

A NEW LITHOSTRATIGRAPHIC SCALE FOR THE PALAEOGENE OF BELGIUM

by

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ABSTRACT

The study of the Belgian Tertiary started more than 150 years ago. Since that time such an enormous amount of data has been gathered, that the commission in charge of the revision of the stratigraphic scale of the Belgian Tertiary decided to limit its activity to the elaboration of a lithostratigraphic scale according to the rules of the IUGS International Subcommittee on Stratigraphic Classification.

The fundamental unit of such a classification system is the Formation and therefore much attention has been given to Formation names. Some of these names are in use since a very long time, others are new. Preference has been given to names of well known localities situated within the main outcrop areas of the Formation under consideration.

Formations may be completely or partially subdivided into Members or may remain undivided. Member names have been selected according the same rules as Formation names. Since members are mostly homogeneous in lithology the Member name may be followed by a rock or sediment name (Vlierzele sand, Asse clay).

Most formations have been assembled into Groups. Group names should be considered as tentative. It is questionable whether an internationally admitted chronostratigraphic name (Rupelian, Ypresian) may also be used as a Group name (Rupel, Ieper).

The efforts of the National Commission for Stratigraphy of the Tertiary resulted in a proposal for a lithostratigraphic scale for the Palaeogene, which was distributed to a limited number of persons in 1988 and discussed consecutively. It turned out that in many aspects the newly proposed scale was strongly resembling the scale of the Belgian geological maps published about 100 years ago with a legend, which was in fact a lithostratigraphic scale "avant la lettre".

KEY WORDS

lithostratigraphy, Palaeogene, Belgium.

RESUME

L'étude du Tertiaire belge a débuté il y a plus de 150 ans. Depuis lors, énormément de données ont été collectées et la commission chargée de la révision de l'échelle stratigraphique du Tertiaire belge a dû limiter ses activités à l'élaboration d'une échelle lithostratigraphique en respectant les règles de la Sous-commission Internationale de Classification Stratigraphique de l'IUGS.

L'unité de base d'un tel système de classification est la formation. La terminologie des formations a fait l'objet d'une attention particulière. Certains termes sont en usage depuis longtemps, d'autres sont nouveaux. La préférence a été donnée aux noms dérivés de localités bien connues, situées dans la zone principale d'affleurement de la formation correspondante.

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Les formations peuvent être subdivisées complètement ou partiellement en membres. La même démarche a été adoptée pour la terminologie des membres que pour celle des formations. Les membres étant généralement de nature lithologique homogène, le vocable qui les désigne peut comporter le nom d'une roche ou d'un sédiment (Sables de Vlierzele, Argile d'Asse).

La plupart des formations ont été rassemblées dans des groupes dont la désignation est proposée avec réserves. La question se pose en effet de savoir si un terme chronostratigraphique internationalement accepté (Rupélien, Yprésien) peut aussi être utilisé comme nom de groupe (Rupel, Ieper).

Les efforts de la Commission Nationale pour la Stratigraphie du Tertiaire ont abouti à une proposition d'échelle lithostratigraphique du Paléogène qui, en 1988, a été soumise à un nombre limité de personnes. Il s'est avéré que l'échelle proposée présente de nombreux points communs avec l'échelle des cartes géologiques belges publiées il y a environ 100 ans avec une légende qui était en effet une échelle lithostratigraphique "avant la lettre".

MOTS CLES

lithostratigraphie, Paléogène, Belgique.

1. INTRODUCTION

The study of the Belgian Palaeogene started more than 150 years ago. Famous geologists like Charles Lyell or André Dumont already performed important field research in this domain around the middle of the nineteenth century. In 1901 Forir wrote an important memoir on the literature concerning the Palaeogene of Belgium published between 1870 and 1900. One of the most recent volumes of the Belgian Society of Geology was entirely devoted to papers concerning the Ypresian stage. These facts make it evident that the amount of data on the Palaeogene of Belgium is enormous.

This abundance of information turned out to be a handicap for the members of the Commission who were in charge of the revision of the stratigraphic scale of the Belgian Tertiary. They decided to limit their task to the elaboration of a lithostratigraphic scale according to the rules of the International Subcommittee on Stratigraphic Classification of the International Union of Geological Sciences.

Probably the members of this Commission were facing a similar situation as Streckeisen did in the sixties, when he had to elaborate a nomenclature and a classification of the igneous rocks. An enormous variety of names were in use, each author having his own classification system. Some of these systems were very different, others quite similar, none was perfect, while some seemed more appropriate to classify specific rock types or to solve specific practical problems.

Streckeisen elaborated a practical compromise between earlier classification systems. It was the result of many years of deliberation between a large group of geoscientists from all over the world. His classification provides a purely geometric ordering of the rocks based on objective, measurable criteria. It resulted in the well known double ternary diagram (fig. 1), divided into fields, each of them correspon-

ding to a couple of rock names (volcanic, plutonic). A first version was published in 1967, followed by many others between 1973 and 1989. Names which seemed less appropriate were modified in later versions, but the frame of the system remained unchanged.

The geologists dealing with the stratigraphy of the Belgian Tertiary went through a similar evolution. Several versions of the lithostratigraphic scale were proposed, names were modified, but a general agreement about the frame of the system was reached quite soon.

2. METHODOLOGY

The fundamental unit of the classification system is the Formation and therefore much attention has been given to Formation names. Some of them are in use since a very long time (Brussel, Boom), others are new (Gent, Kortrijk). Preference has been given to names of well known localities situated within the main outcrop and stratotype areas of the Formation under consideration, while names of isolated outliers in Belgium (Panisel) or abroad (Mons-en-Pévèle), historical names (Oostende ter Streep, Atuatuca) and names of vaguely defined geographical regions (Meetjesland) have been avoided. Formations may be completely or partially subdivided into Members or may remain undivided. Member names have been selected according to the same rules as Formation names. Since Members are mostly homogeneous in lithology the Member name may be followed by a rock or sediment name (Vlierzele Sand, Asse Clay). This is not the case for most Formation names.

Formations have been assembled into Groups, except for two of them (Maldegem, Voort) which remained independent up to now and for one (Heers) whose place in a group is not yet fixed (Haine or Ieper). Group names should be considered as tentative. It has been suggested to use names

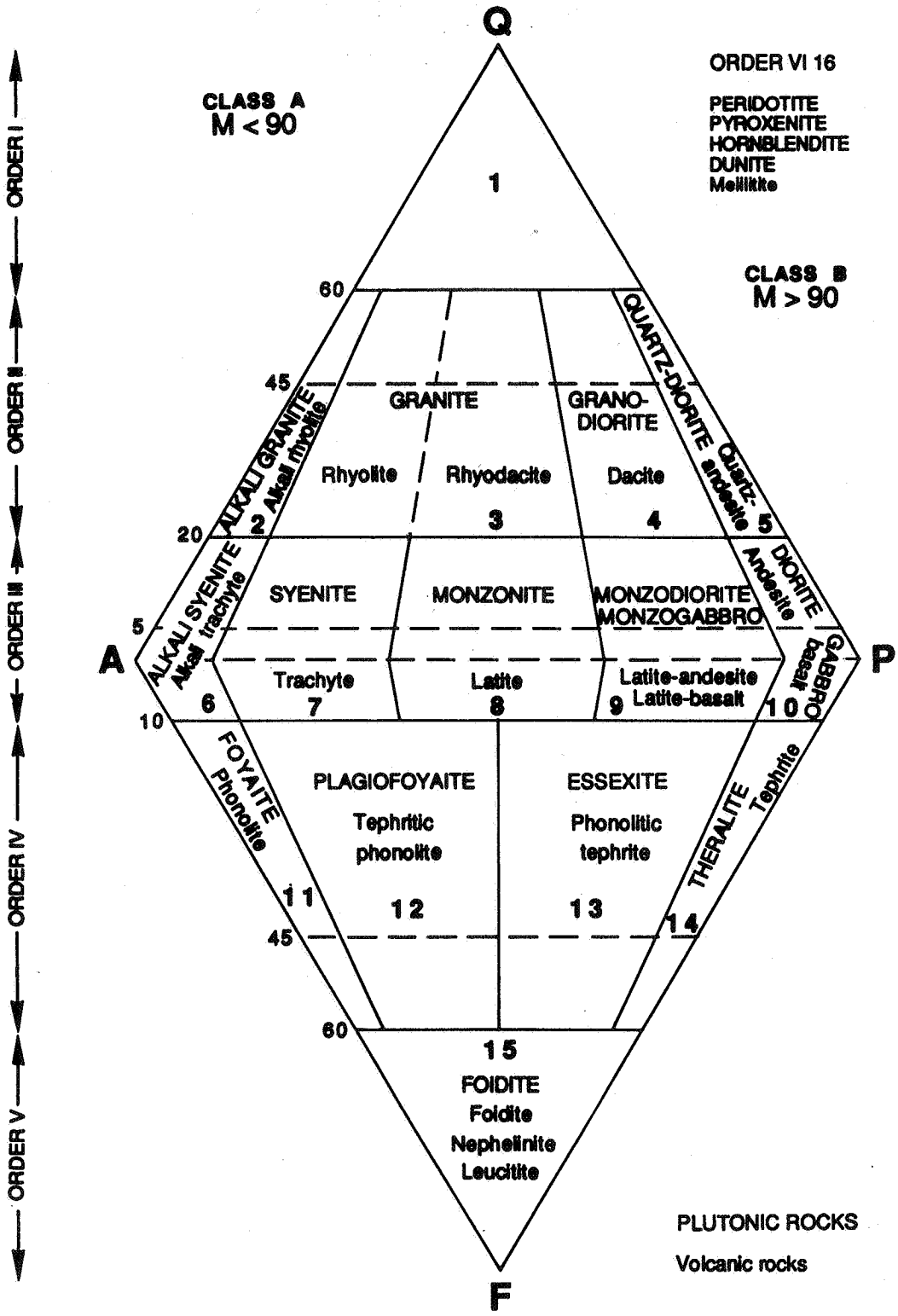


Figure 1. Classification of igneous rocks (after A. Streckeisen, 1967).

PALAEOGENE LITHOSTRATIGRAPHY

GROUPS	FORMATIONS	MEMBERS
(VOORT)	VOORT	Veldhoven
RUPEL <i>(M.OLIGOCENE)</i>	EIGENBILZEN	
	BOOM	Putte Terhagen Belsele-Waas
	BILZEN	Kerniel Kleine Spouwen Berg
TONGEREN <i>(E.OLIGOCENE)</i>	BORGLOON	Ruisbroek / Kerkom Boutersem / Oude Biezen Henis
	ZELZATE / S:H.HERN	Neerrepen Grimmeringen Watervliet Bassevelde
<i>(L.EOCENE)</i>	MALDEGEM	Onderdijk Buisputten Zomergem Onderdale Ursel Asse Wemmel
ZENNE <i>(M.EOCENE)</i>	LEDE	
	BRUSSEL	Chaumont-Gistoux / Bois de la Houssière Neerijse / Diegem / Archennes
	AALTER	Oedelem Beernem
IEPER <i>(E.EOCENE)</i>	GENT	Vlierzele Pittem Merelbeke
	TIELT	Egem Kortemark
	KORTRIJK	Aalbeke Moen Saint-Maur Mont-Héribu
LANDEN <i>(L.PALAEOCENE)</i>	TIENEN	Knokke Erquelinnes / Loksbergen Dormaal
	HANNUT	Grandglise Chercq / Halen / Lincent Waterschei
	BERTAIMONT / HEERS	Gelinden Orp
HAINE- HASPENGOUW <i>(PALAEOCENE- CRETACEOUS)</i>	HAININ	
	MONS	Eisden Opoeteren Maasmechelen
	CIPLY	OPGLABBEEK HOUTHEM

Table 1. Proposal for the new lithostratigraphical column of the Palaeogene (after R. Maréchal *et al.*, 1988).

H A I N E Gr.

W (HAINE BASSIN)

* *	BERTAIMONT Fm.	<i>Infralandénien</i> (1) <i>Paternostre Fm.</i>		variable (3)
	HAININ Fm.	<i>Upper Montien</i>	Mn2 (2)	variable
*	MONS Fm.	<i>Calcaire de Mons</i>	<i>Lower Montien</i>	carbonate
	CIPLY Fm.	<i>Tuffeau de Ciplý</i>	Mn1	carbonate

E (LIMBURG)

	HEERS Fm.	<i>Heersien He</i>	GELINDEN Mb. ORP Mb.	carbonate sand
* *	OPGLABBEEK Fm.	<i>Eysdénien</i> <i>Infraheersien</i>	EISDEN Mb. OPOETEREN Mb. MAASMECHELEN Mb.	sand clay sand
	HOUTHEM Fm.	<i>Tuffeau de Vroenhoven</i>		carbonate

ROBASZYNSKI; DUPUIS; DE GEYTER; LAGA

(1) Former equivalents

(2) Symbols of the old geological map

(3) Dominant lithology

* New names

* Units only present in depth

Table 2. Lithostratigraphy of the Haine Group.

L A N D E N Gr.

Landénien

* TIENEN Fm.	* KNOKKE Mb.	variable
<i>Upper Landénien L2</i>	* LOKSBERGEN Mb.	variable.
	ERQUELINES Mb.	sand
	DORMAAL Mb.	variable
* HANNUT Fm.	GRANDGLISE Mb.	sand
<i>Lower Landénien L1</i>	CHERQ Mb.	variable
	LINCENT Mb.	carbonate
	* HALEN Mb.	silt
	* WATERSCHEI Mb.	clay

Table 3. Lithostratigraphy of the Landen Group.

DE GEYTER

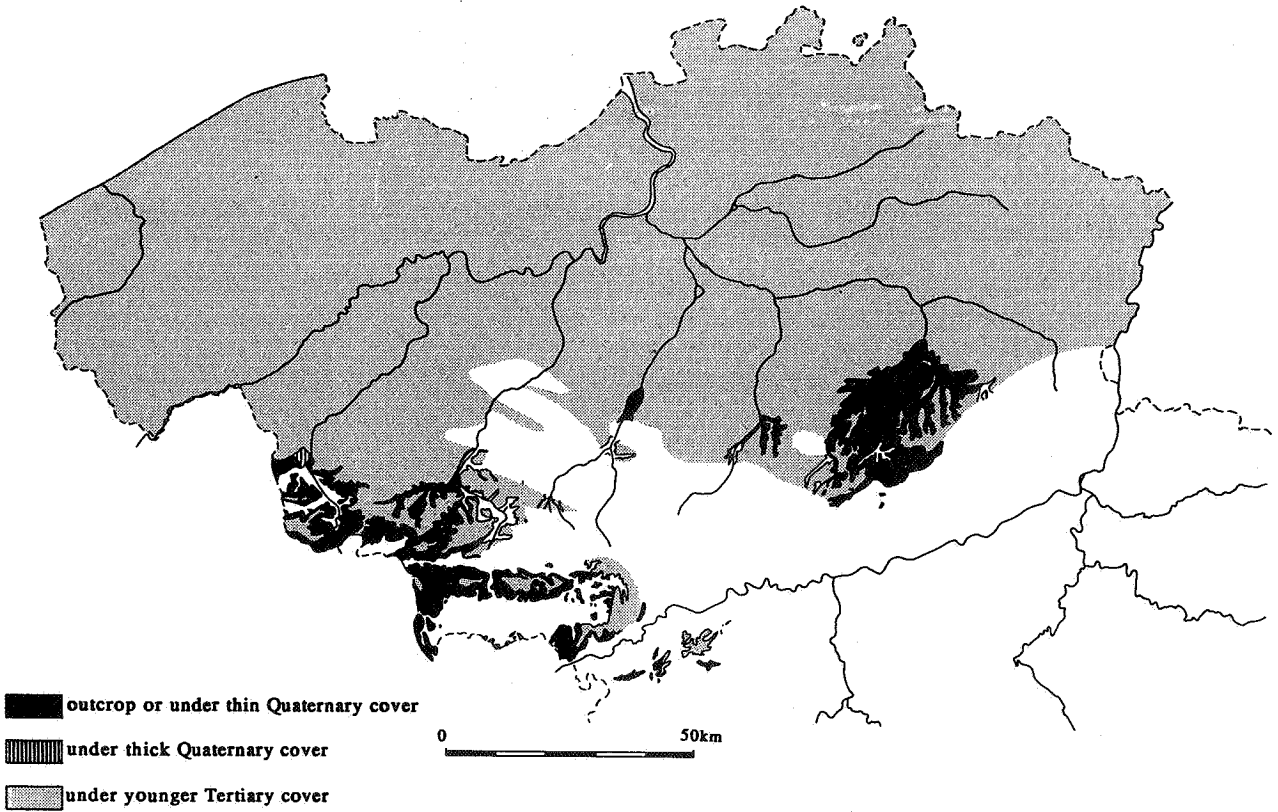


Figure 2. Occurrence of the Landen Group.

of a river (Zenne) or a geographic area (Meetjesland). With this respect it is questionable whether an internationally admitted chronostratigraphic name (Rupelian, Ypresian) may also be used as a Group name (Rupel, Ieper).

The efforts of the National Commission for the Stratigraphy of the Tertiary resulted in a proposal for a lithostratigraphic scale for the Palaeogene (table 1), which was distributed to a limited number of persons in 1988 and discussed consecutively. However, no formal alternative proposals have been made up to now.

Finally it turned out in many aspects the newly proposed scale was strongly resembling the scale of the Belgian geological maps published about 100 years ago with a legend, which was in fact a lithostratigraphic scale "avant la lettre".

The revision of the Geological map started in 1989. Up to now the new lithostratigraphic scale has been used without major difficulties, units ranging between the Tielt Formation and the Rupel Group being mapped. The new map is a subcrop map of the Tertiary with indication of the isopachs of the Quaternary drift mantle or the contour lines of the top of the Tertiary.

3. LITHOSTRATIGRAPHIC SCALE

3.1. Haine Group

The Haine Group may be considered as equivalent to the lower part of the Palaeocene and includes the former stages Montien and (?) Heersien (table 2). The Formations are only exposed in small areas. The proposals for subdivision have been elaborated by Robaszynski, Dupuis, De Geyter and Laga. Most Formation and Member names may be considered as traditional. The lithology is still quite similar to that of the uppermost Cretaceous : marl, more or less friable chalk or limestone.

3.2. Landen Group

The Landen Group corresponds to the upper part of the Palaeocene and is commonly known in Belgium as the Landenien stage. The subdivision of the Group has been worked out by De Geyter (table 3), the Hannut Formation being equivalent to its lower part which is considered as marine in origin, the Tienen Formation to its upper part probably of continental origin. Most Member names are already in use since a long time. In the outcrop zones (fig. 2) the Group mainly consists of sandy deposits,

I E P E R Gr.

Yprésien s.l.

* GENT Fm. <i>Lower Panisélien</i>	P1	VLIERZELE Mb. PITTEM Mb. MERELBEKE Mb.	P1d P1c P1m	sand sandy clay clay
* TIELT <i>leper sand</i>	Yd	EGEM Mb. KORTEMARK Mb.		sand silt
* KORTRIJK Fm. <i>leper clay</i> <i>Argile des Flandres</i>	Yc	AALBEKE Mb. MOEN Mb. SAINT-MAUR Mb. MONT-HERIBU Mb.	Ya+Yb	clay sandy clay clay sandy clay

Table 4. Lithostratigraphy of the Ieper Group.

GEETS

KORTRIJK Formation

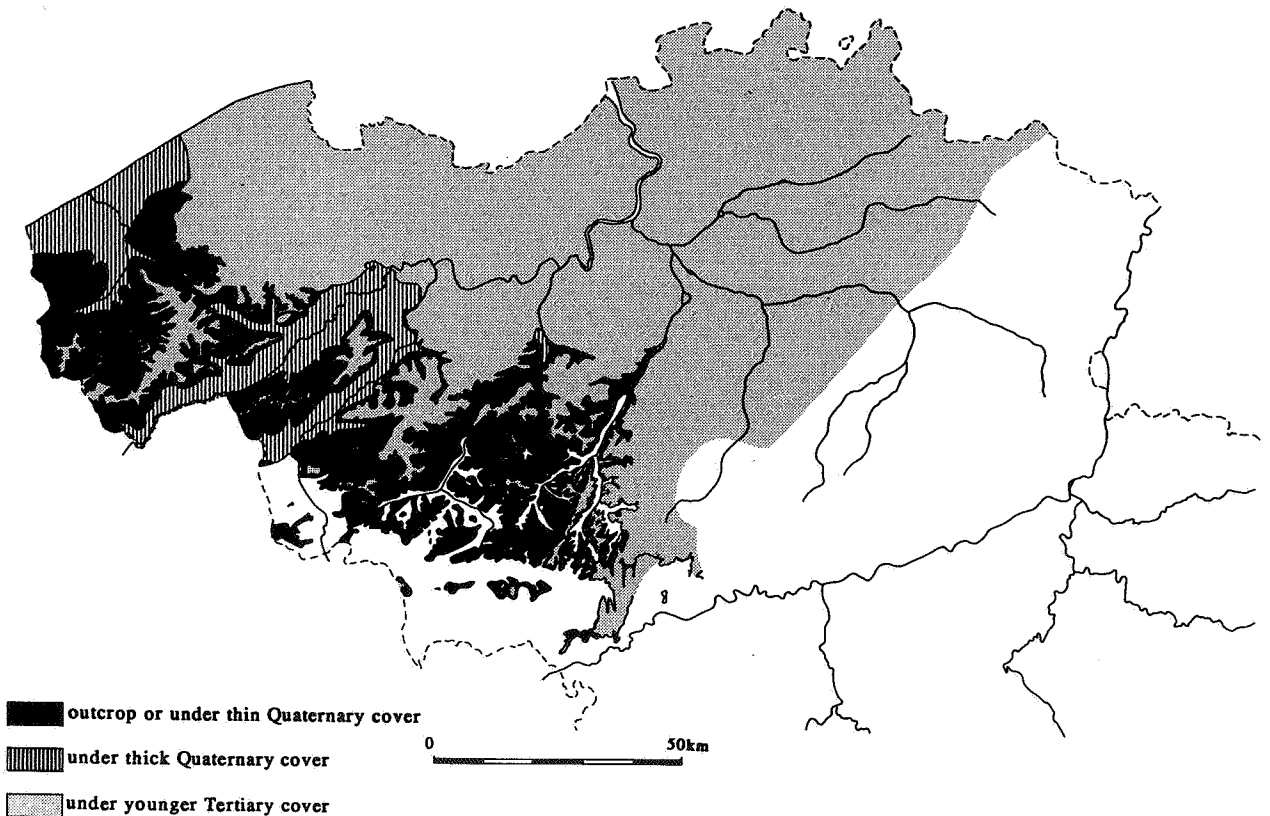


Figure 3. Occurrence of the Kortrijk Group.

TIELT Formation

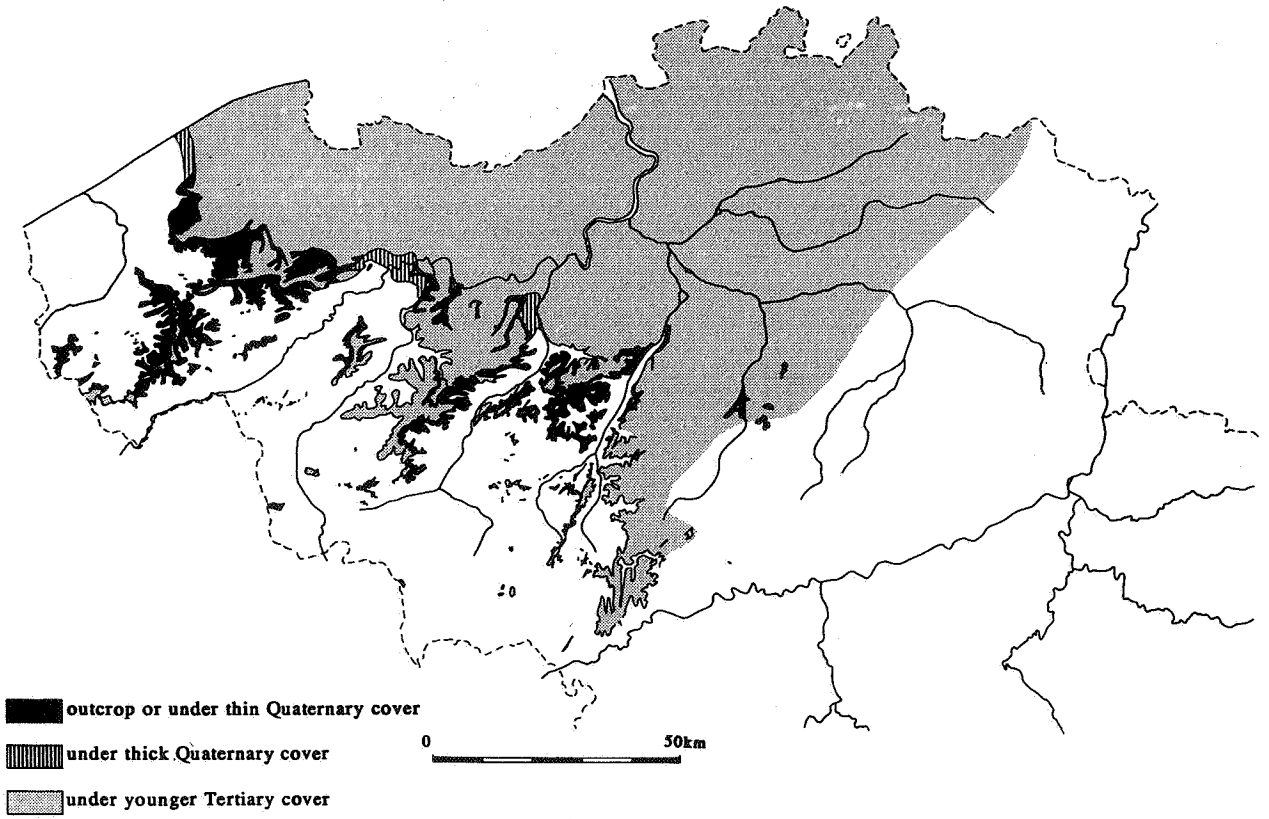


Figure 4. Occurrence of the Tiel Formation.

GENT Formation

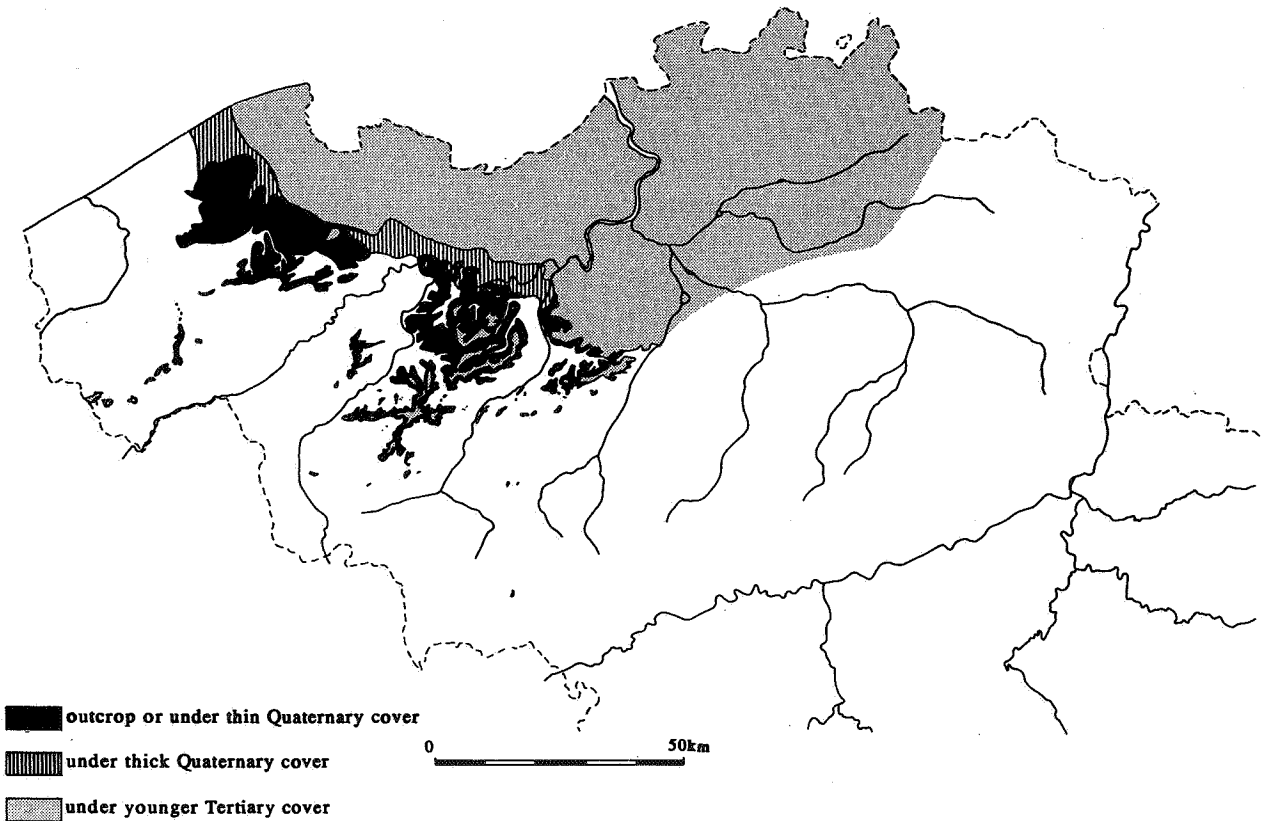


Figure 5. Occurrence of the Gent Formation.

Z E N N E Gr.

LEDE Fm.	<i>Lédien</i> + <i>Laekenien</i>	Le Lk	sand
BRUSSEL Fm.	<i>Bruxellien</i> 5 members (tentative)	B	sand
AALTER Fm. (* Knesselare Fm.) <i>Upper Panisélien P2</i>	OEDELEM Mb. (+ Aalter Mb.) BEERNEM Mb. (P1n?)		sand sandy clay

GEETS; JACOBS; FOBE; HOUTHUYS

Table 5. Lithostratigraphy of the Zenne Group.

AALTER Formation

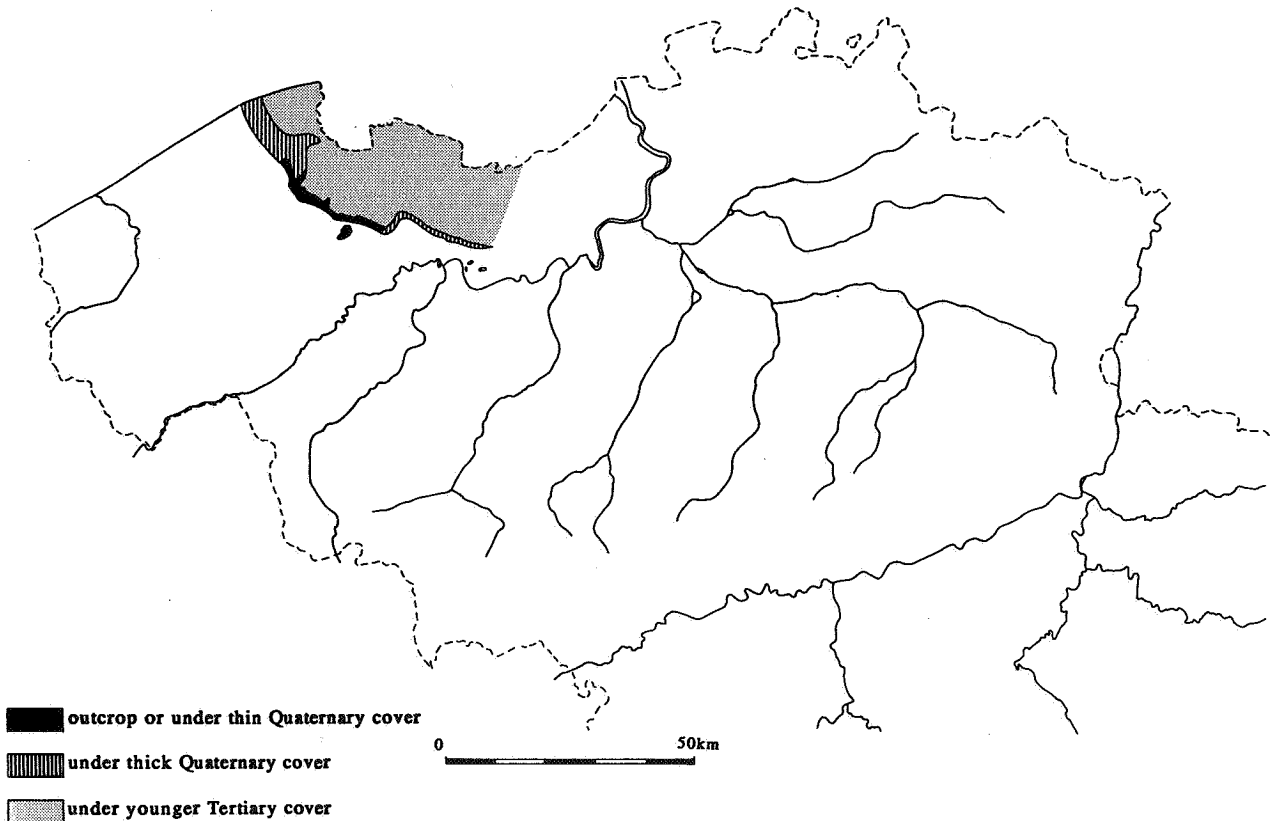


Figure 6. Occurrence of the Aalter Formation.

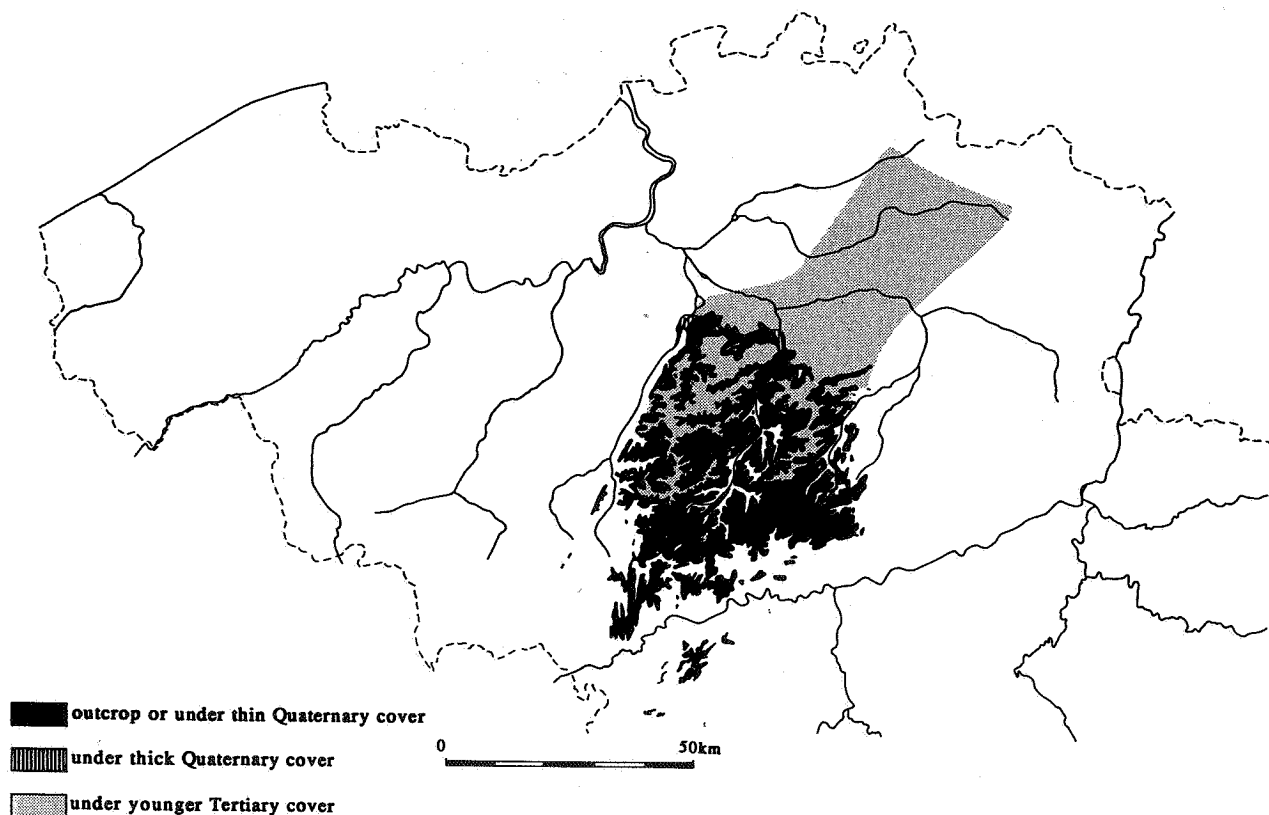


Figure 7. Occurrence of the Brussel Formation.

with some interbedded calcareous or siliceous sandstones.

3.3. Ieper Group

The Ieper Group (table 4) corresponds to the lower part of the Eocene and includes the most important Formations of North West Belgium, namely the Kortrijk Formation, the Tielt Formation and the Gent Formation. The lithostratigraphic scale has been elaborated by Geets. As a whole the Ieper Group is equivalent to the Yprésien stage and the lower part of the Panisélien stage. The Kortrijk Formation (fig. 3) is mainly composed of clay, the Tielt Formation (fig. 4) mainly of silt (Kortemark Member) and fine sand (Egem Member), the Gent Formation (fig. 5) of clay (Merelbeke and Pittem Members) in its lower and sand (Vlierzele Member) in its upper part. The names of the nine members are partly traditional and partly new. Up to now only the Gent Formation and the Egem fine sand Member (upper part of the Tielt Formation) are outcropping in the areas where the revision of the geological map already took place. Whether all members, and in particular the members of the Kortrijk Formation, can be delineated on a map, is still questionable. The distinction is essentially based on grain size: the Mont-Héribu Member includes the somewhat more sandy base of the

Formation, the Saint-Maur Member (Orchies clay in France ?) is mainly composed of heavy clay, the Moen Member (Roubaix clay in France ?) of sandy or silty clay, and the Aalbeke Member (Roncq clay in France ?) of very heavy clay; most transitions between these members are gradual.

3.4. Zenne Group

The Zenne Group (table 5) includes the upper part of the Panisélien stage as well as the Bruxellien and Ledien stages of the former geological map, which now are considered as equivalent to the Aalter (fig. 6), Brussel (fig. 7) and Lede Formations (fig. 8) respectively. The proposal for a new lithostratigraphic scale has been made by Geets, Jacobs, Fobe and Houthuys. In general, the Group may be considered as Middle Eocene. In fact, the Zenne Group is a rather troublesome one. From a lithological point of view the Group shows a rather homogeneous composition: all Formations mainly consists of sand, often with interbedded calcareous or siliceous sandstone layers. However, on land the spatial relationships between the Formations are often difficult to assess precisely. The Formation name Knesselare which was proposed first, has been replaced by Aalter, the former Aalter Member being superfluous, since it only appears to correspond to very fossiliferous lenses within the Oede

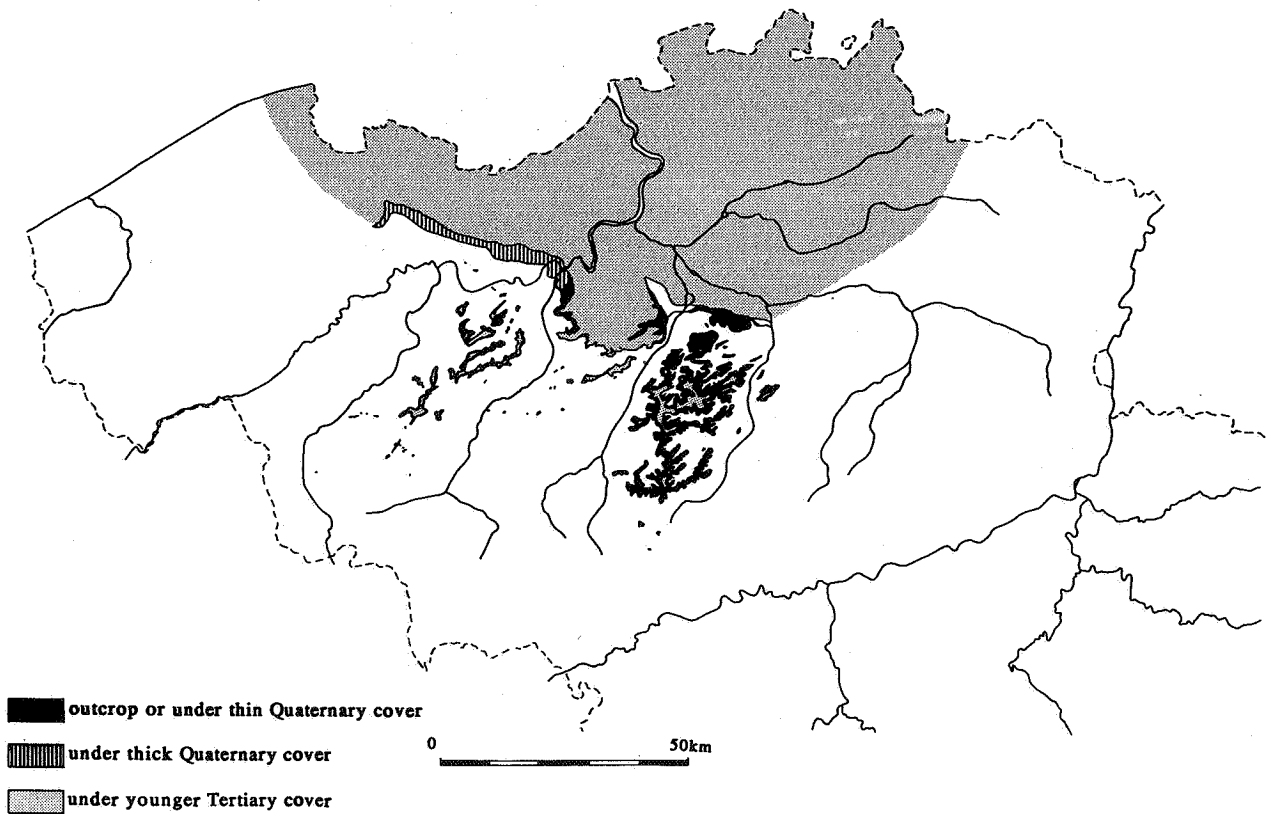


Figure 8. Occurrence of the Lede Formation.

MALDEGEM Fm.

				Gulink notations
Asschien	As			▼
+ Wemmeliën	We	ONDERDIJKE Mb.	(Tg?)	a3 clay
= Bartonien		BUISPUTTEN Mb.		s2 sand
Kallo Fm.		ZOMERGEM Mb.		a2 clay
Meetjesland Fm.		ONDERDALE Mb.	Asd	s1 sand
		URSEL Mb.	Asc	a1 clay
		ASSE Mb.	Asb+	sandy clay
		WEMMEL Mb.	Asa	
			We	sand

JACOBS

Table 6. Lithostratigraphy of the Maldegem Formation.

lem Member. The subdivision of the Brussel Formation in five members is still to be considered as tentative.

3.5. Maldegem Formation

The definition and subdivision of the Maldegem Formation (table 6) are due to Jacobs. The Malde-

gem Formation corresponds to the Wemmeliën and Asschien stages of the geological map, which Belgian geologists use to group as Bartonien (Upper Eocene) since many decades. The name Maldegem has been introduced instead of Meetjesland, since the latter name refers to a vaguely defined geographic region, or instead of Kallo, where the Formation is only present in a deep well. The dominant

MALDEGEM Formation

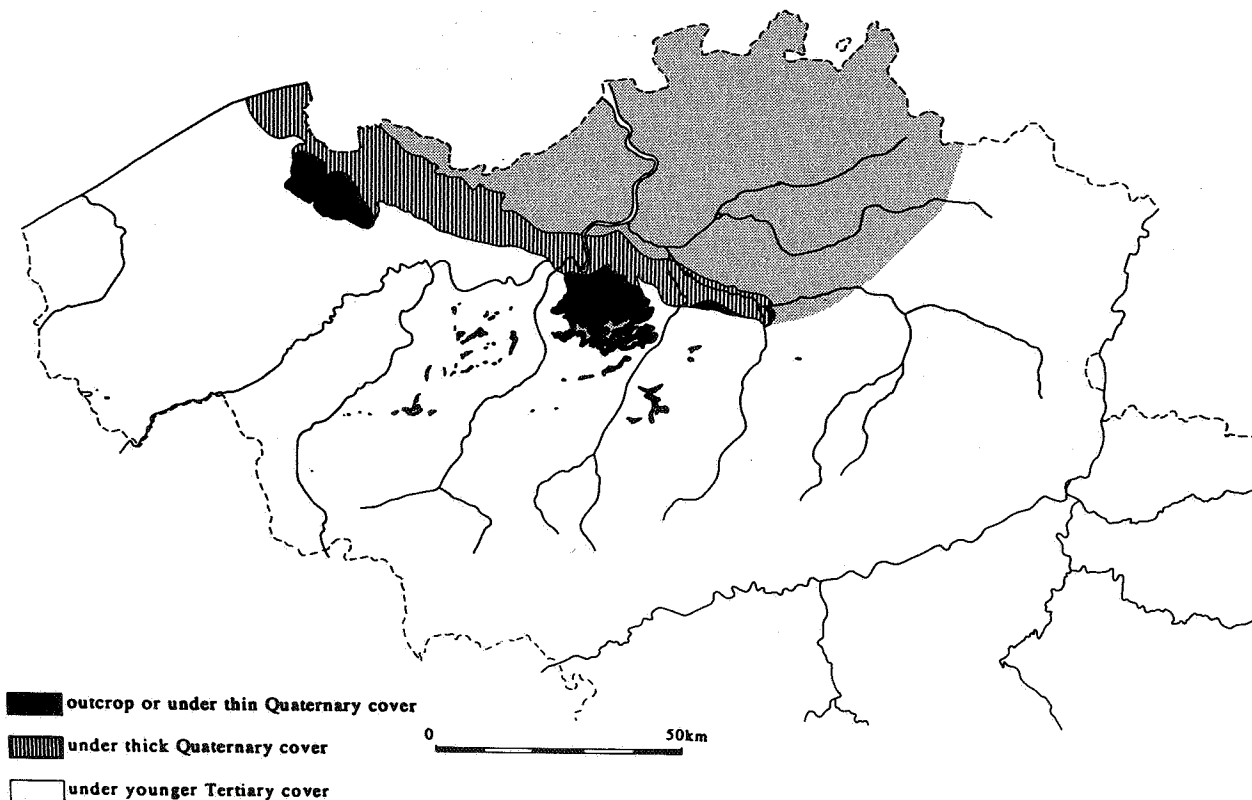


Figure 9. Occurrence of the Maldegem Formation.

TONGEREN Gr.
Tongrien

W*	ZELZATE Fm.	(R1?)	RUIBROEK Mb. WATERVLIET Mb. BASSEVELDE Mb.	(s3)	sand clay sand
*	BORGLOON Fm. <i>Upper Tongrien</i>	Tg2	KERKOM Mb. BOUTERSEM Mb. OUDE BIEZEN Mb. HENIS Mb.	Tg2k Tg2m Tg2c Tg2b	sand sand sand clay
E	*	Tg1	St-HUIBRECHTS-HERN Fm. <i>Lower Tongrien</i>	NEERREPEN Mb. GRIMMERTINGEN	Tg1d Tg1c sand sand

Table 7. Lithostratigraphy of the Tongeren Group.

LAGA; JACOBS; VANDENBERGHE

TONGEREN Group

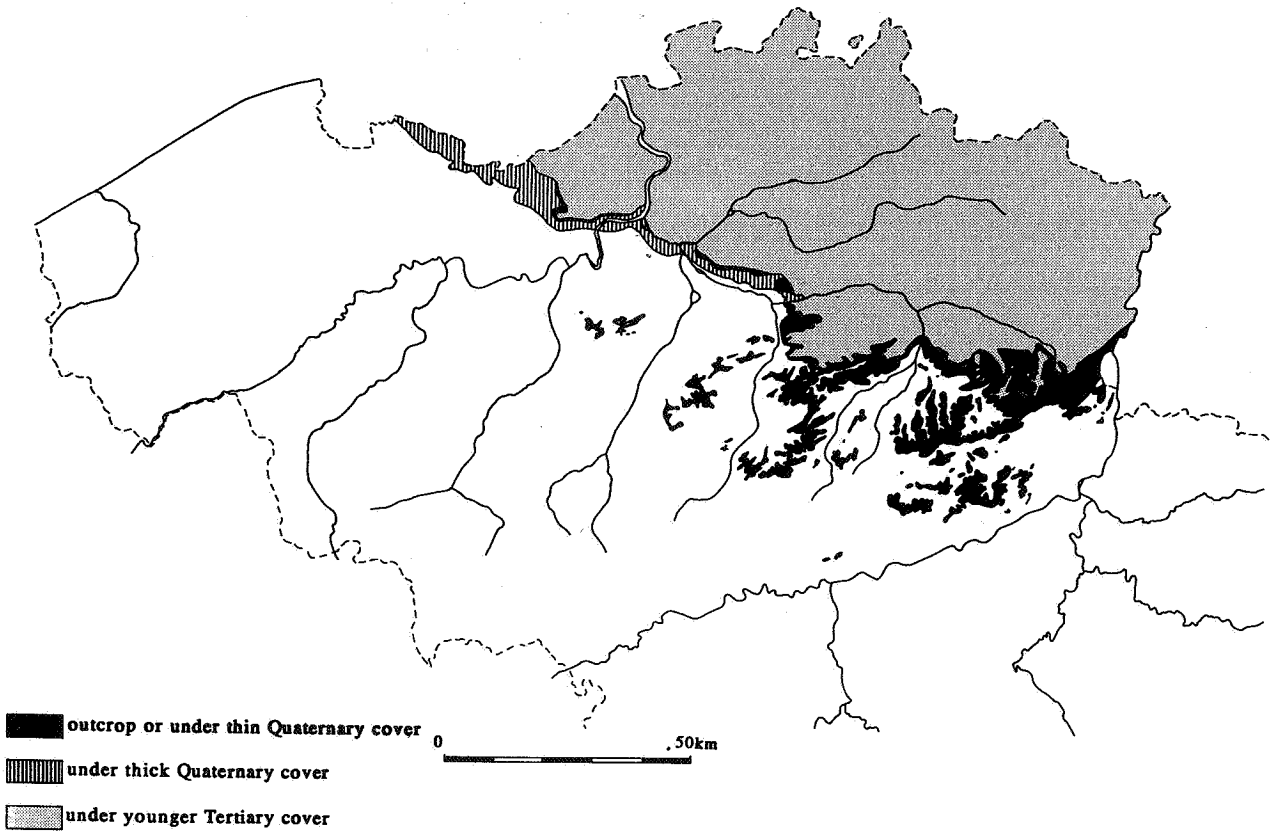


Figure 10. Occurrence of the Tongeren Group.

R U P E L Gr.
Rupélien

*	VOORT Fm. "Chattien"	p.m.		sand
	EIGENBILZEN Fm.	R2d		sand
	BOOM Fm. <i>Boom clay</i> <i>Septarienton</i>	R2c	PUTTE Mb. TERHAGEN Mb. BELSELE Mb.	clay clay clay
*	BILZEN Fm.	R2 pp. R1	KERNIEL Mb. R1b pp. + R2a + R2b KLEIN-SPOUWEN Mb. R1c <i>Nucula comta clay</i> BERG Mb. R1b pp.	sand clay sand

Table 8. Lithostratigraphy of the Rupel Group.

VANDEBERGHE

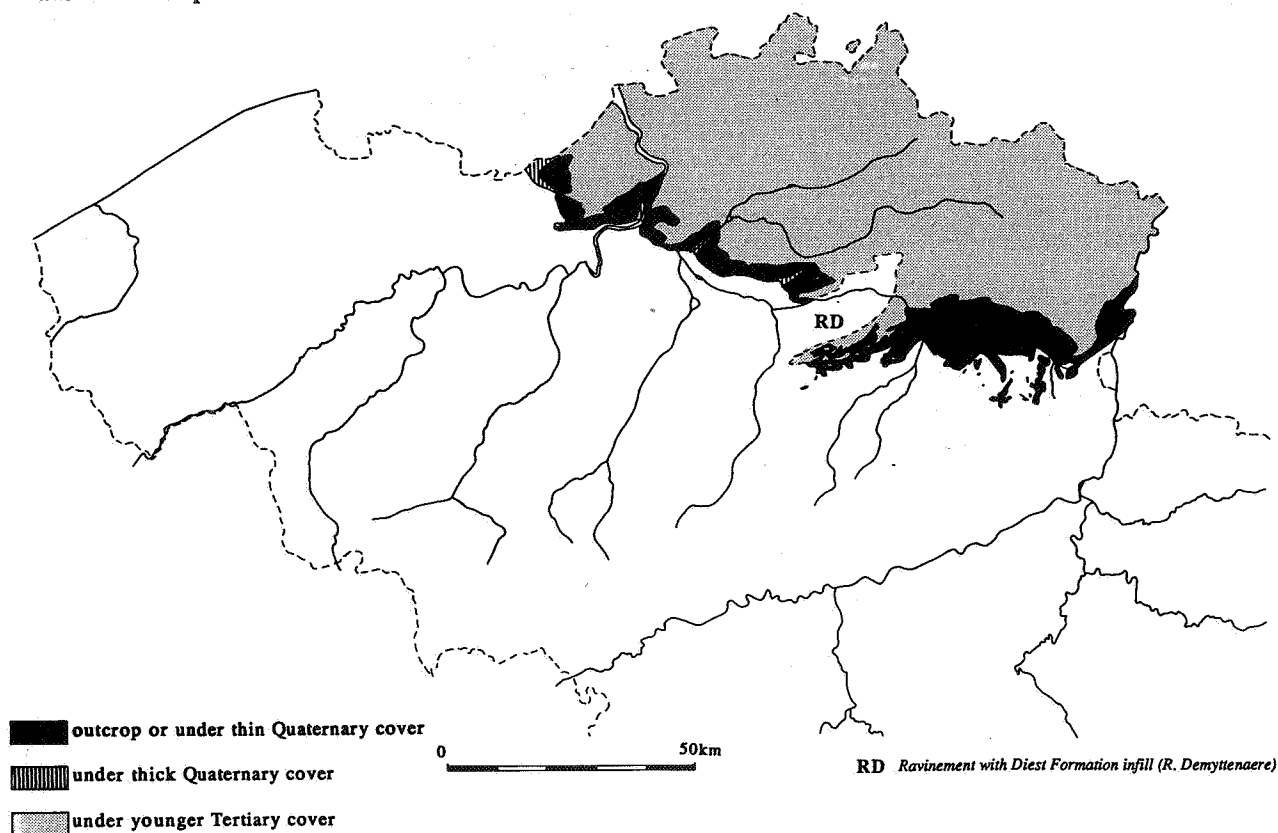


Figure 11. Occurrence of the Rupel Group. RD - Ravinement with Diest Formation infill (R. Demyttenaere).

lithology is clay, with thin interbedded sandy layers. This very regular alternation of clay and sand layers determines the subdivision in Members which were easily mapped in the outcrop areas (fig. 9).

3.6. Tongeren Group

The Tongeren Group is equivalent to the former Tongrien stage, which up to now has always been considered as Lower Oligocene in Belgium. The proposed subdivision (table 7) has been elaborated by Laga, Jacobs and Vandenberghe. The Tongeren Group includes three Formations : the Sint-Huibrechts-Hern Formation, corresponding to the lower (marine) part of the former Tongrien stage, the Borgloon Formation, including the upper (continental) part of this stage, both located in the eastern part of the country around the type locality Tongeren, and the Zelzate Formation, which was introduced later as a possible or probable western equivalent of the former Formations (fig. 10). The Formations are mainly composed of sand, although the Borgloon Formation and the Zelzate Formation include a clayey Member. Member names are traditional in the Hern and Borgloon Formations, but novel in the Zelzate Formation.

3.7. Rupel Group

The proposal for the subdivision of the Rupel Group is entirely due to Vandenberghe (table 8). This Group corresponds to the classical Rupélien stage in Belgium. Considered as Middle Oligocene it includes three Formations : the Bilzen Formation in the eastern part of the country (fig. 11), with at the base the Berg Sand Member, overlain by the Klein-Spouwen Clay Member (also known as *Nucula compta*-clay) and the Kerniel Sand Member; the Boom Clay Formation subdivided into three members according to minor characteristics, such as organic matter or lime content ; the Eigenbilzen Formation, including the glauconitic fine clayey sands overlaying the Boom Clay in Limburg. Whether the Voort Sand Formation with its Veldhoven Clay Member should be included in the Rupel Group or should be considered as a separate Group remains uncertain. These units have been considered as Chattien (Upper Oligocene). They have only been found in wells in the northeastern part of the country.

4 CONCLUSION

The present lithostratigraphic scale has been elaborated mainly for practical use, more specifically for mapping purposes. If necessary, names may still be

modified, but when the new geological maps (1:50000) will be published and the terminology fixed, this new scale will probably become as popular and well established as the former stages, which served for the legend of the old geological map (1:40000).

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Manuscript received on 18.05.92 and accepted for publication on 7.09.92.