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THE MARINE HOLOCENE OF SYLT – DISCUSSION OF THE AGE AND FACIES

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ABSTRACT

Investigation of the marsh area of Sylt during 1965-66-67 yielded new data regarding the development of Sylt during the Holocene. Three transgressions of the sea were established. The deposits of the first belong to the Calais (according to Brand et al. 1966) and the others to the Dunkirk. The ages of the transgressions were determined by means of ^{14}C-analysis and cultural layers. South of Westerland, the fine-grained facies of the second transgression indicates that the area was well protected by the "Geestkerne" and the southern beach-barrier of the island.

INTRODUCTION

The coastal area of Schleswig-Holstein is mainly covered with Holocene deposits. They are thicker and coarser grained in Dithmarschen and Eiderstedt than in North-Frisia (Dittmer 1952). Geological and archeological investigations in the North-Frisian mainlands and in the tidal flats between the coast and the North-Frisian Isles prove that the marsh-area in this region is now considerably smaller than in the Middle-Ages due to destruction by storm-tides in the 17th century (Busch 1940, Bantelmann 1939, 1967; Dittmer 1952; Prange 1964, 1967a, 1968; Wegner 1931; Wiermann 1963). Some of the North-Frisian Isles such as Pellworm, Nordstrand or Langeness are relicts of this old marsh. Other parts of it are found around the Pleistocene deposits of Sylt, Amrum and Föhr.

In 1965, an excavation made by the "Institut für Ur- und Frühgeschichte der Universität Kiel" presented the opportunity to investigate the marine Holocene of Sylt. Under the direction of Prof.Dr. Kossack prehistoric settlements in this area were studied to gain information about the conditions of life near the sea in the late Iron Age and the Roman Imperial Period.

Particular thanks are due to Prof.Dr. Kossack and Prof.Dr. Seibold (Geologisch-Paläontologisches Institut und Museum der Universität Kiel) for their help and many discussions, which have improved my understanding of the prehistorical and geological problems. Further thanks go to Dr. Prange, Kiel, for introducing me to the geology of the marine Holocene, to Dr. M. Geyh, (^{14}C-Laboratory Hannover) and Dipl.-Phys. Erlenkeuser (^{14}C-Laboratory Kiel) for dating the samples mentioned in this paper, and to B. Newton, Kiel, for reading and correcting this manuscript.

THE GEOLOGY OF SYLT

The geological map of Sylt (fig. 1) shows three regions with Pleistocene or Tertiary deposits (Dietz & Heck 1952):

1. the area surrounding Morsum consisting of Tertiary sediments compressed by glacial ice in the northern part, and of Pleistocene deposits in the southern part.
2. the area around Archsum consisting of Holstein-Sea deposits in the northern part and of deposits of Saale glaciation in the southern part.
3. the area between Kampen-Westerland-Keitum consisting of Pleistocene and Tertiary deposits.

These geological units are called "Geestkerne". They are easily recognized in the field because their

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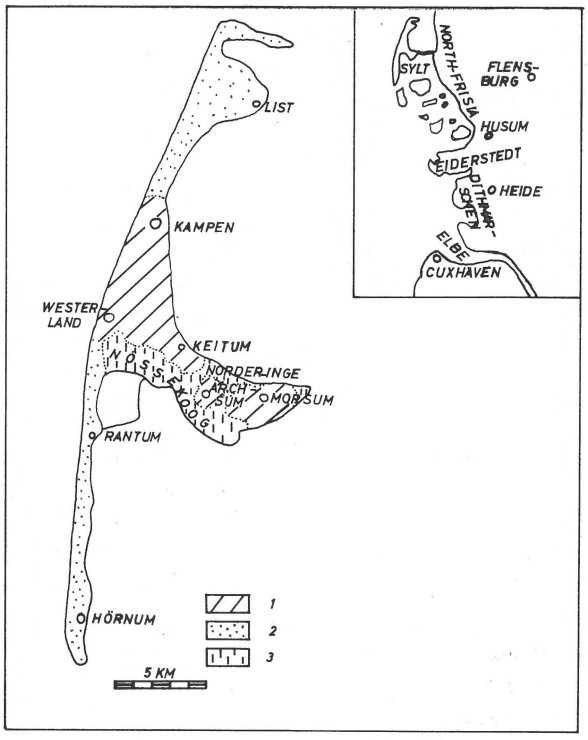


Fig. 1

Geological map of Sylt. 1 = Pleistocene or Tertiary deposits; 2 = beach-barriers covered with dunes; 3 = marine Holocene deposits.

surface is higher than that of the marsh which almost completely surrounds the Geestkerne in the eastern part of Sylt. The marsh-area south of the Geestkerne is called "Nössekoog" and that between Keitum and Morsum north of Archsum is called "Norder-Inge".

The peninsulas north of Kampen and south of Westerland are beach-barriers of unknown age.

SEDIMENTS UNDERLYING THE HOLOCENE DEPOSITS

There are two distinct sediment types underlying the Holocene: in the Nössekoog, loam of the Saale glaciation is dominant with a thin layer of sand above it. In most parts of the Norder-Inge a marine clay of the Holstein-Sea is found below the Holocene deposits. It is often difficult to distinguish this clay from the similar appearing overlying Holocene sediments. The relief of the Pleistocene surface varies greatly and with it the thickness of the Holocene sediments (fig. 2).

THE HOLOCENE DEPOSITS

The Deposits of the First Transgression

The deposits of the first transgression occur only in the Norder-Inge because the Pleistocene surface is particularly low in this region.

Figure 3 shows the stratigraphic sequence. The basis-peat is the first indicator of the rising sea-level. Today it is found only at places well protected from erosion. The deposits change upwards from peat to humic clay, to clay, and then to sand, which in this area is an indicator for the culmination of the transgression. Clay and humic clay in the upper part of this sequence show the regression of the sea. In the north-eastern part of the Norder-Inge, which is not well protected, the basis-peat and the clayey layers have been removed by erosion. A complete regression of the sea at the end of the cycle did not take place. The humic clay shows that a small influence of the sea remained.

In order to date the beginning of the transgression the age of two samples taken from the top of the basis-peat was determined by means of ^{14}C-analysis. The ages were 5,115 ± 200 years BP (Hv 1877) and 4,620 ± 50 years BP (KI 95). The difference in the ages can be explained by the different positions of the localities from which the samples were taken.

The Deposits of the Second Transgression

The deposits of the second transgression occur in the Norder-Inge as well as in the Nössekoog. The Nössekoog sequence begins with peat above the Pleistocene deposits (fig. 4 and 5). Its surface is higher than that of the basis-peat in the Norder-Inge. Much of the Nössekoog peat has been eroded; south of Morsum the erosion was stronger than south of Westerland. In the Norder-Inge the new transgression can be recognized by a decrease of humic components in the section (fig. 3). At the culmination of the transgression, sand was deposited south of Morsum and in the Norder-Inge. South of Westerland, the whole sequence consists of fine-grained deposits. They indicate quiet conditions of sedimentation in a well protected bay, which was formed by the Geestkerne in the north and by the southern beach-barrier of the island in the west. The complete regression of the sea is indicated by wide-spread clay sedimentation and by the formation of a soil horizon.

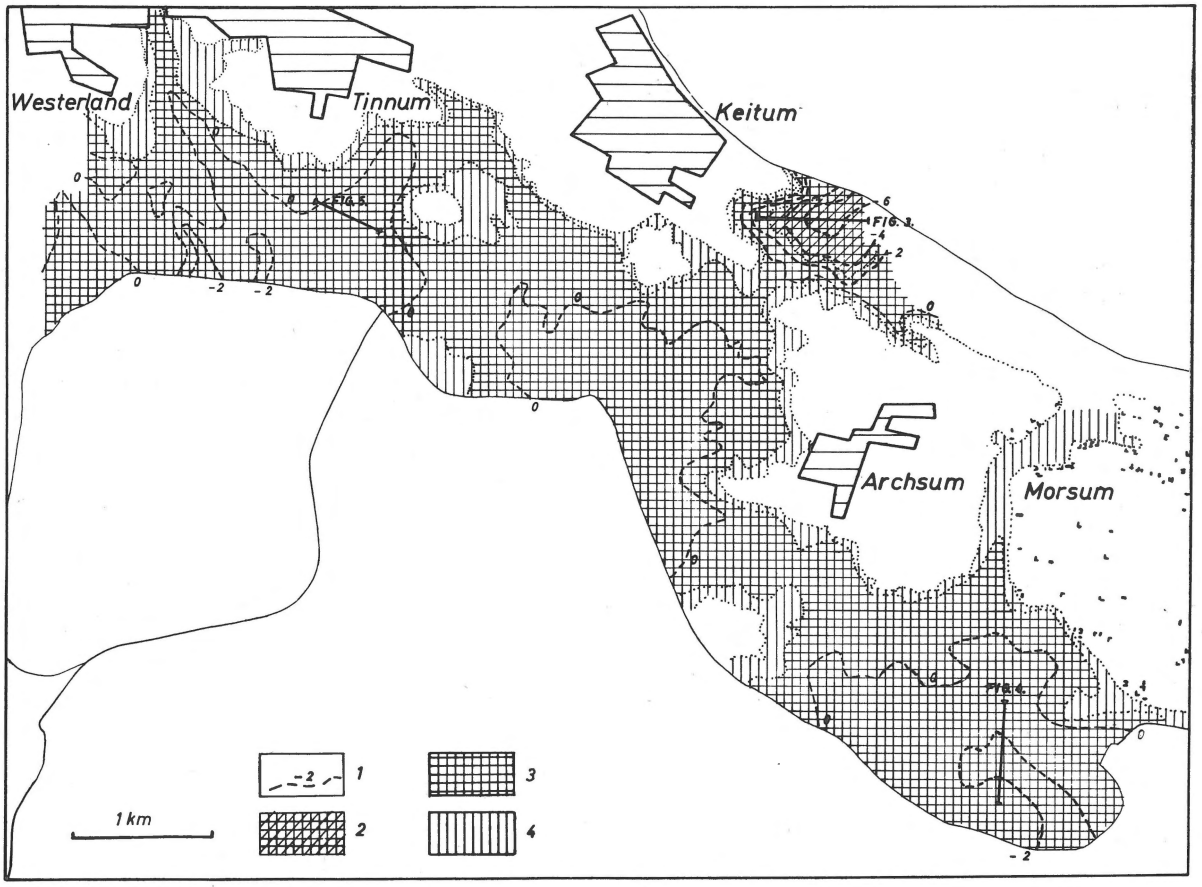


Fig. 2

The relief of the Pleistocene surface and the distribution of the marine Holocene deposits. 1 = Pleistocene surface (2 m below NN); 2 = deposits of the first, second, and third transgression overlying Pleistocene deposits; 3 = depots of the second and third transgression overlying Pleistocene sediments; 4 = deposits of the third transgression overlying Pleistocene sediments.

An attempt was also made to date the beginning of this transgression through ^{14}C-analysis. Samples of peat were taken from directly below the humic clay where the possibility of erosion is remote. The samples yielded the following results:

South of Morsum:	3,260 ± 40 years BP (KI-98)
	3,750 ± 65 years BP (KI-203)
	4,070 ± 105 years BP (Hv-1875)
South of Keitum:	3,820 ± 60 years BP (KI-100)
	3,510 ± 55 years BP (KI-201)
South of Westerland:	4,140 ± 100 years BP (Hv-1876)
	3,300 ± 50 years BP (KI-97)
	3,070 ± 60 years BP (KI-202)
Norder-Inge:	3,970 ± 225 years BP (Hv-1874)
	3,690 ± 50 years BP (KI-200).

Although there is considerable discrepancy in the age of the samples, it should be taken into consideration that the samples were taken from different localities and that the peat surface is not of the same age in the whole of Sylt.

The end of the transgression cannot be dated in this manner because there are no suitable deposits. To obtain the desired date, a cultural layer south of Westerland mentioned by K e r s t e n & L a B a u m e (1959) was investigated to determine its age and stratigraphic position. An excavation made by cand. phil. O. Harck, Kiel, yielded the relicts of two houses, one upon the other, resting on top of the soil horizon above the deposits of the second transgression. Through ceramic dating, Prof.Dr. Kossack determined

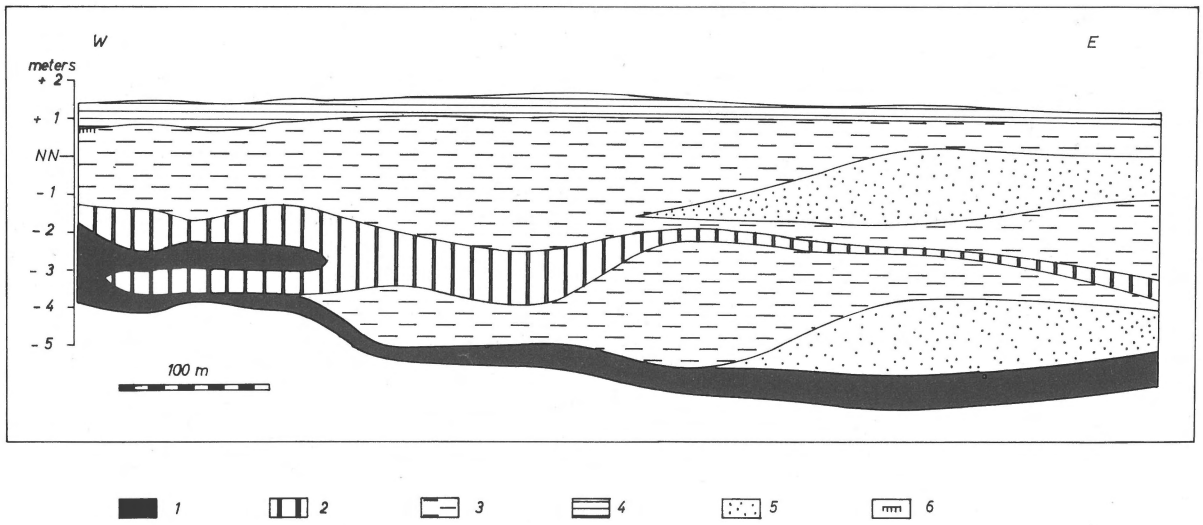


Fig. 3

Cross-section through the Norder-Inge. 1 = peat; 2 = humic clay; 3 = clayey sediment; 4 = thin layered sediment of silt and clay; 5 = sand; 6 = soil horizon.

that the houses were built about the time of Christ's birth. Accordingly, the end of the transgression must have taken place at an earlier date.

c. The Deposits of the Third Transgression

The deposits of the last transgression occur in the whole marsh area of Sylt as a rather thin layer above the soil on top of the second transgression deposits. Areas with different facies can be distinguished. In most regions the deposits are rather fine-grained, but south of Westerland, Keitum and Morsum and in the north-eastern part of the Norder-Inge they are more coarse-grained. There seems to be a relation between the distribution of the more coarse-grained facies in the deposits of this transgression and the areas of greater Holocene sediment thickness. In these areas of more coarse-grained sediments of the third transgression settling of the older deposits had been more effective and allowed local lowering of the surface. During the last transgression of the sea the water was deeper in these regions and the sedimentation of coarser grained material was possible.

It is rather difficult to determine the beginning of the third transgression because there are no deposits suitable for ^{14}C-analysis. To solve this problem the relicts of the "Eidum-Deich", built in the marsh-area during 15^{th} or 16^{th} century (B u s c h 1940) were excavated to determine their stratigraphic position. A layer of clay only 10 cm thick separated the soils overlying the deposits of the second transgression and the base of the Eidum-Deich. This means either a very low sedimentation rate between the beginning of the

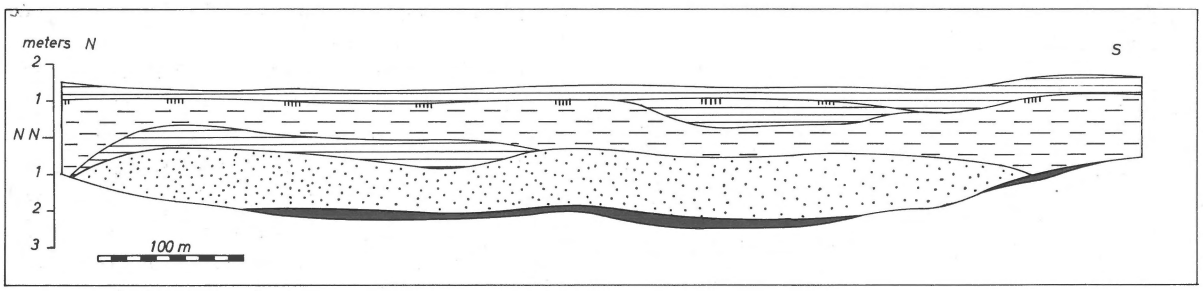


Fig. 4

Cross-section through the area south of Morsum.

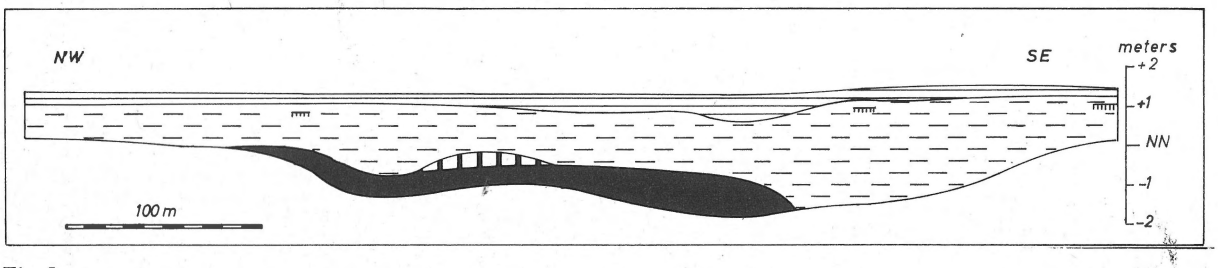


Fig. 5

Cross-section through the area south of Westerland.

first millennium AD and the 15th century, or a rather rapid sedimentation after an interruption. The last possibility seems more plausable as P r a n g e (1964) and W i e r m a n n (1963) have found a sedimentation hiatus in the North-Frisian mainlands lasting from the beginning of the first millennium AD to the 14th century. It is possible that the transgression of the sea in the area of Sylt began a little earlier because the island is more exposed to the sea than the North-Frisian mainlands.

COMPARISON OF THE HOLOCENE OF SYLT WITH THAT OF OTHER AREAS

It has already been mentioned that the subdivision of the North-Frisian continental Holocene is similar to that of Sylt. The first transgression began in Sylt later than in the North-Frisian mainlands. This resulted in the Pleistocene surface lying at a lower level in some parts of continental North-Frisia than in Sylt. Therefore the rising sea-level first reached the North-Frisian mainlands and later Sylt.

It is noteworthy that there is practically no peat between the deposits of the first and the second transgression in the area of Sylt although peat dating from this time is found in nearly all other German and Dutch North-Sea coastal areas. It is possible that the peat in the Norder-Inge was removed by erosion, however, this region is well protected from weststorms by the Geestkern of Westerland. Furthermore the base deposits of the second transgression do not show any indication of erosion. A more reasonable explanation may be this: The Isle of Sylt is situated some distance in front of the continental coast of North-Frisia, and the regression of the sea was not so effective in the Sylt area as in the eastern regions.

The second transgression began in Sylt earlier than in other regions of Schleswig-Holstein.

The Holocene of Sylt can be subdivided into Calais (deposits of the first transgression) and Dunkirk (deposits of the second and third transgression) according to the proposal of B r a n d et al. (1966). A correlation with the Holocene subdivisions of other areas is not absolutely clear.

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