

SEDIMENTOLOGICAL FEATURES OF THE BASE OF THE IEPER GROUP IN BELGIUM

by

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SUMMARY

Grain-size analyses on the sandy base-sediments of the Ieper Group (Lower Eocene) from several outcrops and boreholes in Belgium demonstrated a fining upwards trend by increasing of the silt-fraction ; the least fine deposits were found in the boreholes from the center of Western Flanders.

Textural and facies features point to a deposition on a shallow marine offshore zone, with tidal influences, passing over a the transition zone into a mud shelf.

KEY WORDS

Lower Eocene, Ieper Group, grain-size distribution, depositional environments.

RESUME

Des analyses granulométriques ont été effectuées sur des sédiments de la base du Groupe d'Ypres (Eocène inférieure), provenant de différents affleurements et de sondages en Belgique.

Les sédiments sableux deviennent plus fins vers le haut par l'augmentation de la fraction silteuse ; les dépôts les moins fins ont été trouvés dans les sondages du centre de la Flandre Occidentale.

Les caractéristiques texturales et de faciès laissent supposer un dépôt d'avant-côte, avec des influences tidales, qui passe par une zone de transition vers une plate-forme continentale à dépôt de boue.

MOTS-CLES

Eocène inférieure, Groupe d'Ypres, distribution granulométrique, milieu de dépôt.

SAMENVATTING

Granulometrische analyses werden uitgevoerd op de sedimenten van de basis van de Groep van Ieper (Onder-Eoceen), afkomstig van verschillende ontsluitingen en boringen in België. De zandige sedimenten worden fijner naar boven toe, door verhoging van het silt-gehalte ; de minst fijne afzettingen werden gevonden in de boringen uit het centrum van West-Vlaanderen.

Texturele en faciëskenmerken wijzen op een afzetting op een buitengaatse zone, met getijdeinvloed, die overgaat via een overgangszone naar een vastlandsplat met sliksedimentatie.

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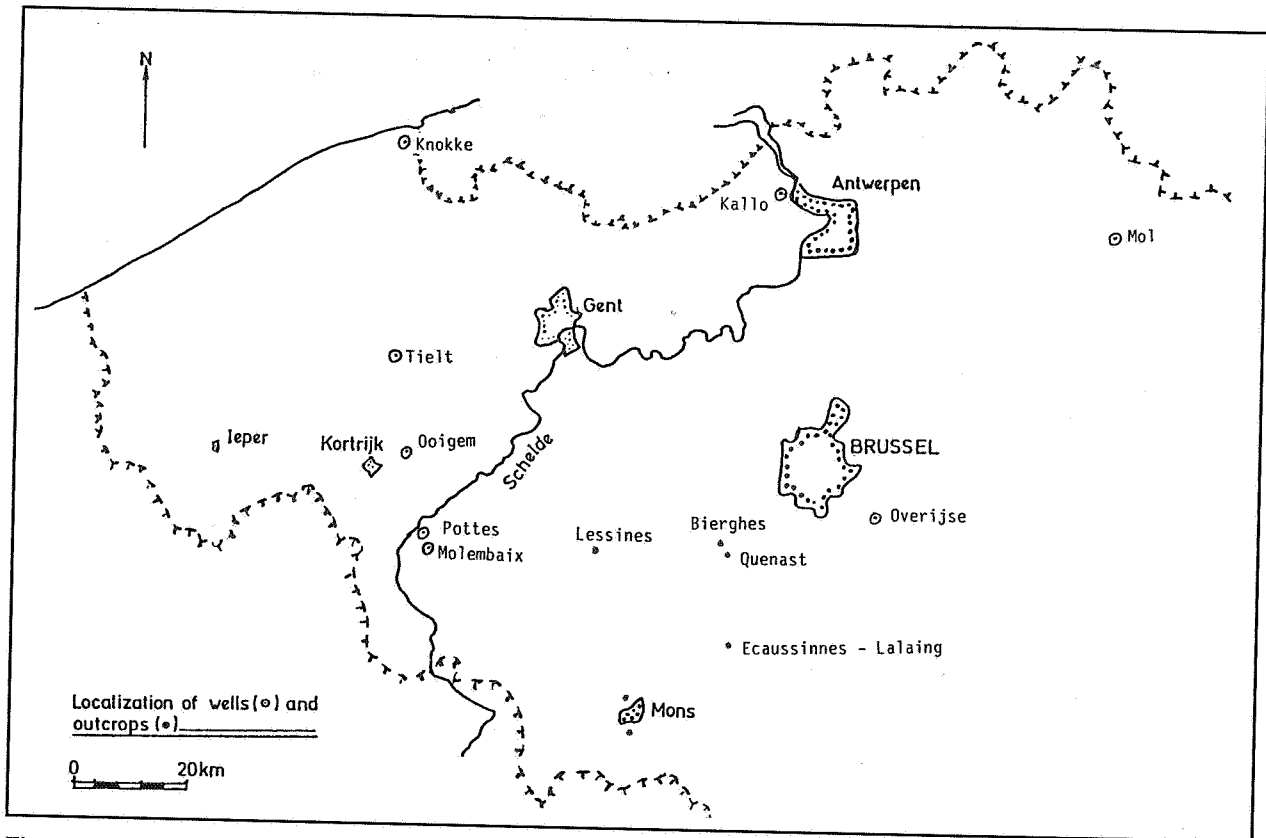


Figure 1. Localization of outcrops and wells.

SLEUTELWOORDEN

Onder-Eoceen, Groep van Ieper, korrelgrootteverdeling, afzettingsomgeving.

1. INTRODUCTION

At the base of the Ieper Group (Lower-Eocene) rather heterogeneous, clayey-silty-sandy sediments occur, brought together in the Mont-Héribu Member (De Coninck *et al.*, 1983).

They have been macroscopically described in 6 outcrops (Mons-Borinage - Mt.Héribu ; Mons-Borinage - Ghlin ; Ecaussinnes-Lalaing ; Rebecq - Quenast ; Rebecq - Bierghes ; Lessines) and 8 boreholes (Celles - Pottes ; Celles - Molembaix ; Wielsbeke - Ooigem ; Tielt ; Beveren - Kallø ; Knokke ; Mol and Overijse) (fig. 1) ; their grain-size distributions have been thoroughly elaborated, and the results have been used for the detailed sediment names in the descriptions.

2. MACROSCOPICAL FEATURES OF THE SEDIMENTS

In the region of the type-locality of Mons-Borinage, the member starts with gray, (very-fine-silty) fine sand,

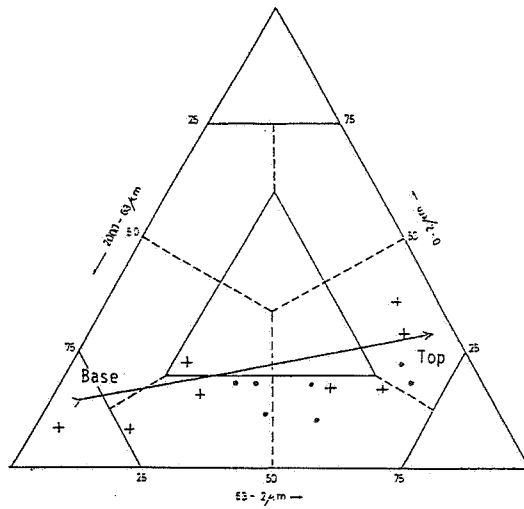
hardened and redly-oxdyzed by groundwater circulation at the contact with the sediments of the underlying Landen Group ; it contains intercalations of coarse-silty, very fine sand or lenses white, fine sand. It is followed by a layered complex of coarse-silty, fine sand and clayey or fine-sandy, coarse silt, covered by compact, coarse-silty, fine sand and fine-sandy coarse silt.

The sedimentation succeeds with an alternation of horizontally- or cross-bedded laminations of clayey or very-fine-sandy, coarse silt and micaceous, clayey, fine sand.

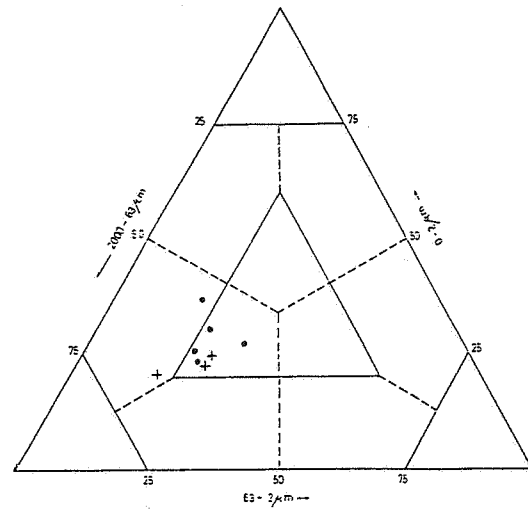
The top consists of horizontal laminations of clayey or very-fine-sandy, coarse silt.

The total thickness fluctuates between 4 and 6 meter.

In the northwestern part of the Hainault province, where the thickness has decreased to 2-2.5 meter, the member consists of glauconiferous, clayey, very-fine silty or coarse-silty, fine to very fine sand, with black



Mons - Borinage •
 Mons - Borinage - Mt. Héribu +



Celles - Pottes •
 Celles - Molembaix +

Figure 2. Texture diagram of the sediments from the region of Mons-Borinage.

Figure 3. Log probability curves of the sediments from the region of Mons-Borinage and the northern part of Hainault.

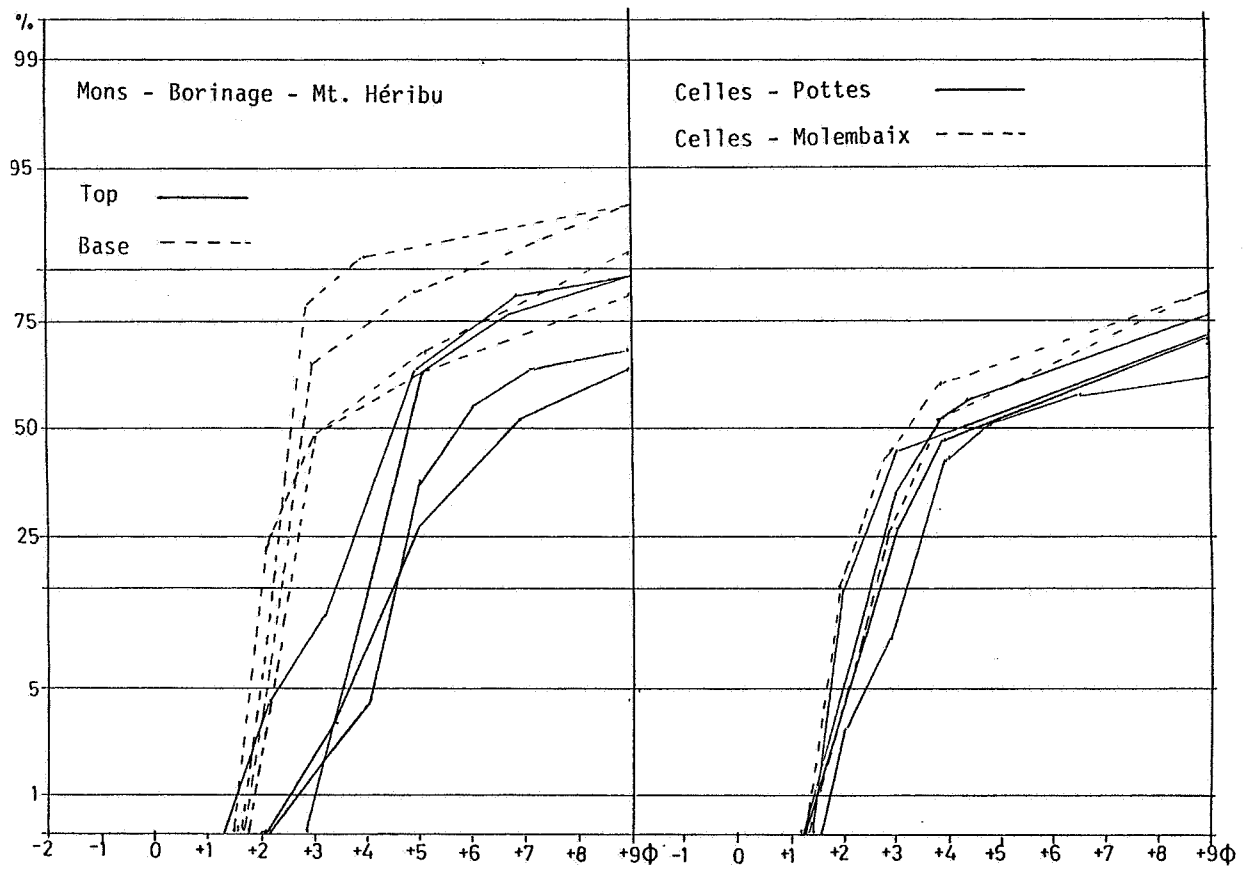


Figure 4. Texture diagram of the sediments from the northern part of Hainault.

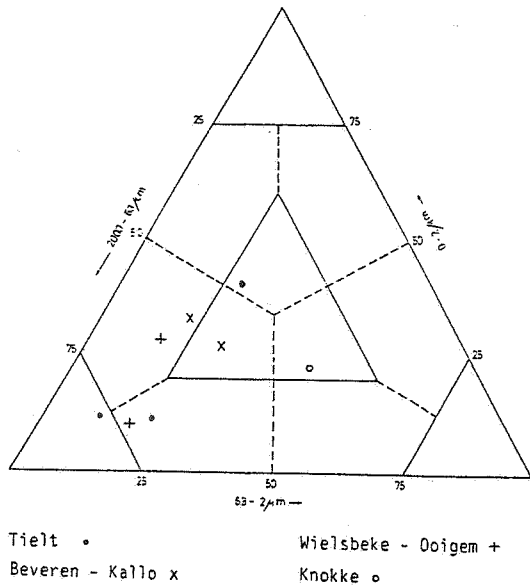


Figure 5. Texture diagram of the sediments from the both Flanders.

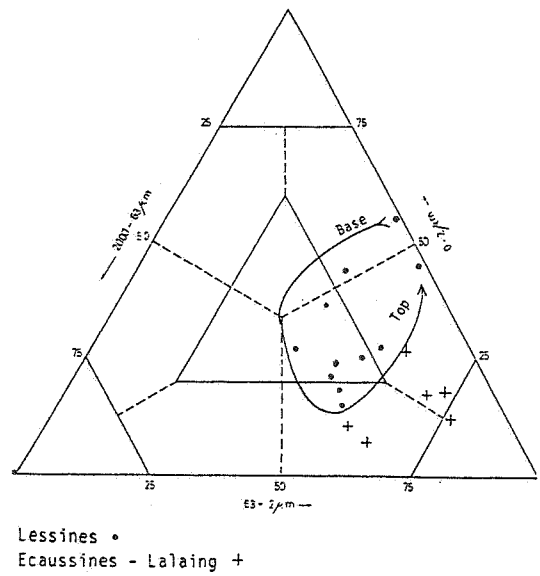


Figure 6. Log probability curves of the sediments from the both Flanders, of the northeast of Hainault and the southwest of Brabant.

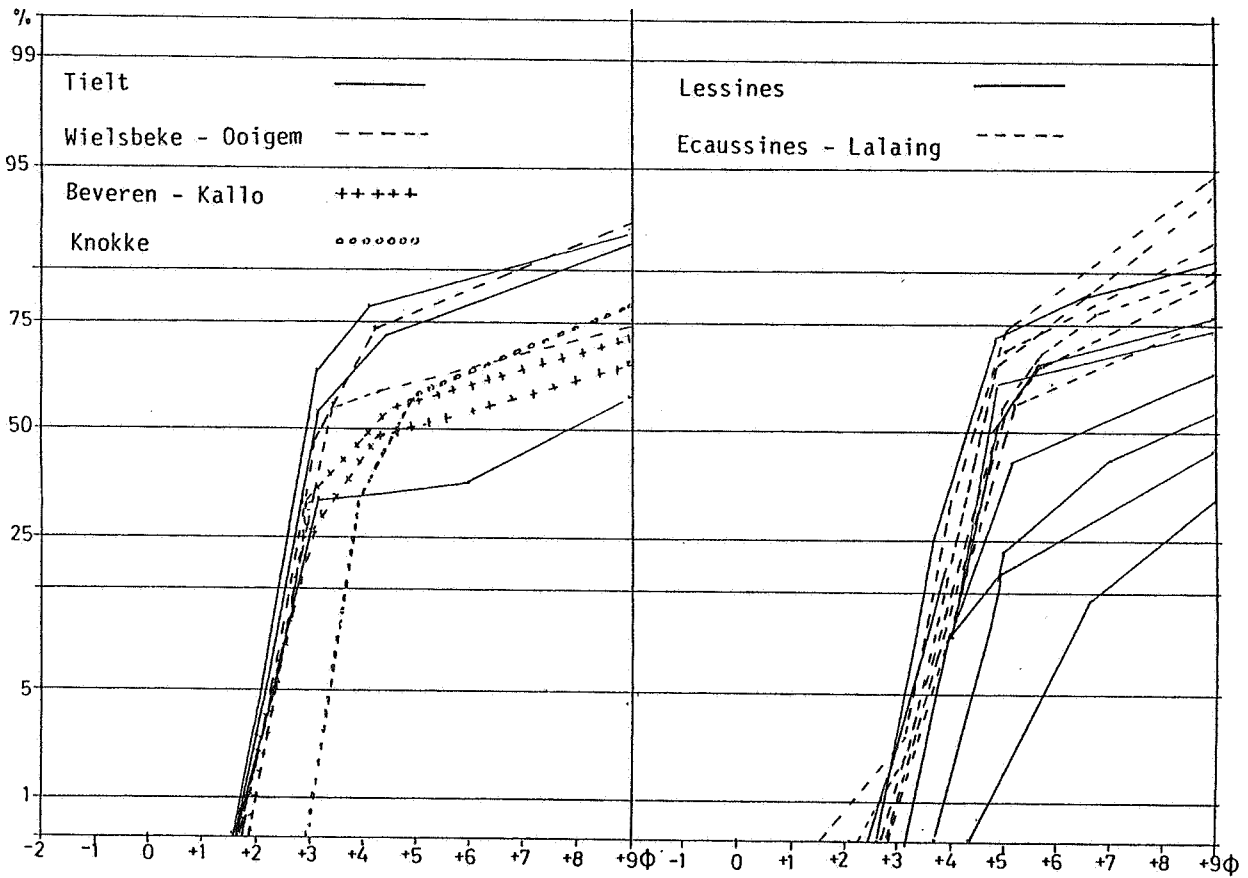


Figure 7. Texture diagram of the sediments from the northeast of Hainault and the southwest of Brabant.

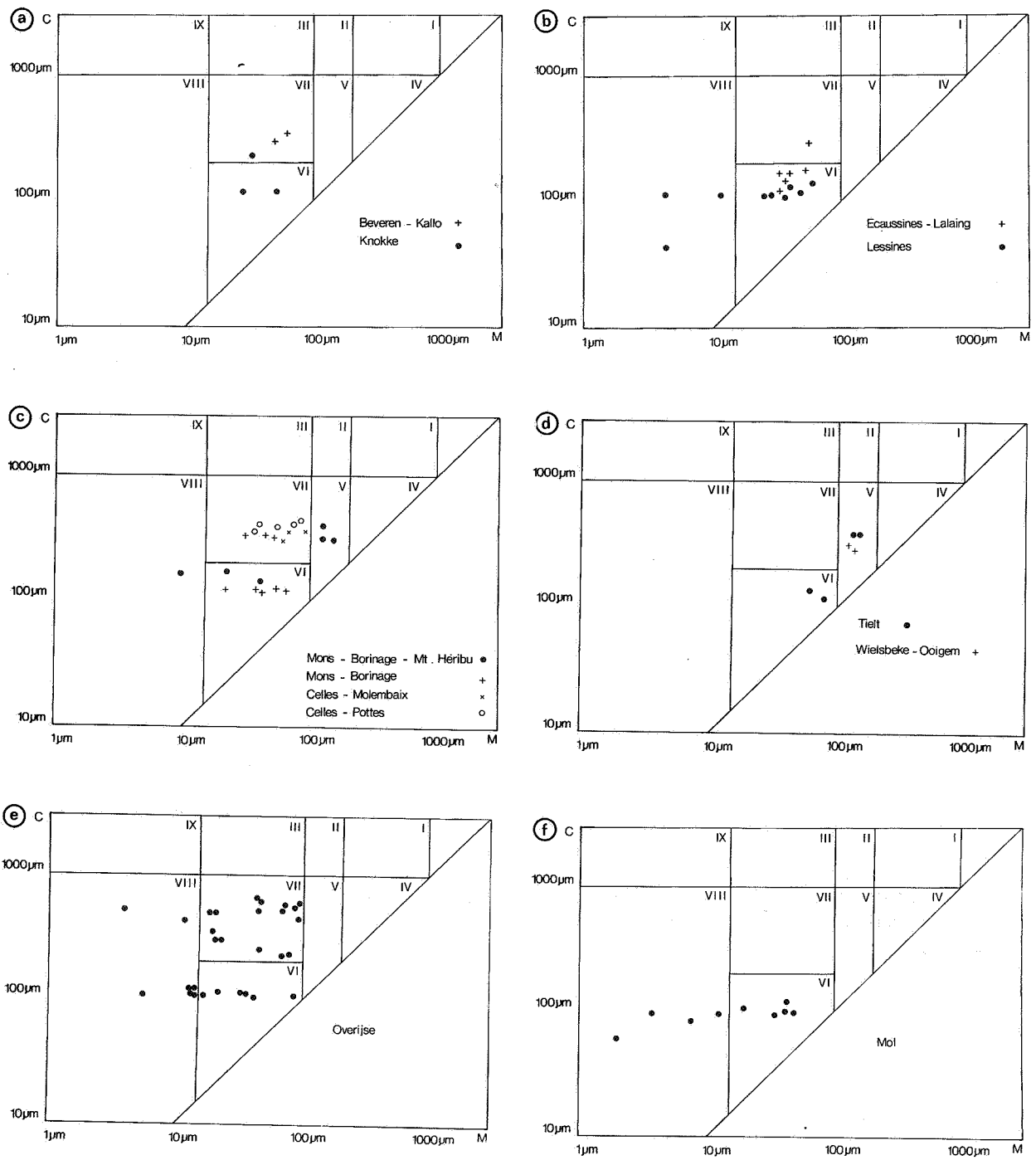


Figure 8. C/M-diagrams of the base sediments of the Lower Eocene.

I, II, III, IX : coarse sediments, containing rolled grains.

IV, V, VI, VII : suspension sediments, with rolled grains, smaller than 1 mm.

IV : highly turbulent, graded suspension sediments.

V : moderately turbulent, graded suspension sediments.

VI : graded suspension deposits.

VII : uniform suspension deposits.

VIII : finest uniform suspension and pelagic suspension deposits.

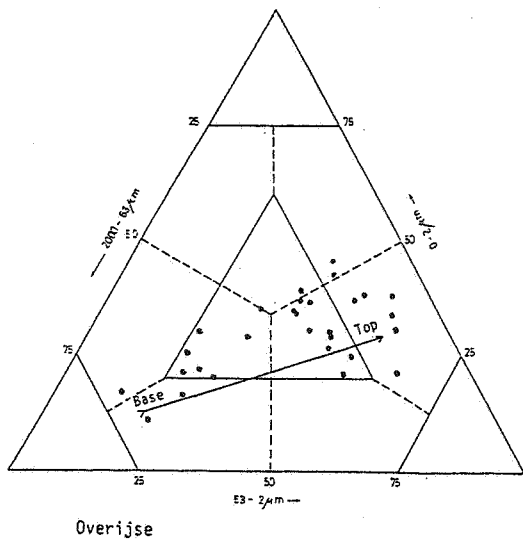


Figure 9. Texture diagram of the Lower Eocene base sediments at the borehole of Overijse.

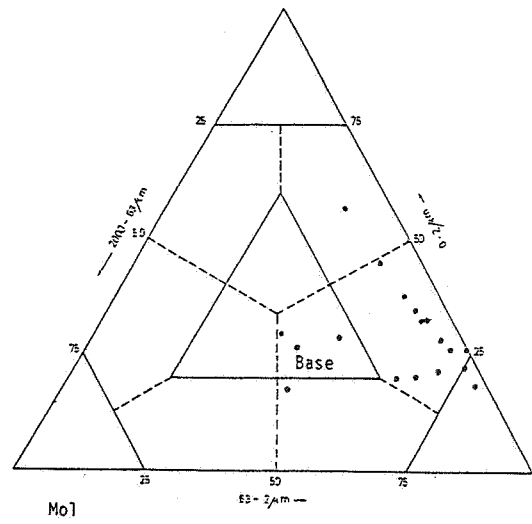


Figure 10. Log-probability curves of the Lower Eocene base sediments at the boreholes of Overijse and Mol.

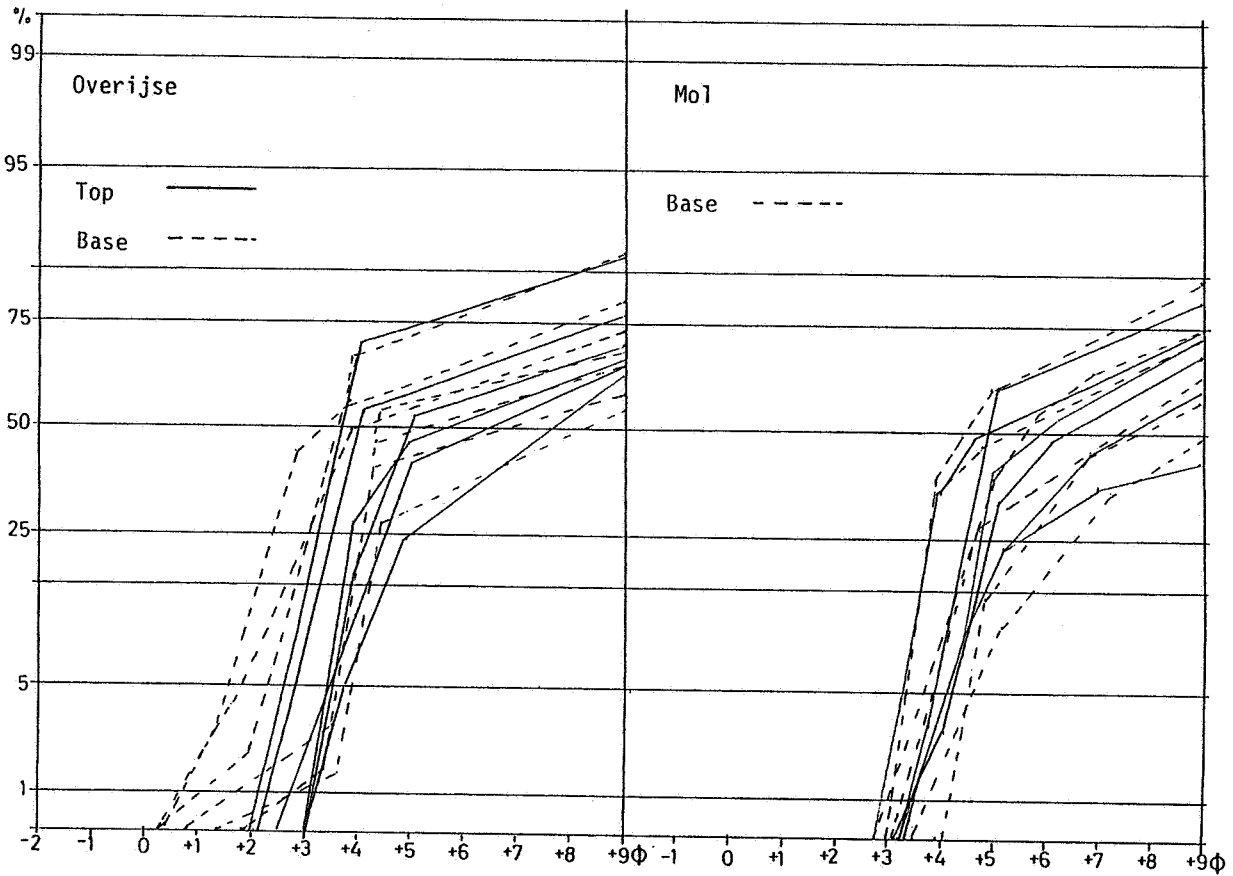


Figure 11. Texture diagram of the Lower Eocene base sediments at the borehole of Mol.

spots of organic material ; the sediment shows fine, horizontal laminations, especially at the top, where thin, clayey intercalations occur.

More to the north, the thickness drops from 2.5 to 1.5 meter ; the deposit consists of very clayey, fine- to coarse-silty, fine sand, which is covered at Tielt by a fine-sandy, very-fine-silty clay. Fossil wood could be found at the base (Tielt).

In the northeast of Hainault and the southwest of Brabant, where these sediments immediately rest on the Paleozoic basement, their thickness varies between 5 and 10 meter. The most important component by far is a, mostly clayey, very-fine-sandy, coarse silt ; it is micaceous and glauconitic and often horizontally laminated.

In Lessines, as in Rebecq-Quenast and Bierghes, the base is formed by a clayey, coarse silt with oxydized spots, whereas in Ecaussines-Lalaing it is formed by a dark, very-fine-sandy, coarse silt, with lenses of very fine sand.

In the center of Brabant, a similar heterogeneous deposit occurs, which reaches 20 meter in the well of Overijse. It consists at the bottom in thin layers clayey, coarse- to fine-silty, fine to very fine sand, alternating with very-fine-sandy, coarse-silty clay. To the top the importance of the clayey, very-fine-sandy, coarse silt increases, alternating with layers very fine sand and very-fine-silty clay.

Farther to the north-east, in the borehole of Mol, the lowermost 16 meter of the Ieper Group starts with a clayey, very-fine-sandy, coarse silt, followed dominantly by a clayey, coarse or very fine silt, with intercalations of thin layers of clayey, (very-fine-sandy) coarse, medium or very fine silt.

3. GRAIN-SIZE DISTRIBUTION

In the triangular texture diagram, the sediments from the type-locality near Mons-Borinage are situated between the sand and the silt field, in a zone with less than 30 % clay fraction. One remarks an increasing of the silt fraction, much more than of the clay fraction, in the sediments from bottom to top in the deposit (fig. 2).

The log-probability curves show only a saltation and a suspension population : the truncation point lies between 3 and 4 ϕ (very fine sand) for the sediments of the lowermost part of the outcrops, and between 4 and 5 ϕ (coarse silt) upwards (fig. 3).

The sediments from the boreholes in northwestern Hainault and the both Flanders lie in the texture diagram near the sandy pole, with less than 30 % of clay (fig. 4 and 5).

All log-probability curves show a break between saltation and suspension population between 3 and 4 ϕ (very fine sand) (fig. 3 and 6).

As could be expected from the description, the sediments from the outcrops in northeast Hainault and southwest Brabant lie in the texture diagram in the siltzone ; with the exception of the basal and the top sediments, which are finer, most of them contain less the 30 % of clay fraction (fig. 7).

The cumulative curves contain only a saltation and a suspension population, with a truncation point between 4 and 5 ϕ (coarse silt). Only the lowermost deposits at Ecaussines-Lalaing show a small traction population (3 %) and a breakpoint between 2 and 3 ϕ (fine sand) with the traction population (fig. 6).

The least fine sediments in this member were found in the boreholes of Wielsbeke-Ooigem and Tielt, where the general average size lies within the coarse silt fraction.

According to Passega's C/M-diagrams, they were deposited from a graded suspension in a moderately turbulent environment (fig. 8d). To the south and the east the sediments grow finer and the general average size switches to the medium silt fraction (or fine silt fraction as in Lessines). They also originated from a graded suspension, but in a low turbulent environment (fig. 8b & c) : the sediments from the northern part of Hainault were deposited from a uniform suspension (fig. 8c).

The sediments also become finer to the north and the general mean lies in the fine silt fraction in the boreholes of Knokke and Beveren-Kallo (fig. 8a) ; they were deposited from a uniform suspension.

The deposits from the borehole of Overijse lie in the texture diagram between the sand- and the silt-pole ; from base to top one remarks an important decrease in sand- and increase in silt fraction, less in clay fraction (fig. 9).

The log-probability plots of the base-sediments show a traction population of 2 to 5 % medium sand. The truncation point between the saltation and the suspension population is situated between 3 and 4 ϕ (very fine sand). The uppermost, more silty part of the member contains only a saltation and a suspension popula-

tion, with a break between 4 and 5 ϕ (coarse silt). From the C/M-diagram one can conclude that the base sediments were deposited from a uniform suspension, whereas the following ones originated from a graded suspension in a low-turbulent environment (fig. 8e).

In the texture diagram the sediments from the borehole of Mol are all situated in the silt-zone, mostly with less than 40 % clay fraction (fig. 11) : a sand fraction is always present, but decreases from base to top.

The cumulative curves show the existence of a saltation and a suspension population, approximately of equal value, with a truncation point between 4 and 5 ϕ (coarse silt), exceptionally between 5 and 6 ϕ (medium silt) (fig. 10). They have been deposited from a graded suspension in a low-turbulent environment (fig. 8f).

4. CONCLUSION

As can be deduced from the log probability plots and the C/M-diagrams, sedimentation took place in a rather quiet environment.

The sediments were probably deposited on a shallow marine, offshore zone : thin units of laminites and cross-bedded sets point to a tidal influence in the sedimentation.

Deposition of the top sediments took place in the transition zone to the mudshelf : it is characterised by a steady increase in the silt fraction, rather than in the clay fraction.

As can be noticed in the different boreholes of Western Flanders, the transition to the higher very-fine-silty clay of a mudshelf environment is rather abrupt.

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Manuscript received on 10.07.92 and accepted for publication on 30.11.1992.