The Helsingør diamicton

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Deglaciation sequences comprising glaciolacustrine sediments overlain by till deposited in a subaqueous environment around the Danish coast of Øresund and in central Northeast Sjælland are grouped into five facies (a, b, c, d and e). Facies a and facies b are clays deposited from suspension fall out in ice dammed lakes. Facies c comprise sand and gravel deposited by traction currents, wave action and sediment gravity flows. Facies d, which is interbedded with or overlies the glaciolacustrine beds, is a diamicton deposited as flow till during the breakdown of stagnant icemasses. Facies e: THE HELSINGØR DIAMICTON is a heterogeneous, flamy diamicton of either NW-Scanian or Baltic provenance deposited by iceberg drop and dump processes in interaction with glaciolacustrine sedimentation.

The Helsingør diamicton was laid down primarily from floating icebergs into a partly ice dammed, partly landsurface confined basin at the very end of the Middle Weichselian during a transgression which built up high level coast lines up to 65 m a.s.l. in Skåne. On northeastern Sjælland deposition took place in the coastal areas at least up to 20 m above the present sealevel.

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Introduction

Considerations on the withdrawal and deglaciation pattern of the youngest Weichselian ice sheet in the Øresund region has a long history in both Swedish and Danish literature (cf. Rørdam 1893; Munthe 1910; De Geer 1912; V. Milthers 1918, 1922, 1927; Madsen 1928; Hansen 1933, 1940, 1965; Wennberg 1949; Lundqvist 1954, 1961; Nilsson 1968; Mörner 1969; Lagerlund 1977a).

During the late glacial phase of the Weichselian stage (Hansen 1965) deglaciation proceeded simultaneously with the transgression of the Younger Yoldia Sea through the Kattegat. In Skåne highly elevated shorelines were developed ranging up to between 20 m and 65 m a.s.l. (cf. Lundqvist 1961; Johnsson 1979; Daniel 1978; Adrielsson et al. 1981). Possible late glacial shorelines have generally been estimated to underlie or coincide with Flandrian shorelevels on the Danish Øresund coast (Mertz 1924). However, S. A. Andersen (1943) argued, that shorelines lying about 10 m a.s.l. arround Helsingør could have developed during the so called Zirphaea transgression. Furthermore, it was suggested, that the Younger Yoldia Sea reached hights between 30–40 m a.s.l. in that area of Northeast Sjælland, thus approaching the values of the highest shorelines along the Swedish coast opposite to Helsingør.

According to Hansen (1940) deposition of late glacial sediments (clay, sand and till) in eastern Denmark and western Skåne was to a very large extent governed by the melting of dead ice masses, and sedimentation of glaciolacustrine mud took place in totally or partly ice dammed lakes or basins. Attempts were made to correlate these, partly varved clays of Danish and South-swedish localities for the purpose of extrapolating the Swedish varve-chronology (De Geer 1926), but as shown by Hansen (1933) with limited successs. In coastal regions a sporadic till-cover was laid down upon the glaciolacustrine sediments as the result of an advance of the so called Øresund-glacier (= Low Baltic Adv.; Hansen 1940, map II), where as flow tills were deposited in dead-ice dammed lakes in the central part of northeast Sjælland.

The presence of a well preserved bone of a ringed seal (Phoca hispida) suggests influence of marine conditions during deposition of the Nivå clay (Iversen 1967, 1973).

Eventhough the late glacial deposits in Skåne have not been absolute dated, a very late Middle Weichselian age (sensu Mangerud et al. 1974) was suggested by Berglund and Lagerlund (1981)

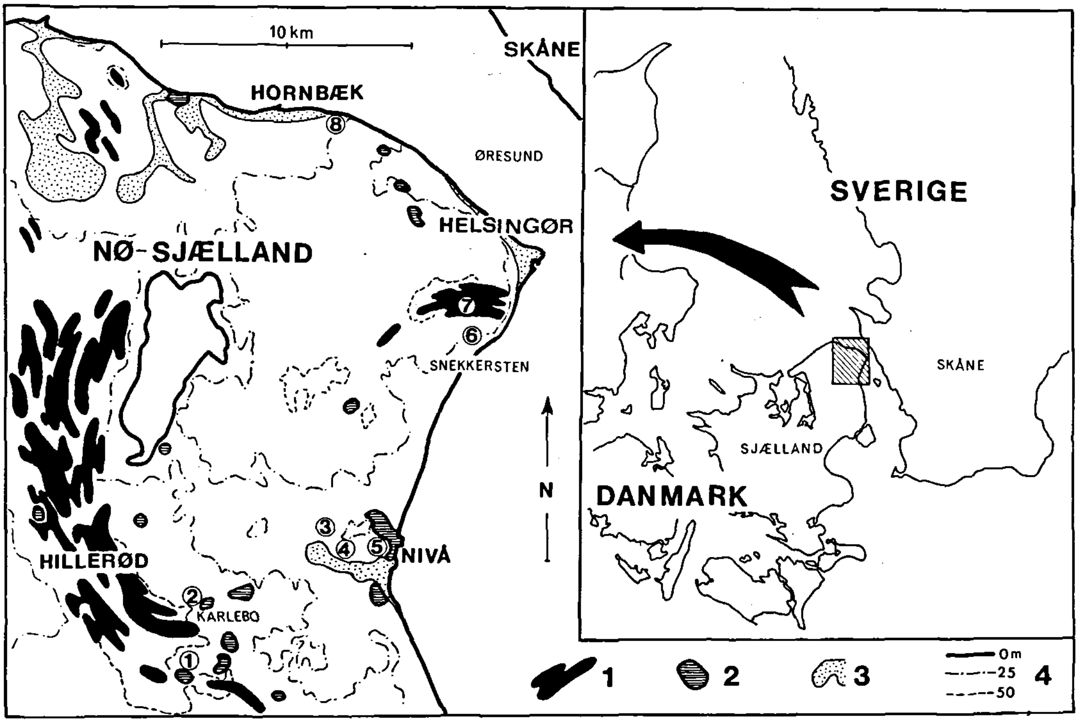

Fig. 1. Key- and locality map. Modified after Rørdam (1893), V. Milthers (1935) & Smed (1982). 1: Icemarginal hills, 2: Late glacial, glaciolacustrine clay, 3: Flandrian, marine deposits, 4: Countour lines.

and through presentation of modern results (Lagerlund 1980; Berglund and Lagerlund 1981; Adrielsson 1984) it is suggested, that glaciolacustrine clay and the (Low Baltic) till cover are related to the break down of the youngest Wechselian ice sheet, and deposition took place proglacially in a subsequeous environment. In recent Danish literature (Houmark-Nielsen 1981, 1983a) this ice sheet is referred to as the Bælthav glacier; a readvance invading northeastern Sjælland and western Skåne from southerly directions during later stages of the Young Baltic glacial phase. Deglaciation was according to Lagerlund (1980, 1983) and Adrielsson (1984) under strong influence of a transgression, which reached more than 40 m a.s.l. on Ven and up to 65–70 m a.s.l. in average on the Skåne mainland.

Marine to brackish conditions during deposition of the late glacial Lomma clay was suggested by Torell (1887) due to the presence of numerous fossils of the high artic cod (Gadus saida) described by De Geer (1887).

The present paper gives an attempt to identify and correlate across Øresund the above mentioned diamictic deposits overlying and interfingering late Middle Weichselian, glaciolacustrine sediments. It is demonstrated that the till bed supposedly deposited by the so called Øresund glacier in fact could not have been layed down by an active icestream, but on the contrary, it was by all appearance sedimented through a combination of depositional mechanisms including dump, drop and subaqueous gravity flows.

The investigated area

During a search along the Øresund coast of northeastern Sjælland in the summer of 1985, 8 localities were selected for further examination. Localities (1–8) are situated in the area around Hillerød and Helsingør (fig. 1).

Locs. 1 and 2 (Hansen 1940, site 87) are clay pits of more than 8 m in depth situated about 45 m a.s.l. upon a segment of the so called Gribskov icemarginal hills southeast of Hillerød. Locs. 3

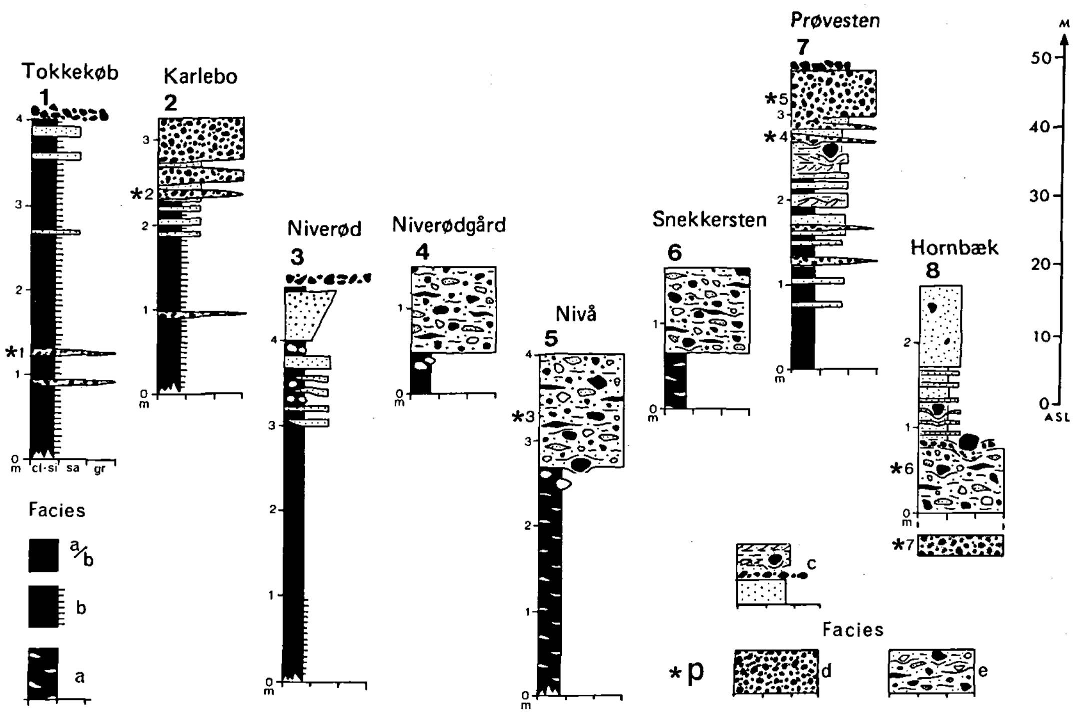

Fig. 2. Stratigraphical columns locs. 1–8. Letters a–e refer to sedimentary facies. Facies e = Helsingør diamicton. P indicate sample location and number.

and 5 (Hansen 1940 sites 88, 90) are claypits of considerable depths and loc. 4 is a construction site. They all lie between 20 m and a little less than 10 m a.s.l. respectively near the top of – or on the eastern flank of the "Nivå clay kame" around Niverød and Nivå. Locs. 6 and 7 are construction sites situated respectively about 20 m a.s.l. at Borupgård, Snekkersten and slightly less than 50 m a.s.l. at Prøvestens Center in the very southern part of Helsingør. Both sites lie on the southeastern rim of a presumed ice pushed ridge, which supposedly marks the northernmost limit of the Øresund glacier advance (V. Milthers 1935; Hansen 1940). Finally loc. 8 is situated about 15 m a.s.l. in a trench dug for an Interscandinavian power cable crossing Øresund at Ellekilde Hage about 2 km east of Hornbæk.

Sedimentary facies

The stratigraphic columns (fig. 2) from the 8 localities generally display glaciolacustrine sequences built up mostly of clay and till. The generally undeformed deposits do not show any sign of active glacitectonic displacement and structures developed by slumping or passive settling occur only rarely.

Five major sedimentary facies (a–e) have been recognized. Deposits of clay (facies a and b) are overlain by and interfinger towards the top with currentbedded or massive sand and gravel (facies c). Occasionally lenses or beds of massive, homogeneous diamicton (facies d) intervene the clay and sand. At highly elevated and inland localities the glaciolacustrine deposits are covered by beds of massive, homogeneous diamicton (facies d), where as low lying, coastal localities display a cover of a flamy, heterogeneous diamicton with dropstones (facies e). The latter facies will be referred to as the Helsingør diamicton. Near Hornbæk it is overlain by planebedded sand and silt in which dropstones occasionally are found.

Facies a and facies b.
Clay of several meters in thickness described as either the A or B type (Hansen 1940) has been recognized as facies a and facies b respectively.

The thorough lamination of facies b is expressed by rapid alternations of clay and well sorted laminae of silt or fine sand. In contrast facies a is a poorly sorted sandy and silty clay, at times showing disorderly and clude lamination and occasional dropstones. It should be noted, that transitional facies (facies a/b, fig. 2) have been observed in what appears to be similar quantities as facies a and facies b.

The clays were deposited by fall out from suspension of silty mud into ice dammed lakes or basins.

Facies c.

Facies c comprises a wide range of current-bedded, crudely bedded or massive, decimeter thick units of sand and gravel. Occasionally dropstones bend bedding planes. Primary sedimentary structures suggest deposition by traction currents, by wave action and subaqueous sediment gravity flows. Facies c was for the larger part most probably deposited in more shallower water and under stronger flow regimes compared to facies a and facies b. The presence of dropstone structures suggests, that ice-rafting occurred during deposition at least in coast near localities.

Facies d.

Facies d is a massive, homogeneous diamicton (fig. 3), that occurs as sheets, lenses or beds. It varies in thickness between a few cm up to about 1 m. The diamicton is non-erosively based, rich in clasts, and matrix apparently consist of the same material as facies a and facies b. Facies d is found at highly elevated localities (locs. 1, 2, 7) interbedding the clay sequences or underlying the till facies e (loc. 8). However, it appears most frequently together with facies c in the top levels as cover of the glaciolacustrine deposits.

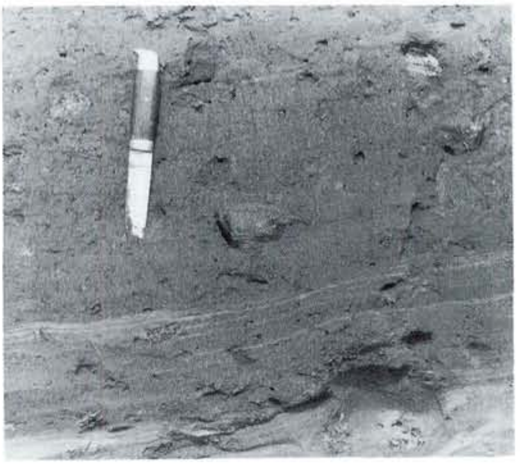

Fig. 3. Flow till (fac. d) interbedded with sand (fac. c), loc. 7, Prøvesten.

The interbedding of facies d with the previously mentioned facies (a, b, c); the massive, nongraded character and the non-erosive bases suggests, (in accordance with Houmark-Nielsen 1983b) deposition by sediment gravity flows. Remobilized glacial debris released from the surface of stagnant ice masses has taken part (as flow till) in the infilling of the ice dammed basins, most frequently during the later stages of deglaciation.

Facies e.

Facies e (the Helsingør diamicton), which is found close to the present coast of Øresund (locs. 4–6, 8; fig. 2) is a heterogeneous, flamy diamicton containing dropped material (fig. 4). The flamy appearance should not be confused with flame structures developed by loading. The texture is of a composite nature. Lenses and smears of red, brown and bluish-grey clay crudely intervene with beds and laminae of silt and sand. Both are in turn interbedded with tongues of flow till (facies d) and dropped diamict material. Occasionally the disorderly bedding is disturbed by slumping or by both bottom and top contact dropstone structures generally appearing as bending and penetration (c.f. Thomas and Connell 1985).

Facies e was most probably deposited through a combination of depositional processes. Parts of the matrix was deposited by suspension fall out from sediment laden water. Some matrix along with the clast material was apparently dumped and dropped most probably from drifting icebergs, while other diamict material was deposited by subaqueous sediment gravity flows. It is suggested, that the basin in which facies e was deposited would be of a considerable size in order to set icebergs in drift.

The Helsingør diamicton

Along the Øresund coast of NE-Sjælland Rørdam (1893) mentioned the presence of glaciolacustrine clay overlain by till material. Ac-

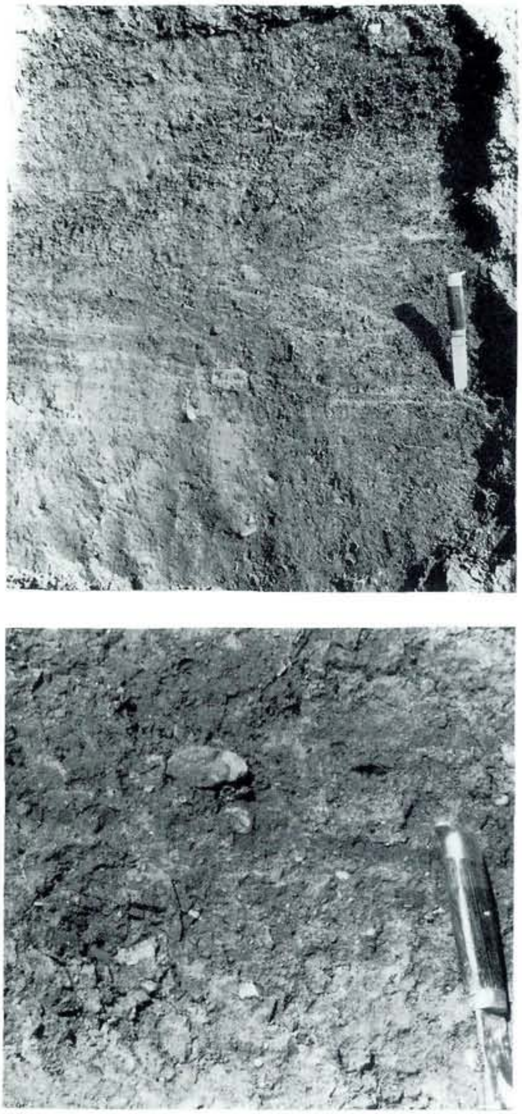

Fig. 4. Drop till: Helsingør diamicton (fac. e) Loc. 5: Nivå (lower) and loc. 6: Snekkersten (upper).

cording to Rørdam the till cover, which in places can be missing, is characterized by numerous "pale-reddish" smears and lenses of red sandstone, and the till constitutes parts of Rørdams upper till of NE-Sjælland rich in Baltic and Dalarian indicator erratics and pressumably deposited during the last glaciation.

Hansen (1940) described till covered, late glacial glaciolacustrine clay from the Nivå area, northeastern Sjælland (fig. 1). It was informally named the Nivaa-Dilluvialler, and this strongly symmict clay was termed type A. It was correlated with late glacial glaciolacustrine clay from western Skåne (Lomma-Røgle clay: Berglund and Lagerlund 1981) by Hansen (1940, p. 303) and it was suggested, that deposition took place in a large basin adjacent to an ice-margin in front of which clast bearing clay containing lumps and lenses of sand were laid down. These glacioaqueous deposits were subsequently overridden by an active icestream (the Øresund glacier = Low Baltic advance in Skåne), which was responsible for deposition of more than 1 m till material overlying the clay.

According to Hansen the till-cover at Nivå, which shows a gradational transition to the underlying clay, seems to be significantly more clayey, better sorted, less rich in clasts and it appears weathered compared to tills that cover the late glacial "younger dilluvial clay of Northsjælland" at more inland situated localities. At these sites S. Hansen suggests, that the cover-till present here was deposited due to remobilization of supraglacial debris, that flowed into the ice dammed basins during the final breakdown of the youngest Weicshelian ice sheet to cover Sjælland.

Even though the "Nivaa-Dilluvialler" and the "younger dilluvialler of Northsjælland" according to V. Milthers (1922) apparently occupy similar stratigraphic positions, the latter clay was thought to have been deposited in a number of restricted, ice-dammed lakes giving rise to a quite different, well laminated clay (type B, Hansen 1940) with good sorting of individual beds. However, S. Hansen points out, that transitional facies between the two clay types frequently occur.

Recent sedimentological investigations on the island of Ven and in western Skåne (Lagerlund 1980; Adrielsson 1984) have suggested, that the youngest till deposits in this region (Lund/Jonstorp/Kyrkbacken till) have a glacioaqueous origin. Clay, silt, sand and diamicton were supposedly deposited from suspension and ice-rafting in connection with the disintegration of the icesheet under a (marine?) transgression, which penetrated the northern Øresund region around the very end of the Middle Weichselian.

Previously this till was referred to as the Low Baltic till, and it was supposedly laid down by an active glacier during the Low Baltic ice advance. This classical model is still favoured by some authors (c.f. Duphorn et al. 1979; Ringberg 1984).

Fig. 5. Helsingør diamicton overlain by sandy beds with dropstones, loc. 8: Hornbæk.

The "Low Baltic" till (Lund/Jonstorp till) overlies brackish and glaciolacustrine deposits in the coasal areas of western Skåne. According to Berglund and Lagerlund (1981) this sequence (Åkarp/Farhult member) was deposited in the time interval between 13500 BP and 13000 BP. E. Lagerlund argued, that the Lund/Jonstorp till was deposited partly due to iceberg drop and dump processes into the basin possibly in connection with a short glacier readvance south of the region. At the same time deposition of the lower part of the above mentioned member (Lomma/Rögle clay) was continuously taking place.

Stratigraphy and distribution

Two of the five investigated sites with the Helsingør diamicton (facies e) have been chosen as reference sections. One, which was previously accessible to study at a construction site situated in the northern part of the investigated area (Hornbæk, loc. 8), exposed the lower and upper bounding units of one subfacies of the Helsingør diamicton dominated by NW-Scanian clast material. Here it is upward bounded by erosionally based gravel overlain by sandy beds (facies c) in which rare dropstones are present (fig. 5), and it is underlain by a Baltic flow till (facies d).

Another reference section is presently found at an abandoned clay pit at Nivå (loc. 5), where deposits of glaciolacustrine clay (facies a and b) underlie a second and Baltic dominated subfacies of the Helsingør diamicton. The lithology, which is described in more detail in a previous paragraph, can be characterized as a heterogeneous, flamy diamicton with dropstones. Thus at the majority of investigated sites, where the Helsingør diamicton is present, it overlies the Nivaa Dilluvialler (Nivå clay) with gradatoinal or nonerosive bottom contacts.

Laterally the distribution seems to be restricted to the coastal area along Øresund and vertically it is so far confined to levels lying up to 20 m above present sealevel. This distribution suggests a depositional basin, which is bound inland by stagnant ice masses situated in the central part of NE-Sjælland and with a water surface elevated at least 20 m compared to the present waters of Øresund.

Provenance and correlation

A few till samples have been subject to clast petrographic examination (fig. 6). The gravel counts tend to suggest, that both till facies (facies d and facies e) display two main rock assemblages of distinctly different provenance, as well

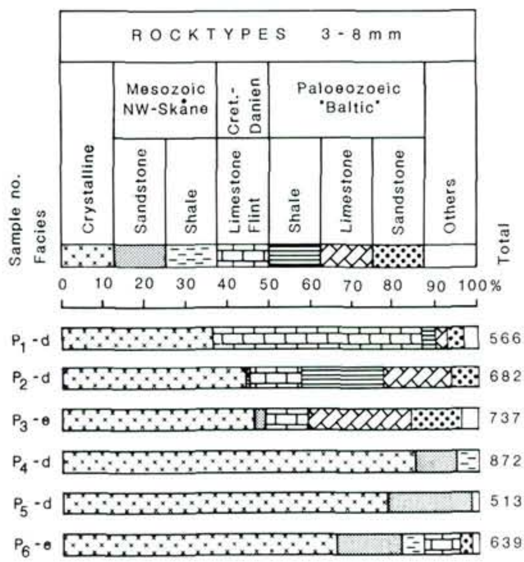

Fig. 6. Gravel counts from till samples 1–7.

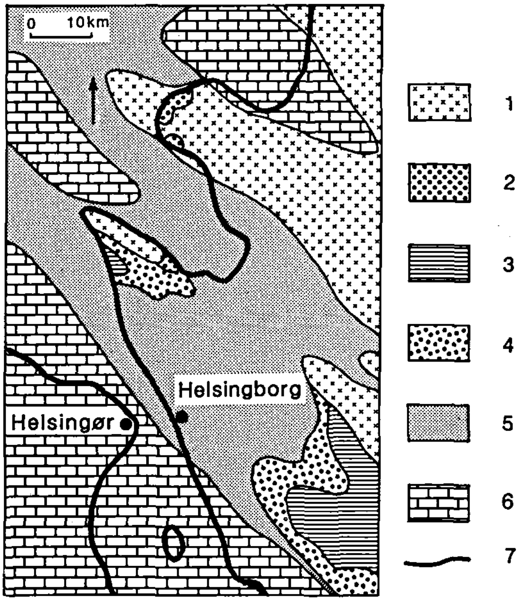

Fig. 7. Prequaternary map of the northern Øresund region simplified after Flodén (1984), Larsen et al. (1968) and Staufors & Bergström (1966). 1: Pre-Cambrian, 2: Cambrian, 3: Silurian, 4: Triassic, 5: Jurassic, 6: Cretaceous and Tertiary, 7: Present shoreline.

as mixtures of these. One is a typical Baltic assemblage with a characteristic content comprising mainly Palaeozoic limestone and shale together with crystalline and Cretaceous-Danian rocks (e.g. fig. 6 sample 2). A second assemblage is characterized by its contents of Rhaetic-Liasic rocks from northwestern Skåne (fig. 7) together with crystalline rocks and in various portions Mesozoic limestone and flint (e.g. fig. 6, sample 6). This assemblage is referred to as a Northwest-Scanian material facies where as the first mentioned assemblage is referred to as a Baltic material facies. It is, however, emphasized, that a certain material facies of a till does not nessecarily reflect a direct glacier transport from the provenance region of the facies (cf. Berglund & Lagerlund 1981).

The clast petrography of facies d indicates, that the stagnant ice cover from which flow tills formed was of a composite nature. Samples 4 and 5 from Prøvesten, Helsingør display a clear NW-Scanian material facies suggesting primary transport from the NE–E. The same primary transport direction is indicated also by the rock assemblage of sample 1 from Tokkekøb. At the Niverødgård site (loc. 4) the Helsingør diamicton shows a high content of chalk which gives the diamicton a white-dotted appearance. Including Baltic rock material this is the most common appearance of the Lund/Kyrkbacken till in Skåne. The Helsingør diamicton displays at sites 4 and 5 varieties of the Baltic material facies that differ from the Karlebo Baltic assemblage of facies d (sample 2). This suggests, that the icebergs, which produced the Helsingør diamicton at Nivå and Niverød have the same provenance as those that produced the Lund/Kyrkbacken till.

In northwestern Skåne the unit equivalent to the Lund till (Jonstorp till) has a characteristic content of Rhaetic-Liassic rocks (Lagerlund 1971, 1977b). Generally, the regional differences in clast composition of the Lund/Kyrkbacken and the Jonstorp till reflect the clast composition of the underlying till (corresponding to the Bælthav Till) deposited by the youngest glacier in the area which moved from a southern sector (Lagerlund 1980). This means, that the icebergs, which deposited the diamict facies (Lund/Kyrkbacken/Jonstorp) till of the Åkarp and Farhult members (Berglund and Lagerlund 1981) to a great extent were more or less locally derived.

The clast content of the Helsingør diamicton in sample 6 near Hornbæk (loc. 8) displays a Northwest-Scanian material facies very similar to the Jonstorp till (Kullen area, northwestern Skåne; Lagerlund 1971, 1977b), but differ from the composition of the underlying, Baltic till (sample 7). Note that the Northwest-Scanian facies of samples 6 means a southerly derived composition in the Kullen area, whereas the same composition on Northeast-Sjælland primary means a transport from the northeast. Judging from this a plausible interpretation of the material facies of sample 6 is, that the diamict material was transported by icebergs coming from northwestern Skåne and the clast composition of the Helsingør diamicton at Hornbæk thus reflects the regionally youngest recorded ice movement from the south-southeast in the northeastern Øresund region.

As a consequence of the above interpretations, we would expect, that the breakdown of the adjacent dead ice on northeastern Sjælland contributed only small portions to the formation of the Helsingør diamicton.

Due to the stratigraphic position on top of the Nivå clay, which in accordance with older litera-

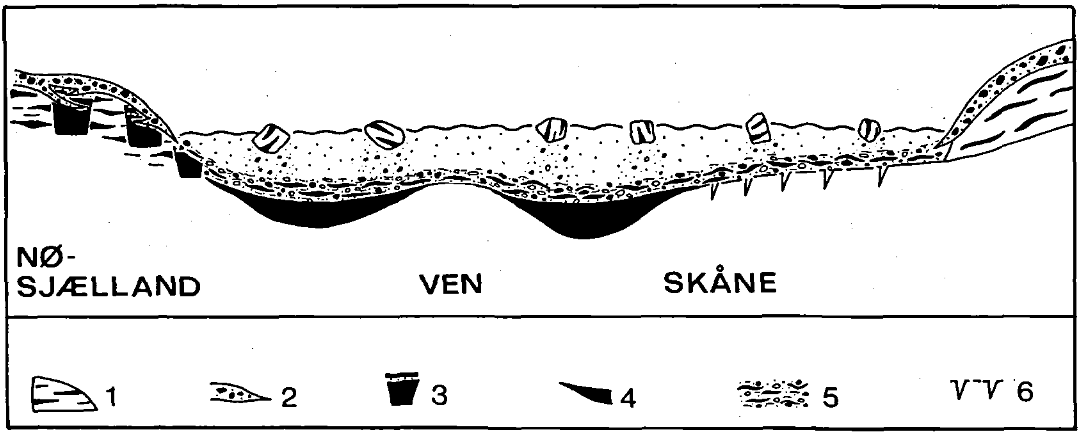

Fig. 8. Sketched depositional model of late glacial sedimentation in the northern Øresund region. 1: Debris laden, stagnant ice. 2: Flow till, 3: Glaciolacustrine clay-kames, 4: Nivå–Lomma–Rögle clay, 5: Helsingør diamicton/Lund–/Kyrckbacken–/Jonstorp till, 6: Periglacial landsurface.

ture is correlated with the Lomma and Rögle clays, the Helsingør diamicton is correlated with the Lund/Kyrkbacken/Jonstorp till in Skåne. The discussion above thus gives a reasonable explanation as to the varying clast composition of the uppermost diamict units in northeastern Sjælland.

Depositional model

The possible course of events that lead to the deposition of the Helsingør diamicton and its eqvivalents in Skåne is pictured in fig. 8. The model is built on information presented in the present paper supplemented with data given by Lagerlund (1980, 1983), Berglund and Lagerlund (1981), Lagerlund et al. (1983), Adrielsson (1984) and Malmberg Persson (1984). The above cited evidence was demonstrated in the field during a NORDQUA-excursion to western Skåne (oct. 1985).

During deglaciation of the last active ice sheet to cover the Øresund region: Bælthav readvance (Houmark-Nielsen 1981), Baltic flow tills were deposited in northeastern Sjælland partly on top of dead ice mases from the Gribskov readvance of the Main Weichselian icestream. At the same time the Baltic, Bælthav Till (Houmark-Nielsen 1987) was deposited outside areas covered by the downwasting NE-ice on Sjælland, and the upper (southerly derived) Baltic facies of the Dalby/Bräcke till and the Laebrink till was laid down in western Skåne and on Ven. During progressive deglaciation deposition of the Lomma/Rögle/Nivå clay took place under marine or brackish conditions in the lower parts of the Øresund region sourrounded by vast masses of stagnant ice.

At higher levels, glaciolacustrine sedimentation continued on NE-Sjælland while newly exposed land-surfaces in western Skåne were subjected to periglacial weathering and denudation and a wind blown surface with numerous ventifacts was developed on top of the Dalby/Bräcke till.

At this point an elevation of the regional watertable from about 10 m a.s.l. to more than 60 m a.s.l. in Skåne and on Ven caused a transgression into glaciolacustrine basins and across periglacial landsurfaces; consequently stagnant ice masses were launched as drifting icebergs escaping northwards and westwards into the southern part of Kattegat. Active ice margins situated east and south of the region eventually calved into the newly opend "paleo-Øresund basin", and whilst glaciolacustrine deposition was continuing, material was dropped and dumped from icebergs causing the sedimentation of the Helsingør diamicton.

On exposed land surfaces along the shores of the basin in Skåne highly elevated coastlines were developed about 65 m a.s.l., where as the coastline in other areas was situated along the margin of downwasting, stagnant ice. It is suggested, that the rim of the composite, stagnant ice mases in NE-Sjælland formed a coastal barrier situated at least 20 m above but assumably not far inland compared to the present coastline.

It is most probable, that the raising of the watertable around the northern Øresund region took place in close connection to the maximum transgression of the Younger Yoldia sea in the northern and western part of the Kattegat and in Vendsyssel. The time of this transgressive maximum has been estimated to lie around 13500 BP (Petersen 1984).

Due to the beginning regression icebergs stranded, the glaciolacustrine sedimentation and drop till fall out ceased and successively declining shorelines were developed downslope in western Skåne. In NE-Sjælland northwest of Helsingør the lowering of the water table caused deposition of gravel and sand near the former regressive coast at present lying about 15 m above sea level.

Future investigations

In order to elucidate the depositional evolution during the late Middle- to early Late Weichselian in eastern Denmark and southern Sweden it would be desirable to follow up the results of this preliminary investigation with systematic and thorough examination of deglaciation sequences in the Øresund region.

Future research should include mapping of the Helsingør diamicton outside areas of glaciolacustrine deposits as well as a search for periglacially formed landsurfaces developed on top of the Bælthav Till in eastern- and northern Sjælland. It is obvious, that the Helsingør diamicton must be present along a much larger stretch than presently known along the Danish and Swedish coast of Øresund and possibly also the southern Kattegat. Even though work is being carried out at present, further studies in Skåne and Halland should contribute knowledge on the interaction between the retreat of the NE-ice, subaqueous proglacial sedimentation, and the development of periglacial landsurfaces.

An aim for a programme of future investigations should primarily include a testing of the depositional model as sketched in the previous section. A soundly based depositional model and an environmental reconstruction would inevitably throw light upon the apparently enigmatic question of the misfitting of the highest, late glacial coastlines on either side of Øresund. The influence of possible neo-tectonic movements on the position of the highest lateglacial shorilines is regarded as either being very limited or of equal value on both sides of Øresund. As shown by Schuldt (1981) the pre-Quaternary surface topography arround the so called Esrum-Alnarp valley indicates, that the valley floor, which lies about 60 m below present sealevel in Skåne and Sjælland, has not been subjected to differential uplift or subsidence during the Weichselian.

Investigations would in turn lead to a correction of shoreline displacement curves and gradients of isostatic uplift in the southeastern margins of the last Scandinavian ice sheet. The need for a co-ordination among locally named till- and clay units will possibly be satisfied through a detailed lithostratigraphic description, and a common denominator embracing the bulk of the deglaciation sequences in the Øresund region will be advanced.

Obviously such a rather ambitious research programme would only be practicable through a close and open minded co-operation of geologists from both sides of Øresund, as well as economic support from institutions in both countries.

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Dansk sammendrag

Foreløbige studier af diamikt materiale, der overlejrer senglaciale issødannelser langs Sjællands Øresundskyst har vist, at till sedimentationen primært var betinget af drop og dumpning af glacigent materiale fra isbjerge. Dette till-dække, der her er benævnt HELSINGØR DIAMICTON, har tidligere været opfattet som afsat af et aktivt isdække kaldet Øresunds-gletscheren.

I forbindelse med afsmeltningen af et komplekst dødisdække, bestående af både tidligere NØ-is såvel som Ungbaltisk, is dannedes en række isdæmmede søbassiner omkring det nordlige Øresund og i det centrale Nordøstsjælland, som gradvist opfyldtes fortrinsvis af issøler.

Fund af adskillige fossile polartorsk og et knoglestykke af ringsæl i Lomma-Nivå leret viser, at der under en transgression, som ramte den nordlige Øresundsregion sent i Midtweichsel, blev lokale isdæmmede søbassiner forbundet med det senglaciale ishav (Det Yngre Yoldia Hav). Samtidig fortsatte issøsedimentationen i det centrale og højereliggende Nordøstsjælland, hvor issøleret ofte overlejres af flow-till sedimenter afsat under dødisdækkets fremadskridende nedsmeltning.

Efterhånden som transgressionen tog fat, søsattes dødisen i de lavere liggende områder og blev som isbjerge sat i drift vest- og nordud. Herved afsattes Helsingør diamicton som drop-till ovenpå issøsedimenterne *i hvert fald op til en højde på mere* end 20 m over nuværende havniveau mellem Helsingør og Nivå, omkring 40 m på Hven og op til 65 m i Vestskåne.

Med en ny forståelse af den senglaciale glacioaqvatiske sedimentation omkring det nordlige Øresundsområde vil fremtidige undersøgelser komme nærmere en løsning af problemerne omkring den tilsyneladende mangel på korrelation mellem de højeste kystlinier i Skåne og på Sjælland, ligesom en moderne deglaciations model for Øresundsområdet vil kunne udvikles til at dække større dele af det skandinaviske isskjolds sydvestlige dele.

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