

Hallaar Member (Kasterlee Formation)

Unit name: Hallaar Member**Hierarchical unit name:** Kasterlee Formation**Type:** Member**Code:** KlHa**Author(s):** Verhaegen Jasper & Vandenberghe Noël**Alternative names:** formerly part of the at the time not yet subdivided Kasterlee Formation sensu De Meuter and Laga (1976) and Laga et al. (2001).**Origin of the name:** Description of the Kasterlee Formation at Heist-op-den-Berg and Beerzel by Fobe (1995)**Status:** Formal**Date:** 01/05/2022**How to refer:** Verhaegen, J. & Vandenberghe, N., 2023. The Hallaar Member, 01/09/2023. National Commission for Stratigraphy Belgium. <http://ncs.naturalsciences.be/lithostratigraphy/Hallaar-Member>**Characterizing description**

In its type area around the hills of Heist-op-den-Berg and Beerzel up to Olen more the north, a disperse gravel of flattened and partly weathered flint pebbles, the Olen Gravel Bed, is present at the base of the Hallaar Member, together with coarse quartz grains and white weathered silex, described in detail in Verhaegen et al. (2014). The Hallaar Member has transitional characteristics between the Diest Formation and Kasterlee Formation. Glauconite content is significantly lower than in the Diest Formation but concentrations of >10% (glauconite/quartz ratio of 0.20–0.68) are still present (Verhaegen et al., 2020). The grain size distribution is bimodal. The coarser mode is similar to the modal grain size of the underlying Diest Sand and can be attributed to reworking of sediment from the Diest Formation. Another finer modal grain size is also present (< 200 µm) which is more typical of the Kasterlee Formation. The sediment has a large fine fraction, with 50% of grains <85 µm. The Hallaar Member has a similar content of dioctahedral 2:1 Al-rich layer silicates (11–15%, 2:1 Al-clay/quartz ratio of 0.22–0.23) to the Diest Formation, yet higher than the overlying Beerzel Member and the sandy parts of the Heist-op-den-Berg Member. Feldspar content (4–5%, feldspar/quartz ratio of 0.06–0.09) is significantly higher compared to the Diest Formation and similar to the overlying Beerzel and Heist-op-den-Berg members. In outcrops or cores, the Hallaar Member may be recognized by its brownish-green weathered color if oxidized above the groundwater table, significant glauconite and clay content, and a mottled appearance due to the presence of green-greyish clay-enriched patches of sediment (Verhaegen et al., 2020).

The Hallaar Member, with its reworking of the underlying Diest Formation sand, appears to be present across most of the occurrence area of the Kasterlee Formation, based on CPT profiles and core observations. On CPT's there is a drop in qc value from the Diest Formation to the Hallaar Member (Vandenberghe et al., 2020). North of Olen no basal gravel is present. In this area, the Hallaar Member is distinguished based on its transitional characteristics between the Diest and Kasterlee formations.

Type section, type locality, type borehole, type CPT and/or type geophysical borehole

The proposed type section of the lower three members of the Kasterlee Formation, including the Hallaar Member, is the sunken lane atop the hill of Heist-op-den-Berg (DOV TO-20140919 and TO-20190617). The type section is described in detail in Verhaegen et al. (2014) and Verhaegen et al. (2020), and was originally proposed by Fobe (1995).

Description upper boundary

In the southern area of Beerzel, Heist-op-den-Berg and Olen, the Hallaar Member is always overlain by Beerzel Member sand. This is a transitional boundary which can be identified based on a shift from the brown-green colour of the Hallaar Member to the yellow-white colour of the Beerzel Member, due to a strong decrease in glauconite and goethite content in the Beerzel Member. The Beerzel Member is a better sorted fine sand with a lower clay content compared to the Hallaar Member.

Towards the north, the Beerzel Member is not always present and the Hallaar Member is often directly overlain by the Heist-op-den-Berg Member. This is a sharper boundary which can be placed at the first cm- to dm-scale clay layer at the base of the Heist-op-den-Berg Member, followed by a sand-clay alternation within the Heist-op-den-Berg Member.

Description lower boundary

The Hallaar Member is always underlain by the Diest Formation, which has a coarser modal grain size and a higher glauconite content. In the type area to the south, the lower boundary is marked by the occurrence of the Olen Gravel Bed, a disperse gravel of flattened flint pebbles with a spotted patina, together with a very coarse quartz fraction (>1 mm) and white weathered silex fragments.

Towards the north, the basal gravel is no longer present making the boundary harder to identify as the Hallaar Member contains reworked Diest Sand, leading to transitional characteristics between the Diest and Kasterlee formations. This may be further complicated in cases where the top of the Diest Formation is also enriched in clay laminae. However in the area east of Kasterlee, the appearance of a fraction >500 µm in the top of the Diest Formation often accompanied by a decrease in the gamma ray signal allows to mark the boundary between both formations. This boundary is consistent with a correlative signal change in CPT measurements. The reworked Diest Sand in the Hallaar Member also influences the gamma ray signal.

Thickness

The Hallaar Member comprises the lower couple of meters of the Kasterlee Formation, in which reworking of the underlying Diest Formation is apparent. In the type section, the thickness is approximately 3 m and this appears rather consistent throughout the occurrence area to the north, with a thickness of 2-3 m.

Occurrence

The Hallaar Member appears as a transitional basal unit of the Kasterlee Formation throughout most of its occurrence area. Only in the northwest such a transitional unit cannot always be observed and the Diest Formation is directly overlain by the Lichtaart Member.

Regional correlations

The base of the Hallaar Member represents a wave-ravinement surface formed due to a rapid transgressional phase, leading also to the reworking of the underlying Diest Sand. As such, the member has mostly developed in the more proximal environments towards the south and east, while it may not be recognized in the northwest (northwest of Kasterlee village), where only the shallow open marine Lichtaart Member is identified. The Hallaar Member is laterally equivalent with the base

of the Lichtaart Member in the northwest, where no significant reworking of the Diest Sand is recorded.

Age

No age data are available for the Hallaar Member, yet it is underlain by the late Tortonian to Messinian Campine Diest Sand and overlain by the Heist-op-den-Berg Member in which dinoflagellate cyst biozone DN10 of late Tortonian to Messinian Miocene age was identified.

Dataset

Data in the LIS are part of the [DOV-Neogene data collection](#), including links to the GSB-collection data sheets.

Subset of the Kasterlee Formation: <https://www.dov.vlaanderen.be/data/opdracht/2020-021580>

Subset of the Heist-op-den-Berg type section: <https://www.dov.vlaanderen.be/data/opdracht/2020-022424>

References

De Meuter, F. & Laga, P., 1976. Lithostratigraphy and biostratigraphy based on benthonic Foraminifera of the Neogene deposits of northern Belgium. *Bulletin van de Belgische Vereniging voor Geologie*, 85/4, 133–152.

Fobe, B., 1995. Lithologie en lithostratigrafie van de Formatie van Kasterlee (Pliocene van de Kempen). *Natuurwetenschappelijk Tijdschrift*, 75, 35–45.

Laga, P., Louwye, S. & Geets, S., 2001. Paleogene and Neogene lithostratigraphic units (Belgium). In Bultynck, P. & Dejonghe, L., (eds), *Guide to a revised lithostratigraphic scale of Belgium*. *Geologica Belgica*, 4/1-2, 135–152. <https://doi.org/10.20341/gb.2014.050>

Vandenberghe, N., Wouters, L., Schiltz, M., Beerten, K., Berwouts, I., Vos, K., Houthuys, R., Deckers, J., Louwye, S., Laga, P., Verhaegen, J., Adriaens, R. & Dusar, M., 2020. The Kasterlee Formation and its relation with the Diest and Mol Formations in the Belgian Campine. *Geologica Belgica*, 23/3-4, 265-287. <https://doi.org/10.20341/gb.2020.014>

Verhaegen, J., Adriaens, R., Louwye, S., Vandenberghe, N. & Vos, K., 2014. Sediment-petrological study supporting the presence of the Kasterlee Formation in the Heist-op-den-Berg and Beerzel hills, southern Antwerp Campine, Belgium. *Geologica Belgica*, 17, 323–332.

Verhaegen, J., Frederickx, L. & Schiltz, M., 2020. New insights into the stratigraphy and paleogeography of the Messinian Kasterlee Formation from the analysis of a temporary outcrop. *Geologica Belgica*, 23/3-4, 253-263. <https://doi.org/10.20341/gb.2020.015>
