Older and Younger Coversand in southern Jutland (Denmark)

ELSE KOLSTRUP AND JEPPE BENDER JØRGENSEN

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During trenching for a gas pipeline in southern Jutland extensive aeolian deposits were observed. This note describes their appearance, texture, and grain-size distributions, and it is concluded that deposits of both Older and Younger Coversands are present.
The lithostratigraphical sequence is identical to that in the coversand areas in The Netherlands, Belgium, and northern Germany.

Else Kolstrup, Danmarks geologiske Undersøgelse, Thoravej 31, DK-2400 København NV, Denmark.
Jeppe Bender Jørgensen, Geologisk Centralinstitut, Øster Voldgade 10, DK-1350 København K, Denmark.
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During trenching for a gas pipeline in southern Jutland a continuous trench, two meters deep, exposed several kilometers of sediments. In order to obtain stable walls in the trench, slanting slopes were dug. As a consequence it was necessary to clean profiles by hand in order to study the sediments. Since the trench was usually filled in after only a few hours, it was often difficult to obtain good photographs because the time was too short to permit drying of the face and the associated accentuation of the layering in the profiles.

In spite of these difficulties it was possible to obtain information concerning structures, grain-size distributions, and transitions between sedimentary beds. From this evidence it is concluded that the sediments in the southern 13 km of the pipeline trench (fig. 1) are dominated by two characteristic sedimentary units, a lower and an upper one. In the following, the two units are described, and the lithostratigraphic sequence is outlined.

Lower unit

In the section in southern Jutland (indicated in figure 1) the lower unit rests upon a layer of polished and faceted pebbles and small stones which in turn rests upon a strongly involuted sequence of sand and gravel. Upwards the lower unit passes gradually into either the upper unit (figs 2 and 3) or there may be a fine-grained layer separating the two units (figs 4 and 5). This separating layer sometimes possesses faint mottling and is dominated by particles ranging from 63 μm to 105 μm.

The lower unit consists almost invariably of

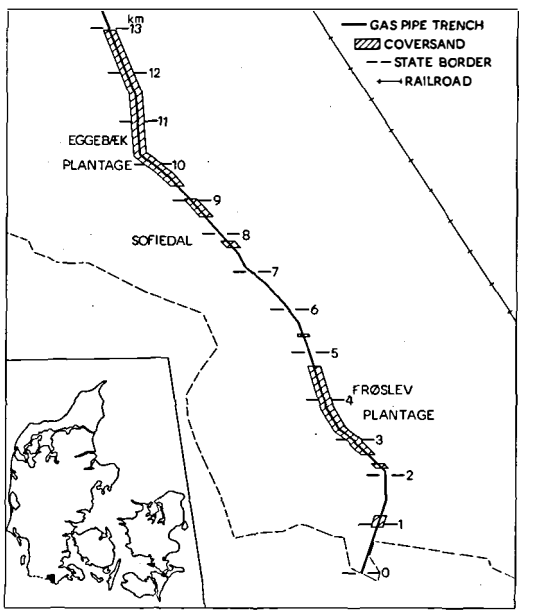

Fig. 1. Location of the southern 13 km of the gas pipeline trench in Jutland with coversand occurrences indicated.

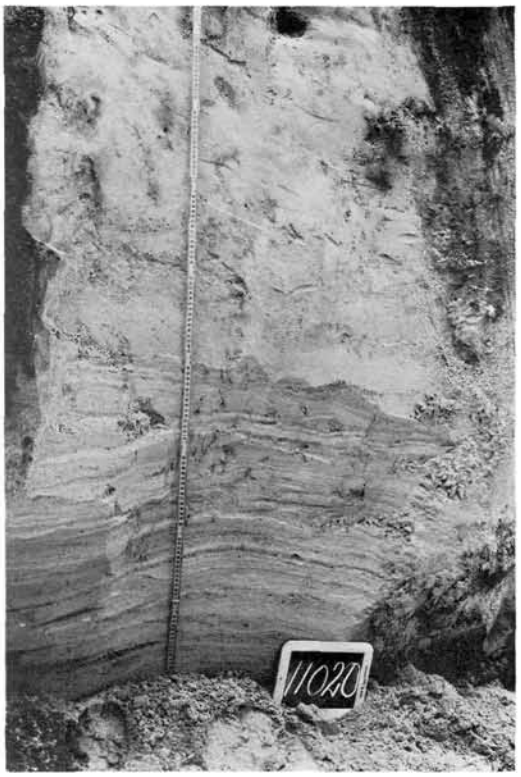

Fig. 2. Km 11.020. Coarsely developed Older Coversand with a gradual transition upwards to Younger Coversand without structures. The visible part of the ruler is 140 cm long.

horizontal laminae which alternate between very fine sand and fine to medium sand (figs 4 and 5). The laminae range in thickness from a few millimeters to a few centimeters. Fig. 6 (B, C, D, E, and F) shows typical grain-size histograms from this type of deposit. However, field study of the grain-size of the individual laminae revealed two size-classes, usually of 63–105 μm and 125–250 μm respectively. Since samples for grain-size analysis contain both the very fine and fine sand laminae, only one maximum is normally found. Usually almost equal amounts of the two size-classes were encountered. However, in some parts of the trench, the fine fraction was dominant. In such profiles decimeter thick layers of very fine sand to silt (sandloess: Woldstedt & Duphorn 1974: 43) were sometimes present (fig. 6: G). In other parts of the trench the coarser fraction prevailed (fig. 2).

The individual laminae within the lower unit can be followed laterally over several meters and the layers are usually undisturbed (figs 2, 4, and 5). In parts of the trench undulations of one to five cm in vertical extent were observed (fig. 3).

The individual grains of this type of deposit are well-rounded to sub-rounded, and polished (fig. 7) and this, together with the good sorting of the sediment and the wind-polished pebbles at the base, points to an aeolian origin.

Although the undisturbed lower unit in southern Denmark is locally more than two meters thick the thickness is usually between 50 and 100 cm.

The appearance and composition of this unit as well as its lithostratigraphic position (see below) is identical to that of the Older Coversand II described from The Netherlands (compare e.g. van der Hammen 1951; Dücker & Maarleveld 1957; Wijmstra, Schreve-Brinkman & de Vin 1971). In the following, therefore, this unit is designated Older Coversand.

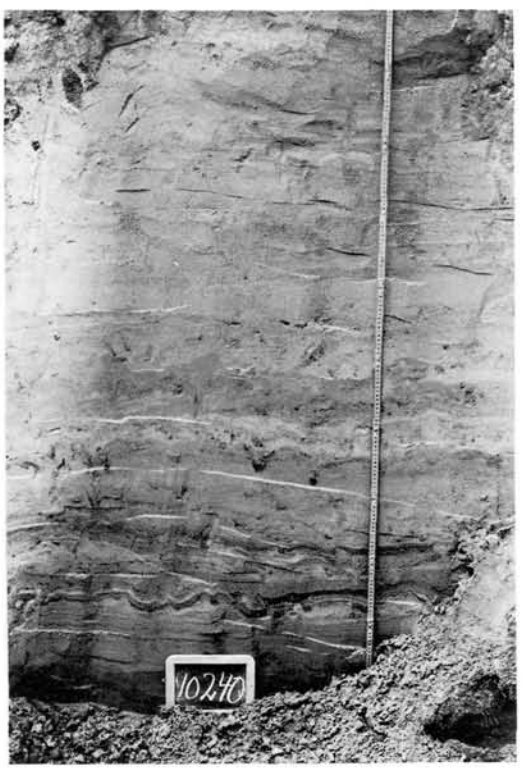

Fig. 3. Km 10.240. Older Coversand with shallow undulations of some of the laminae overlain by Younger Coversand with indistinct layering. The visible part of the ruler is 150 cm long.

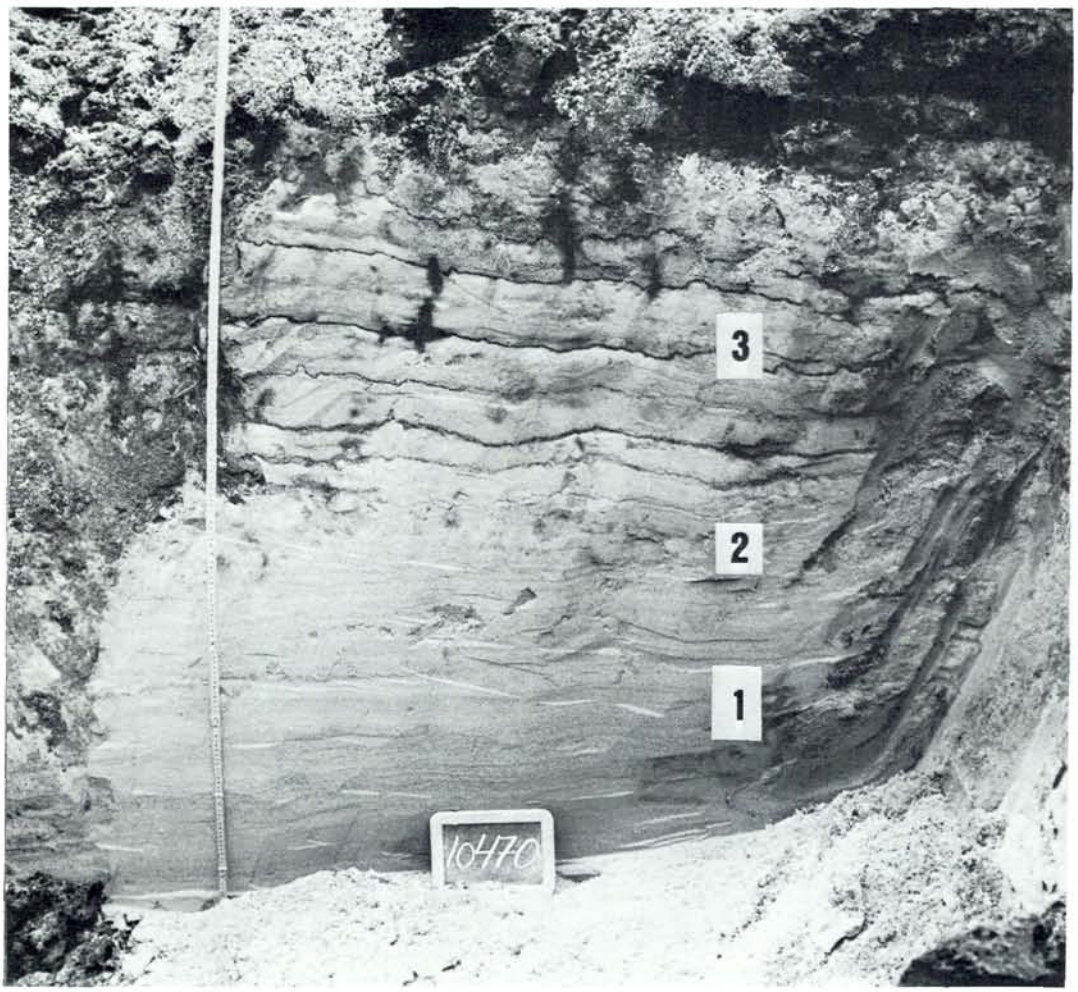

Fig. 4. Km 10.470. 1) Undisturbed Older Coversand, 2) Bioturbated zone, and 3) Younger Coversand with iron-manganese precipitate following the layering of the sediment. The visible part of the ruler is 170 cm long.

Upper unit

The upper unit rests upon the Older Coversand or the bioturbated zone. Its upper part is situated in or just below the top soil and therefore the layering is often disturbed (fig. 3) or has completely disappeared (Fig. 2).

The upper unit also has a horizontal layering of individual laminae which range from a few millimeters to a few centimeters in thickness (figs 4 and 5). However, in the upper unit very fine sand laminae are lacking and it is normally slightly coarser than the Older Coversand. In the field the dominant grain-size class of the upper unit was usually found to be 125–250 μm (fig. 6: A). Locally the grain-size of individual laminae within the upper unit may be coarser (1–2 mm).

As with the Older Coversand, the sand-grains in the upper unit are well-rounded to subrounded and this, together with the good sorting makes an aeolian origin probable. The greatest thickness of the upper unit recorded in southern Jutland is approximately 1.5 m.

Within the upper unit a bioturbated zone is sometimes found (fig. 5) suggesting incipient soil development during deposition.

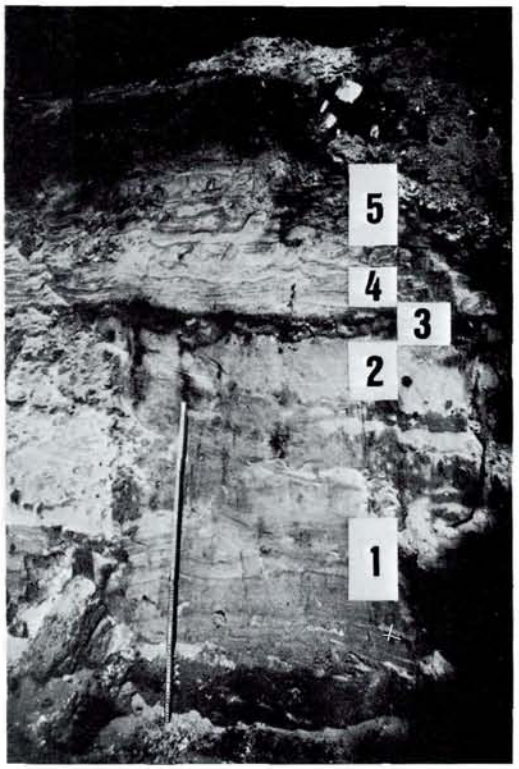

Fig. 5. Km 2.800. 1) Undisturbed Older Coversand, 2) Older Coversand without structures, 3) very fine sand to loam, 4) undisturbed Younger Coversand, and 5) bioturbated Younger Coversand. The visible part of the ruler is 95 cm long.

Also this unit is identical to a unit known from The Netherlands, namely the Younger Coversand (compare e.g. van der Hammen 1951; Dücker & Maarleveld 1957; Wijmstra et al. 1971).

Land surface morphology

Where coversands are found in the upper part of the trench the Younger Coversand usually constitutes the surface layer. Locally the Older Coversand extends to the surface without any Younger Coversand upon it. The land surface in this type of deposit is characterized by gentle slopes and an elevation of between 0.5 m and 1.0 m over 20 to 100 meters of surface is fairly common.

Stratigraphy

The Older Coversand rests upon a layer of wind-faceted and polished pebbles and small stones

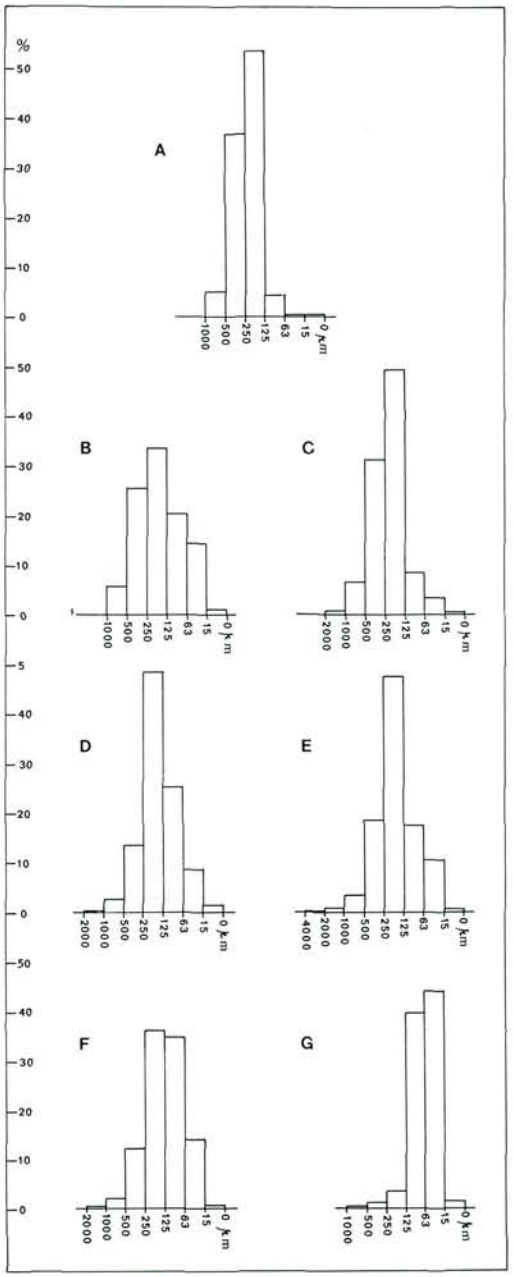

Fig. 6. Histograms showing the grain-size distributions of A: Younger Coversand at km 2.590; B, C, D, E, and F: Older Coversand at km's 2.600, 3.560, 8.715, 10.245, and 11.860 respectively; and G: Strongly loamy sand in the Older Coversand at km 12.170.

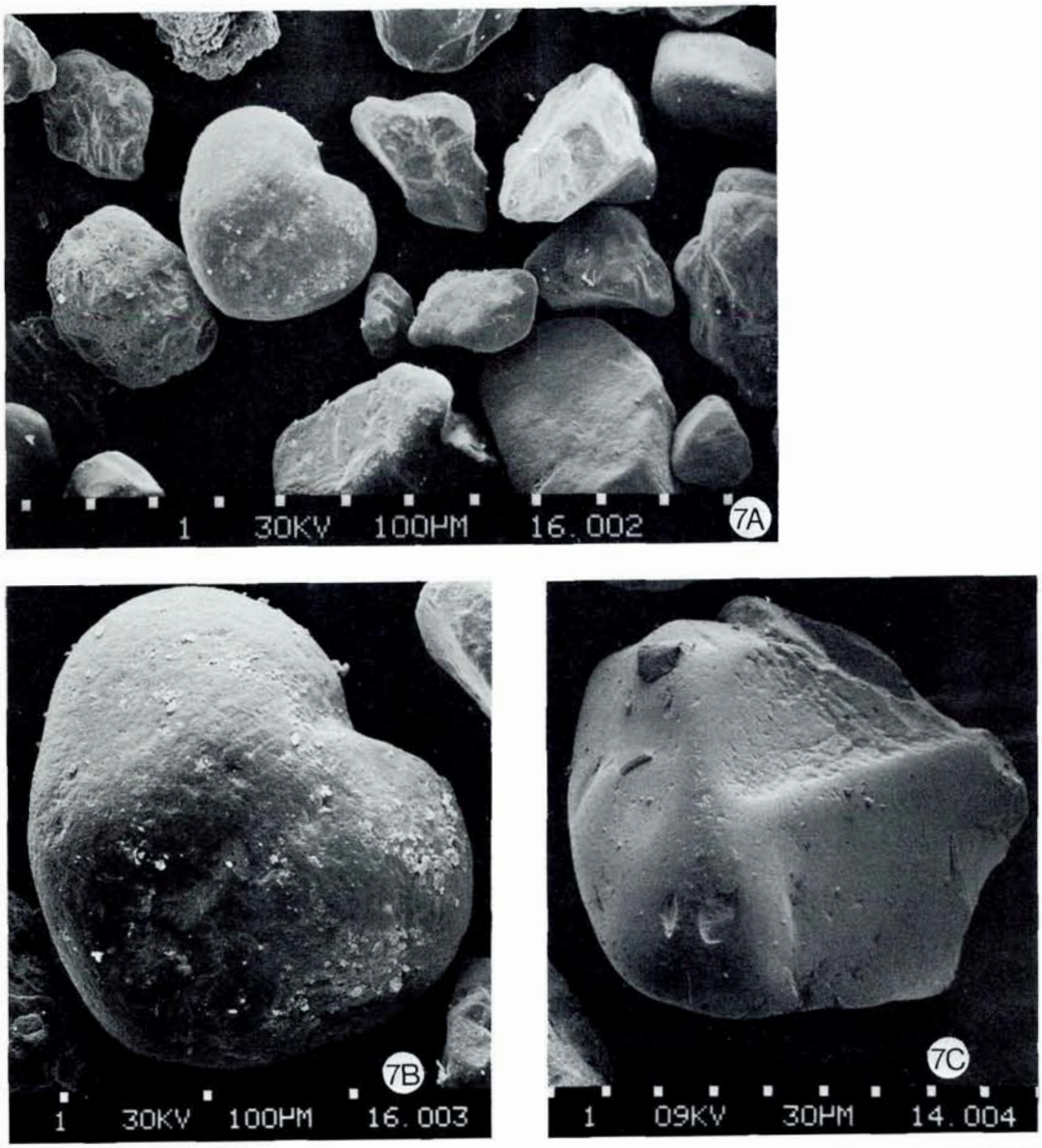

Fig. 7. Scanning electron microscope photograph of the sand grains of a typical coversand sample (A) together with S.E.M. photographs of a single well-rounded (B) and a single sub-rounded sand grain (C).

which in turn rests upon a strongly involuted sequence of sediments. It is overlain either by a fine-grained layer which has been altered by surface processes or it passes gradually into the Younger Coversand which locally contains a bioturbated zone.

This lithological sequence is identical to sequences found in The Netherlands (e.g. van der Hammen 1951; Wijmstra & Schreve-Brinkman 1971; Wijmstra & de Vin 1971; Maréchal & Maarleveld 1955), Belgium (e.g. Maréchal & Maarleveld 1955; Heyse 1975), and northern Germany (e.g. Dücker & Maarleveld 1957).

Studies comparing this type of sequence in The Netherlands, Belgium, and northern Germany conclude that the sequences can not only be li-

thostratigraphically but also chronostratigraphically correlated between these countries (Dücker & Maarleveld 1957; Zagwijn & Paepe 1968). The involutions and the pebble bed underlying the Older Coversand II are of Upper Pleniglacial age (van der Hammen, Maareeveld, Vogel & Zagwijn 1967). The Older Coversand II was deposited during the Upper Pleniglacial (van der Hammen et al. 1967; Kolstrup 1980). The fine-grained layer with mottling which separates the Older Coversand II and the Younger Coversand I represents the Lower Loamy Bed of Bølling age. The Younger Coversand I between the Lower Loamy Bed and the Usselo Soil has become deposited predominantly during the Earlier Dryas. The bioburbated zone between the Younger Coversand I and II, i.e., the Usselo Bed or Soil is of Allerød age. Finally, the Younger Coversand II which rests upon the Usselo Bed is predominantly of Late Dryas age (van der Hammen 1951; Dücker & Maarleveld 1957; Doppert, Ruegg, van Staalduinen, Zagwijn & Zandstra 1975; Cleveringa, de Gans, Kolstrup & Paris 1977). In figure 8 the Dutch stratigraphy is outlined according to van der Hammen (1971).

The striking similarities between the Older Coversands in Denmark and the three above mentioned countries suggest that the Older Coversands were deposited in the same or almost the same environment in the four countries. The same conclusion may be drawn for the Younger Coversands. Furthermore, the identical lithological sequences suggest that changes in environmental conditions were similar in succession in all four countries. It is possble, therefore, that the chronostratigraphic correlation between Belgium, The Netherlands, and Germany might be extended into Denmark, but pollen analysis and radiocarbon dates from the Danish coversands are still lacking. It is hoped that further studies will add more information.

Lithostratigraphical units	Chronostratigraphical units	
Younger Coversand II	Late Dryas	Late Glacial
Usselo Bed or Soil	Allerød	
Younger Coversand I	Earlier Dryas	
Lower Loamy Bed	Bølling	
Older Coversand II		Pleniglacial

Fig. 8. Stratigraphical table of the Late-Glacial and the upper part of the Pleniglacial in the Dinkel valley in the Netherlands according to Van der Hammen (1971).

Conclusions

It has long been known that aeolian deposits are present in parts of southern Jutland (Hansen 1965; Milthers 1925) and Sørensen (1972) briefly mentions coversands. The continuous excavations for the gas pipeline provide a unique opportunity to study the lateral extension of various layers, the stratigraphy of single localities, and the transitions between layers. It is now possible to identify the aeolian deposits and their stratigraphical succession. Both Older and Younger Coversands are represented in southern Jutland and the lateral extension of these deposits within northwestern Europe can thus be extended from the coversand areas in Belgium, The Netherlands, and northern Germany northward into Denmark.

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Dansk sammendrag

Under udgravningen til naturgasledningen i Sønderjylland blev der i den næsten 2 m dybe rende fundet aeoliske sedimenter af ældre og yngre dæksandstype over adskillige kilometer. Denne artikel beskriver dæksandenes udseende og egenskaber i de sydligste 13 km af traceet.

Lithostratigrafien i dæksandsområderne i denne del af Danmark er identisk med den, der findes i dæksandsområderne i Holland, Belgien og det nordlige Tyskland. Nederst findes et involueret sediment med en horisont af vindpolerede sten i toppen. Derover findes ældre dæksand overlejret af yngre dæksand. Mellem ældre og yngre dæksand findes lokalt en bioturberet zone, og enkelte steder er yngre dæksand opdelt i to lag adskilt af en bioturberet horisont. Formodentligt er den miljømæssige udvikling i de fire lande forløbet parallelt.

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