Oorderen Member (Lillo Formation)

Unit name: Oorderen Member

Hierarchical unit name: Lillo Formation

Type: Member

Code: LiOo

Author(s):

- Compiled by: Deckers Jef, Louwye Stephen & Goolaerts Stijn
- Modification from: De Meuter & Laga (1976)

Alternative names: "Sables à Trophon antiquum"; "Sables à Fusus contrarius"; "Sables à Neptunea contraria"; "Sables de Kallo » (see De Meuter & Laga (1976) and Louwye et al. (2020) for references and more historical details)

Origin of the name: former village of Oorderen in the Harbour of Antwerp region, situated north of the Churchilldok.

Status: Formal

Date: 01/05/2022

How to refer: Deckers, J., Louwye, S. & Goolaerts, S., 2023. The Oorderen Member, 01/09/2023. National Commission for Stratigraphy Belgium. http://ncs.naturalsciences.be/lithostratigraphy/Oorderen-Member

Characterizing description

The Oorderen Member as introduced by De Meuter & Laga (1976) is a greyish fine-grained, shelly unit containing numerous shells and shell grit, both dispersed in a glauconiferous quartz sand matrix as well as arranged into a number of cm to dm thick shell beds. The basal shell layer is generally several dm thick, contains also gravel with large pebbles, reworked shells and cetacean bones. Major shell beds show load casting, and generally, three of these can be followed over adjacent outcrops several kilometres apart. Three intervals characterized by different sedimentary structures (respectively: throughs and storm beds, predominantly homogenized sand, predominantly bioturbated clayey sand) and mollusc fauna composition (respectively frequent occurrence of: Atrina fragilis kalloensis (previously Pinna pectinata), Cultellus cultellatus, Angulus (or Tellina) benedeni benedeni), and separated by shell beds that experienced load coasting, can be recognized all over the Port of Antwerp area, namely the Atrina (previously Pinna) level, the Cultellus level and the benedeni level (previously Angulus or Tellina benedeni level, or clayey Oorderen) (see Vervoenen, 1995; Marquet, 1998; Marquet & Herman, 2009 and others).

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

De Meuter & Laga (1976) named Oorderen, a former village to the north of the city of Antwerp as type locality. These authors also selected the temporary outcrop of the Boudewijnsluis (DOV kb7d15w-B282) described by De Heinzelin de Braucourt (1955) and where the member occurs between -10.5 and -13.5 m TAW as type section.

In the Tunnel Kanaaldok section of Laga (1972) (now named Tijsmanstunnel) (GSB 015W0304; DOV BGD015W0304), the stratotype-section of the Lillo Formation, the member corresponds to the

interval between 15 and 21 m depth, translating to -13.5 m TAW to -19.5 m TAW (Figure 0-1). On the nearby CPT (DOV GEO-20/034-S5), the Oorderen Member is characterised by relatively uniform friction ratios (between 1 and 2%) and cone resistance values of on average around 30 MPa.

In the Verrebroekdok section of Goolaerts (2000) (DOV TO-19990901), the member outcropped between -5.8 and -11.2 m TAW (fide Deckers et al., 2020; Figure 0-2).

Type geophysical borehole is borehole Stabroek (GSB: 015W0216; DOV kb7d15w-B296) with the Oorderen Member from 26 m to 36 m depth (Laga, 1979; Figure 0-3).

Description upper boundary

In its southernmost area, it is overlain by Quaternary strata, while further north, it is consistently overlain by the Kruisschans Member of the Lillo Formation. The Oorderen/Kruisschans boundary is not always easy to pinpoint, the main criterion as defined by De Meuter & Laga (1976) is the change from the sand and clay being mixed by burrowing (Oorderen Member), to being separated in cm-thick layers or lenses (Kruisschans Member). On Cone Penetration Tests, the boundary correlates to an upwards decrease in cone resistance combined with an increase in friction ratio (Deckers et al., 2020; Figure 0-1 and Figure 0-2)). On geophysical borehole logs, this boundary coincides with an upwards increase in gamma-ray values and decrease in resistivity values (Figure 0-3).

Description lower boundary

The lower boundary overlies erosively the Luchtbal Member, or where it has removed the latter it overlies the Kattendijk Formation. In outcrops, the boundary with the Luchtbal Member or Kattendijk Formation is rather easy to pinpoint. In boreholes however, this can be more difficult. The main differences with the underlying Kattendijk Formation are different contents of glauconite (10% versus 20%), much higher amounts of shells & shell grit and, as a result of the two former, a difference in color (brown-grey versus more green-grey). On Cone Penetration Tests, the boundary with the Kattendijk Formation and Luchtbal Member can be difficult to identify, although the latter generally shows lower friction ratios than the Oorderen Member (Figure 0-1). On geophysical borehole logs, the boundary with the Kattendijk Formation coincides with an upwards decrease in gamma-ray values and increase in resistivity values (Figure 0-3).

Thickness

In the Port of Antwerp area, the member has a maximum thickness of up to 7 m (Van Haren et al., 2021). It is truncated in southern direction by the Kruisschans Member, so that it becomes absent in the City of Antwerp area. Further east, in the Grobbendonk outcrop (DOV TO-19970101), the member is thought to be lacking in between the Luchtbal and Kruisschans members (Vandenberghe et al., 2000). Further north in the Campine area, the member seems to have a rather uniform thickness (between 5 to 10 m; Deckers et al., 2019).

Occurrence

From the Waasland area in the west (Laga, 1971), across the City of Antwerp and Port of Antwerp areas into the western Campine area. It presumably covers the western Campine area up to roughly the SW-NE line between Beerse and Weelde in the east. Here, the transition towards the time-equivalent Poederlee Member is proposed (Louwye et al., 2020).

Regional correlations

It correlates with part of the Oosterhout Formation in the Netherlands.

Age

Early late Pliocene. See Louwye et al. (2020) and references therein.

Dataset

Data in the LIS are part of the DOV-Neogene data collection, including links to the GSB-collection data sheets:

Name	GSB name	DOV name	GSB Collections URL	DOV URL
Outcrop Boudewijnsluis		kb7d15w-B282		https://www.dov.vlaanderen.be/data/boring/1952-080889
Outcrop Tunnel Kanaaldok	015W0304	BGD015W0304	https://collections.naturalsciences.be/ssh-geology-archives/arch/015w/015w0304.txt	https://www.dov.vlaanderen.be/data/boring/1999-161693
Outcrop Verrebroekdok		TO-19990901		https://www.dov.vlaanderen.be/data/boring/1999-161693
CPT Verrebroekdok		GEO-97/138-SM196		https://www.dov.vlaanderen.be/data/sondering/1998-005094
Grobbendonk outcrop		TO-19970101		https://www.dov.vlaanderen.be/data/boring/2020-175886

Extra data:

Name	GSB name	DOV name	GSB Collections URL	DOV URL
CPT Tunnel Kanaaldok		GEO-20/034-S5		https://www.dov.vlaanderen.be/data/sondering/2020-079300
Borehole Stabroek	015W0216	kb7d15w-B296	https://collections.naturalsciences.be/ssh-geology-archives/arch/015w/015w0216.txt	https://www.dov.vlaanderen.be/data/boring/2016-147541

References

Deckers, J., De Koninck, R., Bos, S., Broothaers, M., Dirix, K., Hambsch, L., Lagrou, D., Lanckacker, T., Matthijs, J., Rombaut, B., Van Baelen, K. &Van Haren, T., 2019. Geologisch (G3Dv3) en hydrogeologisch (H3D) 3D-lagenmodel van Vlaanderen. Studie uitgevoerd in opdracht van het Vlaams Planbureau voor Omgeving, departement Omgeving en de Vlaamse Milieumaatschappij. VITO, Mol, VITO-rapport 2018/RMA/R/1569. https://archief-algemeen.omgeving.vlaanderen.be/xmlui/handle/acd/251494

Deckers, J., Louwye, S. & Goolaerts, S., 2020. The internal division of the Pliocene Lillo Formation: correlation between Cone Penetration Tests and lithostratigraphic type sections. Geologica Belgica, 23/3-4, 333-343. https://doi.org/10.20341/gb.2020.027

de Heinzelin de Braucourt, J., 1955. Deuxième série d'observations stratigraphiques au Kruisschans. Coupes de l'écluse Baudouin : I. Analyse stratigraphique. Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre, 31/66, 1–29.

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, 85/3-4, 133–152.

Goolaerts, S., 2000. Sedimentologische, stratigrafische en paleoecologische studie van de Pliocene en Quartaire afzettingen aangetroffen in fase 2 van het Verrebroekdok, provincie Oost-Vlaanderen. Proefschrift Licentiaat Geologie (unpublished Master Thesis), KULeuven, Leuven, 133 p.

Laga, P., 1971. De Neogene afzettingen van het Waasland (kb Beveren-Waas). Belgische Geologische Dienst, Professional Paper, 1971/7, 11 p.

Laga, P., 1972. Stratigrafie van de mariene Plio-Pleistocene afzettingen uit de omgeving van Antwerpen met een bijzondere studie van de foraminiferen. Unpublished Ph.D. Thesis. Katholieke Universiteit Leuven - Faculteit Wetenschappen, Leuven. 3 vol., 252 p.

Louwye, S., Deckers, J. & Vandenberghe, N., 2020. The Pliocene Lillo, Poederlee, Merksplas, Mol and Kieseloolite Formations in northern Belgium: a synthesis. Geologica Belgica, 23/3-4, 297-313. https://doi.org/10.20341/gb.2020.016

Marquet, R., 1998. De Pliocene gastropodenfauna van Kallo (Oost-Vlaanderen, België). Belgische Vereniging voor Paleontologie, 17, 246 p.

Marquet, R., Herman, J., 2009. The stratigraphy of the Pliocene in Belgium. Palaeofocus 2, 1-39.

Vandenberghe, N., Herman, J., Laga, P., Louwye, S., De Schepper, S., Vandenberghe, J., Bohncke, S.J.P. & Konert, M., 2000. The stratigraphic position of a Pliocene tidal clay deposit at Grobbendonk (Antwerp Province, Belgium). Geologica Belgica, 3/3-4, 405–417. https://doi.org/10.20341/gb.2014.040

Van Haren T., Deckers J., De Koninck R., Dirix K., Maes R., Hambsch L. en Van Baelen K., 2021. Ondiep geologisch 3D lagen- en voxelmodel van regio Antwerpen. Studie uitgevoerd in opdracht van de Vlaamse overheid, departement Omgeving, Vlaams Planbureau voor Omgeving, https://archief-algemeen.omgeving.vlaanderen.be/xmlui/external-handle/Onderzoek-2639700

Vervoenen, M., 1995. Taphonomy of some Cenozoic seabeds from the Flemish Region, Belgium. Professional Paper 272, 1-115.

Annexes

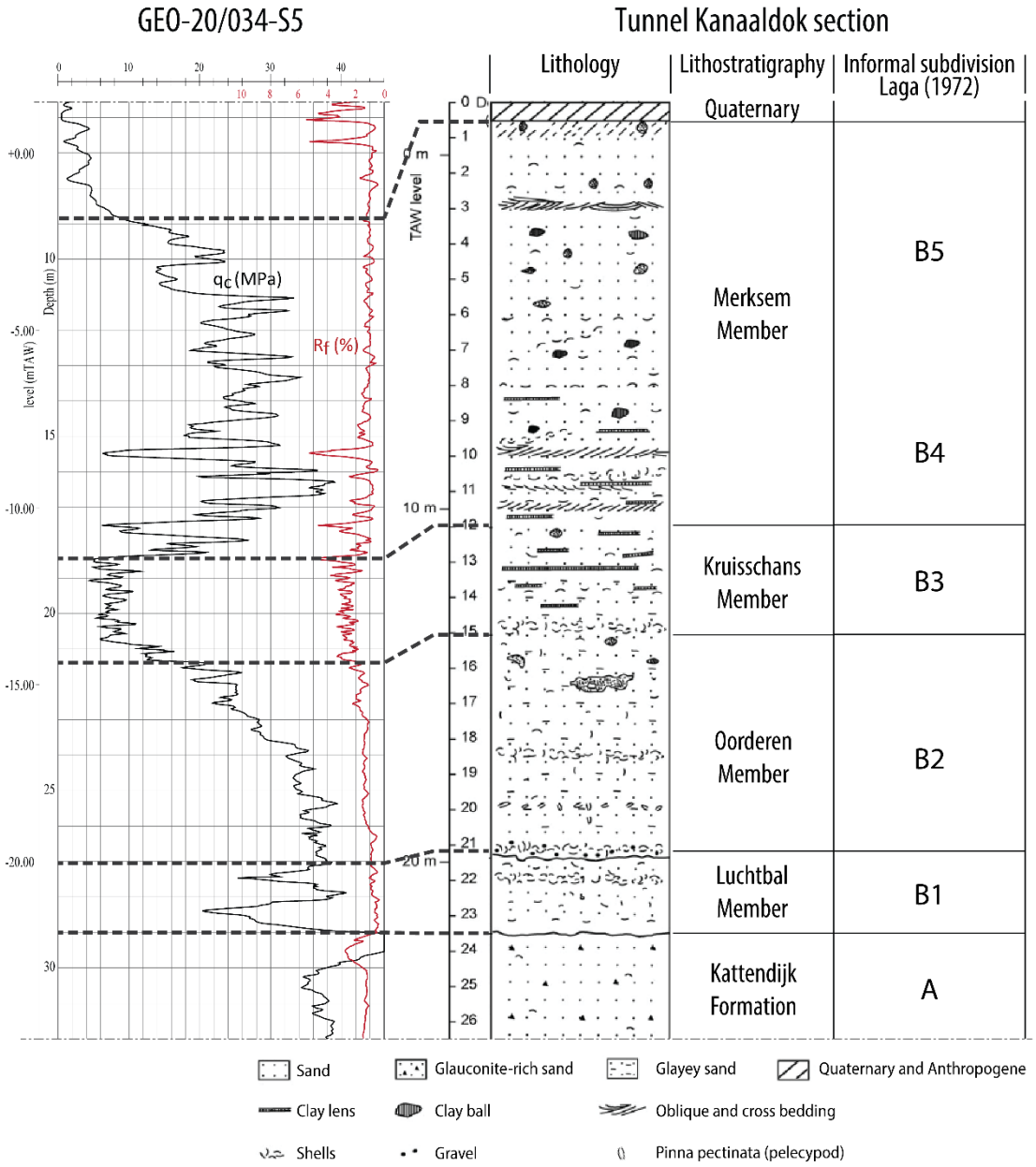

Figure 0-1: The Oorderen Member at the Tunnel Kanaaldok section as described and interpreted by Laga (1972) and correlation with a nearby CPT by this study.

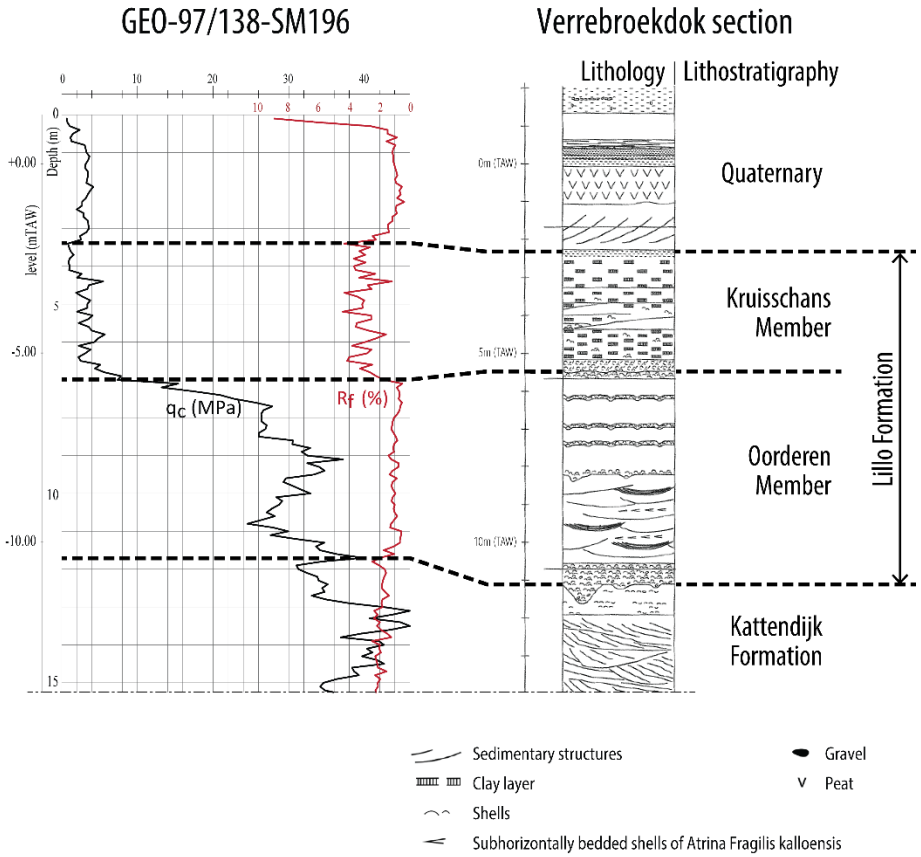

Figure 0-2: The Oorderen Member at the Verrebroekdok section of Goolaerts (2000), with formal lithostratigraphic interpretation and expression on a nearby CPT by Deckers et al. (2020).

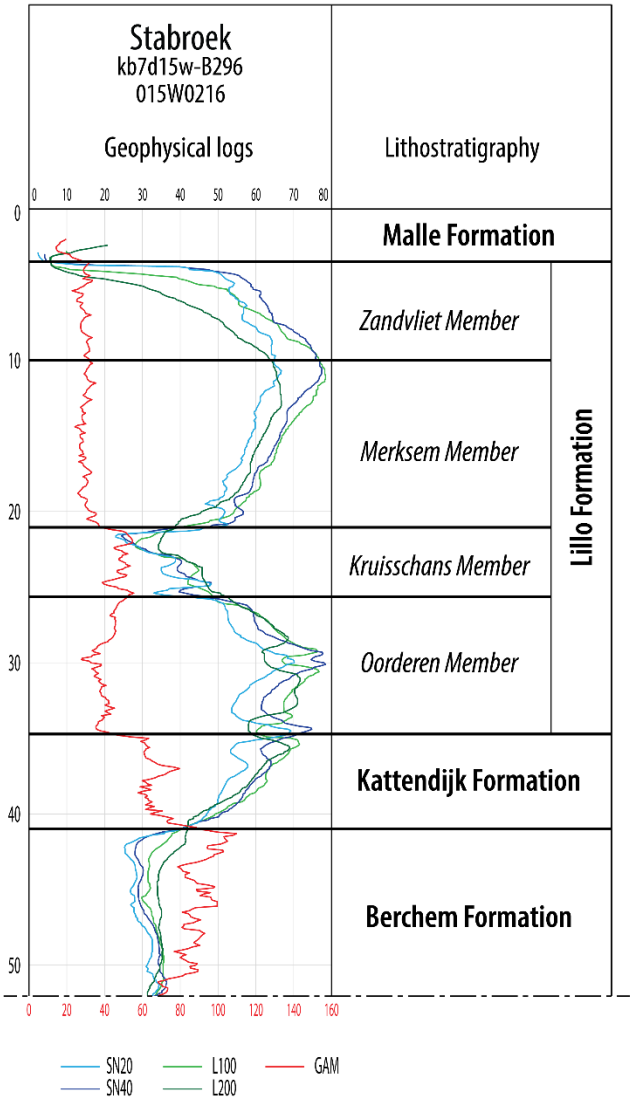

Figure 0-3: Log-expression of the Oorderen Member in borehole Stabroek after Laga (1979).