, following the established typology (Deckers, 1979; Price, 1975; Newell & Vroomans, 1972; Bohmers, 1963; Bohmers & Wouters, 1956), are

Table 5. Modified rock at S23.

S23 #	Maximum dimension (cm)	Weight (g)	Description
38	5.3	22.3	Flake with one smoothed surface
42	4.6	15.8	Flat pebble with one smoothed surface
1189	6.2	96.8	Ovoid hammerstone with two pitted ends and one smoothed side
1350	9.1	257.9	Flat, pear-shaped cobble with bifacially flaked edge along one side ("chopping tool") and one polished side
1372	12.2	493.9	"Pick" fragment, ground to a point at one end, broken transversely, no indication of hole. Slightly convex in longitudinal cross-section.
1498	4.6	10.9	Small fragment with one smoothed side

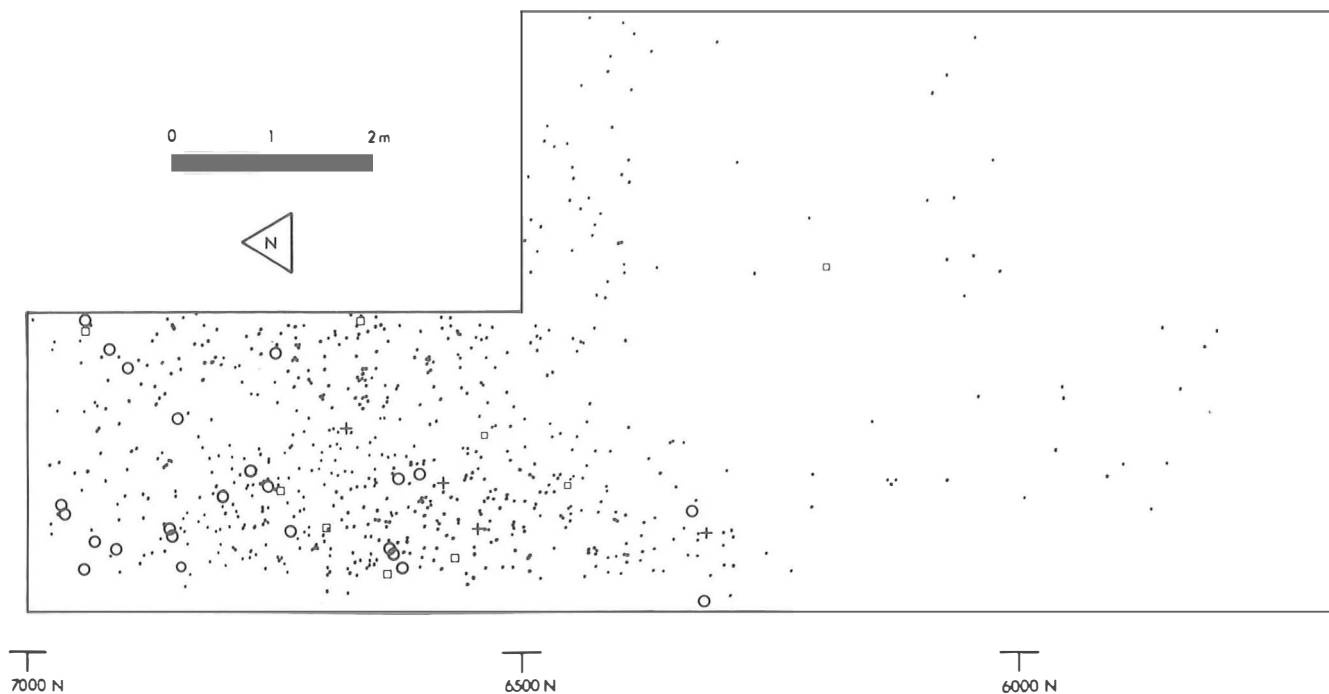


Fig. 10. S23: Artifact distribution.

present at the dune in parcel H46 (fig. 12). A, B, and C points, needle-shaped points, double points, trapezes and triangles, all appear in the Mesolithic by 5500 B.C. (Newell, 1973, Graph 3) and correlate with the earlier radiocarbon dates from S21 and S22. Other point types, present at H46, are not characteristic of the Mesolithic and are indicative of a somewhat younger occupation. The surface-retouched point found in the erosion layer at S23 (fig. 12) is not typically Mesolithic. Two transverse points were also recovered from Grave VIII at S21 where they were found among the bones of the burial (de Roever, 1976). The *pièce esquillée* is unusual in a Mesolithic context in the Netherlands. Other artifact types such as the scrapers and borers, as well as the “macehead” and the “pick” fragments, are more ubiquitous and less diagnostic.

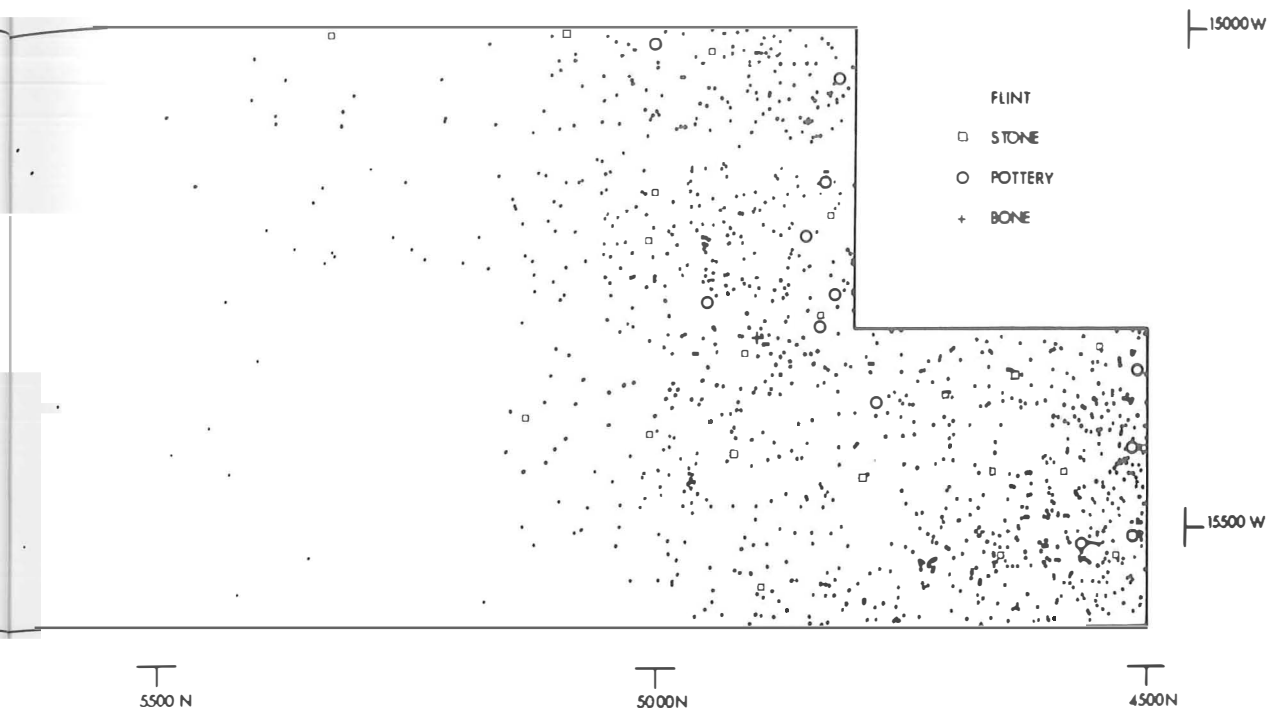
Interestingly, the lithic artifacts from S23 are remarkably similar to those excavated in 1974 at S11 (Whallon & Price, 1976, p. 227).

Counts and percentages for the major type groups at these two sites are presented in table 6. With the exception of a few more trapezes and knives and fewer retouched flakes at S11, the differences between the two sites are insignificant.

Ceramics from H46 are generally thick with S-shaped profiles, flaring rims, occasional decoration and pointed bases. These sherds do not resemble the TRB materials from the northern Netherlands and are more closely related to the pottery of the Ertebølle-Ellebek cultures of northern Germany and southern Scandinavia (de Roever, 1979).

4.7. Depositional processes

It is not possible at the present time to assign accurate dates to the occupations at S23 on the basis of geological events. We can only establish an approximate beginning and end for the period of potential habitation. The formation of the dune at the close of the Pleisto-



cene around 8000-7000 B.C., marks one end of this sequence. Submergence of the dune by rising water levels and peat growth by 3000 B.C. or shortly thereafter (Jelgersma, 1961; de Roever, 1976, p. 218) concludes the occupational history of the dune. A date of 3660 B.C. (GrN-5067 5610 ± 60 B.P.; Ente, 1976) from peat just at the surface of the dune at -6.15 m N.A.P. supports this picture.

The processes of erosion, deposition, and soil formation occurring within the roughly 5000-year period of potential occupation are not well understood but some insight may be gained from the distribution and character of archaeological materials at the dune. Because of the deep vertical distribution of artifacts along the slopes of the dune, stratigraphic separation of the various archaeological components initially would appear as a means of establishing both chronological and depositional contexts for the material.

Figure 13 shows the south wall of the excavation unit at S23 (location, see fig. 10) with

a backplot of the artifacts found within one meter of this wall. The vertical dispersal of the artifacts is evident on this backplot. Within this one meter zone at the south wall of the excavation the slope of the dune is less than 25 cm and thus should not contribute significantly to the deep vertical dispersal of the artifacts. The band of erosion sand within the profile (layer 2, fig. 13) is almost certainly a later intrusion, perhaps along channels left by decayed tree roots.

A histogram of the number of artifacts by depth (fig. 14) in this profile does indicate differential distribution of the artifacts through the deposit. Two modes are seen in the histogram: one at approximately -5.05 m N.A.P. and a second at -5.45 m N.A.P. These modes are suggestive of at least two stages in the deposition of artifacts. The relatively rapid rise of the first mode at -5.05 m on the histogram may correspond to a living floor directly on the present surface of the dune. This surface would have been covered by peat growth some-

Table 6. S11 (1974) and S23 (1976): Retouched tools, counts and percentages from both erosion layer and dune sand.

Type	S23		S11	
	#	%	#	%
Points	18	5.8	8	6.5
Trapezes	6	1.9	7	5.6
Triangles	4	1.3	2	1.6
Backed Blades	37	11.9	17	13.7
Borers	20	6.4	10	8.1
Burins	2	0.6	4	3.2
Scrapers	65	20.9	25	20.2
Knives	1	0.3	5	4.0
Retouched Flakes	114	36.7	31	25.0
Retouched Blades	40	12.9	14	11.3
Pièce Esquillée	4	1.3	1	0.8
n =	311	100.0	124	100.0

time around 3000 B.C. according to Jelgersma's curve for the rise of sea level (Jelgersma, 1961; Ente, 1976). As we observed in S24, artifacts continue on the surface of the dune, beneath the peat, at a depth of -8.40 m N.A.P. Thus, portions of the upper occupation surface of the dune, particularly those lying along the deeper slopes, should pre-date 3660 B.C., the radiocarbon date from peat just above the surface of the dune at a depth of -6.15 m N.A.P.

The second mode in the vertical distribution of artifacts centers on a dark humic band in the profile (fig. 10) that likely represents a buried soil and former surface of the dune. The sands above this lower surface do not appear to be water-lain. No bedding is observable in the profile and there is no sorting of artifacts by weight as might be expected with water activity. Figure 15 is a scatterplot of flint artifact weight by depth in this profile. Flint material weighing between 0.01 and 3.0 grams is plotted on this graph. For the sake of clarity, pieces larger than 3 grams were not plotted, but these few larger pieces show a

similar homogeneous distribution through the profile. The absence of sorting suggests that human activity, eolian erosion, and/or slope wash may be responsible for the build up of sand between the lower surface and the top of the dune. The vertical dispersal of artifacts through these two major levels is likely due to natural activities in the soil such as root growth, animal burrowing, and other processes of bioturbation.

Although no definitively diagnostic artifacts are present in this south profile at S23, several artifact categories are suggestive of a date for the development of the dune above the lower surface. Backed blades, typical of the Mesolithic period, are found throughout the vertical spread of material. A *pièce esquillée*, rare in a Mesolithic context, occurs at -5.48 m N.A.P. within the lower level of the distribution.

A major question concerns the vertical distribution of pottery at the dune sites. Four pieces of pottery were found close to the south profile at S23. All of these pieces are within or

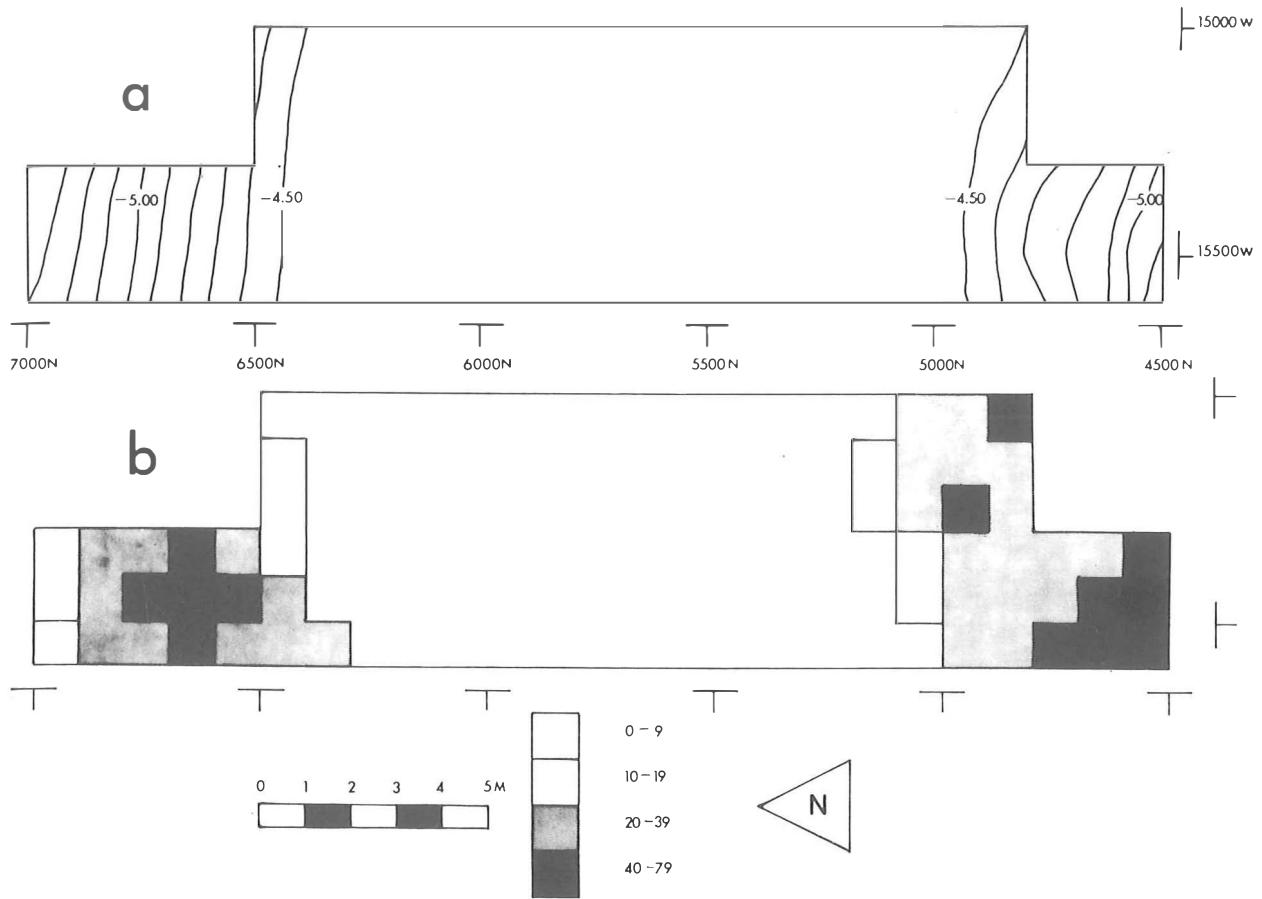


Fig. 11 a-b. S23: (a) Contours of the dune surface in the excavation unit. Contour interval is 10 cm. (b) Artifact density per square meter in the excavation unit.

closer to the upper level in the profile (fig. 13). At S22, ceramics were found at or near the surface of the dune (de Roever, 1976, p. 215) and thus may also be restricted to the upper portion of the deposits. At S11 there is also a tendency for ceramic materials to occur higher in the vertical distribution of materials (Whallon & Price, 1976, p. 226) although the sherds are distributed over 30 cm vertically in some areas of the site. If pottery is confined to the upper levels in the dune sites as it appears, then some stratigraphic separation of purely Mesolithic occupations from a higher, later ceramic horizon is indicated.

The dates for the ceramic horizon can only

be approximated. The radiocarbon determination of 3600 B.C. on peat at the surface of the dune should provide a *terminus post quem* for this upper horizon. At present only a single date of 4300 B.C. can be directly associated with the pottery at S23. This is the date from Feature 27, a hearth which contained a potsherd in the fill. Other dates from H46 of approximately 5800 B.C. and 4800 B.C. are attributable to purely aceramic, Mesolithic occupations and may belong with the lower surface of the deposits. I would argue that at some point, perhaps shortly after 4800 B.C., there was a period of major dune disturbance with deposition of sand along the slopes of

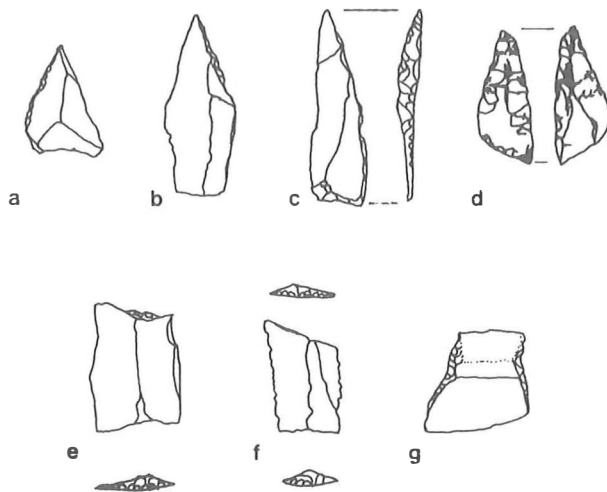


Fig. 12 a-g. Projectile points from S23: (a) A point, (b) B point, (c) C point, (d) surface-retouched point, (e) trapeze, (f) right-angle trapeze, (g) trapeze. Full size.

the dune, followed by a new occupation around 4300 B.C. by a pottery-using population.

Some information is also available on the occupations from the features at S22 and S23, in spite of the wave erosion of the peat and sand deposits at the top of the dune. The features found within this zone of erosion (fig. 7) are generally not vertically separated but appear at the same level in the dune. There is some slight vertical separation of a few features in areas on the margin of the erosion zone where the A horizon is still intact. Most features appeared as black ovals in the A horizon while others did not appear until much of the A horizon had been removed (e.g., Feature 16). Again, two possible occupation horizons are suggested.

Finally, the fill of the graves was distinguishable in the A horizon (cf., fig. 6) and consisted of a homogeneous, light-grey sand. This grave fill is almost certainly the result of the mixing of the A and B horizons and the sterile dune sand when the graves were originally excavated and filled. The graves thus appear to have been dug following the formation of the soil on the dune and very

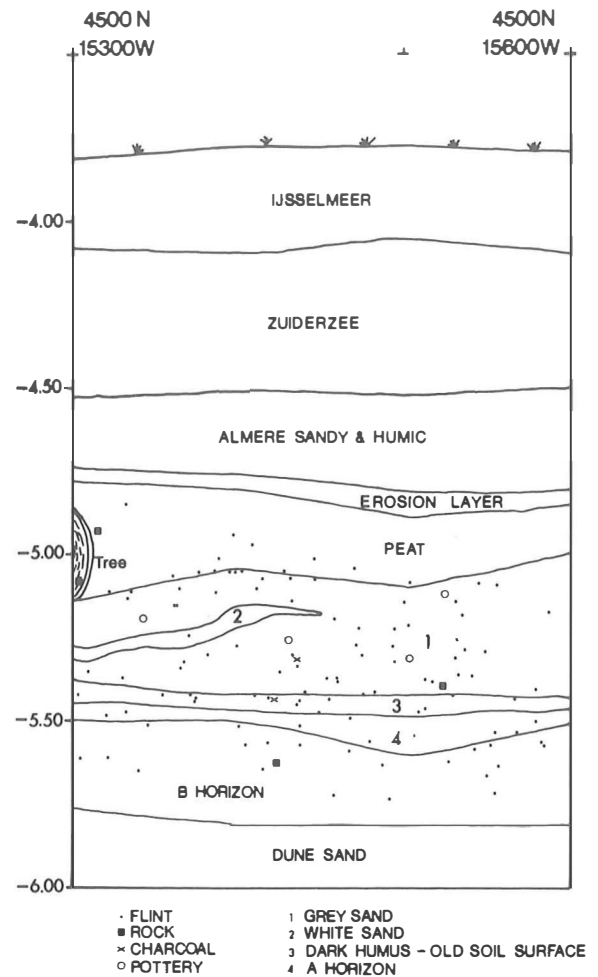


Fig. 13. S23: Profile of the south wall with vertical artifact distribution. Location of the section is shown in figure 10.

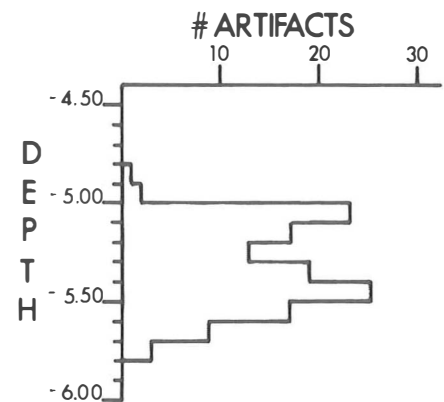


Fig. 14. Histogram of vertical artifact distribution in the three south squares of S23.

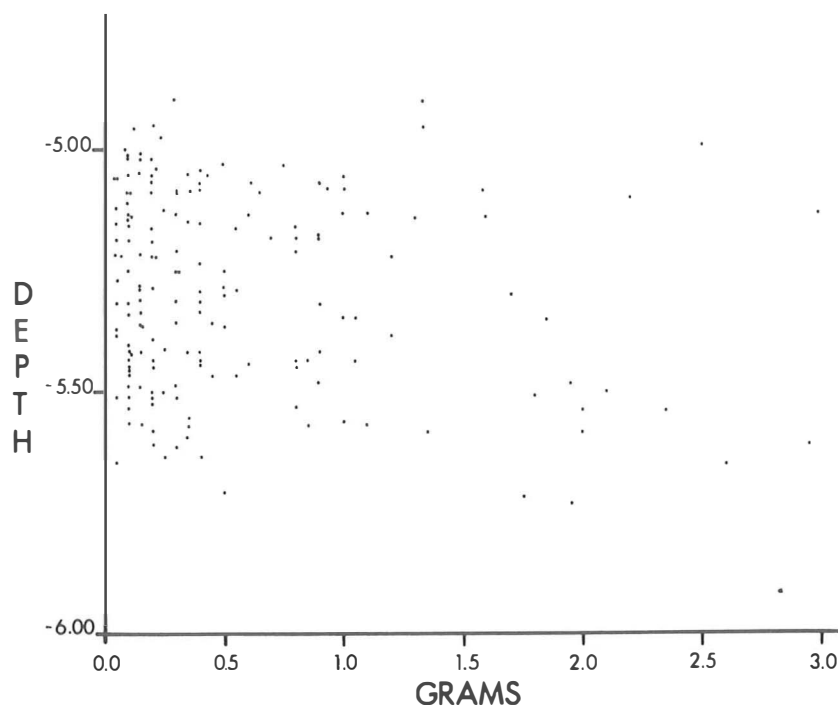


Fig. 15. Scatterplot of flint artifact weight by depth in the three south squares of S23.

probably after the occupation of the upper horizon.

5. SUMMARY AND CONCLUSIONS

Continuing investigations in the Swifterbant area over the last twenty years have resulted in the recovery of the remains of human occupation dating from both the Mesolithic and the Neolithic periods. The somewhat higher elevations of the river dunes appear to have been favored locales for habitation.

During the Boreal period of the early Post-glacial, this area would have been a fairly typical coversand environment in a riverine regime. The landscape would have been dominated by a relatively stable Boreal forest. As conditions became moister and sea level rose after 5500 B.C. in the Atlantic period, the area was transformed into a bog and creek system in a fresh water tidal delta environment. A marsh forest would have been present with much alder, oak, and pine. Lime trees would

have been common on the river dunes (Casparie *et al.*, 1977). Finally the area would have been inundated by rising water levels sometime after 3000 B.C.

Although much of the occupation horizon on the river dune at H46 has been truncated by erosion, some of the materials collected from the site appear to document a *Ceramic Mesolithic* occupation. Ceramic Mesolithic sites are also recorded along the Atlantic and Baltic coasts of Europe. In northern Germany and southern Scandinavia pottery is found with the Ertebølle-Ellebek cultures of the Mesolithic. Although organic materials are not preserved and macrolithic tools such as flint axes are missing in the river dune sites at Swifterbant, the date of 4300 B.C. at S23 falls within the range of the Ertebølle of Denmark which begins around 4600 B.C. (Brinch Petersen, 1973). Ceramics in the Danish Ertebølle, similar in size and shape to the Swifterbant material (de Roever, 1979), appear after 3800 B.C. in southern Scandinavia. In France, ceramics in association with Mesolithic re-

mains have been reported along the Atlantic coast at Roucadour (Roussot-Laroque, 1977). This material is dated to approximately 4000 B.C. and the ceramics are similar to the Swifterbant material with pointed bases and heavy-walled construction. The evidence from these areas supports the earlier hypothesis of Schwabedissen (1966) that ceramics may have diffused into northern Europe along the coast prior to or simultaneously with the appearance of inland pottery-using farming cultures.

An earlier utilization of the dune is indicated as well. Radiocarbon dates of roughly 5800 B.C. and 4800 B.C., along with certain lithic artifacts, provide evidence for earlier Mesolithic occupations, corresponding to the Boreal and Late Mesolithic periods of Newell (1973). The graves on the dune, intrusive through the developed soil horizon, must post-date 4300 B.C. These graves are likely from the end of the period of potential occupation on the dune. The facts that the graves are intrusive through the soil and that the bones of the burials are partially preserved argue for interment at a time when water levels were higher in the area. These graves may well be contemporaneous with the Neolithic settlements and burials from the clay levee sites in the Swifterbant area. The levee burials are dated to 3590 B.C. by a radiocarbon date on bone collagen from a grave in parcel G42 (GrN-5606 5540 \pm 65 B.P.; Van der Waals & Waterbolk, 1976, p. 7).

The graves at H46 show a distinct orientation (figs. 4 & 7). With only one or two exceptions, the longitudinal axes of the graves follow the top of the dune and are located near the former crest.

From the angle of the north and south slopes of the dune (fig. 3), the crest of the dune must have stood at least 75 cm higher than its present surface, or at approximately -3.75 m N.A.P. The orientation and placement of the graves thus also argues for the original location of the graves in the highest and driest areas available and at a late date in the period of potential occupation.

Although one of the major goals of the 1976

project, the location and recovery of an intact Mesolithic occupation surface was not achieved, the season was successful. Earlier excavations at the dune were completed and an additional burial removed before it was destroyed by the drying of the dune. The new excavation unit, S23, completely transected the dune and provided valuable information on the occupational history of the site.

In essence we have learned that the higher areas of the dune have been badly disturbed. In areas along the slopes of the dunes, two probable cultural horizons are present and vertically separate, albeit with some overlap. Artifactual material, vertical separation, and radiocarbon dates argue for a possible Ceramic Mesolithic in the Swifterbant area. However, because of the disturbance of the dune and the overlap of the cultural horizons, successful recovery of an intact surface from this period may be possible only in deeper excavations — where the water table will make discovery difficult — or on those lower dunes (e.g., S11) that were not truncated by marine erosion. Clearly, more investigation is needed with better stratigraphic separation to adequately document the settlements of the pre-Neolithic inhabitants of the Swifterbant area.

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A final note concerns an earlier publication. Due to an unfortunate set of circumstances, certain information mistakenly appeared in my article "Mesolithic settlement systems in the Netherlands" in 1976 in *The Early Postglacial Settlement of Northern Europe* edited by Dr. P.A. Mellars. Dr. R.R. Newell of the Biologisch-Archaeologisch Instituut had requested that data from several Mesolithic sites in the Netherlands not be published in that article and I was unable to have the information omitted. My apologies to Dr. Newell for any inconvenience.

7. BIBLIOGRAPHY

- BOHMERS, A., 1963. A statistical analysis of flint artifacts. In: D. Brothwell & E. Higgs (eds.), *Science in Archaeology*. London, pp. 469-481.
- BOHMERS, A. & A. WOUTERS, 1956. Statistics and graphs in the study of flint assemblages. *Palaeohistoria* 5, pp. 27-28.
- BRINCH PETERSEN, E., 1973. A survey of the Late Paleolithic and the Mesolithic of Denmark. In: S.K. Kozłowski (ed.), *The Mesolithic in Europe*. Warsaw, pp. 77-127.
- BRINKHUIZEN, D.C., 1976. De visresten van Swifterbant. *Westerheem* 25, pp. 246-252.
- CASPARIE, W.A., B. MOOK-KAMPS, R.M. PALFENIER-VEGTER, R.C. STRUIJK & W. VAN ZEIST, 1977. The palaeobotany of Swifterbant – a preliminary report. Swifterbant Contribution 7. *Helinium* 17, pp. 28-55.
- CLASON, A.T., 1978. Worked bone, antler and teeth – a preliminary report. Swifterbant Contribution 9. *Helinium* 18, pp. 83-86.
- CLASON, A.T. & D.C. BRINKHUIZEN, 1978. Swifterbant. Mammals, birds, fishes. A preliminary report. Swifterbant Contribution 8. *Helinium* 18, pp. 69-82.
- CONSTANDSE-WESTERMANN, T.S. & C. MEIKLEJOHN, 1979. The human remains from Swifterbant. Swifterbant Contribution 12. *Helinium* 19, pp. 237-266.
- DECKERS, P.H., 1979. The flint material from Swifterbant, Earlier Neolithic of the northern Netherlands. I. Sites S-2, S-4, and S-51. Final Reports on Swifterbant II. *Palaeohistoria* 21, pp. 143-180.
- ENTE, P.J., 1971. Sedimentary geology of the Holocene in the Lake IJssel region. *Geologie en Mijnbouw* 50, pp. 373-382.
- ENTE, P.J., 1976. The geology of the northern part of Flevoland in relation to the human occupation in the Atlantic time. Swifterbant Contribution 2. *Helinium* 16, pp. 15-35.
- HACQUEBORD, L., 1974. De geologie van de noordwesthoek van Oostelijk Flevoland. *Berichten Fysisch Geografische Afdeling der Rijksuniversiteit Utrecht* 8, pp. 43-51.
- HACQUEBORD, L., 1976. Holocene geology and palaeogeography of the environment of the levee sites near Swifterbant (polder Oost Flevoland, section G36-41). Swifterbant Contribution 3. *Helinium* 16, pp. 36-42.
- HEIDE, G.D. VAN DER, 1966a. Enkele aantekeningen betreffende prehistorische bewoning van het oostelijk deel van het Zuiderzeegebied. *Kamper Almanak*, pp. 200-214.
- HEIDE, G.D. VAN DER, 1966b. Opgraving bij Swifterbant. *Fibula* 7, pp. 86-89.
- HULST, R.S. & A.D. VERLINDE, 1976. Geröllkeulen aus Overijssel und Gelderland. *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek* 26, pp. 93-126.
- JELGERSMA, S., 1961. *Holocene sea level changes in the Netherlands*. Maastricht.
- MEIKLEJOHN, C. & T.S. CONSTANDSE-WESTERMANN, 1978. The human skeletal material from Swifterbant, Early Neolithic of the Netherlands – inventory and demography. Final Reports on Swifterbant 1. *Palaeohistoria* 20, pp. 39-89.
- NEWELL, R.R., 1973. The Postglacial adaptations of the indigenous population of the Northwest European Plain. In: S.K. Kozłowski (ed.), *The Mesolithic in Europe*. Warsaw, pp. 399-440.
- NEWELL, R.R. & A. VROOMANS, 1972. *Automatic Artifact Registration and Systems for Archaeological Analysis with the Philips P1100 Computer: A Mesolithic Test Case*. Oosterhout.
- PRICE, T.D., 1975. Mesolithic settlement systems in the Netherlands. Unpublished Ph.D. dissertation. University of Michigan, Ann Arbor.
- PRICE, T.D., R. WHALLON, JR. & S. CHAPPELL, 1974. Mesolithic sites near Havelte, province of Drenthe (Netherlands). *Palaeohistoria* 16, pp. 7-61.
- ROEVER, J.P. DE, 1976. Excavations at the river dune sites, S21-S22. Swifterbant Contribution 4. *Helinium* 16, pp. 209-221.
- ROEVER, J.P. DE, 1979. The pottery from Swifterbant – Dutch Ertebølle? Swifterbant Contribution 11. *Helinium* 19, pp. 13-36.
- ROEVER-BONNET, H. DE, A.C. RIJPSTRA, M.A. VAN RENESSE & C.H. PEEN, 1979. Helminth eggs and gregarines from coprolites from the excavations at Swifterbant. Swifterbant Contribution 10. *Helinium* 19, pp. 7-12.
- ROUSOT-LAROQUE, J., 1977. Néolithisation et Néolithique ancien d'Aquitaine. *Bulletin de la Société Préhistorique Française* 74, pp. 559-582.
- SCHWABEDISSEN, H., 1966. Ein horizontierter "Breitkeil" aus Satrup und die mannigfachen Kulturverbindungen des beginnenden Neolithikums im Norden und Nordwesten. *Palaeohistoria* 12, pp. 409-468.
- WAALS, J.D. VAN DER, 1972. Die durchlochten Rössener Keile und das frühe Neolithikum in Belgien und den Niederlanden. In: H. Schwabedissen (ed.), *Die Anfänge des Neolithikums vom Orient bis Nordeuropa*. Teil VA. Köln, pp. 153-184.

- WAALS, J.D. VAN DER, 1977. Excavations at the natural levee sites, S2, S3/5, and S4. Swifterbant Contribution 6. *Helinium* 17, pp. 3-27.
- WAALS, J.D. VAN DER & H.T. WATERBOLK, 1976. Excavations at Swifterbant – discovery, progress, aims, and methods. Swifterbant Contribution 1. *Helinium* 16, pp. 4-14.
- WATERBOLK, H.T., 1976. Oude bewoning in het waddengebied. In: *Waddenzee, natuurgebied van Nederland, Duitsland en Denemarken*. Harlingen/'s-Gravenhage, pp. 211-221.
- WHALLON, R., JR. & T.D. PRICE, 1976. Excavations at the river dune sites S11-S13. Swifterbant Contribution 5. *Helinium* 16, pp. 223-229.