

CONCLUDING REMARKS

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The marine deposits from the Quaternary of Vendsyssel in northern Denmark have for many years been subdivided on the basis of the content of molluscs. The youngest unit is the *Mya arenaria* layers, roughly covering Sub-Atlantic time in the Blytt-Sernander-Jessen sequence. The Postglacial warm interval is represented by the *Tapes* or *Littorina* deposits, subdivided into *Dosinia* layers or Younger *Tapes* layers and Older *Tapes* layers, covering Sub-Boreal and Atlantic times. Below this there is a hiatus in the marine sequence, the so-called "Fastlandstid" covering the time from Boreal through Older *Dryas* in the Blytt-Sernander-Jessen sequence. The Lateglacial marine *Zirfaea* layers, which seem to be of Bølling age, occur below the hiatus. Then follows the Younger *Yoldia* Clay, with its shallow-water equivalent Upper *Saxicava* Sand above it and Lower *Saxicava* Sand below. This combined unit is of Oldest *Dryas* age and rests upon sandy till and glacial deposits from the Weichselian maximum advance. Below these glacial deposits the marine Older *Yoldia* Clay occurs at many localities. This was correlated with the *Portlandia arctica* Zone in the Skærumhede boring of 1905, which also contained an *Abra nitida* Zone and a *Turritella terebra* Zone.

In the later years samples of mollusc shells, and other matter, from the marine deposits of Vendsyssel have been dated by C¹⁴. Some of the results were published, i.a. by Tauber (1966), whereas others have come to our knowledge by kind personal information from the geologist H. Krog from the Geological Survey of Denmark. The previously established stratigraphical units have been inserted in the chart, fig. 43 together with some of these datings, the lowest and highest age obtained for each unit being presented.

The foraminifera faunas analysed during the present research characterise the previous units in the following way:

The *Tapes* or *Littorina* deposits are usually dominated by *Ammonia batavus* and *Protelphidium anglicum*. The *Zirfaea* layers are characterised by large *Elphidium* species such as *E. albumbilicatum*, *E. incertum*, *E. subarcticum*, and *E. asklundi*, but there is a dominant occurrence of *Elphidium clavatum* and *Cassidulina crassa* in this unit. The Younger *Yoldia* Clay, with the *Saxicava* sands, is completely dominated by *Elphidium clava-*

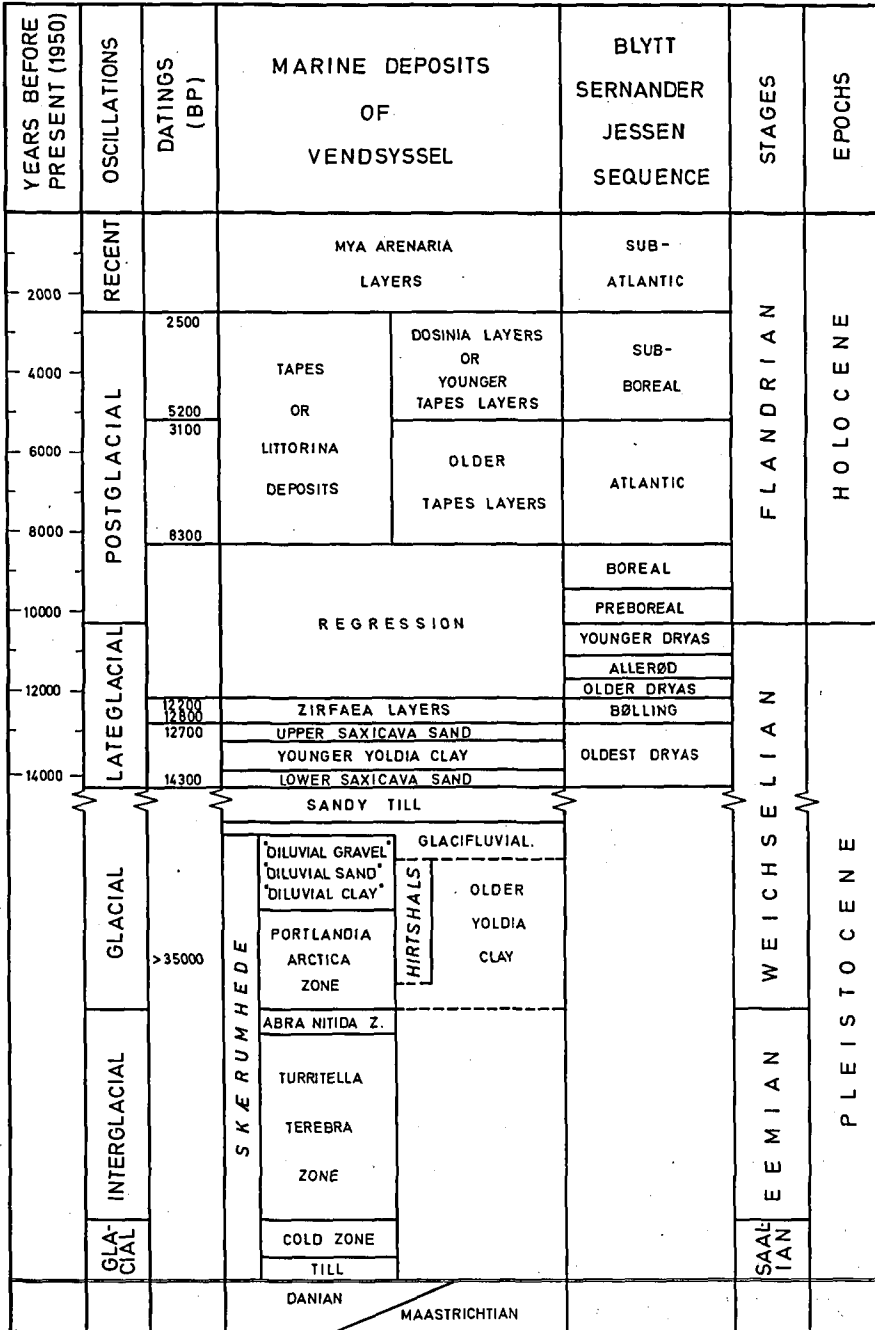


Fig. 43. The marine Quaternary of Vendsyssel.

tum, *Cassidulina crassa* being second in abundance. The two species usually account for more than 90 % of the assemblage. The Older *Yoldia* Clay, in a wide sense, in addition to *E. clavatum* and *Cassidulina crassa* contains *Nonion labradoricum*, *Islandiella norcrossi*, *Virgulina loeblichii*, *Elphidium asklundi*, and *E. groenlandicum* as characteristic species, with some boreal elements such as *Uvigerina peregrina*, *Nonion barleeanum*, *Hyalinea baltica*, *Ammonia batavus*.

The Older *Yoldia* Clay at Hirtshals, in the northern part of Vendsyssel, was subdivided into seven zones, and its correlation with the *Portlandia arctica* Zone of the Skærumhede boring has been confirmed. The present investigations at Hirtshals demonstrate that the Older *Yoldia* Clay there probably comprises also a part of the so-called "diluvial clay" and "diluvial sand" of the Skærumhede boring. Two Weichselian interstadials seem to be represented in the Older *Yoldia* Clay at Hirtshals.

The foraminifera of the Older *Yoldia* Clay in Vendsyssel, Denmark, show great similarity with the foraminifera of the submorainic Sandnes Clay and the so-called marl clay of Jæren on the Norwegian North Sea coast, and also with foraminifera in clay from the island of Karmøy, north of Sandnes. The Sandnes Clay has been subdivided into four zones on the basis of foraminifera, and this clay is supposed to have been deposited during a complex Weichselian interstadial of long duration. The upper zones of the Hirtshals clay in Vendsyssel, viz. the zones A to C may be correlated with the zones 1 to 3 in Sandnes. Marine deposits comparable to the older zones at Hirtshals have not been found in Sandnes. In the chart, fig. 43, the Sandnes Clay corresponds to the upper part of the Older *Yoldia* Clay at Hirtshals. The Older *Yoldia* Clay at Frederikshavn, Stortorn and Løkken in Vendsyssel contains faunas correlatable with those of zone 1 and 3 in the Sandnes Clay and zone A and C of the Older *Yoldia* Clay at Hirtshals.

The foraminifera from the Skærumhede boring in 1905, left by the late Dr. A. Nørvang and kindly placed at our disposal by geologist A. Buch of the Geological Survey of Denmark, show that the assemblages of the *Abra nitida* Zone and the *Turritella terebra* Zone are completely different from those of the *Portlandia arctica* Zone. They are equally distinct from other Older *Yoldia* Clay assemblages in Vendsyssel and from the Sandnes Clay and Jæren faunas in Norway. The foraminifera of the *Abra nitida* Zone together with the *Turritella terebra* Zone reflect real interglacial and not interstadial conditions. We, therefore, believe, and this is partly in accordance with the original interpretation of the mollusc assemblages in the zones that the *Abra nitida* Zone and the *Turritella terebra* Zone are of Eemian age. In the lowest part of the Skærumhede boring, but above the till which occurs there, arctic foraminifera reappear. If this arctic assemblage is not reworked, this part of the boring, and the underlying till, is probably of Saalian age.

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