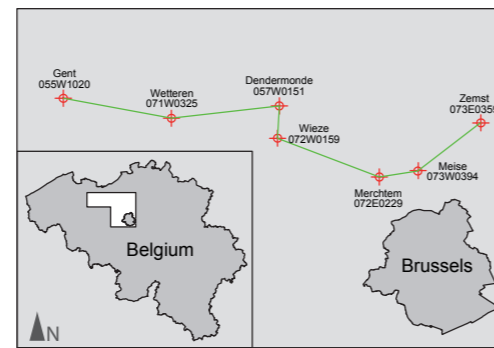
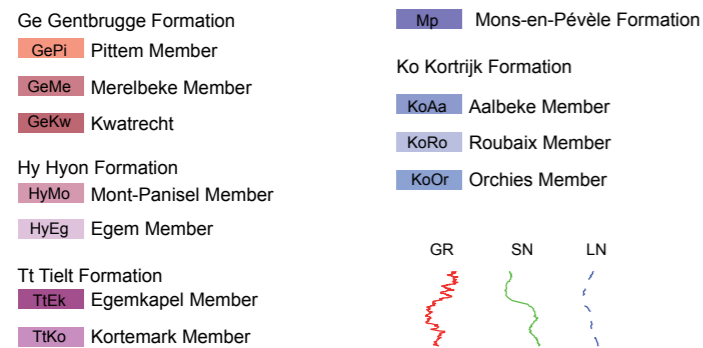
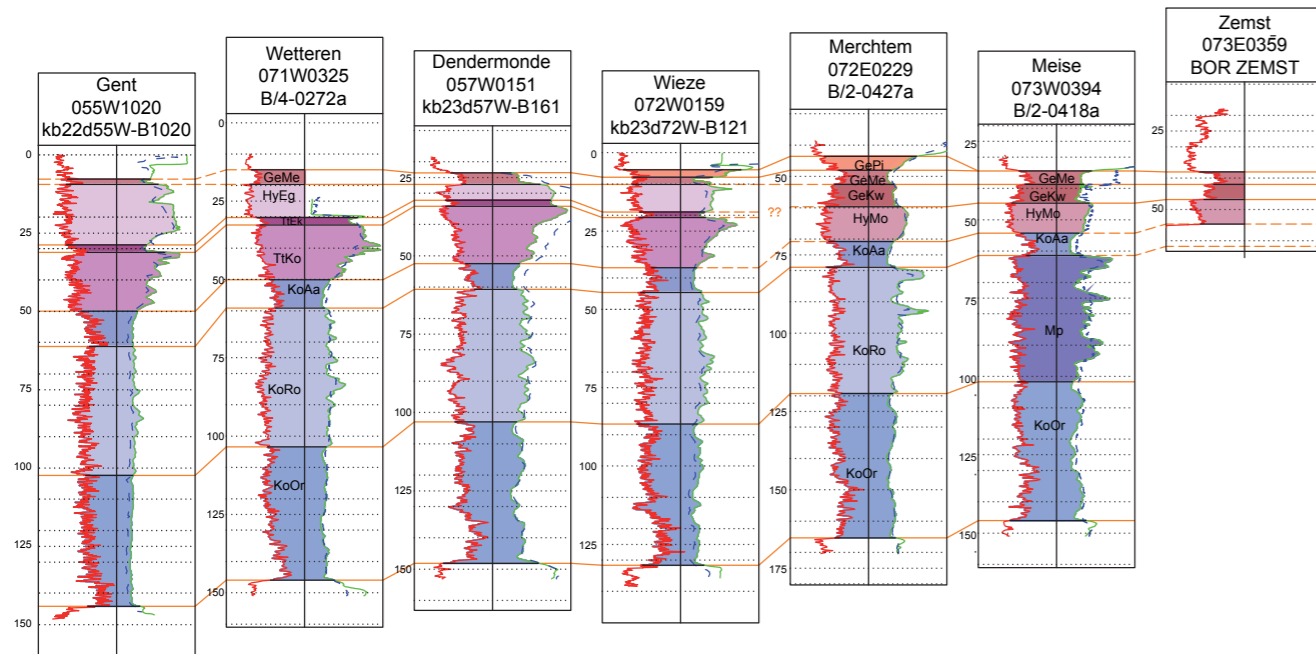


West-East geophysical well correlation profile by Johan Matthijs



Contact and questions

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More stratigraphic investigations and information

- National Commission for Stratigraphy Belgium
<http://ncs.naturalsciences.be/paleogene-neogene/ieper-group>
- DOV, borehole information and geological maps of Flanders
<https://dov.vlaanderen.be>
- Geological Survey of Belgium (RBINS)
<http://www.naturalsciences.be>

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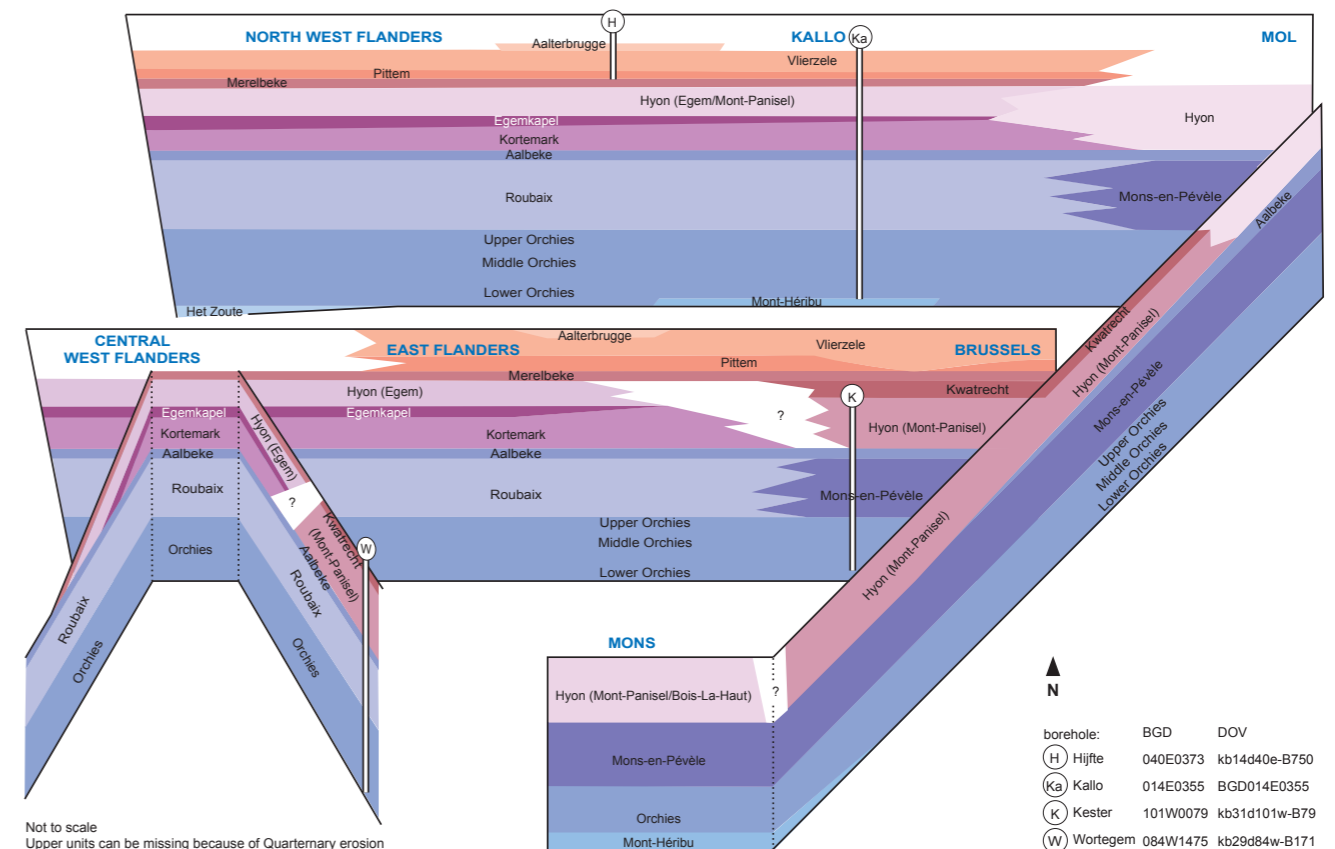
Lithostratigraphy Ieper Group

A practical guide to identify a lithostratigraphic unit in the Ieper Group
The National Commission for Stratigraphy of Belgium, 2017

<http://ncs.naturalsciences.be/paleogene-neogene/ieper-group>

Based on 'Steurbaut et al., 2016. Lithostratigraphy Ieper Group'.
Coordinated by Noël Vandenberghe & Marleen De Ceukelaire

- To differentiate between the lithological units in the Ieper Group is particularly difficult because the sediments are all very similar. They are fine-grained from clays and silts to very fine glauconitic sands, of similar grey dominated color, without obvious mineralogical differences and with sparse macrofossils. Therefore attributing single samples 'at sight' to the different units is generally hardly possible.
- The most practical way to determine the lithostratigraphy in a particular case is to understand the vertical position of a sample, an outcrop or a borehole section with respect to the known vertical succession of the lithostratigraphic units occurring between bottom and top of the Group. This known vertical succession is established as the result of all stratigraphic research during many previous decades. The vertical succession varies somewhat between geographical areas as a result of the paleogeography of the deposits of the Ieper Group.
- The stratigraphic table summarizes all identified units. But the panel-diagram helps to understand the more precise vertical and especially lateral geometrical relations between the units in the different geographical areas.
- The short description of all the units including their expected thickness range should allow, with the help of the panel-diagram, to understand the lithostratigraphic units in a particular case.
- In addition to this narrative description, a geophysical characterization of all the units in terms of the commonly available resistivity and natural radioactivity measurements in boreholes, is given in the figures of the boreholes. New geophysical curves can generally be well compared to the already interpreted curves.



Lithostratigraphic units of the Ieper Group

1.1 Kortrijk Formation

Description: Marine deposit, consisting mainly of clay and clayey sediments.

Thickness: 125 m in the northern part of West-Flanders, but decreases in eastern and southern direction.

1.1.1 Het Zoute Member

Description: Silty to sandy clay with lenses of very fine silty sand. Coarser grained and more angular grains are identified as degraded volcanic ash. Pebbles occur in the base of the overlying clay.

Thickness: It is a thin unit of almost 5 m.

Occurrence: Only identified at the base of the Ieper Group section in the Knokke borehole (011E0138) at the Zoute hamlet.

1.1.2 Mont-Héribu Member

Description: Laminated glauconite bearing clayey sand, sandy clays and silty clays or clayey silts. The base can be cemented clayey sand or just unconsolidated sand. It occurs at the very base of the Ieper Group, except where the Zoute Member is present, and the definition of the Mont-Héribu is limited to the sandy base of the Ieper Group.

Thickness and occurrence: This sandy base is 6 m in the Mons Basin, \leq 10 m southwest of Brussels and in most boreholes it is limited to 1 - 2 m. Rarely noticed in most boreholes except for a very short pattern of rapidly fining upwards GR and RES geophysical signature.

1.1.3 Orchies Members

Description: Compact and heavy stiff bluish-grey clay occurring at the base of the Ieper Group, except if the sandy Mont-Héribu Member is present. A pebble layer has been reported occasionally at its base. The Orchies Members are overlain by more sandy or silty clay deposits of the Roubaix Member or the Mons-en-Pévèle Formation.

Remark: By visual inspection further lithological subdivision can hardly be made but geophysical log signatures do show a systematic variability.

Thickness and occurrence: The total thickness can be \leq 45 m. This member consistently occurs where the Ieper Group occurs in Belgium.

Lower Orchies Member

Description: The top of the very high gamma-ray basal section.

Thickness: 5 - 15 m.

Middle Orchies Member

Description: Topped by a marked gamma-ray low about 10m below the top of the Upper Orchies Member or the base of the Roubaix Member.

Thickness: 15 - 20 m.

Upper Orchies Member

Description: The base of the Roubaix Member is defined by the transition from silty clay above to heavy clay below, a transition commonly identified in borehole studies and a fortiori when the fine sandy Mons-en-Pévèle Formation occurs over the Orchies Members.

Thickness: 10 m.

1.1.4 Roubaix Member

Description: It consists of silty to fine sandy calcareous clays, contrasting with the underlying (Orchies Member) and overlying (Aalbeke Member) compact heavy clays. Calcareous fossils like nummulites and molluscs are present. Glauconite-rich horizons occur. The more heterogeneous composition of the sediment is expressed by layering well visible in the geophysical logs.

Thickness and occurrence: \pm 40 m in south Belgium to \leq 60 m in north Belgium.

1.1.5 Aalbeke Member

Description: Very compact heavy clay without sand fraction. It sharply contrasts with more silty to fine sandy overlying Tielt or Hyon Formations and underlying Roubaix Member or Mons-en-Pévèle Formation. The Aalbeke Member is mostly non calcareous. Small pale yellowish brown phosphate nodules are common. This homogeneous clay unit is relatively thin and can be mistaken for other even thinner clay units above, namely the Egemkapel and the Merelbeke Members and a complete vertical succession can be required to unequivocally identify these different clay-rich layers.

Thickness and occurrence: It occurs throughout the subsurface of Flanders and has an average thickness of about 10 m varying between 5 and 15 m.

1.2 Mons-en-Pévèle Formation

Description: Succession of meter scale laminated beds of pure very fine sand often cross stratified and of strongly bioturbated clayey sand, in particular closer to the base. The sand is micaceous with commonly very fine glauconite. Several coarser beds are packed with nummulites and are locally cemented into limestone beds.

Remark: Interfingering of Roubaix Member type sandy clay and Mons-en-Pévèle Formation type fine sand is observed. It is suggested that if such transitional section consists of over 50 to 60% sand layers, the unit should be named Mons-en-Pévèle Formation and otherwise as Roubaix Member of the Kortrijk Formation.

Laga et al. (2001) ⁽¹⁾			Tertiary Lithostratigraphy Flanders (2010) ⁽²⁾			NCS (2017) ⁽³⁾					
GROUP	FORMATION + Code	MEMBER	GROUP + Code	FORMATION + Code	MEMBER + Code	MEMBER + Code	Description	FORMATION + Code	GROUP + Code		
IEPER	GENTBRUGGE Ge	Vlierzele	GENTBRUGGE Ge	Vlierzele GeVI	Aalterbrugge GeAb	Aalterbrugge GeAb	clays and sand with lignite and wood (\leq 10m)	GENTBRUGGE Ge	IEPER IE		
		Pittem		Pittem GePI	Vlierzele GeVI	Vlierzele GeVI	fine glauconitic sand (\leq 20m)				
		Merelbeke		Merelbeke GeMe	Pittem GePI	Hooglede Bed GeHg	silty clay and clayey sand (15 - 20m) sandstone (40cm)				
	TIELT Tt	Egem	Egem	TIELT Tt	Egem TtEg	Merelbeke GeMe	Merelbeke GeMe	heavy to silty clay (6 - 7m)	HYON Hy	IEPER IE	
						Egemkapel	Kwatrecht GeKw	Kwatrecht GeKw			layered complex of sand and sandy clays (5m)
							Kortemark	Mont-Panisel HyMo			Mont-Panisel HyMo
		Aalbeke	Aalbeke	Kortrijk Ko	Mont-Héribu KoMh	Bois-la-Haut HyBo		Bois-la-Haut HyBo			glauconitic, sorted fine to medium sand (3 - 4m)
						Roubaix	Egem HyEg	Egem HyEg			fine sand (25m)
						Het Zoute	Egemkapel TtEk	Egemkapel TtEk			heavy clay (6m)
	Mont-Héribu	Kortemark TtKo	Kortemark TtKo	grey silty clay with sandy layers (\leq 25m)							
		Het Zoute	Het Zoute	Kortrijk Ko	Mont-Héribu KoMh	Aalbeke KoAa	Aalbeke KoAa	very compact heavy clay (5 - 15m)	MONS-EN-PEVELE Mp	IEPER IE	
	Roubaix					Moen KoMo & Mons-en-Pévèle KoMp	Roubaix KoRo	silty to fine sandy calcareous clays (40 - 60m)			
	KORTRIJK Ko	KORTRIJK Ko	Orchies	KORTRIJK Ko	Saint-Maur KoSm	Upper Orchies (10m) KoOu	Upper Orchies (10m) KoOu	heavy stiff bluish-grey clay (10 - 45m)	KORTRIJK Ko	IEPER IE	
						Middle Orchies (15 - 20m) KoOm	Middle Orchies (15 - 20m) KoOm				
Lower Orchies (1 - 15m) KoOl						Lower Orchies (1 - 15m) KoOl					
Mont-Héribu KoMh						Mont-Héribu KoMh	clayey sand, sandy clay (5 - 10m)				
					Het Zoute KoZo	Het Zoute KoZo	Silty to sandy clay (5m)				

(1) Laga, P., Louwye, S. & Geets, S. (2001). Paleogene and Neogene lithostratigraphic units (Belgium). *Geologica Belgica* 4/1-2: 135-152.

(2) Tertiary Lithostratigraphy Flanders, version 2010. Retrieved from <http://dovvlaanderen.be>.

(3) <http://ncs.naturalsciences.be/paleogene-neogene/ieper-group>. Based on Steurbaut, E., De Ceukelaire, M., Lanckacker T., Matthijs, J., Stassen, P., Van Baelen H. & Vandenberghe, N. (2016). Lithostratigraphy Ieper Group.

The criterion will need further refinement and the study of more wells with appropriate means of objectively establishing the sand-clay proportion.

Thickness: ± 40 m and ≤ 50 m in the Mons-en-Pévèle area.

Occurrence: The Mons-en-Pévèle Formation is occurring especially in the south but extends towards the east in Flemish Brabant and northeast into Limburg.

1.3 Tielt Formation

Description: It consists of marine very fine sandy, coarse silt and clay lithologies. It contrasts with the underlying clay of the Aalbeke Member and the overlying sandy deposits of the Hyon Formation which includes the Egem sand Member.

Thickness: ≤ 25 m in the centre of the outcrop area, decreases to the south and the east, and probably also to the north.

Occurrence: The formation outcrops in the north of Hainaut, the south and the centre of East- and West-Flanders and the western and southwestern part of Flemish Brabant; it occurs in the subsurface of the western and northern part of Belgium.

1.3.1 Kortemark Member

Description: It consists of grey silty to very fine sandy clay. Silt and sand is distributed in the clay in layers of cm to dm thickness and dm thick sandy layers occur near the base. Also thicker subunits can be distinguished. The Kortemark Member occurs between the heavy clay of the Aalbeke Member below and of the Egemkapel Member above.

Thickness and occurrence: The Kortemark Member occurs north of Kortrijk and in particular in the west of Flanders where it can reach more than 25 m thickness. It is also known towards the east and northeast of Flanders (Antwerp Province) where it becomes thinner.

1.3.2 Egemkapel Member

Description: A thin heavy clay unit, contrasting with underlying silty to sandy clays of the Kortemark Member and the sandy overlying deposits the Egem Member. The contacts with under- and overlying units are erosive. A thin transgressive sandy layer, less than 1m thick, occurs at the base and can be well expressed on borehole logs.

Thickness: ± 6 m.

Occurrence: It consistently occurs throughout central Flanders and even the west of the Antwerp Campine area; the unit disappears towards the east of East Flanders and Flemish Brabant.

1.4 Hyon Formation

Description: It consists of fine sand, with dispersed clay or layers of clay, rich in glauconite and including sandstone layers and concretions.

The Formation is subdivided in Egem Member, Mont-Panisel Member, Bois-la-Haut Member. The Egem sand Member is included to make a practical lithological distinction with the more clayey Tielt Formation. The lateral geometrical relationship between the Egem and Mont-Panisel Members is consistent with earlier observations in which the Mont-Panisel Member is described as 'Panisel Sand'.

The Mont-Panisel Member has a more constant composition than the Egem Member. The Mont-Panisel Member consists of poorly sorted clayey glauconitic sands. The Mont-Panisel Member contains numerous irregularly shaped siliceous sandstone concretions whilst sandstones in the Egem Member are rare. The Egem Member consists of well sorted laminated fine sands in which also dm scale thick clay layers can occur.

Remark: Often it is not possible to distinguish the Egem Member from the Mont-Panisel Members, and are sediments best described as Hyon Formation.

In the Egem Member in West Belgium at least 3 subunits can be systematically identified between the Egemkapel Member and the Merelbeke Member; towards the east in the area around the boundary with the Flemish Brabant province, these subdivisions disappear and the sediments become more clay-enriched. This more clayey sediments in the east also contain sandstones and are considered as the Mont-Panisel Member.

Also towards Flemish Brabant, the Mont-Panisel Member overlies the Aalbeke Member, implying the absence of the Kortemark Member and the Egemkapel Member in the area where the Egem Member is replaced by the Mont-Panisel Member.

1.4.1 Egem Member

Description: The sediment is a finely laminated, well sorted, generally fossiliferous fine sand with mica and glauconite. Lamination is mainly horizontal but also cross lamination, hummocky stratification and the infill of broad shallow gullies occur. Cm and dm scale heavy clay layers occur, often cut by erosive sand-filled channels. The base of the Egem Member is strongly erosive above the Egemkapel Member.

Subdivisions of regional occurrence exist in the Egem Member, in which lateral lithological evolutions seem to occur. In particular to the northwest the lower parts evolve towards clay. Remark: In the Brugge-Knokke area the lower part is developed as a clay and only the upper sand part can be considered as the Egem Member.

Thickness: ≤ 25 m.

Occurrence: The Egem Member occurs over most of the provinces of West and East Flanders. Its reported extension northeastward into the Antwerp province is more prudently identified at the formation level as Hyon Formation.

1.4.2 Bois-la-Haut Member

Description: It is highly glauconitic, highly bioturbated, rather well-sorted fine to medium sand with clayey patches in contrast to the finer and less-sorted sand of the overlying Mont-Panisel Member.

Thickness: 3,6 m.

Occurrence: This Member is the separate layer at the base of the section in the Mont-Panisel borehole (151E0340, between 18 and 21,58 m).

1.4.3 Mont-Panisel Member

Description: It consists of poorly sorted, faintly laminated, prominently glauconitic and highly bioturbated clayey fine sand identified at the Mont-Panisel near Mons. The sand also contains numerous irregularly shaped siliceous sandstone concretions and locally poorly cemented nummulite-bearing sandstones.

Thickness: ≤ 20 m.

Occurrence: The Mont-Panisel Member near Mons is not in direct contact with the Mont-Panisel Member in the Flemish Brabant - Antwerp area.

1.5 Gentbrugge Formation

Description: The Formation is defined to contrast with the sandy underlying Hyon Formation and overlying Zenne Group. It is made up by several layers of very fine sediment of marine origin: silty clay or clayey silt at the base, followed by an alternation of glauconitic and bioturbated, clayey, silty, very fine sand layers. These dominantly clayey and silty layers are covered by horizontally bedded or cross-bedded fine glauconitic sand. The sediments contain different layers of sandstones.

The clayey nature of the Kwatrecht Member and the clayey parts in the Vlierzele Member justify their ranking in the Gentbrugge Formation.

Thickness: ≤ 50m in the north, decreasing to the south and east.

Occurrence: The formation mainly outcrops in the centre of East and West Flanders and on the hills in the southern part of East and West Flanders. Outliers exist in northern Hainaut and eastwards from the Zenne River. It occurs also in the subsurface of the province of Antwerp and northwest Belgium.

1.5.1 Kwatrecht Member

Description: A layered complex of greenish glauconitic and micaceous bioturbated sand and sandy clays, without stone beds underlying the Merelbeke Member and overlying the Egem Member in the Gent area and the Mont-Panisel Member to the east. A twofold subdivision of the sand between the Aalbeke and Merelbeke Members in Flemish Brabant is interpreted as the Kwatrecht Member overlying the Mont-Panisel Member.

Thickness: ± 5 m.

Occurrence: This member is recognised in the east of the Flemish Brabant province.

1.5.2 Merelbeke Member

Description: A compact heavy to silty clay containing some thin sandy laminae with organic matter. Where it occurs, it overlies the Egem Member, the Mont-Panisel Member or the Kwatrecht Member and it is overlain by the Pittem Member.

Thickness: ≤ 6 - 7 m.

Occurrence: The Member occurs in the western part of the Flemish Brabant province and in the north of the provinces of East and West Flanders but its distribution is irregular because of erosion by later Eocene deposits.

1.5.3 Hooglede Bed

Description: The Bed is a pale yellowish brown, limonite stained, cemented and originally shelly coarse-grained sandstone layer; most shells have been dissolved and left large voids. Coarse glauconite grains are dispersed across the sandstone and glauconite staining occurs in the dissolved shell voids. The sandstone bed overlies the Egem Member and occurs at the base of the Pittem Member.

Thickness: ± 40 cm.

Occurrence: The bed occurs in the classical Ampe/Egem extraction pit - 053W0060 at Egem.

1.5.4 Pittem Member

Description: Consists of a bedded alternation of thin, dm-scale, layers of silty clay and clayey fine glauconitic sand, commonly bioturbated and some of the layers cemented into thin sandstone and siltstone beds. Traces of dissolved sponge spiculae and fossils occur in the cemented beds. Traces of lignite have been reported. Towards the south the Pittem Member becomes more sandy.

Thickness: ± 15 ≤ 20 m.

Occurrence: Occurs almost continuously in a small zone north of a line Torhout-Tielt-Oudenaarde-Ninove and in West Flemish Brabant but continues in the subsurface over a larger area north of this line. South of this line it occurs only in the South Flemish hills.

Remark: The Pittem Member includes the Hooglede Bed.

1.5.5 Vlierzele Member

Description: Consists of a lower part of mostly bioturbated, slightly clayey, glauconitic green-grey sand, fairly homogeneous, and an upper section of alternating units of horizontally laminated and tidal cross-bedded sand with mud drapes and homogeneous sand intercalations without any structure; this upper part also contains lignite lumps and humic intercalations. Macrofossils are very rare. Thin cemented siliceous sandstone beds commonly occur and irregularly shaped siliceous sandstone concretions are also common.

On a regional scale the base of the Vlierzele Member is erosive into underlying strata.

Thickness: The maximal total thickness is ± 20 m. In the Vlierzele area itself the upper cross bedded sand is 7m thick and the lower more homogeneous sand at least 5m.

Occurrence: The Vlierzele Member outcrops in the northern and central parts of the provinces East and West Flanders and in the western part of the Flemish Brabant province. It also occurs as outliers in the top zones of the South Flemish hills. In northern Flanders the sediment properties are more variable.

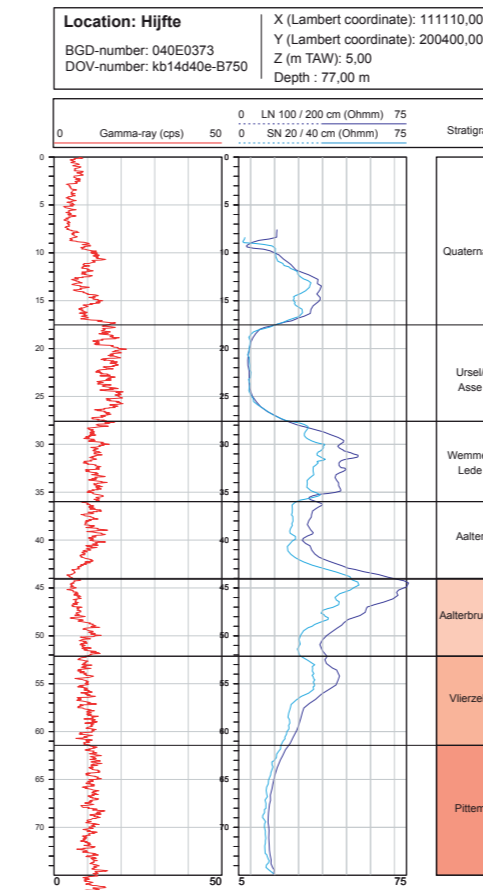
1.5.6 Aalterbrugge Member

Description: Consists of a complex of continental clays and sand occurring between the glauconitic marine sands of the Vlierzele Member below and the Aalter Formation (Zenne Group) above. It also contains lignite beds and drift wood that is sometimes silicified.

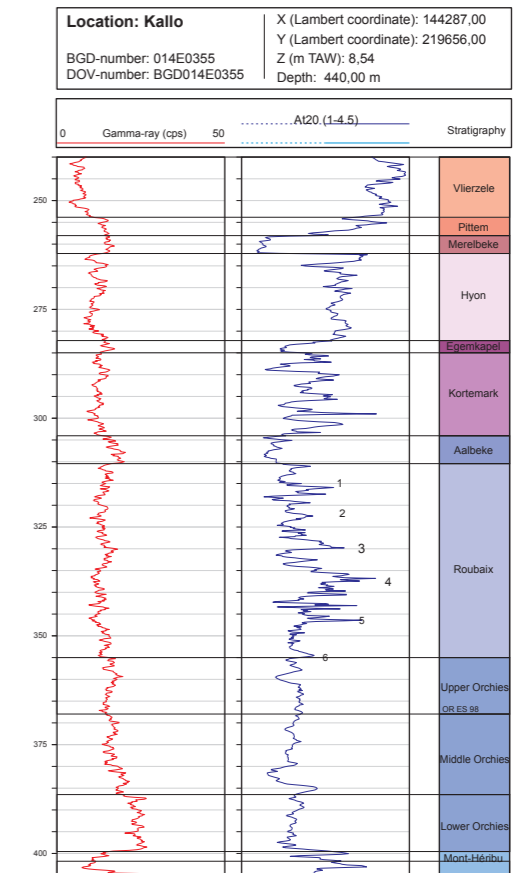
Thickness: from a few meter to ≤ 10m.

Occurrence: Close to the surface in the area of Brugge, Gent and Wetteren and also reported deeper in boreholes north of Antwerp.

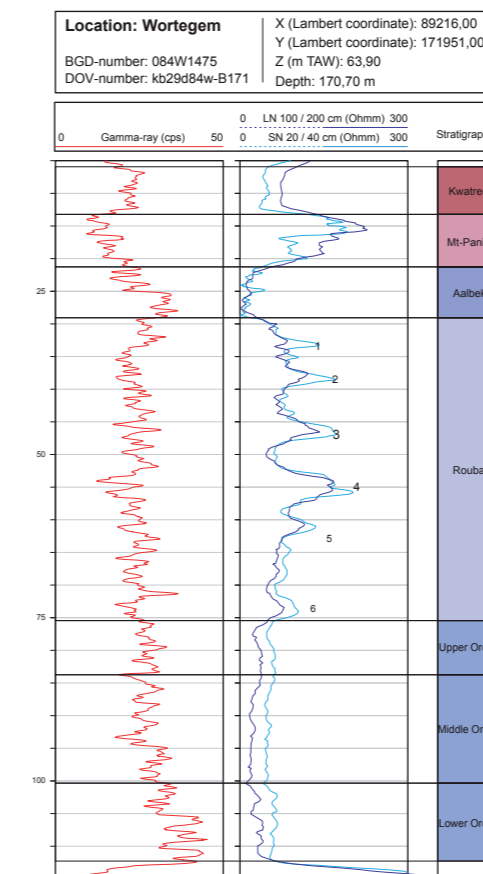
Geophysical reference wells



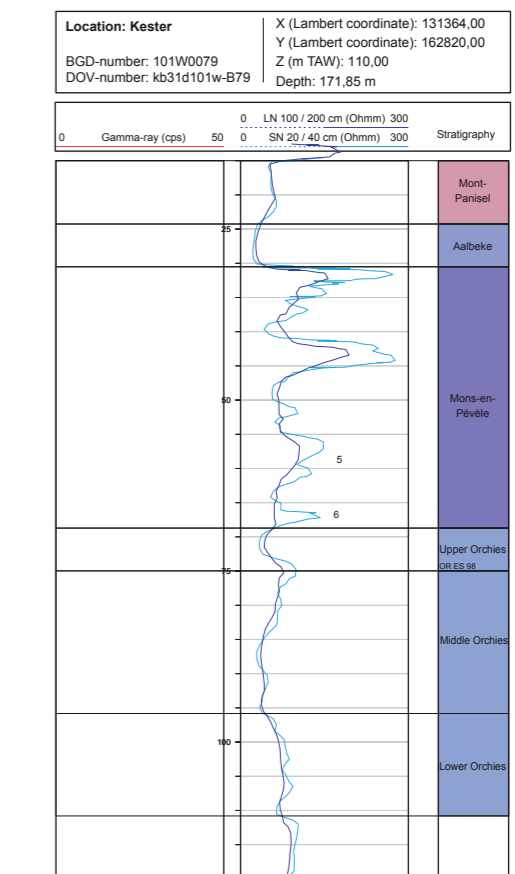
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