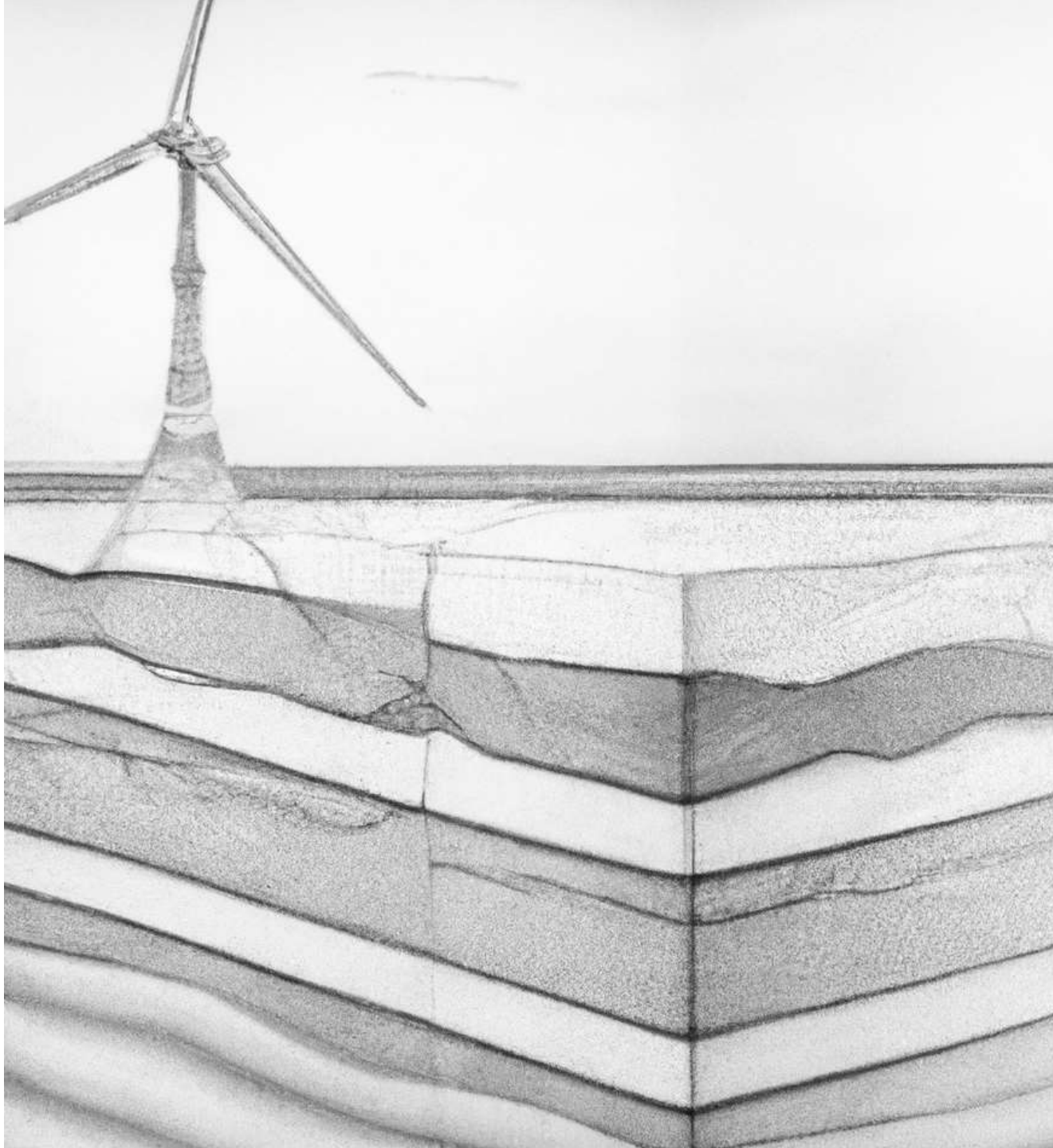
7 September 2023 – InnovOcean Campus

Clay Tectonics IAB



Agenda

14u-16u00 Industrial Advisory Board (Meeting room Homarus, first floor)

Welcome and introduction (Hans Pirlet, VLIZ)

- State of affairs and next steps for the geophysical field measurements and processing strategy (Thomas Mestdagh, VLIZ)
- Preliminary results of geological analysis and reconstruction (Harisma Andikagumi, UGent)
- Data management and disclosure of geophysical field measurements (Jelle Rondelez, VLIZ)

Coffee Break

- Field sampling and geotechnical/geological analyses - state of affairs and next steps (Bruno Stuyts, VUB / Marc De Batist, UGent)
- Open discussion about preliminary results and next steps of the project (all)

Role Industrial Advisory Board

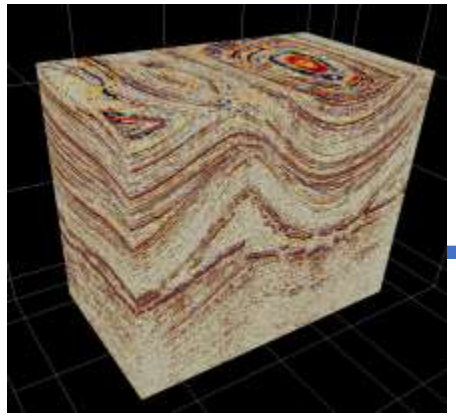
Objectives of this meeting

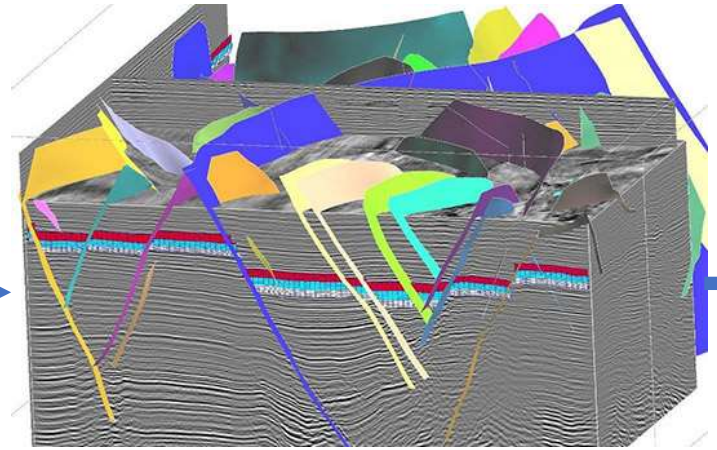
- The IAB will ensure that the concrete **implementation** of the project by the project parties involved is **optimally aligned with the needs of the companies** and members of the target group.
- The IAB monitors the implementation of the project and functions as a **sounding board for the possibilities of economical and/or societal valorisation** of the project results.

=> **Progress meeting** (preliminary results + feedback on next steps and valorisation potential)

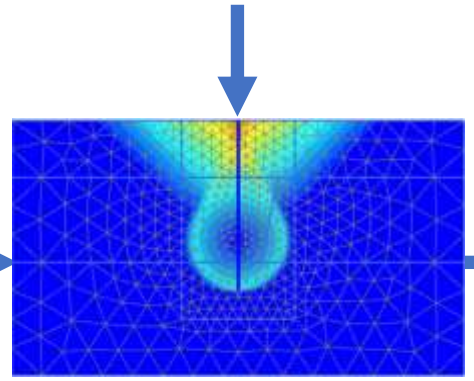
Outline Clay Tectonics

Influence of clay tectonics in the North Sea on offshore wind foundation design and installation





Onshore sampling



WP4 – Valorisation and stakeholder interaction

WP1 - Innovative geophysical field measurement & processing strategy

WP2 - Geological analysis and reconstruction

WP3 - Geotechnical characterisation & simulation

WP5 – data management

State of Affairs Clay Tectonics

GANTT-chart

Gantt-chart of project activities

A Gantt chart elaborating the timing of the project tasks, as well as the associated milestones (M) and deliverables (D). The light blue areas indicate potential follow-up or valorisation activities (e.g. the publication of project results in peer-reviewed scientific journals).

	2023												2024												2025					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
WP1 - Innovative geophysical field measurement and processing strategy																														
T1.1 Identify representative study area		D1.1																												
T1.2 Develop survey strategy																														
T1.3 Innovative field measurements										M1.1																				
T1.4 Processing & data integration														D1.2																
WP2 - Geological analysis and reconstruction																														
T2.1 Mapping and analysis of CTFs															M2.1															
T2.2 Fault reactivation features																														
T2.3 Clay tectonics origin & processes																		D2.1												D2.2
WP3 - Geotechnical characterization and simulation																														
Task 3.1 Literature and data review			M3.1																											
Task 3.2 Onshore sampling and testing								D3.1																						
Task 3.3 Ground model												M3.2																		
Task 3.4 Simulations																		D3.2												
Task 3.5 Foundation-related risks																					D3.3									
WP4 – Valorisation and stakeholder interaction																														
Task 4.1 Industrial Advisory Board	M4.1																													
Task 4.2 Dialogue with authorities	M4.2																													
Task 4.3 Link with certification criteria																														D4.1
Task 4.4 Dissemination - publications																														
WP5 – Data management																														
Task 5.1 Data management plan			D5.1																											
Task 5.2 Data system geophysical data																				D5.2										
Task 5.3 Data ingestion																														
Task 5.4 Data publication																						M5.2								
Task 5.5 Geotechnical data platform						M5.1																								
WP6 – Project coordination															D6.1															D6.2

Deliverable 1.1

Report on the selection of study areas based on available geophysical datasets and literature

CLAY TECTONICS PROJECT – DELIVERABLES

D1.1 REPORT ON THE SELECTION OF STUDY AREAS BASED ON AVAILABLE GEOPHYSICAL DATASETS AND LITERATURE

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1. Introduction

The Clay Tectonics project (2023-2025) is a cSBO-project funded by Flanders Innovation and Entrepreneurship (VLAIO) through the Blue Cluster (DBC). The project aims to investigate the influence of clay tectonic features (CTFs) within the Kortrijk Formation on offshore wind foundation design and installation in the Belgian Part of the North Sea (BPNS). The project partners (VLIZ, UGent, VUB - OWI-Lab) will apply a multidisciplinary strategy, combining geophysical, geological and geotechnical methods.

The scope of the first work package in this project (WP1) is to develop an innovative field measurement and processing strategy to generate ultra-high-resolution, pseudo-3D seismic data volumes, using parametric echosounders, single- and multi-channel sparker systems and a chirp sub-bottom profiler mounted on an Autonomous Underwater Vehicle (AUV). The goal is to adequately visualize the different types of CTFs occurring in the Kortrijk Formation. After all, it is described that the nature and intensity of the CTFs exhibit geographical variations (De Batist, 1989). Based on a first reconnaissance of the northwestern part of the BPNS, a few small study areas will be selected that can be considered representative for the entire Princess Elisabeth Zone (i.e. the designated zone for new offshore wind developments). In this respect, a first, essential consideration is to carefully select the appropriate study areas for the envisaged detailed acoustic measurements.

The goal of this deliverable (D1.1) is to document the selection of the study areas that will be targeted during the Clay Tectonics project, as well as the substantiation and approach that were used for this selection. In a first step, the selection procedure consisted of an evaluation of existing information on CTFs in the BPNS (with a particular focus on the Princess Elisabeth Zone), including literature and previously collected geophysical datasets (section 2). Secondly, based on this information coupled to a list of practical and methodological constraints, different study areas for performing the acoustic measurements are selected and substantiated (section 3).

2. Information available prior to the project

2.1. Literature

The presence of CTFs in the BPNS was discovered in the 1980s, based on high-resolution seismic (mainly sparker) profiling (Henriet et al. 1983; Henriet et al. 1988). It was reported that the deformations predominantly affect the Lower-Eocene (Ypresian) Kortrijk Formation (see Paleogene subcrop map in Fig. 1), which was corroborated by evidence from onshore outcrops (De Batist, 1989; Henriet et al. 1991; Verschuren, 1992; Verschuren, 2019). In the BPNS, the CTFs appear as imbricated fault systems with tilted blocks and inclined fault planes, collapse structures and festoon-like sequences of cuspate anticlines, often developing into diapir-like escape pipes which locally pierce into the Quaternary cover (Henriet et al. 1983).

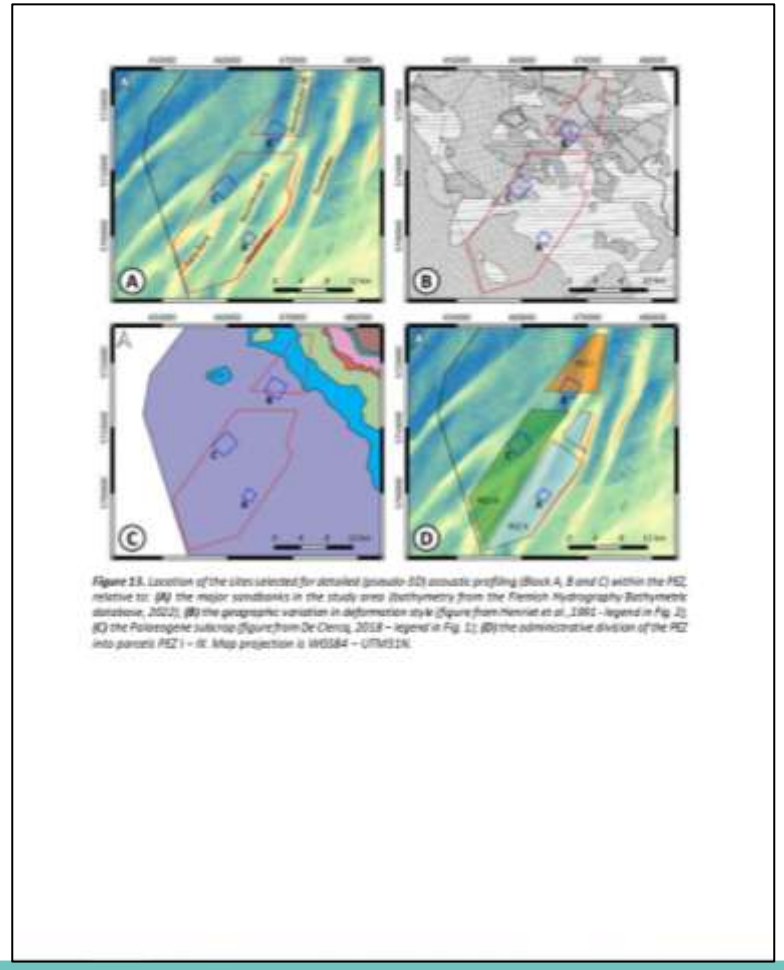
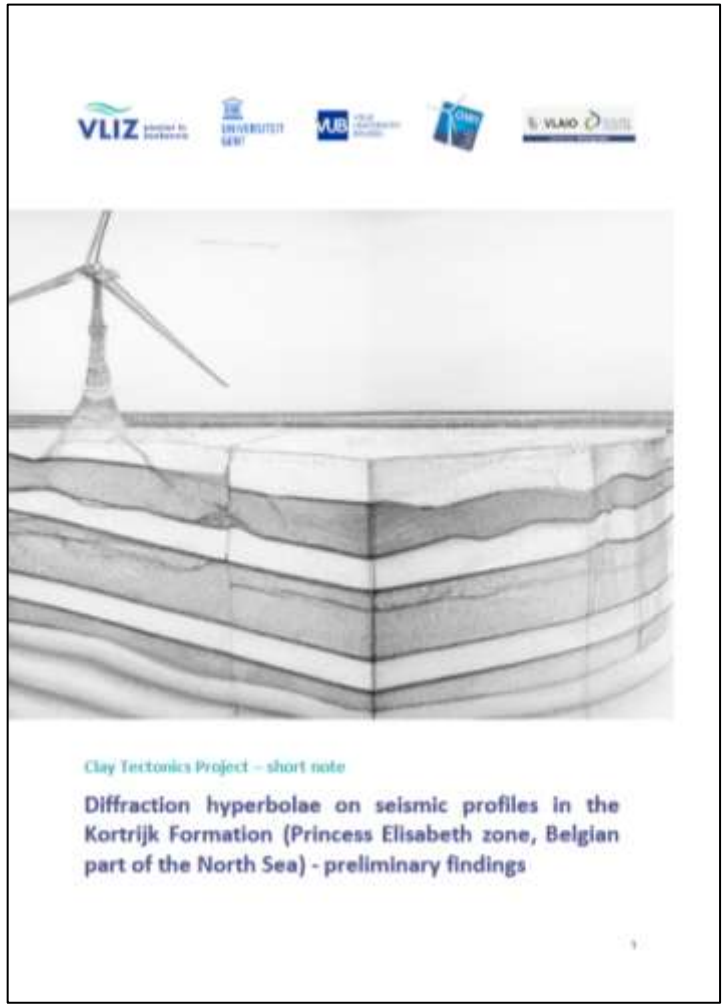


Figure 13. Location of the sites selected for detailed (pseudo-3D) acoustic profiling (Block A, B and C) within the PEZ, relative to: (A) the major sandbanks in the study area (bathymetry from the Flemish Hydrography Bathymetric database, 2022); (B) the geographic variation in deformation style (figure from Henriet et al., 1991 - legend in Fig. 2); (C) the Paleogene subcrop (figure from De Clercq, 2018 – legend in Fig. 1); (D) the administrative division of the PEZ into parcels PEZ I – IX. Map projection is WGS84 – UTM31N.

Valorisation activities

Overview first 6 months of the project

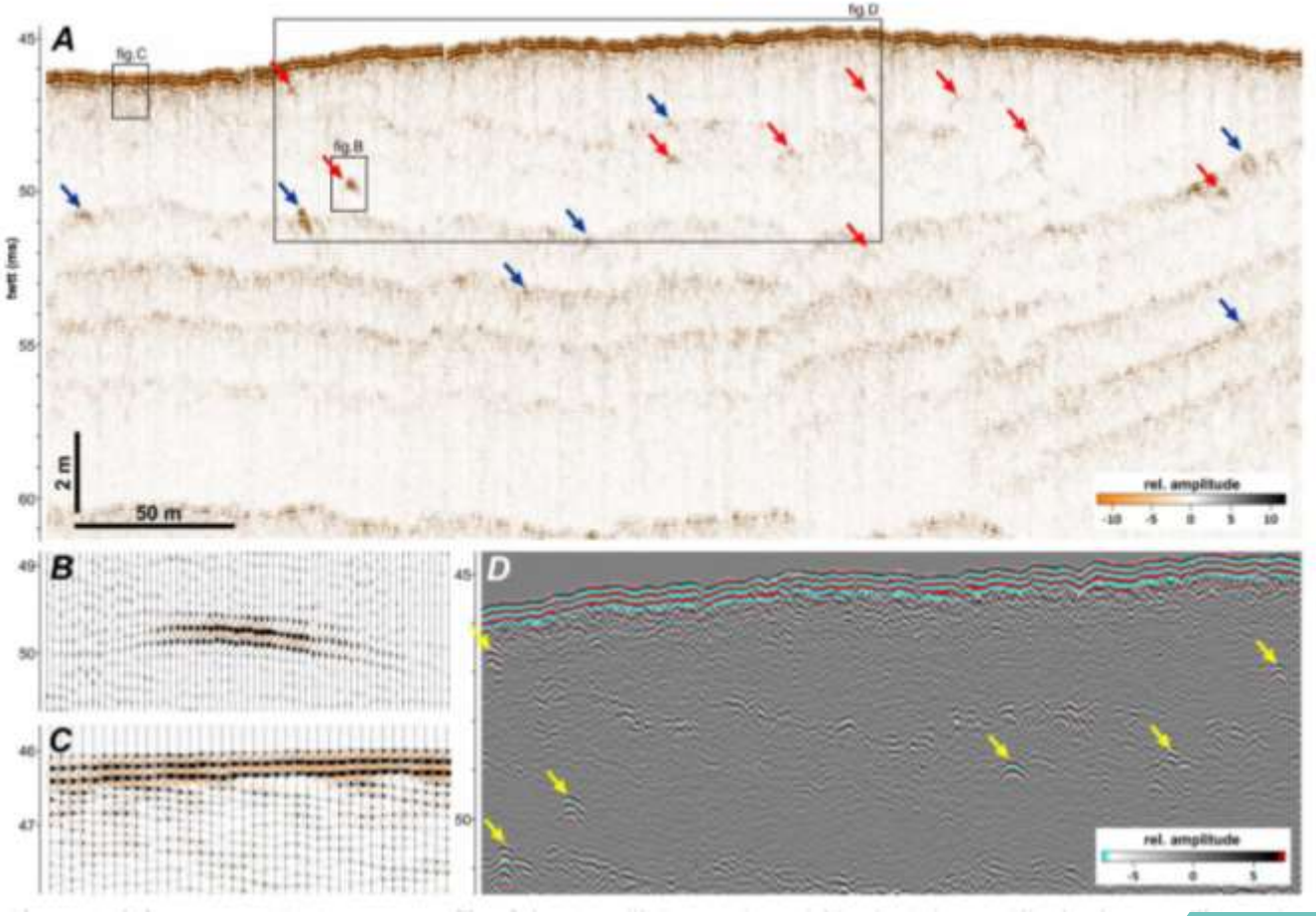
- Bilateral meetings with several amongst you;
- Project was presented on several occasions;
- Contact with new companies was made (for example with companies involved in Dunkirk);
- Data transfer agreement was signed with ELIA;
- Short note on diffraction hyperbolae.



Valorisation activities

Short note diffraction hyperbolae

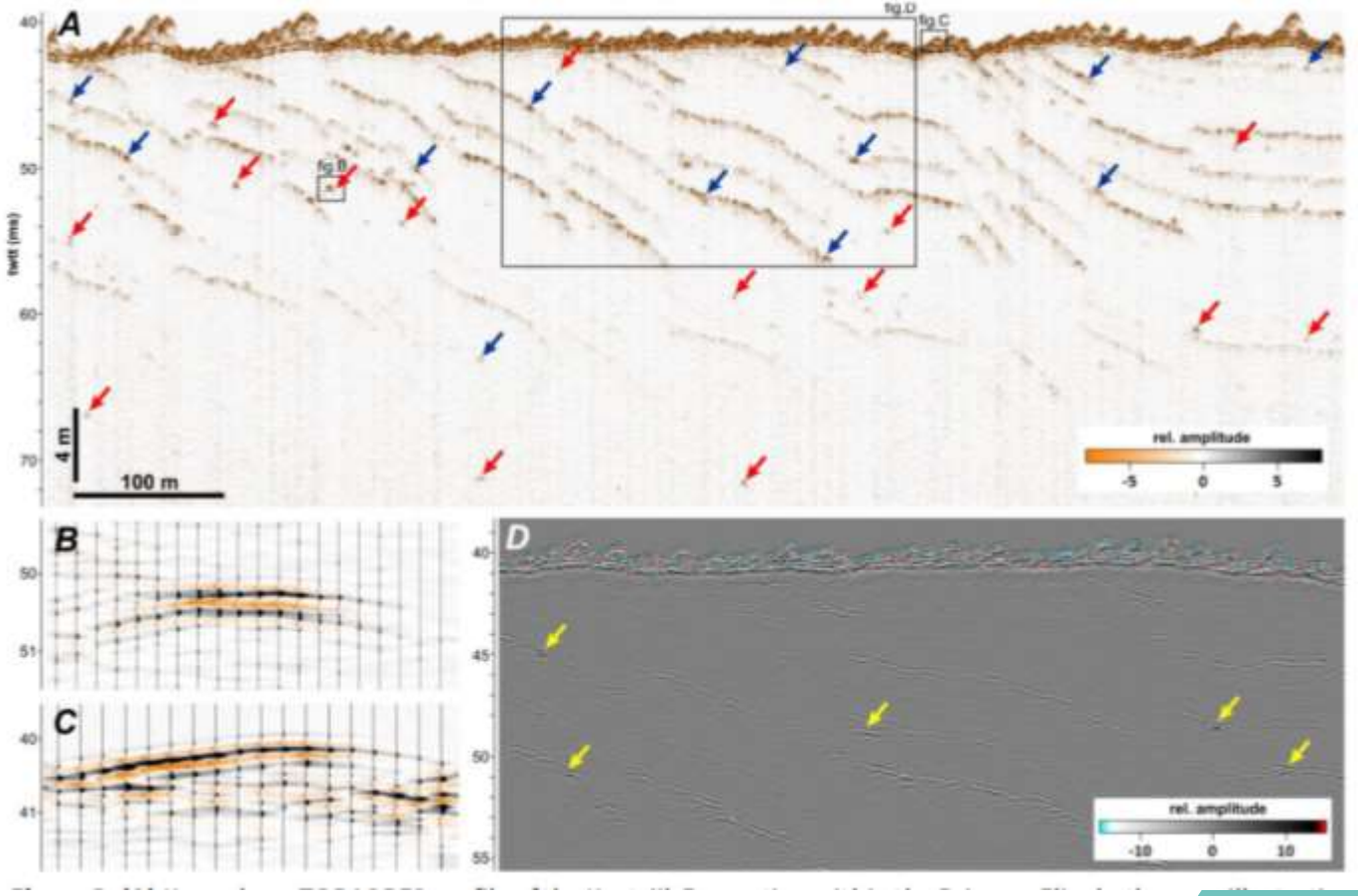
- A considerable number of diffraction hyperbolae were observed in high-resolution geophysical data throughout the Kortrijk Formation
- Subsurface discontinuities which radially scatter (rather than reflect) incident acoustic energy.
- Potential candidates: steeply dipping interfaces, structural complexities, or isolated features representing a significant and abrupt contrast in acoustic properties.



Valorisation activities

Short note diffraction hyperbolae

- Potential candidates: steeply dipping interfaces, structural complexities, or isolated features representing a significant and abrupt contrast in acoustic properties.
- The latter features may be denser (e.g. due to the presence of clay stones) or less dense (e.g. due to the presence of gas/fluid pockets) than the surrounding sediments.
- Signal polarity of the diffractions is identical to the polarity of the seabed reflection => features have a higher acoustic impedance than the overlying/surrounding sediment

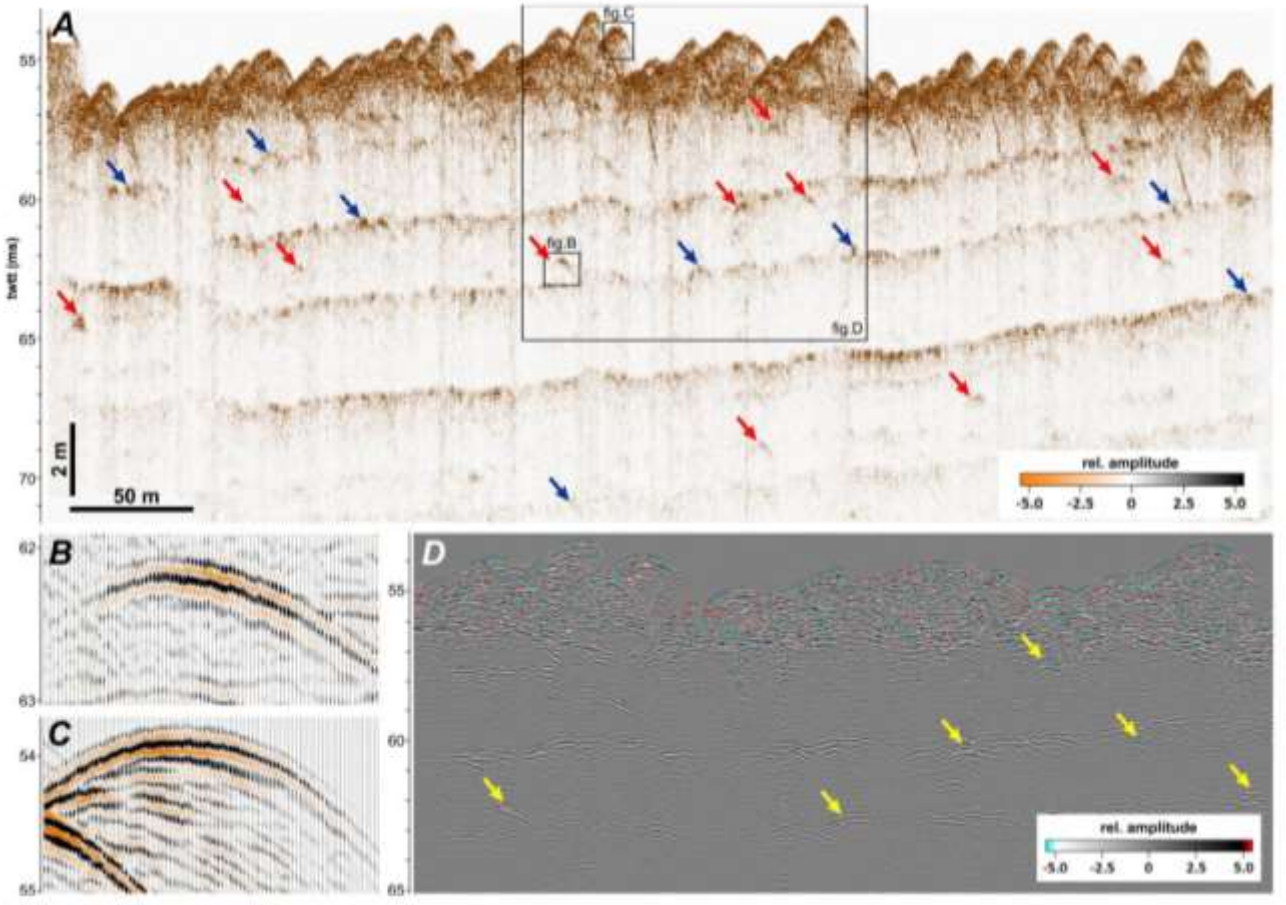


Valorisation activities

Short note diffraction hyperbolae

The vertical distribution of the diffraction hyperbolae through the profiles appears rather random, although two categories can be distinguished:

- (i) diffraction hyperbolae linked to reflection horizons (blue arrows)
- (ii) isolated diffraction hyperbolae (reds arrows)



Valorisation activities

Short note diffraction hyperbolae

- In contrast to the Boom Formation (clay layer with well described horizons with hard concretions (so-called septaria)), the literature makes little reference of (sizeable) nodules in the Kortrijk Formation.
- Recently, more detailed observations of nodules have been made in a clay quarry in the Member of Aalbeke.
- It was reported that the nodules (with diameters of several decimeters) were not confined to a specific horizon but appeared scattered throughout the entire clay layer.

Figure 4. *Pictures of concretions that were observed in the Member of Aalbeke (Kortrijk Formation) in a clay quarry of Wienerberger nv (Reyniers 2020).*

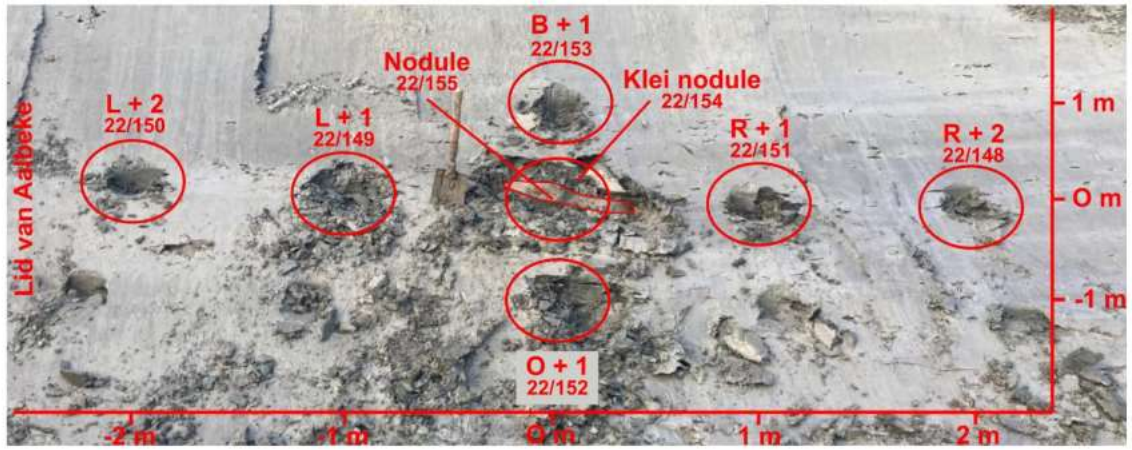


Figure 5. *Picture of the sampling strategy that was applied in the vicinity of a clay nodule in the Kortrijk Formation by Croenen (2022).*

Valorisation activities

Short note diffraction hyperbolae

- Siderite- and phosphate-bearing carbonate nodules
- A rather fine and soft texture with no internal fissures (septae).

These nodules may be a valid candidate to explain the diffraction hyperbolae in the profiles of the parametric echosounders.

Claystone layers within the Ieper Clay Group were also included as a geohazard for the installation of offshore wind farms in the Geological Desk Study of the Princess Elisabeth Zone

Preliminary results!

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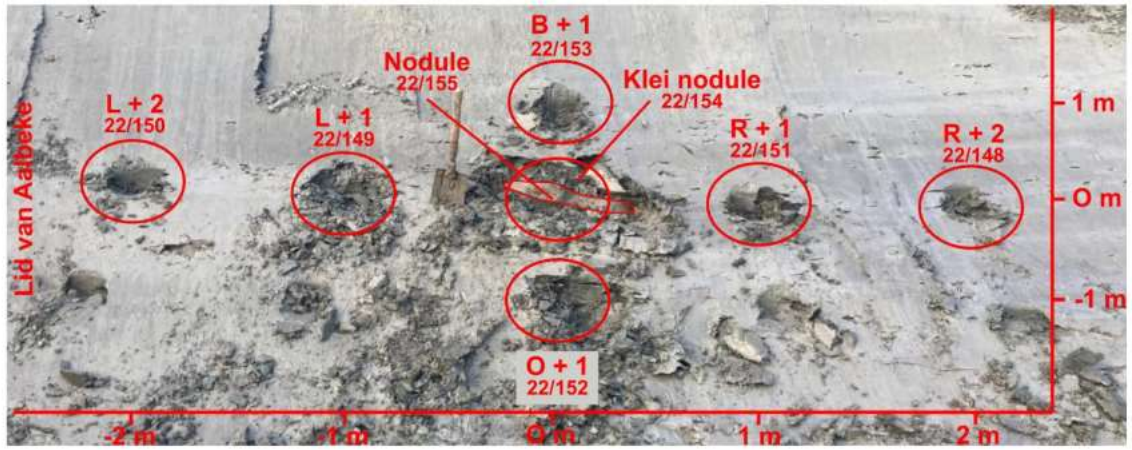

Figure 5. *Picture of the sampling strategy that was applied in the vicinity of a clay nodule in the Kortrijk Formation by Croenen (2022).*

Thanks for the attention!

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OWI lab

VLIZ

UNIVERSITEIT GENT

VLAIO

BLAUWE CLUSTER

samen voor #sterkgroeien