

## Veldhoven Formation

**Unit name:** Veldhoven Formation

**Hierarchical unit name:**

**Type:** Formation

**Code:** Vd

**Author(s):**

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**Alternative names:** Voort Formation. Former Veldhoven Member is renamed to Wintelre Member.

**Origine of the name:** -

**Status:** Formal

**Date:** 01/05/2022

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### Characterizing description

The Veldhoven Formation consists of fine grained glauconitic mollusc-bearing sand (Voort and Someren members) containing in some locations rich mollusc beds near its base (Voort Member in Campine coalfield) and with a clay unit in its middle part (Wintelre Member) . Other clayey intercalations can occur in the sand.

### Type section, type locality, type borehole, or type geophysical borehole

Belgian parastratotype borehole Molenbeersel, drilled 1988 till final depth of 1773 m; GeoDoc 049W0226, ground level +33 m; Lambert coordinates x 247660, y 207752, Voort Formation 680 – 975 m below ground level.

Someren Member	680-774 m	S&T 2 to 4
Wintelre, ex-Veldhoven Member	774-840 m	S&T 1
Voort Member above gamma-ray peak	840-920 m	S&T 07 to 09
Voort Member gamma-ray peak interval	920-940 m	S&T 06
Voort Member below gamma-ray peak	940-975 m	S&T 05

Lithostratigraphic subdivision of the Veldhoven Formation in the Molenbeersel borehole, with depth range and corresponding Schneider and Thiele (1965) hydrostratigraphic codes of the Lower Rhine Basin and Chattian age assignments based on correlation with type sections in the Lower Rhine coal and salt districts. Table 1 in Duser & Vandenberghe, 2020 (cf. Matthijs et al., 2016).

### Description upper boundary

The Veldhoven Formation is fully developed only in the Roer Valley Graben. In the Belgian part of the graben the covering strata are assigned to the more greenish clayey Houthalen Sand, with high gamma

ray reading at the base of the Bolderberg Formation. Across the Belgian – Dutch boundary the corresponding overlying strata are assigned to the Groote Heide Formation (Munsterman et al., 2019).

In the eastern Limburg Campine the Veldhoven Formation, represented by the Voort Member only, is also covered by the Houthalen Member of the Bolderberg Formation, with similar characteristics as in the graben.

The Veldhoven Formation in the western Antwerp Campine, also represented by the Voort Member only in the Mol area and by residual deposits further west, is covered by the Berchem Formation, characterised by black glauconitic sand with gamma-ray peak.

**Description lower boundary**

In rotary drilled boreholes the Veldhoven Formation passes rather inconspicuously in the Eigenbilzen Formation. Distinction between both units can be based on a higher glauconite content and more grey-green colour and consequently higher gamma-ray readings for the lower part of the Veldhoven Formation i.e. the Voort Member, which also contains more molluscs. Resistivities are nevertheless lower in the Voort Member compared to the underlying Eigenbilzen Formation because of a lower clay content. However, the contact between Voort Member and Eigenbilzen Formation corresponds to an unconformable contact due to different dip related to reactivation of the graben (Eigenbilzen dipping to the north, Voort to the north east).

Due to an increasing hiatus towards the west, the Veldhoven Formation – or at least its residual remnants – rest on Boom Clay in the Antwerp harbour area (provided there is biostratigraphic control, otherwise they will remain unnoticed).

**Thickness**

The thickness is 295 m in borehole Molenbeersel, in the Roer Valley Graben where the Veldhoven Formation is fully developed. Outside the graben the Veldhoven Formation is gradually wedging out.

**Occurrence**

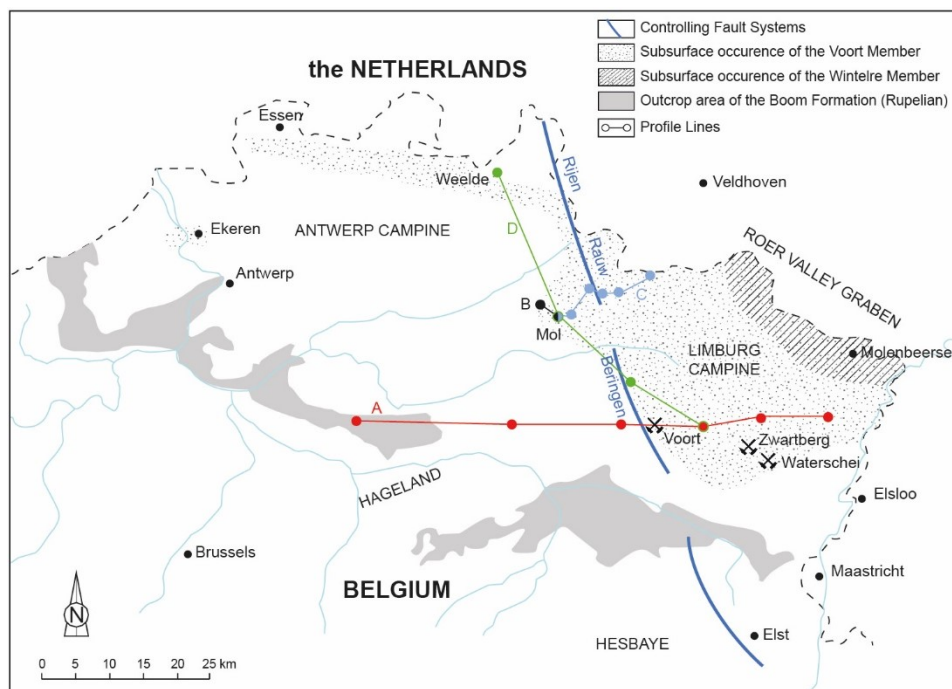


Figure 0-1 Subcrop map of Veldhoven Formation (Fig. 1 in Dusar & Vandenberghe, 2020).

The Veldhoven Formation is the youngest of the Paleogene stratigraphic units in Belgium, but it is also the first formation whose depositional area and thickness is controlled by active subsidence of the Roer Valley Graben. Hence, the Veldhoven Formation is subcropping in the Roer Valley Graben and adjoining part of the Campine Basin (Figure 0-1). As this formation is only accessible from boreholes, initial information came from the Campine coal mining district. There, only the lower part of the formation is encountered, named Voort Sand, after the locality name where the shafts of colliery Zolder were sunk (Van Straelen, 1923). This became the original type section of the Voort Formation, but is now considered as the type section for the Voort Member of the Veldhoven Formation.

### Regional correlations

The Veldhoven Formation is put in equivalence with seismostratigraphic units V-VI (after NITG, 2001 and Verbeek et al., 2002), whereby unit V encompasses the Eigenbilzen Formation and the Veldhoven Formation up to the Wintelre Member, and unit VI the Someren Member. Each member of the Veldhoven Formation has a different seismic character: prograding for the lower Voort Member, more continuous reflectors on the clay-sand alternation in the middle Wintelre Member (building the top of seismostratigraphic unit V) and more transparent for the upper Someren Member (characteristic for seismostratigraphic unit VI) (Matthijs et al., 2016).

In the Lower Rhine Graben the Köln Formation is the lateral equivalent to the Belgian Veldhoven Formation and consists of cycles of marginal marine sand, minor fluvial sand, lagoonal or lacustrine clay and lignite layers (Schäfer and Utescher, 2014, fig. 3 and Hager et al., 1998, fig. 3). Schäfer and Utescher (2014) also show the Schneider and Thiele (1965) hydrostratigraphic codes in the Köln Formation; these codes are used in the Hager et al. (1998) sections and profiles. Because of their persistent character they could represent glacio-tectonic cycles as already postulated by Hager et al. (1998) and correlate with sand – clay alternances in the Veldhoven Formation in Belgium.

The Veldhoven Formation has been defined in the Netherlands for describing the strata covering the Rupel Formation (Boom – Eigenbilzen Formations in Belgium), with rapidly increasing in thickness towards the Roer Valley Graben and cut by the Mid Miocene Unconformity. Hence, biostratigraphic control of the deposits became essential for a good understanding.

In Belgium the process of distinguishing this formation, which is nowhere outcropping neither, was initialised by the discovery of Chattian faunas. This led to the definition of the Voort Formation (now Voort Member of Veldhoven Formation) in the Limburg Campine and its recognition on a more limited scale in the Antwerp Campine (Buffel et al., 2002). Subdivision of the more complete section in the Belgian part of the Roer Valley Graben led to the acceptance of the Dutch lithostratigraphical subdivision, thereby replacing Voort by Veldhoven as the formation name (it should be noted that no biostratigraphical or sedimentological studies are available for the graben deposits).

Towards the southeastern part of the Limburg Campine and across the Meuse river into Dutch South Limburg the Veldhoven Formation is in hiatus but the Elsloo gravel, occurring at the base of the overlying Miocene Bolderberg Formation, contains Chattian fossils derived from an eroded Voort Member.

The Bonnelles sand unit of the Tertiary sand outliers in Hesbaye and Condroz regions is probably of Chattian age and corresponding to the Voort Member of the Campine, although precise age correlations are lacking. Bonnelles Sands overlying sand is assigned to the Sint-Huibrechts-Hern Formation in the Hesbaye and to Sart-Tilman sand in the Condroz, equally correlated to the 'Tongrian' Sint-Huibrechts-Hern Formation. The Bonnelles Sand is covered by coarse to gravelly sand loosely assigned to the Miocene in the Condroz / Ardennes and to the Bolderberg Formation in Hesbaye.

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Residual Chattian deposits in the Antwerp harbour area corresponding to the Voort Member are covered by the Edegem Member of the Berchem Formation. However, these residual Chattian deposits could only be positively identified based on by micropaleontological dating. It is likely that similar, yet undated deposits elsewhere in the Antwerp harbour area remain included in the Edegem Member of the Berchem Formation.

Current stratigraphic subdivision places the Berchem Formation above the Veldhoven Formation. In the Netherlands, the Groote Heide Formation, which is stratigraphically covering the Veldhoven Formation, is correlated to the Antwerp Member of the Berchem Formation only.

### Age

Van Simaey (2004) and De Man et al. (2010) have described two gravel layers in the Veldhoven Formation from Weelde and Mol-1 boreholes in the Antwerp Campine, which subdivide the Chattian deposits in three parts corresponding to changes in the dinoflagellate cyst zonation. They are parallel to the boundaries between dinocyst zones NSO-6 - NSO-7 and NSO-7 - NSO-8 respectively.

Munsterman & Deckers (2020) confirmed the presence of Aquitanian sediments above the Chattian sediments, underneath the black sand of the Berchem Formation (equivalent to the Groote Heide Formation in the Netherlands) in the Weelde borehole, suggesting that residual deposits of the same age as the Wintelre or Someren members are occurring outside the graben.

There exists a discrepancy in interpretation between the former and the latter authors. Munsterman & Deckers (2020) place the Veldhoven (named Voort) – Berchem Formation boundary below the gravel layers in the Weelde borehole, which Van Simaey (2004) and De Man et al. (2010) consider as an intra-Chattian boundary, in line with the Chattian as described in Hager et al. (1998).

### Dataset

Data in this LIS are part of the [DOV-Neogene data collection, including links to the GSB-collection data sheets](#), more specifically in the dataset [NCS Neogene 2020 Duser and Vandenberghe, 2020](#).

Name	GSB name	DOV name	GSB Collections URL	DOV URL
Belgian parastratotype borehole Molenbeersel	049w0226	kb18d49w-B226	<a href="https://collections.naturalsciences.be/ssh-geology-archives/arch/049w/049w0226.txt">https://collections.naturalsciences.be/ssh-geology-archives/arch/049w/049w0226.txt</a>	<a href="https://www.dov.vlaanderen.be/data/boring/1987-042705">https://www.dov.vlaanderen.be/data/boring/1987-042705</a>
Mol-1 borehole	031w0314	ON-MOL-1	<a href="https://collections.naturalsciences.be/ssh-geology-archives/arch/031w/031w0314.txt">https://collections.naturalsciences.be/ssh-geology-archives/arch/031w/031w0314.txt</a>	<a href="https://www.dov.vlaanderen.be/data/boring/1997-160115">https://www.dov.vlaanderen.be/data/boring/1997-160115</a>
Weelde borehole	008e0159	kb8d8e-B161	<a href="https://collections.naturalsciences.be/ssh-geology-archives/arch/008e/008e0159.txt">https://collections.naturalsciences.be/ssh-geology-archives/arch/008e/008e0159.txt</a>	<a href="https://www.dov.vlaanderen.be/data/boring/1996-098751">https://www.dov.vlaanderen.be/data/boring/1996-098751</a>

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