# WEICHSELIAN ICE ADVANCES AND DRIFT SUCCESSIONS IN DENMARK

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*Abstract.* The older and more recent literature on ice advances and drift successions in southern and eastern Denmark is reviewed, in order to show how closely Danish and Scanian till stratigraphies are related. The concept of kineto-stratigraphic drift units is outlined and, following S.A. Andersen, three major and separate advances are distinguished: (1) the old Baltic advance; (2) the central-Jutland advance, reaching the portion of the Main Stationary Line which shows a N.-S. trend in Jutland and the equivalent of the Brandenburg (Frankfurter) advance; (3) the eastern-Jutland advance (the equivalent of the Pommeranian). The eastern flank of the ice lobe which reached the easter-Jutland ice-border line is believed to be represented by the maximum extension of Young Baltic ice into southern and eastern Skåna. The young age of some ice-border lines on the Danish isles is questioned and it is suggested that they were formed during the advance of the eastern-Jutland and Young Baltic ice-lobe or even during earlier advances. A preliminary correlation of the drift successions left by the successive advances is given in Fig. 2.

## INTRODUCTION

The study of the stratigraphy of the glacial drift in Denmark was initiated by J.F. Johnstrup in the 1860s. The establishment of the Geological Survey of Denmark (DGU) in 1888 gave a strong impetus to further stratigraphic and lithologic studies of the Quaternary. Among the early pioneer surveyors, K. Rørdam, N.V. Ussing, V. Madsen, A. Jessen and V. Milthers deserve particular mention. V. Milthers (Rørdam & Milthers 1900, p. 69) was the first to give a clear explanation of a Danish ice-border landscape, that of the moraine systems in Odsherred, north-western Zealand. Ussing in two classic papers (1903 and 1907) outlined the Main Stationary Line in central Jutland, the build-up of sander in front of it, and the evolution of the drainage pattern during the recession of the central-Jutland ice. Harder (1908) described in great detail the eastern-Jutland ice-border line. However, it was V. Milthers who with hard and efficient work in many fields soon became the leading Danish Quaternary geologist, and he held this position for more than half a century. To him, we owe the method of indicator counts (Milthers, 1909), and he was co-author of one of the most important contributions to Danish Quaternary stratigraphy (Jessen & Milthers, 1928), to mention the two most outstanding contributions in the large production of a long life. "Old Milthers", as he was called when his son, Keld Milthers, also joined the staff of the DGU, was a very modest but also a stubborn person, who did not remain silent if he disliked opposing views. In his young days, V. Milthers was much inspired by Gerard De Geer, and it is somewhat ironic that it should be another ardent pupil of this great Swedish master who most strongly aroused Milthers's anger. It was S.A. Andersen who met this fate – with all its consequences. However, S.A. Andersen continued independently with his field work and research, and his eyes as well as his pen became sharpened. A wealth of field data and original ideas are to be found in his usually much condensed papers. One of his merits was the part that he played as *advocatus diaboli* in Danish till stratigraphy.

### *The Scanian enigma*

Although Denmark and Skåne have much of their geological and historical evolution in common, attempts to correlate and collaborate across Øresund have not been as frequent as might be expected. Gry (1932) extended the study of indicator boulders to Skåne, and Hansen (1940) described Late Glacial lake deposits from both Denmark and Skåne. Wennberg (1949) worked his way from Skåne to the Danish isles and made contributions to Danish till stratigraphy. Lately Mørner (1969) has discussed the ice recession from Denmark and southern Sweden.

Since the days of Holst, Holmström and Munthe, it has repeatedly been discussed whether the recession of the (northern to) north-eastern ice took place in such a way that the later Baltic ice invaded a mainly ice-free landscape in southern and western Skåne or whether this recession and advance were penecontemporaneous processes, so that the two ice streams palyed bull and bull-fighter. We call this problem the Scanian enigma – remembering that its solution is also of paramount importance to Danish Quaternary Geology. As the following review shows, the problem has been touched on repeatedly in the Danish literature.

*Advances, re-advances or differential movements?*

Discussing the different systems of glacial striae in eastern Denmark, and in eastern Zealand in particular, Bøggild (1899) remarked: "It still remains to be settled whether the ice streams which produced the different systems were continuous or separated by a time during which the ice receded a greater or lesser distance from the given locality". Concerning the change from the north-eastern ice to the Baltic ice, however, he explicitly stated: "A comparison between the results obtained from the glacial striae with those arrived at from a study of the tills deposited by the same streams makes it the more clear that we are dealing with separate advances" (Bøggild 1899, p. 97, translated).

Milthers (1901) strongly opposed this view. He rightly claimed that all the striations discussed were formed during the last glaciation. His former chief, K. Rørdam (1893), considered that the north-eastern till originated from the Great Glaciation, that the stratified drift above it was interglacial, and that the upper till, the Baltic till, represented the last glaciation. Milthers's arguments in support of his own conception that during the last glaciation there was only one ice cover with changing directions of movement and with repeated re-advances, were, however, stronger in their polemic than in their scientific content.

Harder (1908, pp. 224—225) clearly expressed the opinion that the eastern-Jutland ice border was formed by a real advance with a changed direction of supply (from the SE.) and that it could not be considered as a mere re-advance of the receded central-Jutland ice. However, the question as to how far (and for how long a time) the central-Jutland ice receded before the eastern-Jutland advance commenced was largely left unanswered by Harder.

Madsen (1928, pp. 103—115), in his review of the deposits from the last glaciation, argued that Jutland, Funen and Langeland all became ice-free before the advancing eastern-Jutland ice invaded the country. He also assumed that the eastern-Jutland ice receded from Funen and from at least parts of Zealand before the Belt advance set in. This latter in turn was succeeded by the Langeland advance, which he thought represented the beginning of Gothigalacial time (of De Geer). Stonecounts (Ussing & Madsen, 1897) in the different till beds exposed at the surface or in the coastal cliffs played a major role in Madsen's correlations.

In a study of the indicator boulders and glacial landscapes of Denmark, Keld Milthers (1942), concluded (contrary to Harder (1908) and Madsen (1928)) that the eastern-Jutland ice-border line was formed during a small but probably long-lasting oscillation during the general withdrawal from the Main Stationary Line. The central-Jutland ice was called "the older Dalecarlian-Baltic stream", and the eastern-Jutland ice was merely called "the younger Dalecarlian-Baltic stream". However, the quite extensive and often thick deposits of stratified drift between the old and young Dalecarlian-Baltic tills worried Milthers somewhat (K. Milthers, 1942, p. 110), because he could hardly explain their formation as other than extramarginal. Milthers's reluctance to accept the eastern-Jutland ice-border line as a feature marking a major change in the trend of glaciation forced him to reinforce the Belt advance and to invent two long and narrow Belt streams reaching as far north as southern Djursland. Andersen (1933), Wennberg (1949), Berthelsen (1949) and Smed (1962) present evidence contradicting this hypothesis.

The preponderance of either red or brown Baltic quartz porphyries in the block associations of certain deposits has often served as a base (or rather a starting-point) for far-reaching speculation on the changing directions of glacial supply through the Baltic. Little is known about the source region of these indicators, but to the present author it appears geologically sounder to assume that they were derived from a more or less interstratified sequence of flows and intrusions rather than that they came from distinctly separated cliffs. V. Milthers's (1933 and 1948*b*) countings on Gotska Sandön and Gotland do not contradict a more complex field setting, which incidentally would not invalidate the stratigraphical applicability of the Baltic quartz porphyries any more than would a spreading and mixing through transport and erosion of older deposits.

These critical remarks do not imply that the present author completely disputes the usefulness of indicator counts. A study of the block content, inclusive of indicators, may – when restricted to stratigraphically well-defined units – supply valuable *additional* evidence as to the provenance of successive ice advances.

In an extensive study of deposits from the last glaciation in the Danish isles and in Skåne, Wennberg (1949) applied his concept of differential movements in the inland ice (Wennberg 1943). According to this model, differential movements occurred where two simultaneously operating ice streams (a Småland ice coming from the NE., and a Baltic ice coming from the SE.) overlapped. Wennberg ascribed the complex structures in the stratified drift of the so-called hat-shaped hills of Langeland and north-western Zealand to such differential movements. S.A. Andersen (1966*a*) interpreted that hat-shaped hills as "Durchragungs-Strukturen" in the sense of Schröder (1889). Shortly after, Rasmussen (1967) suggested that these peculiar hills were but dislocated kames, the deposits of which had been laid down and deformed in glacial lakes situated along the border between a slower-moving distal part and a faster-moving proximal part of the inland ice. Recent and largely unpublished structural studies tend to show that the hat-shaped hills of north-western Zealand are ice-transgressed erosional remnants of former, much larger, overfold structures, which were formed during the earliest Weichselian ice advance (Berthelsen, 1971*a*), thus more or less confirming Andersen's (1966*a*) view.

The picture of successive ice-border lines and recession lines drawn by K. Milthers (1942) and V. Milthers (1932, 1948*a*) was, but for minor revision and some additions, accepted in the "official" reviews supplied by Hansen & Nielsen (1960) and Hansen (1965).

S.A. Andersen, however, repeatedly objected to this general scheme (see, for example, Andersen, 1931, 1946, 1950, 1957 and 1966*b*). Andersen emphasized the importance of achieving a stratigraphical and geological understanding. His papers of 1950 and 1957 on the till stratigraphy of northern Zealand and Lolland are outstanding examples of this line of approach.

According to S.A. Andersen, there were three major glacial advances into Denmark during the Weichselian, each leaving a till formation, and all separated by interstadials or time intervals of (almost) complete recession. These advances were the Old Baltic advance, the central-Jutland advance and the eastern-Jutland or Baltic advance.

Wennberg (1949), discussing the Weichselian stratigraphy, placed the Old Baltic advance before the "Skærumhede interstadial", just as S.A. Andersen placed it before his "Old Baltic interstadial" (Andersen, 1946), but as regarded the relative ages of the central-Jutlandic and the eastern-Jutland advances, these two authors disagreed.

Unfortunately, only brief accounts have as yet been published about measurements of the striae on boulder pavements found at different levels during the excavation of the dry docks at Lindø, Funen (Nielsen, 1961; Smed, 1962). The interesting account of the pollen and spores contained in the different till horizons found at Lindø (Svend Th. Andersen, 1965) only further underlines the need for a more through presentation and analysis of these field data.

As the reader may have noticed, the present author has tried to avoid using in this paper the system of lettering the tills (C, D, E and so on) introduced by V. Madsen. The reason for this is not that the letters have also been used to designate the ice-border lines marking the maximum extension of the given till formation, but mainly that *conflicting* views on the correlation of ice borders and till formations have rendered the use of this system rather confusing.

To sum up this review, we find in the literature conflicting views on the significance of the different ice-border or recession lines and the stratigraphic models suggested vary accordingly. The picture which Mörner (1969) presents of the ice recession from Denmark and southern Sweden more or less unites these views, although the on-shore part of his recession lines shows mainly an "official" trend.

## *Some considerations of principles*

The task of working out a regional till stratigraphy for the Weichselian may at first sight appear overwhelming and hopeless. Each advance or re-advance often caused eroision, erasure or disturbance of older deposits, the stratigraphic profiles becoming incomplete. Admixtures of older drift material make stone countings difficult to interpret, if the generally preferred principle of simplicity is followed.

Glacial striae on solid bedrock or boulder pavements, till-fabric studies (Krüger, 1970) and structural analysis of the glacially induced deformations may help to distinguish a kineto-stratigraphic drift unit, that is, the sedimentary unit deposited by an ice sheet or stream possessing a characteristic pattern and direction of movement. In such work, glaciotectonic studies, introduced into Denmark by Gry (1940), are of the utmost importance, and it is worht while starting with the structurally most complicated regions before more regularly built-up areas are surveyed. The reason for this is that a more comprehensive stratigraphic column can be worked out in glaciotectonically disturbed regions.

As stressed by S.A. Andersen, detailed studies of the depositional structures found in the stratified drift also supply valuable information. Allen's (1968) outstanding work on natural and experimentally produced sedimentary structures allowes a more complete analysis of the environment of deposition than was hitherto possible.

The study of periglacial and permafrost-conditioned structures supplies important information on the depositional environment or post-depositional conditions. Field work conducted during the last few years has shown that in north-western Zealand fossil ice wedges are by no means rare, and it appears that cryoturbation and ice-wedge structures are particularly abundant at certain stratigraphic levels. As was first shown by Svensson (1963), photogeological reconnaissance is a valuable aid in detecting periglacial phenomena. Recently even detailed glaciotectonic structures have been traced in cultivated fields (but not in those cultivated for a long time!) by means of aerial photographs (Berthelsen, 1971*a*).

In the same paper, Berthelsen described large (50–200 m) polygonal patterns and suggested that these are related to ice-wedge casts in sub-morainic meltwater deposits. Recently similar patterns have also been observed on aerial photographs from north-eastern Zealand but, since in this region ice-wedge casts cannot be traced in the field, the question as to the origin of this type of patterned ground must be left open.

The permafrost layer also had an important influence on glaciotectonic deformation. In many cases it is possible to deduce the thickness of a former permafrost layer directly from the thickness of thrust slices, nappes or *Decken* (Richter, Schneider & Wager, 1951). The principles developed by Rubey & Hubbert (1959) may also be applied to explain how an advancing ice sheet causes an increase in the pore-water pressure just below the permafrost layer in front of the ice margin. This fluid pressure may control the development and localisation of thrusts and "nappes". The weight of the overthrust mass increases pore-water pressure in more distal areas, and thrusting proceeds. It appears, on the other hand, that shear moraines, in the sense of Bishop (1957), rarely become fossilised as recognisable features except for the movement planes found in the basal parts of lodgement tills.

Carey's principle of rheidity and rheid folding (Carey, 1954 and 1962; see aslo Holmes, 1965) also has an important bearing on glaciotectonics and glaciology.

These remarks on principles have been included in order to show that glaciogeological research requires a many-sided approach to the problems if further progress—even in till stratigraphy – is to be made.

The idea of kineto-stratigraphic drift units outlined above is illustrated in Fig. 1. Till is shown in solid black, and outwashed stratified drift by dotted areas. The vertical scale in the profile is exaggerated. The length of the profile may be from about 100 m to more than 200 km. All the deposits shown are supposed to belong to but *one* kineto-stratigraphic unit. The stratified drift members lettered $A_1$, $A_2$, and $A_3$ were formed during the general advance, the member lettered S was formed during a standstill corresponding to the maximum transgression of the ice sheet, and $R_1$ and $R_2$ stand for "recessional" deposits. In the proximal part of the glaciated area, deformations caused by "progressive" advances have been reworked during "recessional" advances, so that unconformable relations between till beds of one and the same larger unit have developed. If of regional extension, a kineto-stratigraphic drift unit acquires the rank of a glaciostratigraphical unit (Flint, 1971, pp. 373–374).

Working along these lines, the author and his associates have started new till-stratigraphical studies in eastern Denmark. So far, however, only introductory field work has been carried out. The outline of the Weichselian advances and drift succession given below is therefore to a considerable extent based on relevant, and what are believed to be also reliable, older observations and data. In consequence, the author reserves the right to suggest changes or ammendments in the future.

## *Major advances and drift units*

The following outline only deals with the areas included in Fig. 2. In northern, western and southern Jutland, investigations are currently being conducted by staff members of the DGU, and important new information may be expected in the near future.

### *The Old Baltic advance*

The first Weichselian ice advance that invaded the region covered by Fig. 2 appears to belong to the Old Baltic advance, which left a till particularly rich in Silurian limestone of Baltic derivation. According to S.A. Andersen (1933) and Wennberg (1949), the red Baltic quartz porphyry is also common. The Old Baltic till is represented by the oldest post-Eemian till in Ristinge cliff (S.A. Andersen, 1950), and most probably also by the lowermost till in Halkhoved cliff (Jessen, 1930; S.A. Andersen, 1950, p. 551). Where the Old Baltic till is not underlain by Eem deposits, its Weichselian age is hard to prove and on the whole it can be said that little is known about the exact borders of the Old Baltic ice-stream within the area covered by Fig. 2.

The Old Baltic stream probably passed over Skåne from the ESE. or E., as is suggested by the glacial striae. Cepek (1968) pointed out that the first Weichselian ice that reached the Baltic coast of East Germany was the Brandenburg advance (which in the present author's

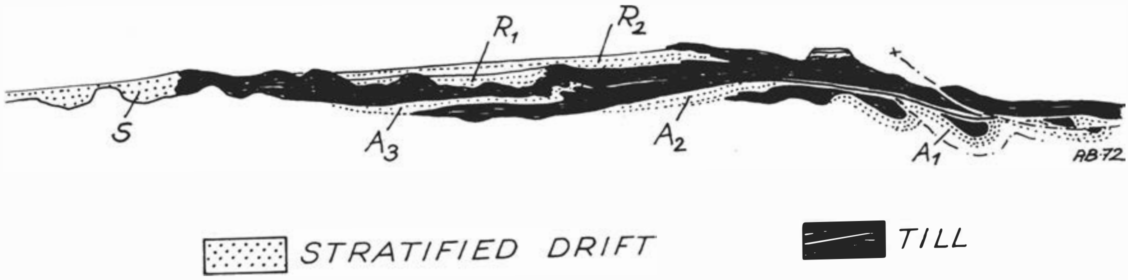


*Fig. 1.* A diagrammatic sketch of a kineto-stratigraphic drift unit. Till is shown in solid black, stratified drift in dotted areas. For further explanation, see the text.

opinion is equivalent to the central-Jutland advance), but Groth (1971) describes Old Baltic till from northeastern Mecklenburg.

The Old Baltic advance was followed by a probably long-lasting and complex "interstadial". The so-called amber-twig-bearing sands found as big "xenoliths" in the subsequently deposited north-eastern till of northern Zealand, and also the Alnarp sediments of Skåne (see, for example, Nilsson, 1971; Miller, 1971) were probably deposited during this period. The Older Yoldia Clay of Vendsyssel, which according to Feyling-Hansen *et al.* (1971) embraces two Weichselian interstadials, may be of more or less the same age.

The lower parts of the Skærumhede sequence (i.e. the *Turitella terebra* and the *Abra nitida* zones) conceivably represent the Eemian interglacial (Nordmann in Jessen *et al.,* 1910; Feyling-Hanssen *et al.,* 1971). The interstadial age of these zones suggested by S.A. Andersen (1946), Wennberg (1949, p. 14) and several subsequent authors would, however, fit in well with the observed geographical distribution and the lithostratigraphical characters of the sequence.

## *The central-Jutland advance*

During the Main Weichsel stadial, ice moved from the N. as well as from the NE. to almost due E. up to the Main Stationary Line in Jutland. Limiting our considerations to the region covered by Fig. 2, we may call the ice wich advanced towards and became stationary along the part of the MainStationary Line which shows a N.-S. trend, the central-Jutland ice. In accordance with S.A. Andersen, the till deposited by this ice is designated the north-eastern till. From the dating of the Brandenburg advance in East Germany (Cepek, 1965, 1968), the age of the climax of the central-Jutland advance can be inferred indirectly as falling between 20 000 and 19 000 years B.P.

Recent investigations (Ødum, 1969; Larsen, Liboriussen & Willumsen 1972) in the Hobro-Randers country between the Main Stationary Line and the younger eastern-Jutland Line, have shown that in the periglacial regime in front of the advancing central-Jutland ice, great sander were built up by meltwater (streaming WNW) in the lower parts of the Saale landscape, the highest parts of which (Saalean push moraines) reached above the sander as "hill islands". Covered by the till of the transgressing central-Jutland ice, these sander now form the gently undulating moraine plateau in central-Jutland, and the former Saalean push moraines, although covered by north-eastern till, still form clearly expressed morphological features. These relations show that purely morphological studies may lead to serious misunderstandings (see, for example, Gripp, 1964, and the critique given by S.A. Andersen, 1965).

It has also recently been suggested (Berthelsen, 1972) that some so-called tunnel valleys of central-Jutland may be interpreted as glacially eroded, former meltwater-stream valleys, the water of which emerged from the advancing central-Jutland ice and converged westwards. Probably water/ice or snow hampered the formation of permafrost below these valleys, while it was developing extensively below the higher ground. This may explain why the valleys were preferentially eroded by the transgressing ice. The formation of cryolaccoliths below the valleys may have contributed further to their present uneven profiles.

## *The eastern-Jutland advance*

In contradistinction to most Danish Quaternary geologists, S.A. Andersen thought that the central-Jutland ice, except for some local, buried, dead-ice masses, receded from Denmark before the next stadial, the eastern-Jutland (or Pommeranian) advance commenced. Often thick and extensive deposits of stratified drift separate the tills referred to the central-Jutland and the eastern-Jutland advances. Their depositional structures suggest proglacial sedimentation. In north-western Zealand periglacial structures, such as fossil ice wedges, bear further witness to their extra-marginal

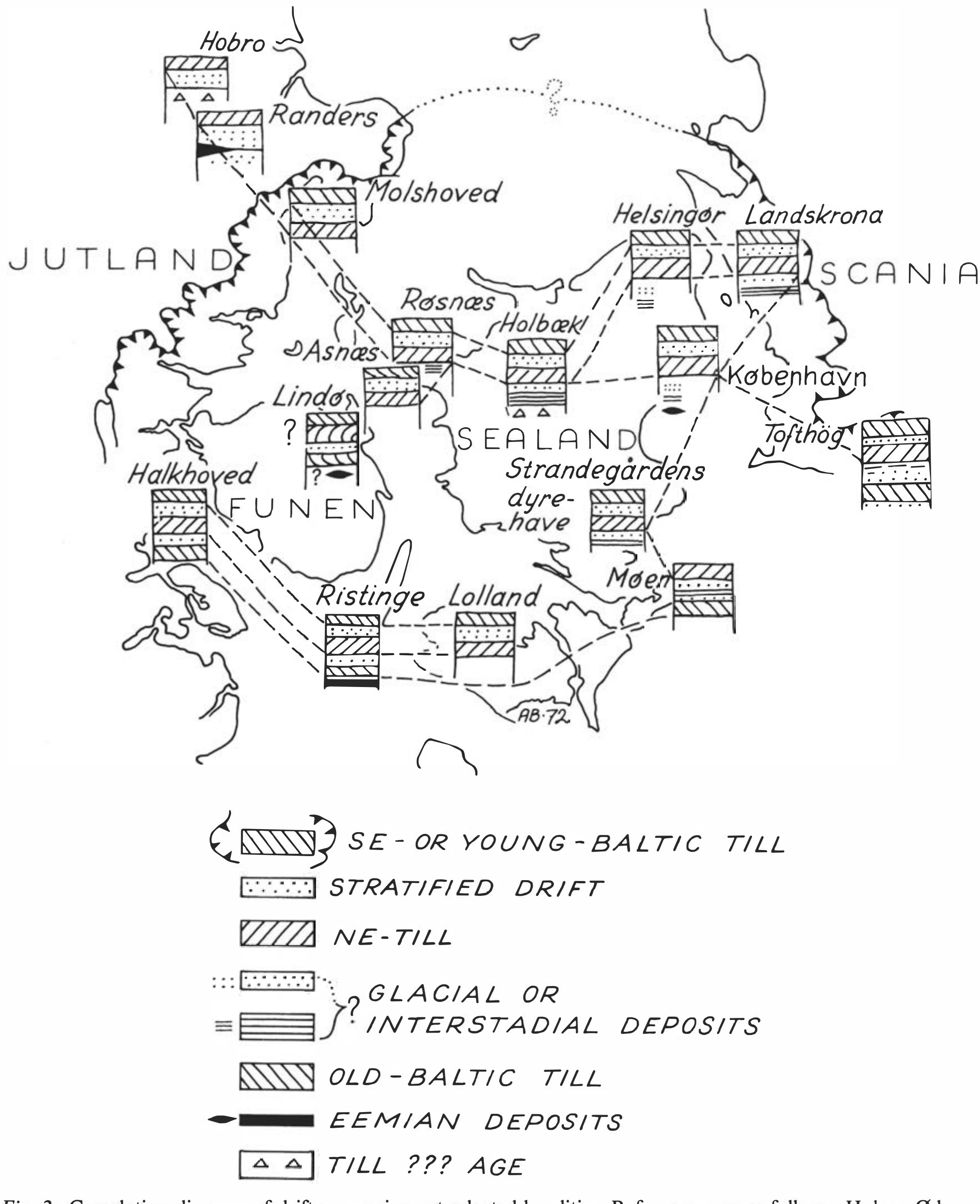


*Fig. 2.* Correlation diagram of drift successions at selected localities. References are as follows: Hobro, Ødum (1969); Randers, Larsen *et al.* (1972); Molshoved, Thamdrup (1970); Halkhoved, Jessen (1930) and Andersen (1950); Lindø, Svend Th. Andersen (1965), Asnæs-Røsnæs, Berthelsen (1971 and pers. obs.); Holbæk, Ødum (1933) and Milthers (1943); Helsingør, Rørdam (1893, and pers. obs.); Landskrona, Johnsson (1956); Copenhagen, Rørdam (1899) and Milthers (1935); Tofthög, Nilsson (1971) and Miller (1971); Strandegaardens dyrehave, Ødum (1933); Møen, Hintze (1937); Lolland, Andersen (1957); Ristinge, Rosenkrantz (1944) and Andersen (1950 and pers. obs.). The thicknesses of the different lithological units are not drawn to scale. Older deposits occurring as floes are indicated below some columns.

The suggested connection between the eastern-Jutland ice-border line and the line indicating the maximum extension of the Young Baltic ice in Skåne is also shown. The position of the ice front in the Kattegat is purely hypothetical.

origin. It appears as if the ice-wedge structures recorded by Nørvang (1942, 1946) W. of and right up to the eastern-Jutland ice-border line may be traced eastwards to Zealand in the stratified drift here underlying the south-eastern till left by the eastern-Jutland advance (Berthelsen, 1971*a*). In north-eastern Zealand, only a thin layer of stratified drift (if present at all) separates the north-eastern till from the younger south-eastern till, but in this layer ventifacts occur.

The so-called fissure valleys found NW. of Aarhus and west of the eastern-Jutland ice-border line were ascribed to orogenic and tectonic processes by Milthers (1916). K. Hansen (1971), in a re-study, proposed an origin by headwards erosion of landslide features, but the "fissure" pattern is strongly reminiscent of the extremely periglacially conditioned fissures depicted by Svensson (1962, Fig. 3) from the permafrozen ground of Trail Island, eastern Greenland (Berthelsen, 1971*b*).

On East German teritory, the ice sheet of the Brandenburg (and the Frankfurter) advance is known to have receded beyond the present southern coast of the Baltic Sea before the ice of the Pommeranian advance reached the country. During the recessional stage, the fossiliferous limnic clays of the *Blankenberg* "interstadial" were deposited (Cepek, 1968). Interestingly enough, a certain climatic amelioration at this time (Lascau) has also been recorded in the isotope studies of the ice core from Cape Century, Greenland (Dansgaard, Johnsen & Møller, 1969).

The present author shares S.A. Andersen's view that the eastern-Jutland advance was the last major advance in Denmark. The climax of the advance most probably fell around 14 000 years B.P., as is suggested by the radiocarbon age obtained from shells in the Lower Saxicava Sand and the Younger Yolida Clay in Vendsyssel (meltwater from the eastern-Jutland ice made the waters of the Younger Yoldia Sea brackish where it poured into the sea around Aalborg). Berglund's (1971) find of *Bølling* sediments in a peat bog on Kullen (N. of Øresund) is of great interest in this connection, since the bog overlies Baltic till resting on north-eastern till (Lagerlund, 1971; Berglund, 1971). The Baltic till on Kullen, therefore, may well be of the same age as the south-eastern till left by the eastern-Jutland ice in eastern-Jutland. This line of thought leads to the picture shown in Fig. 2, where the eastern-Jutland ice-stream is depicted as a broad lobe. The western border of the lobe corresponds to the eastern-Jutland ice-border line and the eastern to the maximum advance of the Young Baltic ice in southern and western Skåne. Probably the frontal parts of the lobe calved into the Younger Yoldia Sea in the Kattegat. This picture is somewhat similar to the sketch given by Lundquist (1965, Fig. 13), recalls more the map drawn by Rørdam (1909; see also Milthers, 1932, Fig. 5), and is almost identical to De Geer's (1884) outline of the second advance of the Scandinavian land ice. If it is correct, the deglaciation of eastern Jutland and the Danish isles took place entirely in Gothiglacial time, as defined by De Geer.

Such a conception, however, is in strong contrast to the commonly accepted pictures of the deglaciation of the Danish isles and the Øresund region (see, for examples, Hansen, 1965). Undoubtedly, recessional re-advances of the generally withdrawing eastern-Jutland or Baltic ice did occur. Convincing examples are found in south-eastern Jutland and in north-western Zealand, where the re-advances caused the formation of local outwash plains. However, other ice-border lines, believed to be recent features developed during the last deglaciation, may well prove to be of a considerably older age. Some may have been formed during the advance of the eastern-Jutland ice, others by the central-Jutland ice. The hat-shaped hills of north-western Zealand may even represent relics of Old Baltic push structures which endured the transgression of two subsequent major advances.

Combined stratigraphical and glaciotectonic studies are currently being conducted in order to eludicate these interesting but intricate problems. One outcome of this work has been the discovery that in some regions (for example large parts of north-eastern Zealand) the erosional action of the youngest ice greatly surpassed its depositional effect, so that glaciotectonic "windows" were formed.

## *Back to the Scanian enigma*

As suggested in the correlation of the drift successions at selected localities (see Fig. 2), the author has accepted the full significance of the above-mentioned point of view, which not only simplifies the till stratigraphy but also makes it possible to establish a more coherent picture of the kinematics of the successive Weichselian ice streams in Skåne and south-eastern Denmark. On Danish territory (? at least) three major and *separate* advances can be traced. Somewhere, closer to the source region of the streams, they may well have acted simultaneously and differential movements may have resulted. Did that occur in south-eastern Skåne?

ACKNOWLEDGEMENTS

The author has profited much from discussions with his colleagues Steen Sjørring, Kaj Strand Petersen (DGU), Leif Aabo Rasmussen, and Peter Konradi (DGU). T.C.R. Pulvertaft kindly improved the English manuscript. Statens Forskningsråd provided financial support for the purchase of the motor vehicle used in the current research project.

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