

Clay Tectonics

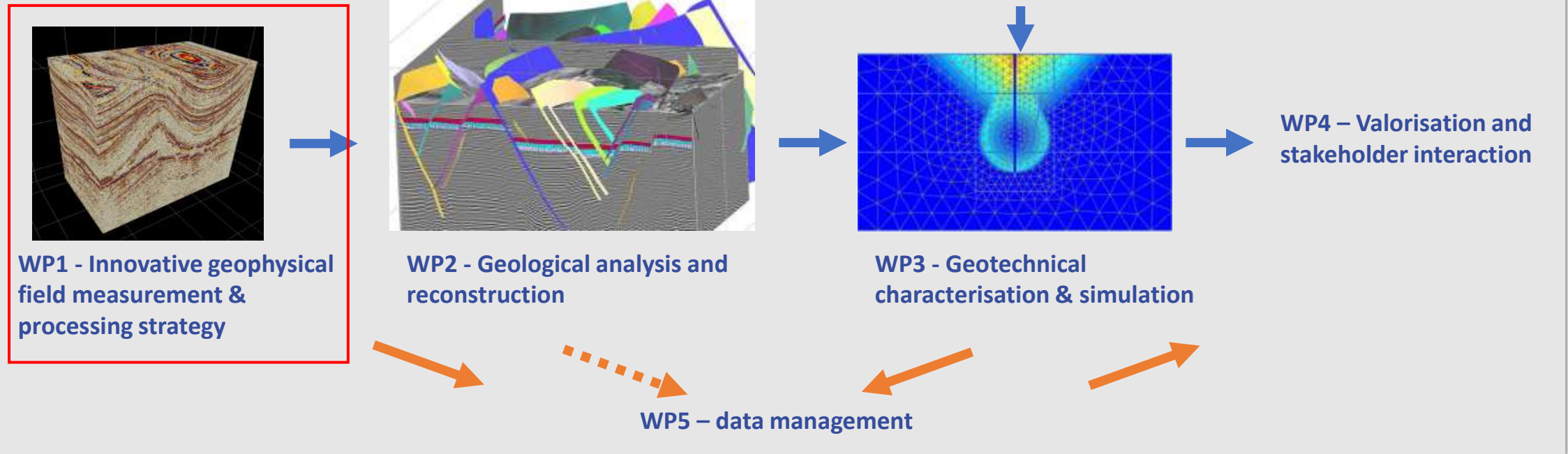
State of affairs and next steps for the geophysical field measurements and processing strategy

Thomas Mestdagh

Industrial Advisory Board Clay Tectonics project – 7 September 2023

Clay Tectonics WP1 - Geophysical field measurements and processing

Clay Tectonics project structure



1. **Deliverables** - D1.1 – Report on the selection of study areas based on available geophysical datasets and literature
2. **Geophysical field measurements** - Update on finished and planned work (2023 – 2024)
3. **Processing strategy** - Overview of next steps

Clay Tectonics WP1 - Geophysical field measurements and processing

1. Deliverables

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

D1.1 – Report on the selection of study areas based on available geophysical datasets and literature

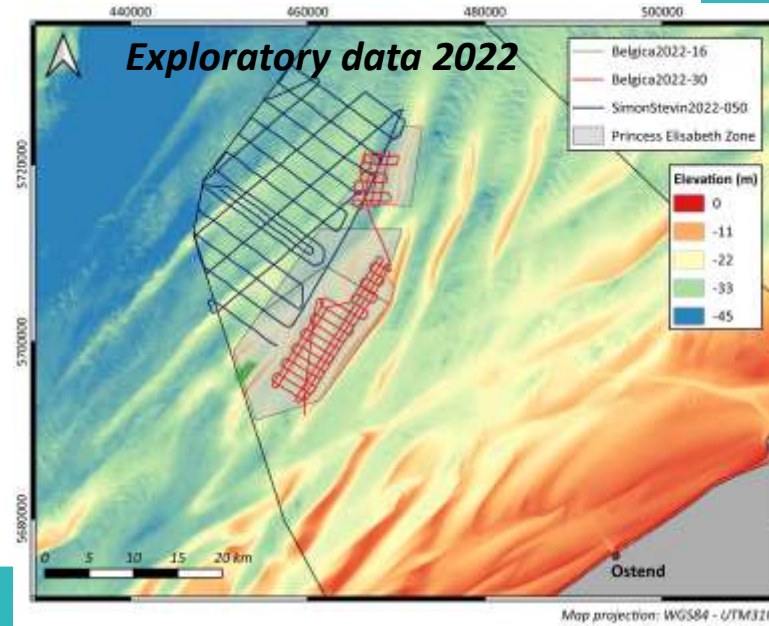
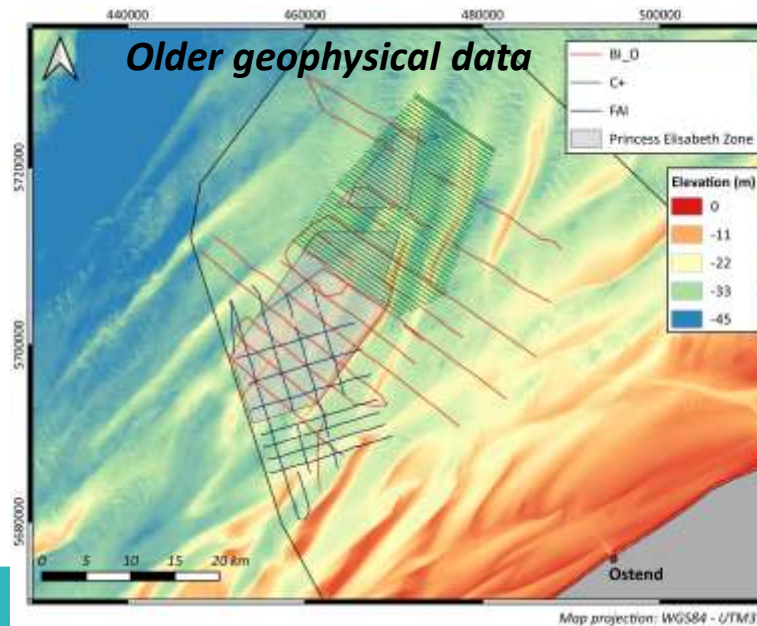
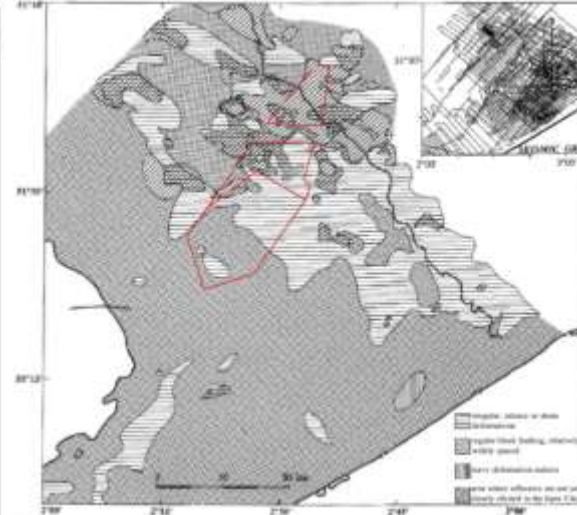
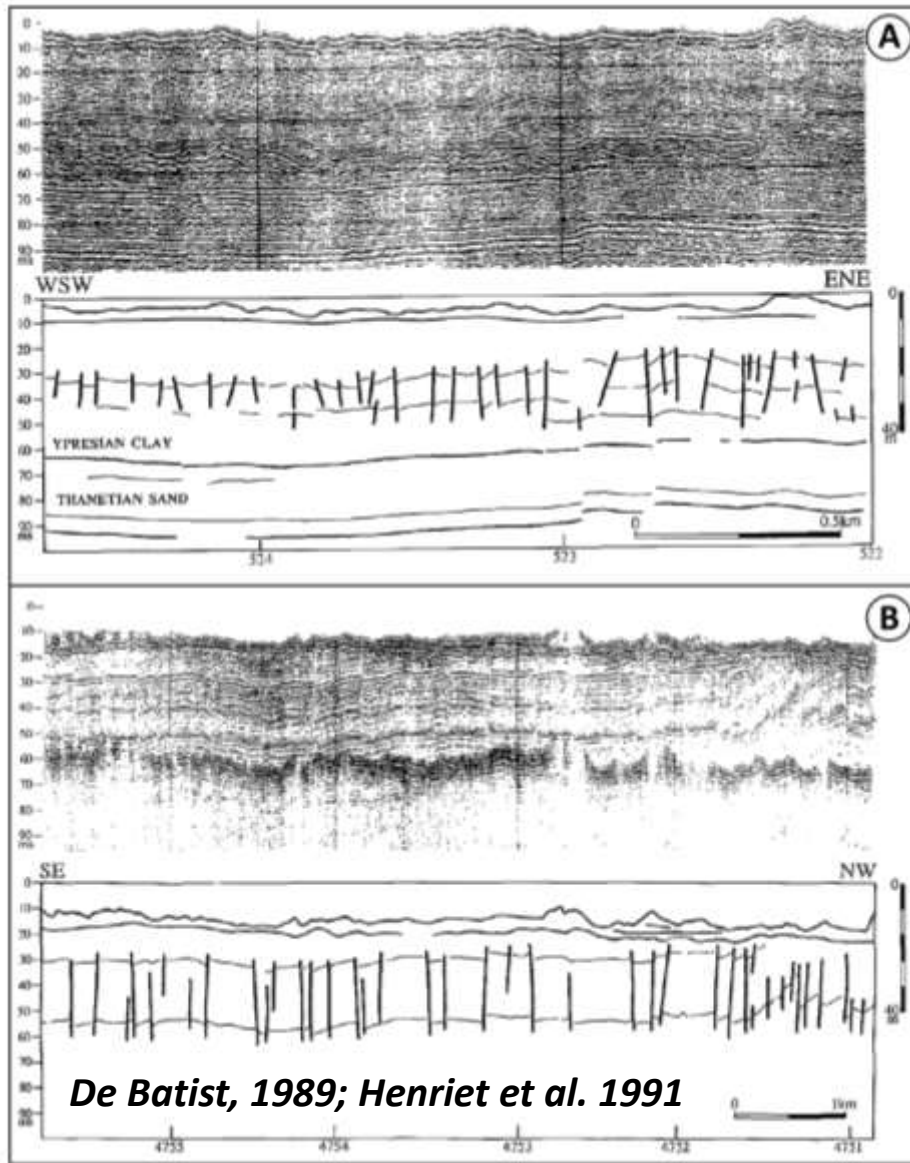
- Information available prior to the project
 - Literature
 - Older geophysical data
 - Exploratory data 2022
- New study areas
 - Criteria
 - Selection

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1. Deliverables

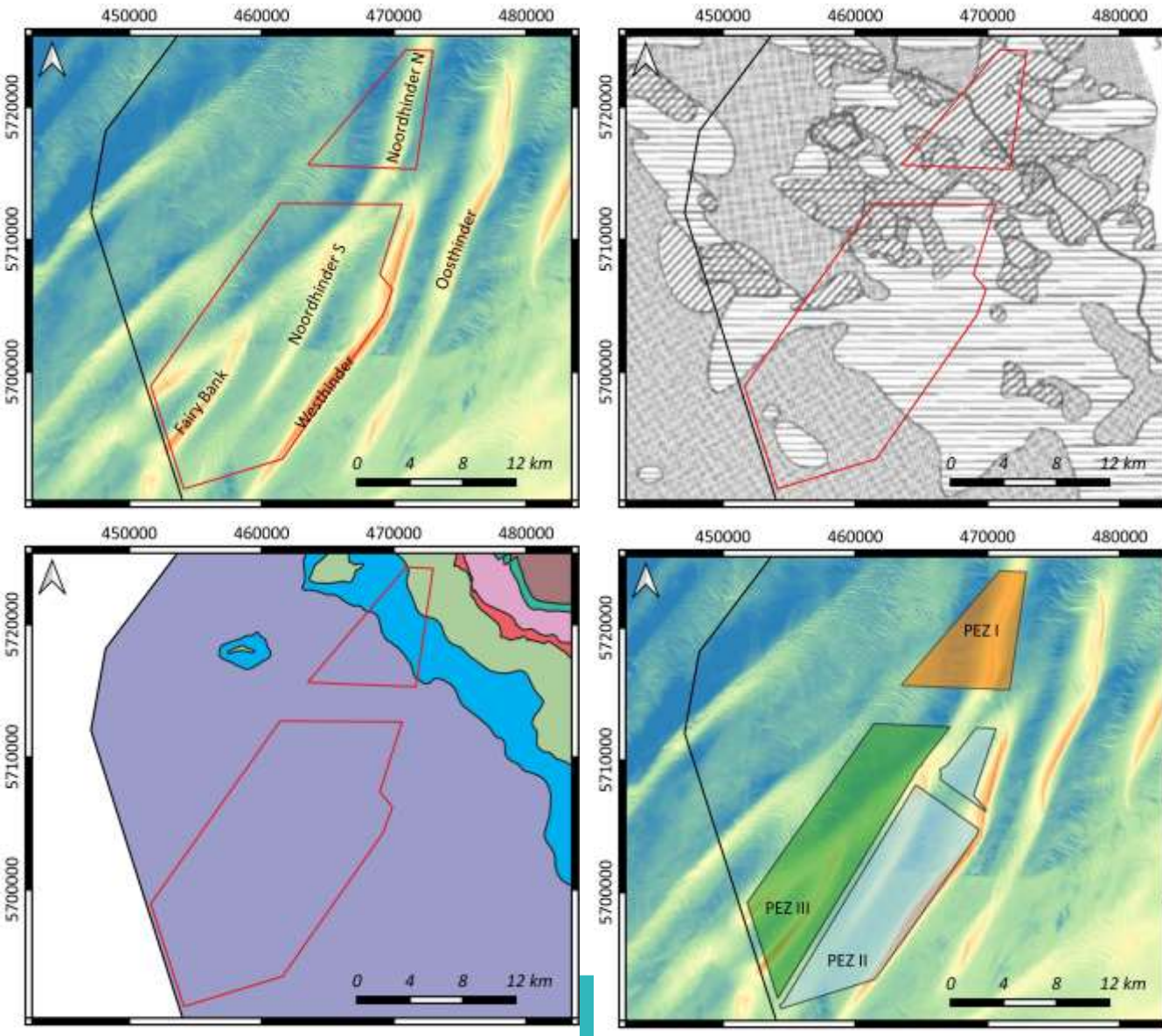
Information available prior to the project

- Literature
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1. Deliverables

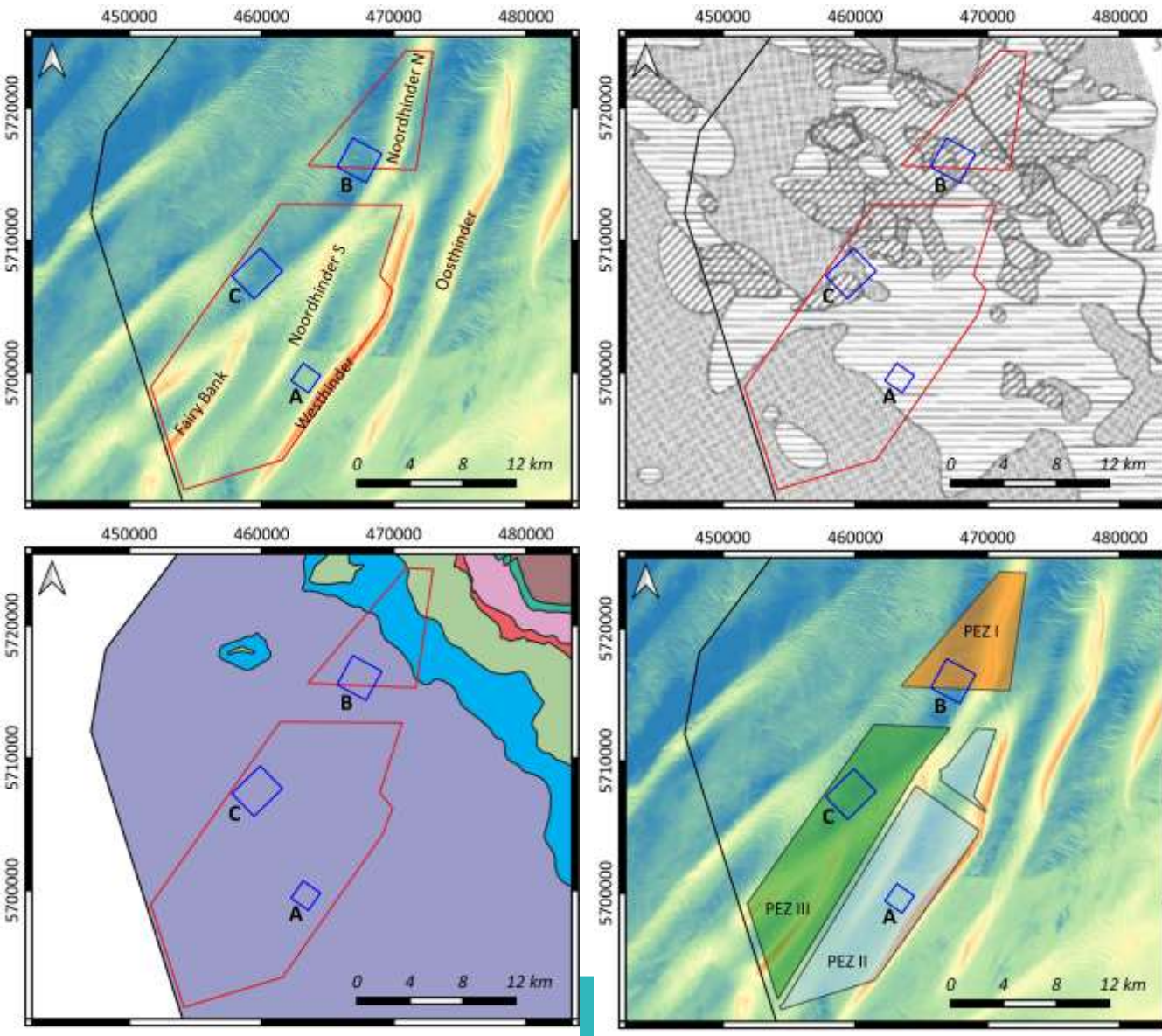


New study areas: criteria and selection

- Presence of identifiable reflectors
- Bottom penetration
- Deformation style variability
- Kortrijk Formation subcrop
- Parcel division Princess Elisabeth Zone
- Size of the study areas and line spacing

Clay Tectonics WP1 - Geophysical field measurements and processing

1. Deliverables



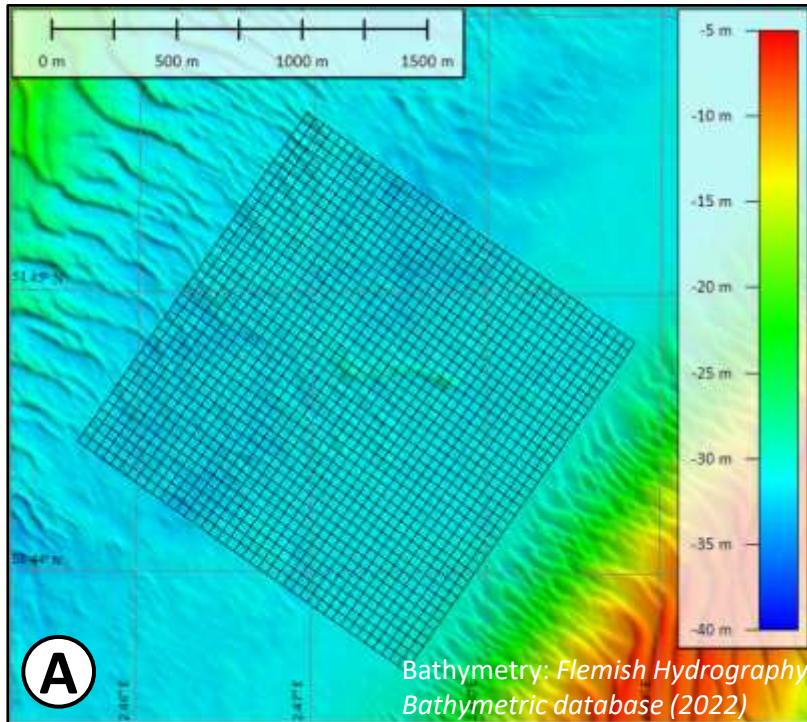
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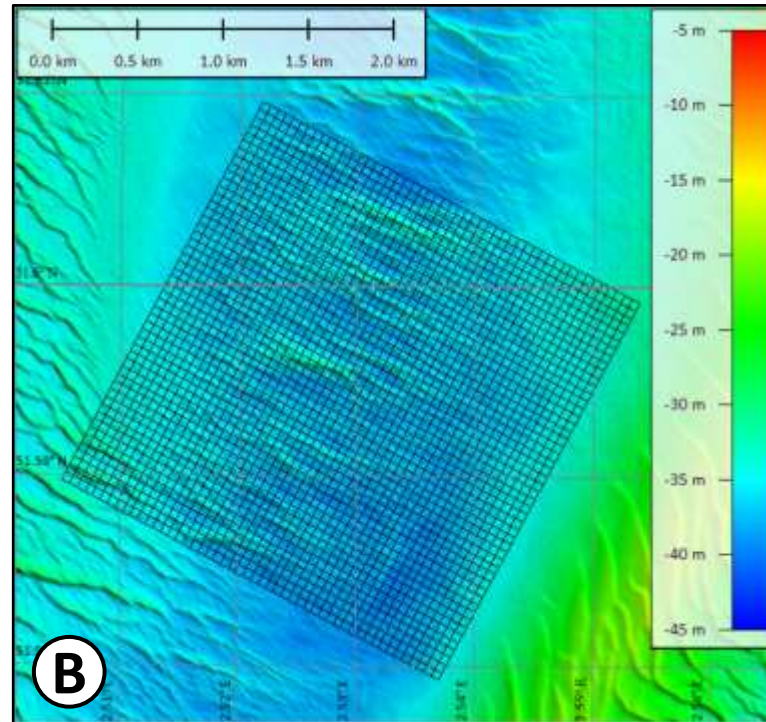
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1. Deliverables

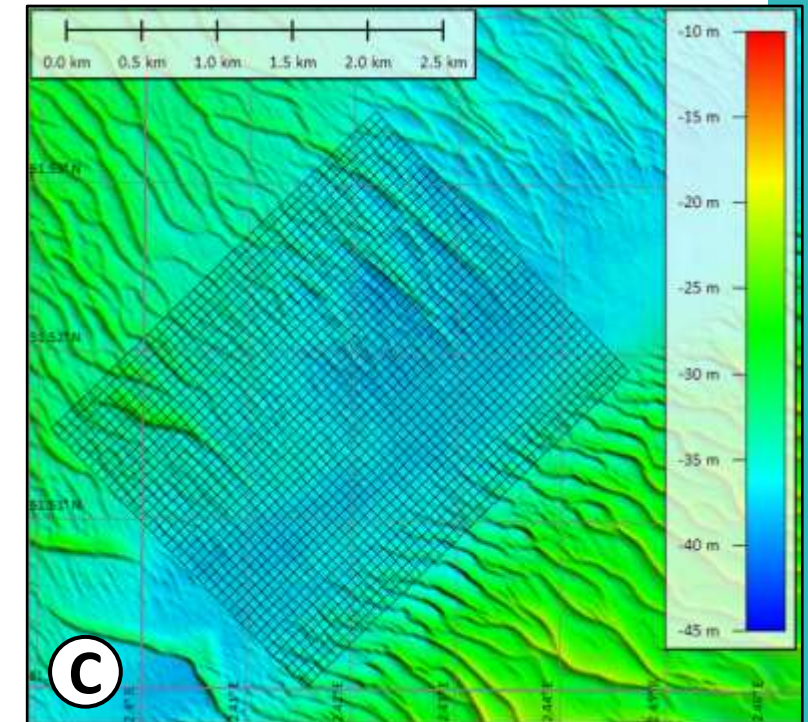
New study areas: criteria and selection



Block A
1.6 x 1.6 km
40 m line spacing (in- and crosslines)



Block B
2.5 x 2.5 km
50 m line spacing (in- and crosslines)

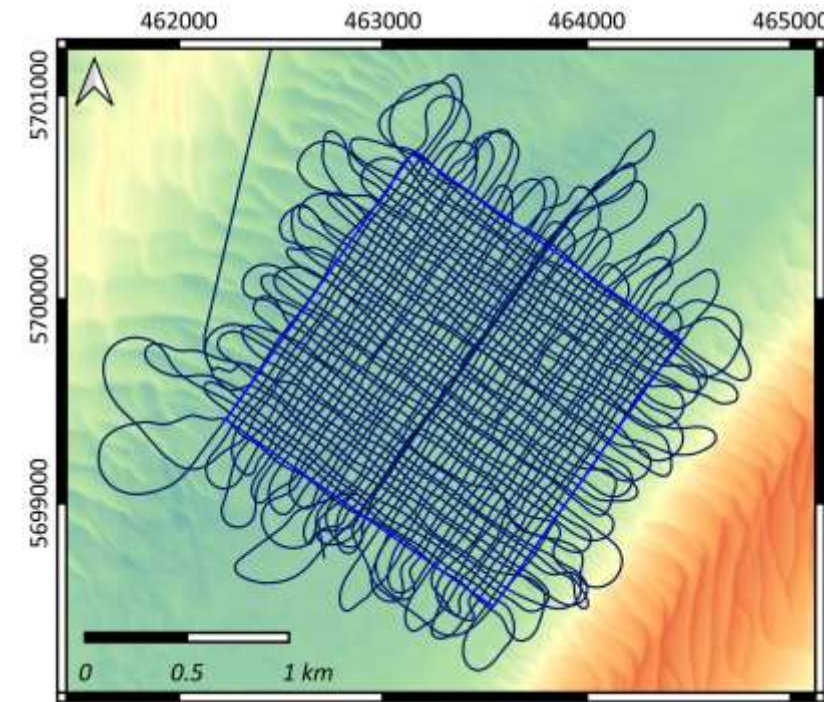


Block C
2.4 x 3 km
60 m line spacing (in- and crosslines)

Clay Tectonics WP1 - Geophysical field measurements and processing

2. Geophysical field measurements 2023 – 2024

Finished work 2023

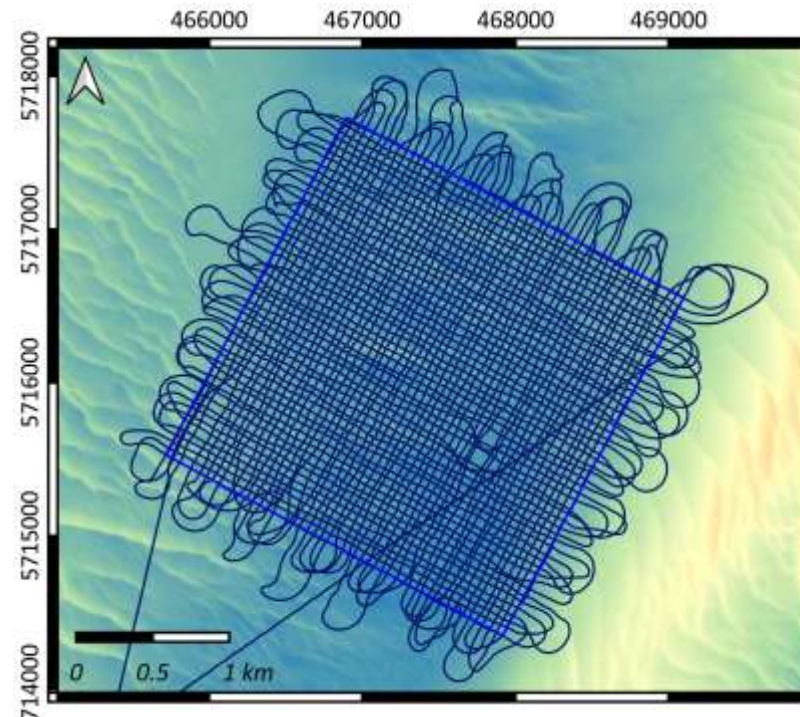


Block A

1.6 x 1.6 km

40 m line spacing (in- and crosslines)

RV Simon Stevin February 2023

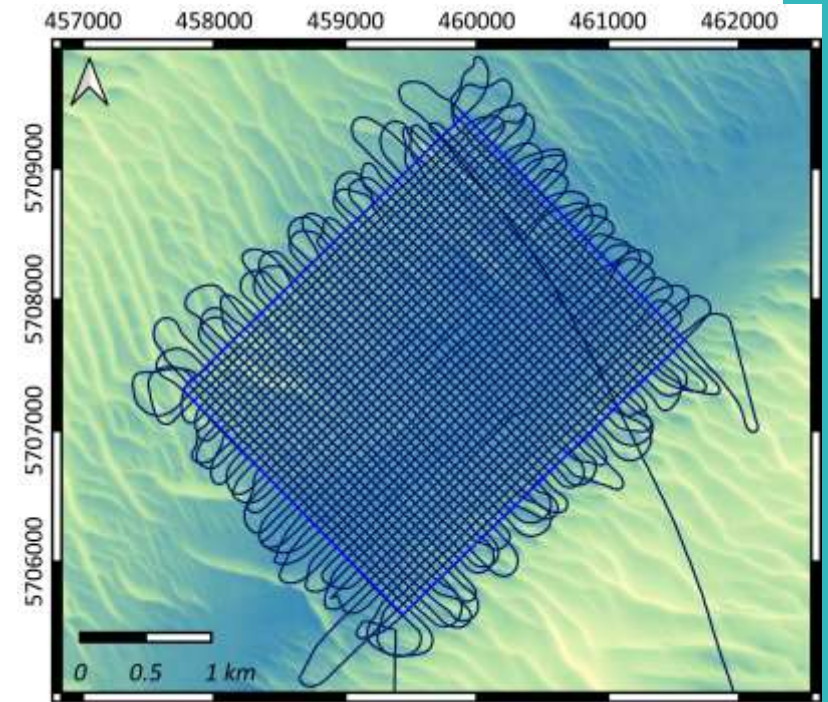


Block B

2.5 x 2.5 km

50 m line spacing (in- and crosslines)

RV Simon Stevin February 2023



Block C

2.4 x 3 km

60 m line spacing (in- and crosslines)

RV Simon Stevin April 2023

Clay Tectonics WP1 - Geophysical field measurements and processing

2. Geophysical field measurements 2023 – 2024

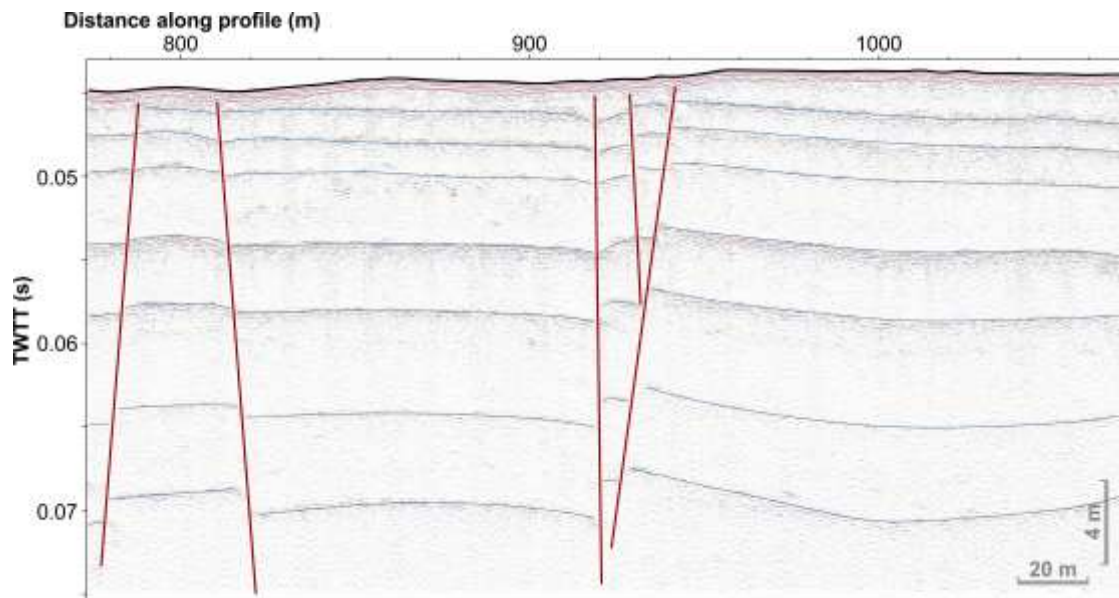
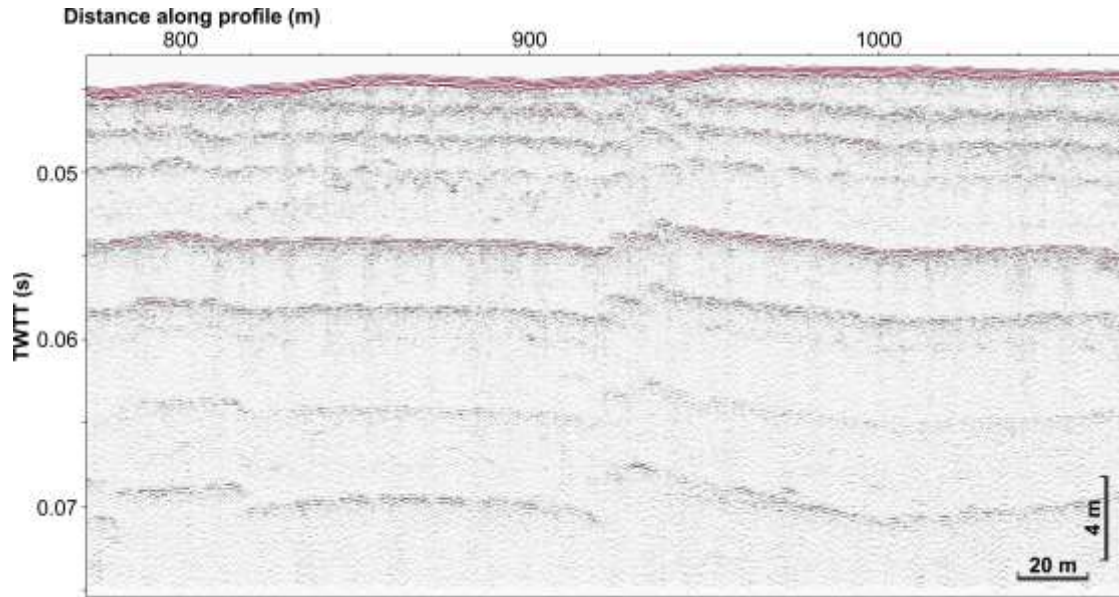


Finished work 2023

METHOD	COVERAGE
Parametric sub-bottom profiler High-frequency channel Low-frequency channel microPAM recorder	all lines A, B, C all lines A, B, C tested on selected lines A
Sparker 24-channel streamer 2-channel streamer	alternating with 2-channel A, B, C alternating with 24-channel A, B, C
Multibeam echosounder Bathymetry Backscatter Water column	full coverage A, B, C full coverage A, B, C selected lines A, B

Clay Tectonics WP1 - Geophysical field measurements and processing

2. Geophysical field measurements 2023 – 2024



Planned work

○ RV Belgica campaign November 2023

○ AUV Barabas

- Small grids with closely spaced lines
- Focus on smallest-scale fault attributes
- Sub-bottom profiling (chirp)
- Side scan sonar



○ Additional (ship-based) acoustics

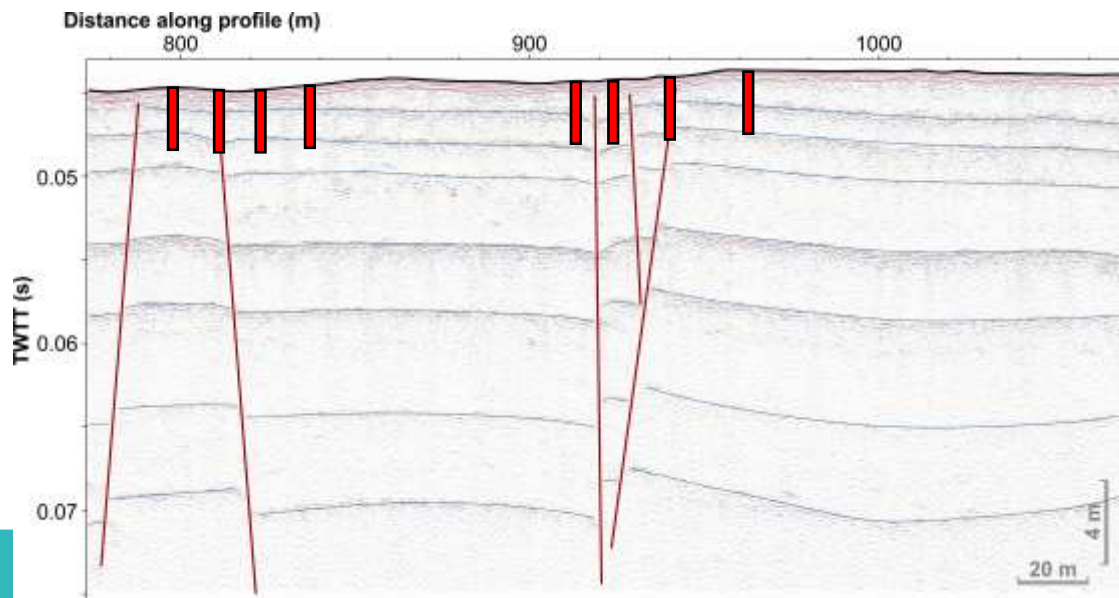
Clay Tectonics WP1 - Geophysical field measurements and processing

2. Geophysical field measurements 2023 – 2024



Planned work

- Shiptime request RV Simon Stevin 2024
 - Vibrocoring
 - Ground-truthing of reflectors
 - Transects across faults
 - Additional (ship-based) acoustics



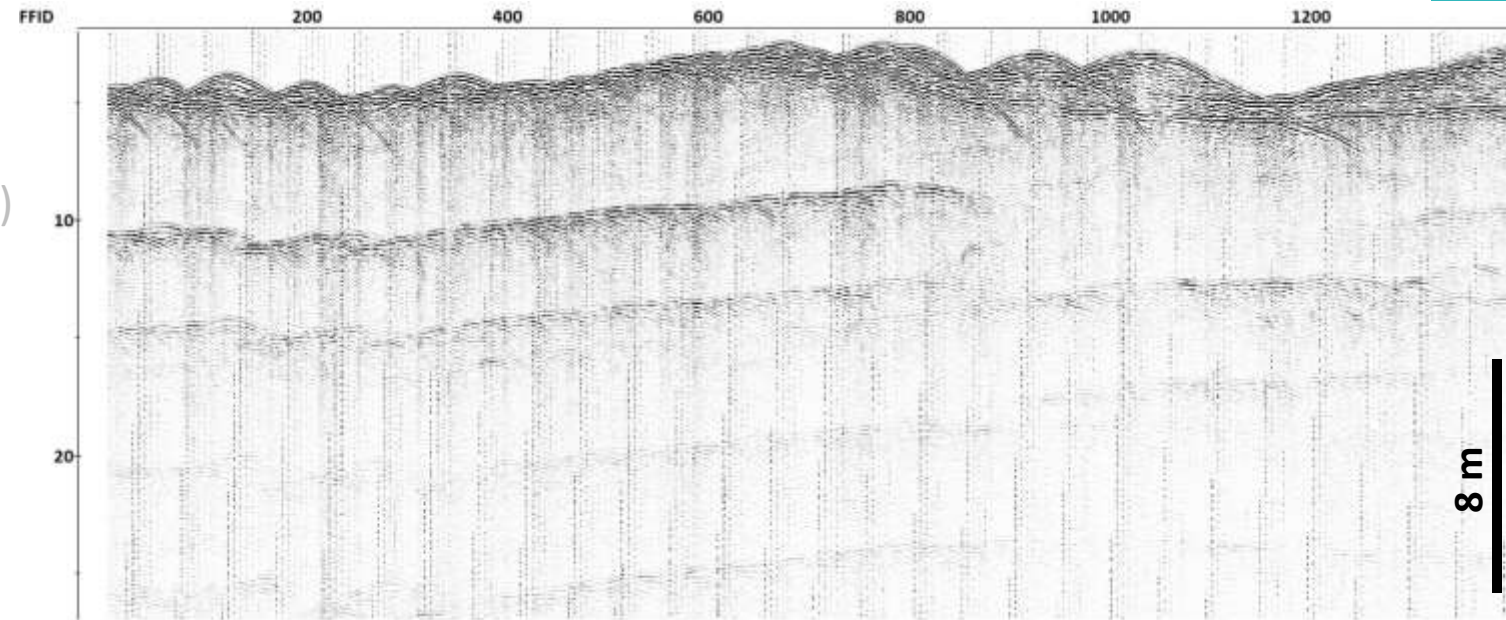
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3. Processing strategy

1. Parametric sub-bottom profiles

Finished: design and testing processing flow

- Navigation QC/processing
- Burst noise removal (sparker interference)
- Frequency filtering
- Amplitude balancing
- 2D spatial filtering
- Tidal correction



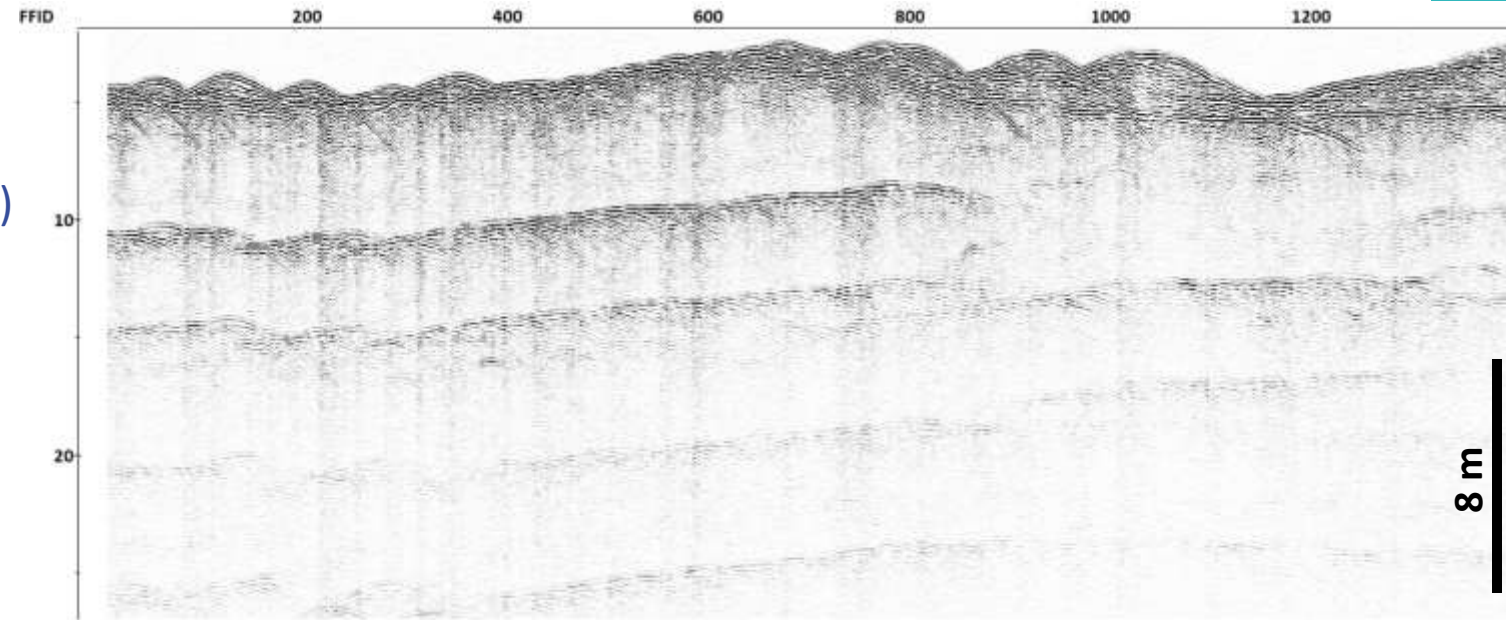
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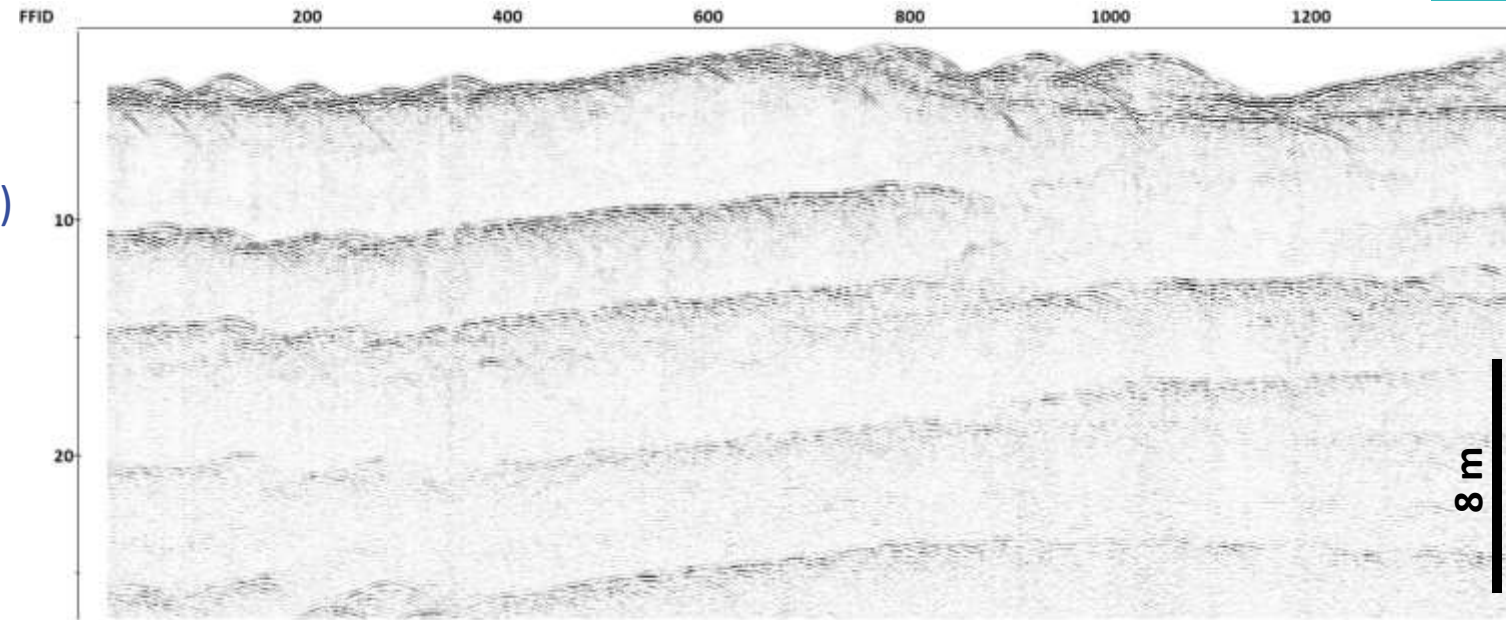
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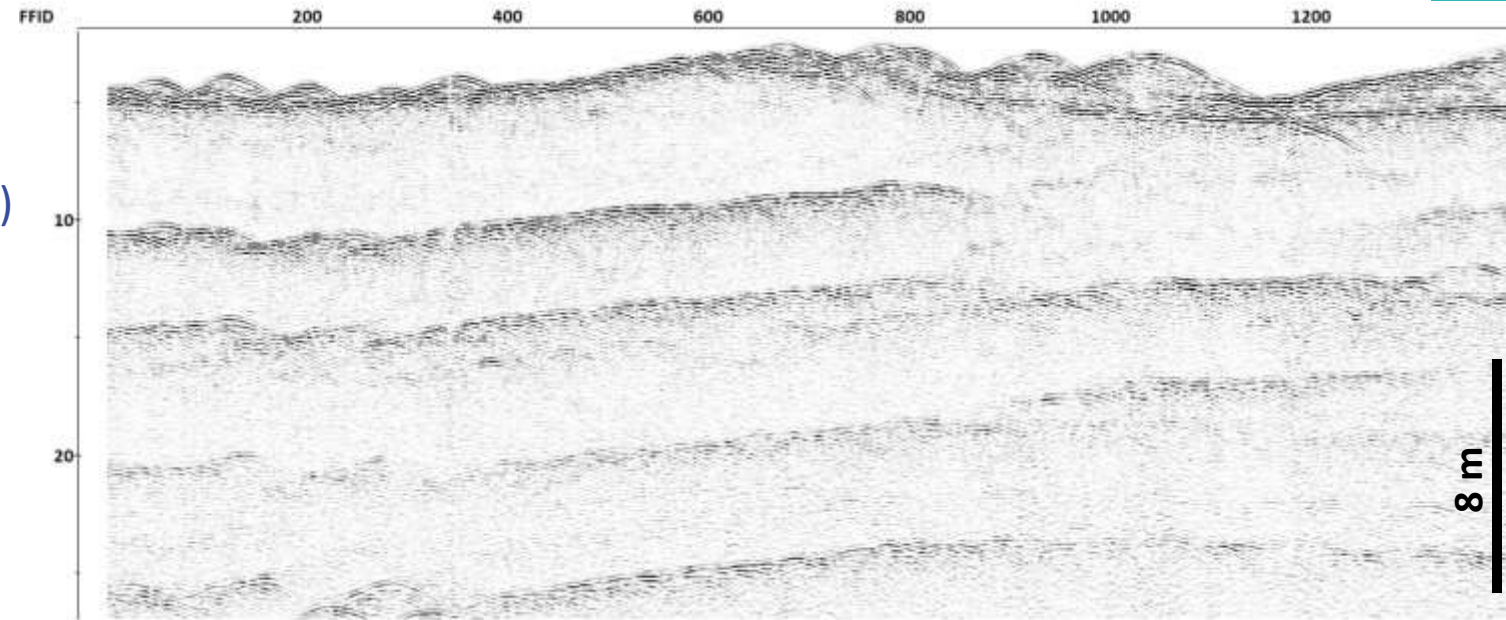
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Next: batch processing



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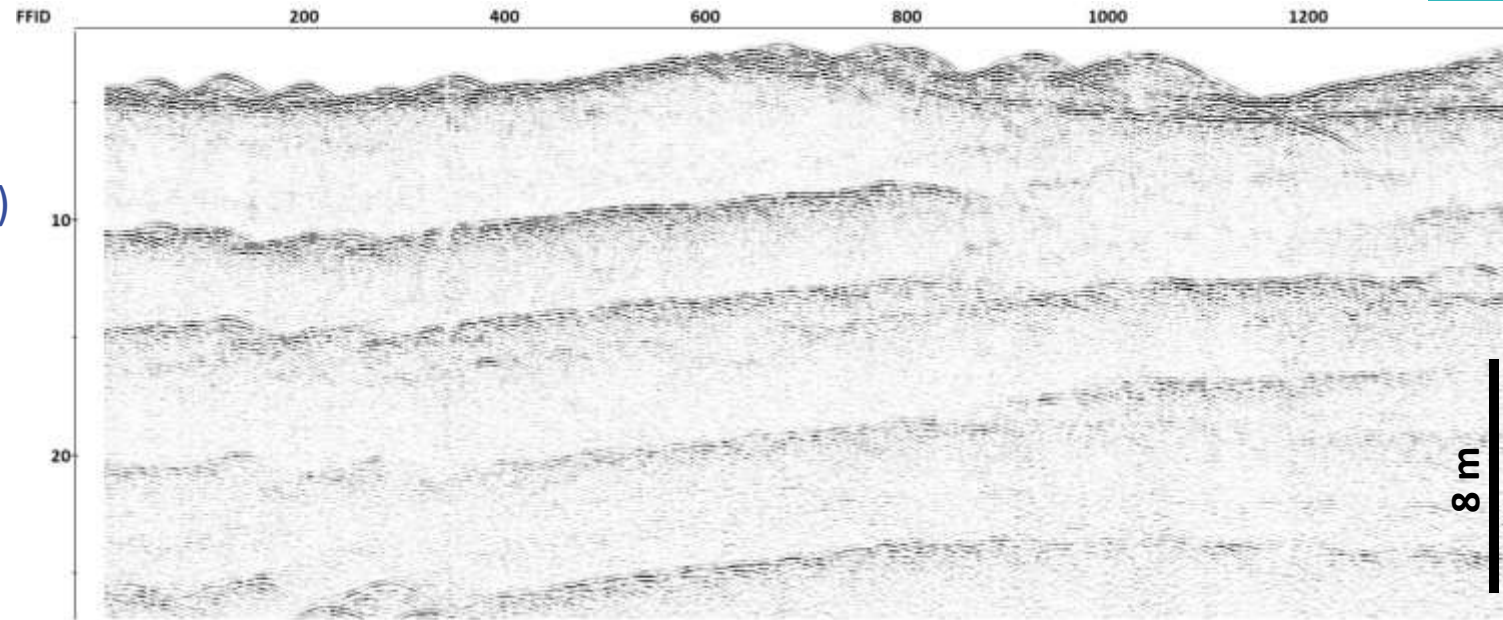
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Next: batch processing

2. Sparker profiles

Ongoing: design and testing processing flow



Clay Tectonics WP1 - Geophysical field measurements and processing

3. Processing strategy

1. Parametric sub-bottom profiles

Finished: design and testing processing flow

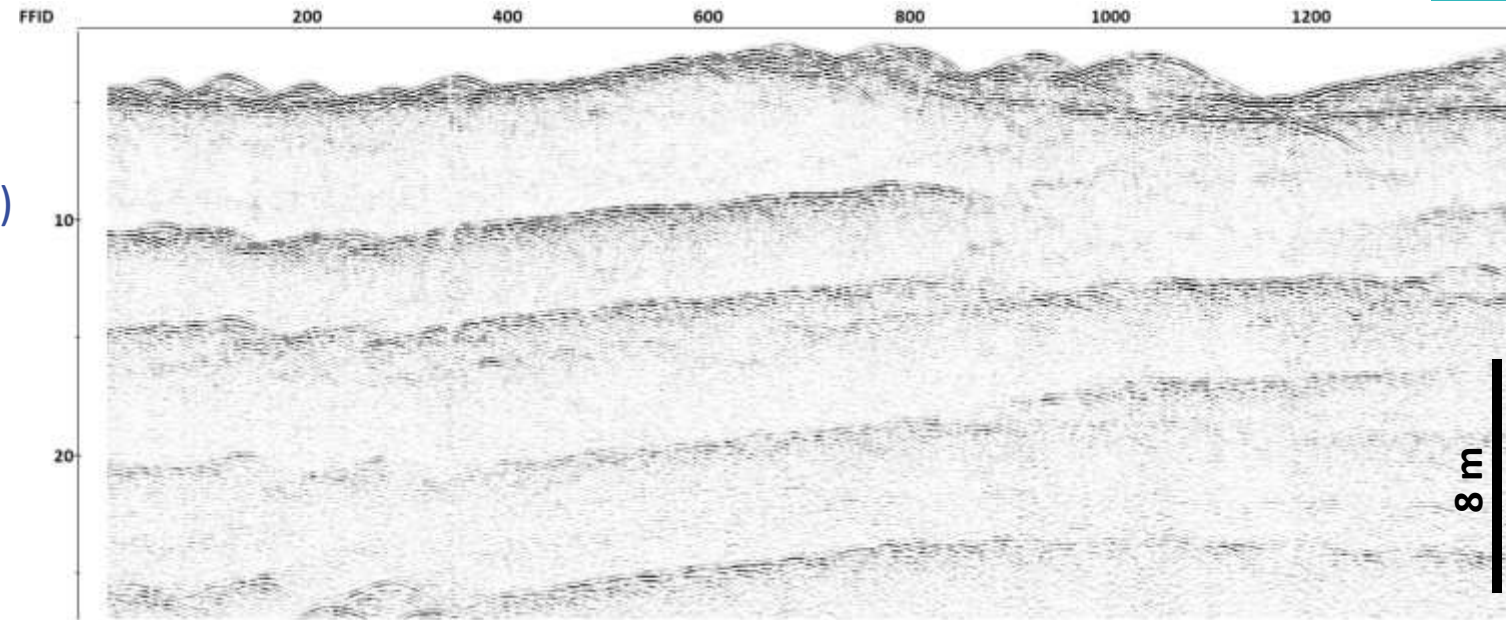
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Next: batch processing

2. Sparker profiles

Ongoing: design and testing processing flow

3. Data fusion and visualisation



Thank you!

Contact:

thomas.mestdagh@vliz.be

Seascapes Past & Future:

www.vliz.be/en/seascapes-past-future



De Batist, M. (1989). Seismostratigrafie en structuur van het paleogeen in de Zuidelijke Noordzee – Volume 1: tekst. PhD Thesis. Rijksuniversiteit Gent, Faculteit der Wetenschappen: Gent. 107 pp.

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