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SEDIMENTOLOGICAL INVESTIGATION OF THE MONT-PANISEL BORING

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SUMMARY

Different sedimentological investigations (grain-size analysis, heavy minerals, glauconite- and carbonate content) show that 3 groups of sediments can be distinguished. The two lowermost groups have been deposited on the shoreface under increasing energetic conditions, comparable with the depositional environment of the Egem Member of the Ieper Formation, whereas the topgroup has been sedimented on a less energetic shoreface, like the transitional facies from the Pittem Member towards the Vlierzele Member of the Mont-Panisel Formation.

Two different heavy mineral distributions have been observed, one characterised by much zircon, garnet and epidote in the lowermost sediments, and a second one with much tourmaline and parametamorphic minerals in the younger sediments. A change in source area is probably the origin of that difference.

RESUME

A l'aide de différentes analyses sédimentologiques (granulométrie, minéraux denses, teneur en glauconie et carbonate) trois groupes de sédiments ont pu être identifiés. Les deux groupes inférieurs ont été déposés à l'avant-côte sous des conditions à énergie croissante, comparable au milieu de dépôt du Membre d'Egem de la Formation d'Ypres. Les sédiments du sommet du sondage se sont déposés sur une avant-côte à faible énergie, comme le faciès de transition entre le Membre de Pittem et celui de Vlierzele de la Formation du Mont-Panisel.

Deux distributions différentes de minéraux lourds ont été observées. Les sédiments inférieurs contiennent beaucoup de zircon, du grenat et de l'épidote, tandis que les autres sont caractérisés par l'abondance de tourmaline et de minéraux métamorphiques. Un changement de source est probablement à l'origine de ces différences.

KEY WORDS

Lower Eocene, grain size, depositional environment, heavy minerals.

MOTS CLES

Eocène inférieur, granulométrie, milieu de sédimentation, minéraux lourds.

1. INTRODUCTION

Grain-size analysis, determination of glauconite- and lime content, weight-percentage and distribution of heavy minerals have been executed on 70 sediment samples of the Mt. Panisel boring. A graphical representation of the results of that investigation is presented in fig. 1.

2. GRAIN-SIZE DISTRIBUTION

From top to bottom, three different sediment groups can be distinguished (figs. 1, 2 and 3).

2.1. Group I (0-17,8 m) : clayey fine sand, very poorly to extremely poorly sorted, with an average mean (M_Z) of 5,34 ø and a sorting coefficient (σ_I) of 3,56 ø Near to the top, two thin layers of fine-sandy clay appear.

2.2. Group II (17,8-22,2 m) m: fine sand, poorly sorted : M_Z= 2,76 ø,σ_I = 1,13 ø

2.3. Group III (22,2-65 m) : very fine sand, exceptionally clayey, poorly sorted (average mean 4,41 ø and sorting coefficient 1,95 ø,

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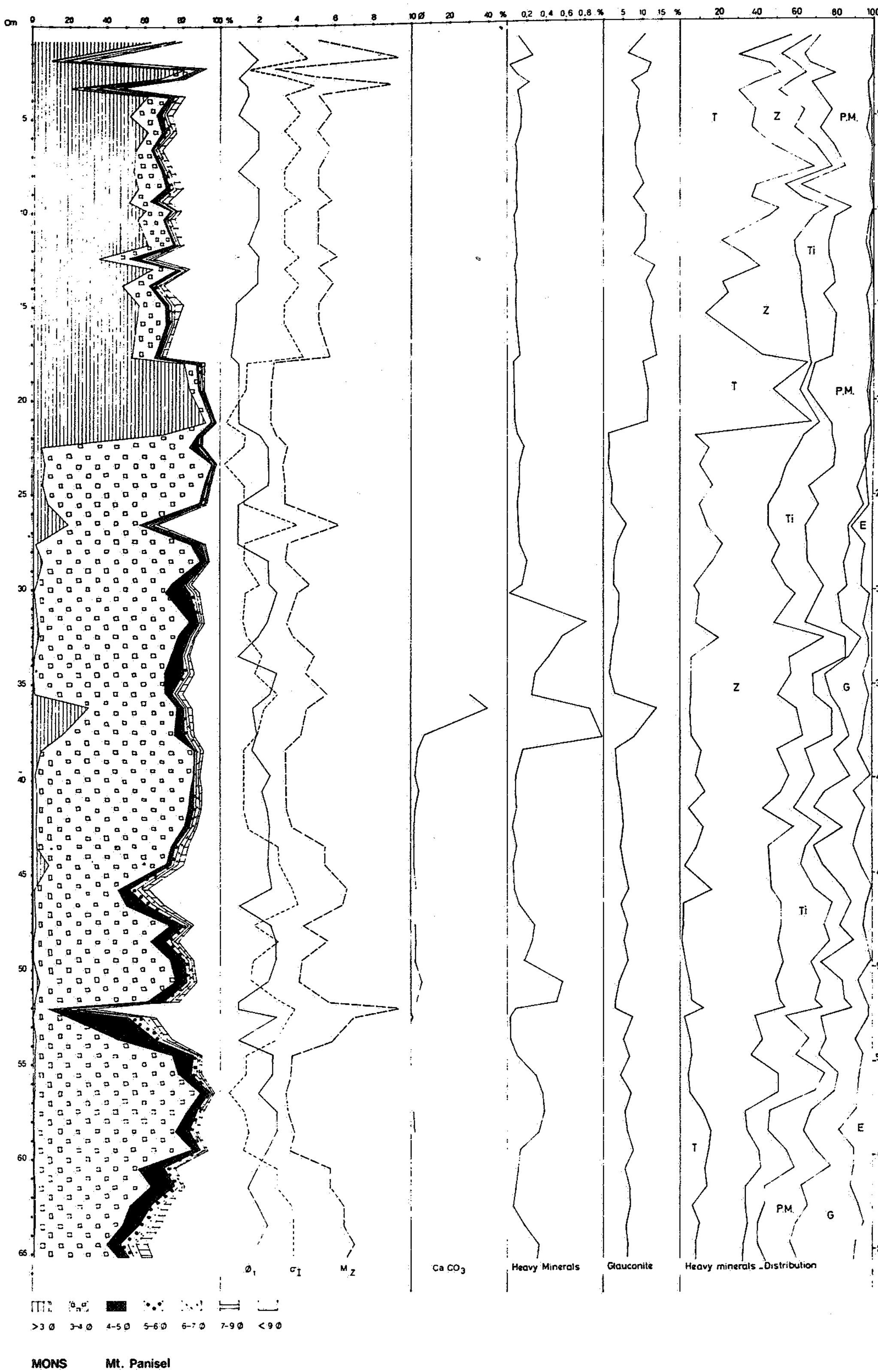

Figure 1 Graphical representation of the results of the sedimentological investigation.

III_a). It passes downard into clayey, fine-to-coarse silty, very fine sand, very poorly to extremely poorly sorted (M_Z = 6,37 ø,σ_I = 3,53 ø, III_b). At 27 m and 36 m less finer sand, with a smaller clay content, appears, whereas at 52 m a thin layer of very-fine-silty clay occurs.

In the M_Z/σ_I-diagram (fig. 4) the three groups occupy three well delimited zones.

3. GRAIN-SIZE DISTRIBUTION OF OTHER EOCENE SANDS

As has been suggested in the preliminary paper about the Mt. Panisel boring (Dupuis *et al.*, 1988), the grain-size characteristics of a few "sands", deposited in the South of the Eocene basin are compared with these of the sediments of the Mt. Panisel boring.

3.1. Peissant-sands (Geets, 1984) : these sediments occupy a hill crest at Estinnes-Peissant, south of Binche and are noted as Upper Ypresian Yd on the Geological map. At the top they seem to pass gradually into the Morlanwelz argilite member (Gulinck & Hacquaert, 1954), which has the same age as the Orchies Clay Member of northern France (Steurbaut, 1988) (some description of old excavations or borings also notice the presence of "argilites" under the Peissant-sands).

They consist of poorly sorted, fine sand (M_Z= 3,20 ø,σ_I= 1,82 ø), faintly horizontally layered, with thin clay- and sandstone layers (Geets, 1984).

In the triangular texture diagram (fig. 5) and in the M_Z= 3,20 ø,σ_I-diagram (fig. 6) they occupy the same area as the sediments of Group II.

3.2. Trélon-sands : are situated between Philippeville, Avesnes and Trélon (Northern France). They were regarded as a lateral equivalent of the Peissant-sands (Leriche, 1936) and their fossil content corresponds with that of the lower part of the Cuise Sands (Feugueur, 1963).

They consist of clayey (coarse silty), very fine sand, very poorly sorted (average mean 4,87 ø, average sorting coefficient 2,59 ø) (Geets, 1984). They are plotted in the graphical representation (figs 5 and 6) in the same zone as the sediments at the base and

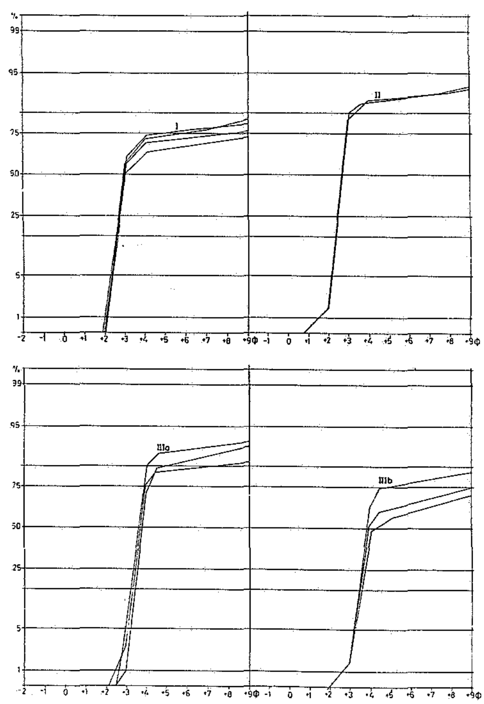

Figure 3 Cumulative curves of the sediment groups from the Mont-Panisel boring.

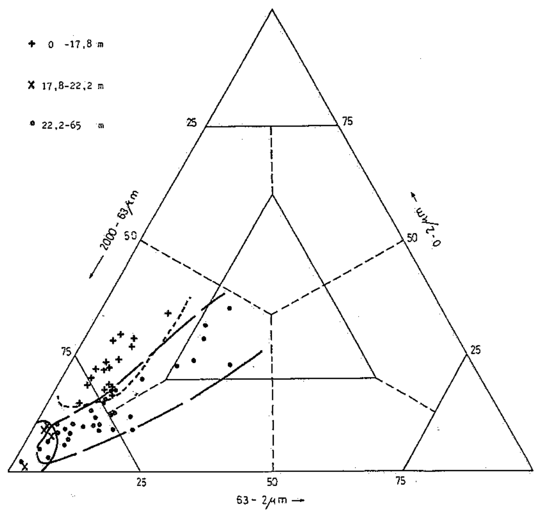

Figure 2 : Triangular texture-diagram.

+ 0 - 17,8 m
x 17,8 - 22,2 m
. 22,2 - 65,0 m

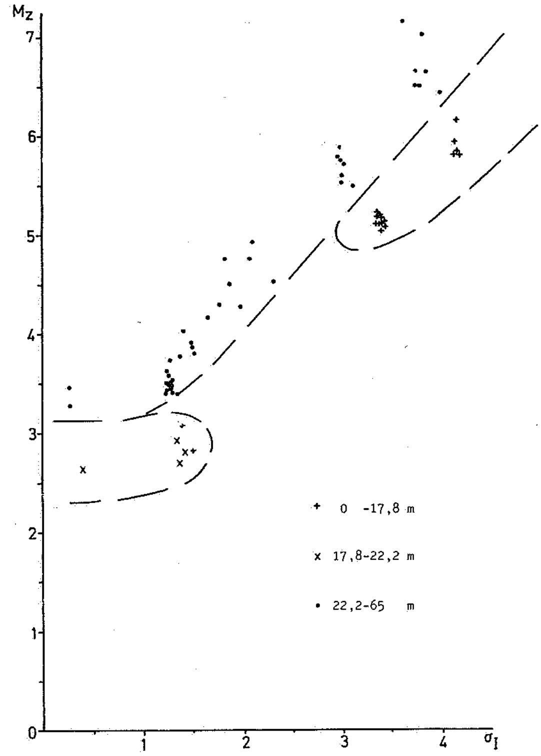

Figure 4 : $M_z \sigma_I$-diagram of the 3 sediment-groups from the Mt.-Panisel boring.

+ 0 - 17,8 m
x 17,8 - 22,2 m
. 22,2 - 65,0 m

the center of Group II from the Mt. Panisel boring.

3.3. Mons-en-Pévèle-"sands" are a lateral equivalent of the Roubaix Clay Member (Steurbaut, 1988). Samples from two outcrops and accompanying hand borings at Mons-en-Pévèle were investigated.

The sediments are very poorly sorted coarse silts, exceptionnally very fine sandy, with an average mean of 6,67 ø and a sorting coefficient of 2,85 ø (De Moor & Geets, 1973). No sediments, resembling the Mons-en-Pévèle silts, are found in the Mt. Panisel boring.

4. SEDIMENTOLOGICAL INTERPRETATION

Since results of grain-size analyses are a little meagre to determine the sedimentological environment of the sediments, we were looking for comparable sequences in outcrops, where possible structures and other characteristics could give more information on depositional features.

4.1. Sediments of Group III, II

A similar coarsening-upwards sequence like Group III, was found from the base to the top of the sands of the Egem Member in the sand- and clay pit at Pittem-Egem (fig. 7) : clayey, fine to coarse-silty, very fine sands pass gradually into pure very fine sands.

They pass into the fine sands of Group II (upper two meter of the Egem member at Pittem-Egem) ; the same sequence can be observed in the Tielt, Kallo and Knokke wells (Geets, 1978a and b, Geets & De Geyter, 1990).

Tide-influenced sand-bars, hummocky cross-stratification, gullies filled up with broken shell-fragments and clay-pellet-layers point to a deposition on a prograding high-energetic shoreface,

Mont-Panisel	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
I. 0 - 17,8 m	38.95	24,05	12,67	3,90	8,33	9,24	1,10	0,81	0,81
		75,67			22,	57			
II. 17,8 - 22,2 m	47,50	19,00	7,00	3, 00	8,25	12,00	1,00	1,25	0,75
		73,50			24,	25			
III. 22,2 - 65,0 m	9.11	39,84	17;29	0,89	6,04	6,02	0,80	14,20	5,51
		66,24			13,	78			

Table 1 : Heavy mineral distribution of the sediments from the Mt. Panisel boring.

1. Tourmaline
2. Zircon
3. Ti-Minerals
4. Andalusite
5. Staurolite
6. Kyanite
7. Sillimanite
8. Garnet
9. Epidote (Pyroxenes, Amphiboles)

where sedimentation was largely influenced by tidal currents and storm-periods.

4.2. Sediments of Group I

These same clayey fine sands as in Group I were found in outcrops of the Mt. Panisel Formation at Hooglede, Staden, Tiegem, Baaigem, Gavere (fig. 7). They belong there to a transition facies of the sediments of the Pittem Member towards the Vlierzele Member, or replace the Pittem Member in the southerly outcrops of that Formation.

They are more or less structureless or show small cross-stratification units ; thin clay-layers are observed. These clayey sands were probably deposited on a less-energetic shoreface.

5. GLAUCONITE-, HEAVY MINERALS- AND CARBONATE-CONTENT (fig. 1)

The sediments of Group I are the richest in glauconite : they averagely contain 10 % of that mineral, opposite to 8 % in Group II. Group III has only 5 % : here the percentage diminishes from bottom to top.

On the contrary, Group III contains more heavy minerals (0,25 %) than the sediments of Group I and II (both 0,10 %). The carbonate content is very low.

A remarkable exception of these figures is noticed in the sediments near 36 m : the carbonate content (from shell fragments) is 40 %, glauconite occupies more than 14 % of the sediment and the sand contains nearly 1 % of heavy minerals. It was already noticed that this sediment was less fine than the other very fine sands of Group III. It probably represents a storm deposit.

6. HEAVY MINERAL DISTRIBUTION (fig. 1, tab. 1)

6.1. Description

A neat difference exists between the heavy mineral distribution of Group I and II on one hand, and Group III on the other hand.

The top-sediments contain approximately 75 % of ubiquists, with a dominance of tourmaline over the other species ; that dominance is strongest in Group II, where tourmaline occupies 47 % of the total heavy mineral distribution. Zircon is the second important mineral (resp. 24 and 19 %), followed by the Ti-minerals (12 and 7 %).

Kyanite and staurolite are the most important minerals in the parametamorphic group, whereas garnet and epidote are very subordinate.

The importance of the ubiquists has lowered to 66 % in the sediments of Group III ; at the same time, zircon became the most frequent mineral.

With more than 14 %, garnet occupies the second place. Staurolite and kyanite are still the most important species in the parametamorphic group.

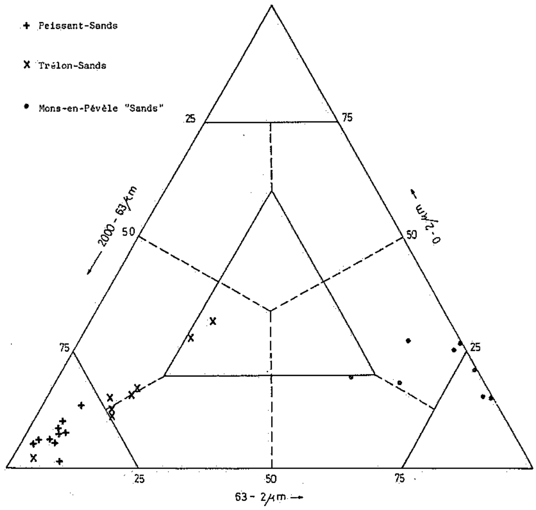

Figure 5 : Triangular texture-diagram of some Eocene sands.

+ Peissant Sands
x Trélon Sands
. Mons-en-Pévèle "Sands"

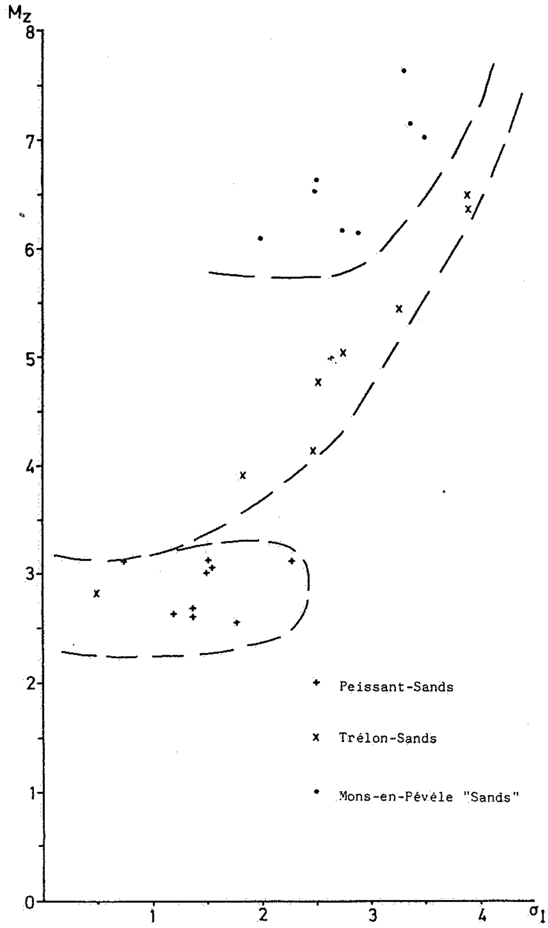

Figure 6 : $M_z\sigma_I$-diagram of some Eocene "sands".

Peissant Sands
Trélon Sands
Mons-en-Pévèle "Sands"

Epidote (and in lesser amount pyroxenes and amphiboles) takes more than 5 % of the heavy mineral distribution.

6.2. Interpretation

The sudden change in heavy mineral distribution between Group II and Group III is not so easy to explain : on one hand the abundance of tourmaline in Group II is perhaps due to a less finer sand fraction. On the other hand, the disappearance of garnet and epidote, normally of the same size as tourmaline, can only be explained by a change in source area, since intrastratal solution of these two minerals would not have suddenly stopped at the top of Group III.

The heavy mineral distribution of Group III corresponds with the one of the sediments from the Cretaceous of the Mons Basin (Geets & De Breuck, 1980) and even from the so-called Heers Formation and the base of the Landen Formation of the same basin (Geets, De Breuck & De Geyter, 1980). One finds a dominance of zircon amongst the ubiquists, and a lot of garnet and epidote.

In the sediments of the Tertiary outliers at Chimay and Viroinval-Dourbes in the Entre-Sambre-et-Meuse region, tourmaline is the most important mineral of the ubiquists, whereas garnet and epidote are nearly absent (Geets, 1984). If these sediments really belong to the Landen Formation, as has been proposed, they could have served as the source for the sediments of Group I and II.

From the combined density-mineral distribution diagram (Geets & De Breuck, 1979) (figs. 8 and 9) it is obvious that the sediments from Group III,

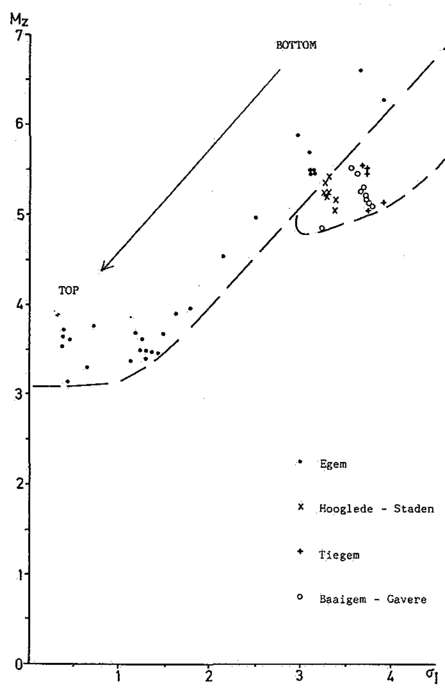

Figure 7 :$_z/\sigma_I$-diagram of Eocene-sands from outcrops.

. Egem
x Hooglede - Staden
+ Tiegem
o Baaigem - Gavere

with more than 70 % of heavier species, were deposited under more energetic conditions, than those of Group I, with less than 70 % heavier species. The less finer sediments of Group II are projected in the area with a dominance of less heavier mineral species : this is due to the abundance of large tourmaline grains in the fine-sand fraction.

7. CONCLUSIONS

The sediments of Group III and II from the Mt. Panisel boring were deposited on a high-energetic, tide-influenced shoreface, with an intrusion of storm-deposits. They were formed under the same circumstances as the sediments of the Egem Member from the more northerly part of the basin. The name "Mons-en-Pévèle Sands" as a lithostratigraphic term for these sediments doesn't seem an appropriate one, because of the difference in texture (very fine sands versus coarse silts) ; the Mons-en-Pévèle "Sands" were probably deposited in the transition zone between a mud shelf and a shoreface.

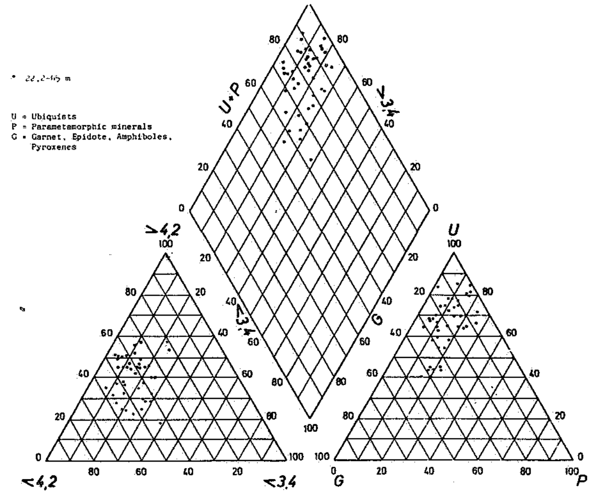

Figure 8 : Heavy-minerals content : combined density - mineral distribution diagram for Group III.

. 22,2 - 65,0 m
U = Ubiquists
P = Parametamorphic minerals
G = Garnet, Epidote, Amphiboles, Pyroxenes

The first wrong use of that term by Kaasschieter (1961) started a chain reaction, wherein the term has been used for different deposits. Probably by lack of exposures in the type-locality, the original Mons-en-Pévèle sediments have texturally and sedimentologically not been compared with the later so-called "Mons-en-Pévèle" sands.

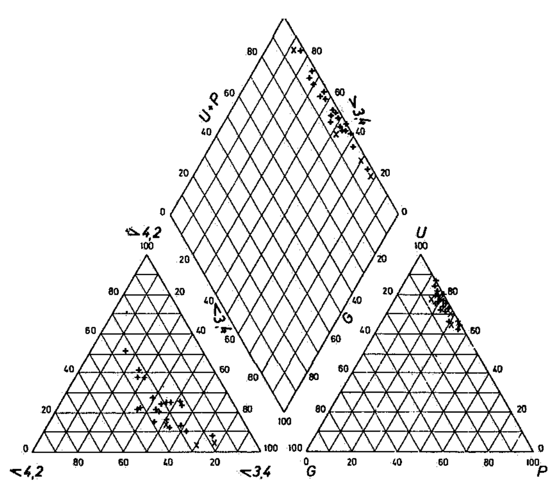

Figure 9 : Heavy-minerals content : combined density - mineral distribution diagram for Group I and II.

+ 0 - 17,8 m
x 17,8 - 22,2 m

The sediments of Group I were deposited on a less energetic shoreface, comparable to the environment of the transition facies between the Pittem and the Vlierzele Member in the northern part of the basin.

The sediments of Group III, with zircon, garnet and epidote as the most characteristic minerals, show the same heavy mineral distribution as the sediments from the Cretaceous and the Lower Paleocene in the Mons Basin. From the base of Group II, tourmaline and parametamorphic minerals become more important, whereas garnet and epidote nearly dissappear : a possible source could have been the so-called Landen Formation deposits in the south of the Entre-Sambre-et-Meuse region.

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