

# Proceedings of the 11<sup>th</sup> Workshop “Seabed Acoustics”, Presentation P06:

## Extensive channel systems, gas indicators, and infrastructure — A multi-sensor geophysical site investigation of the subsoil in the North Sea

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5<sup>th</sup> November 2025



Extensive channel systems, gas indicators, and  
infrastructure —  
A multi-sensor geophysical site investigation of  
the subsoil in the North Sea

Innomar Workshop "Seabed Acoustics" 2025



## Agenda

### Data Acquisition

- Equipment
- Survey

### Data Processing

- Pre-processing
- Processing
- Tide Correction

### Interpretation

- Subsoil Stratigraphy
- Channel Structures
  - SBP
  - MCS
- Gas Indicators
- Anthropogenic Features

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## Data Acquisition - Survey

- Area: North Sea
- Total survey length: 2392.51 km
- Layout: 2D line grid at 150 m spacing (inline & crossline)
- Survey speed: 4 kn
- Duration: ~ 2 months in spring/summer



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## Data Acquisition - Equipment

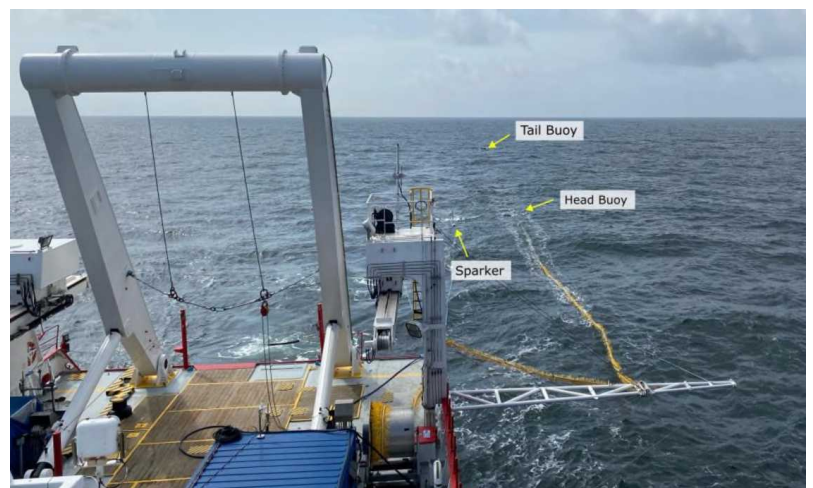
- **Innomar Medium 100**
  - Secondary low freq.: 6 kHz
  - Ping Interval: 9 Hz
  - Pulse form: Single Pulse
  - Power: 100%
  - HF/LF Gain setting: 4/5 dB
  - Recording: full wavefield
  - Max. file size 512 MB



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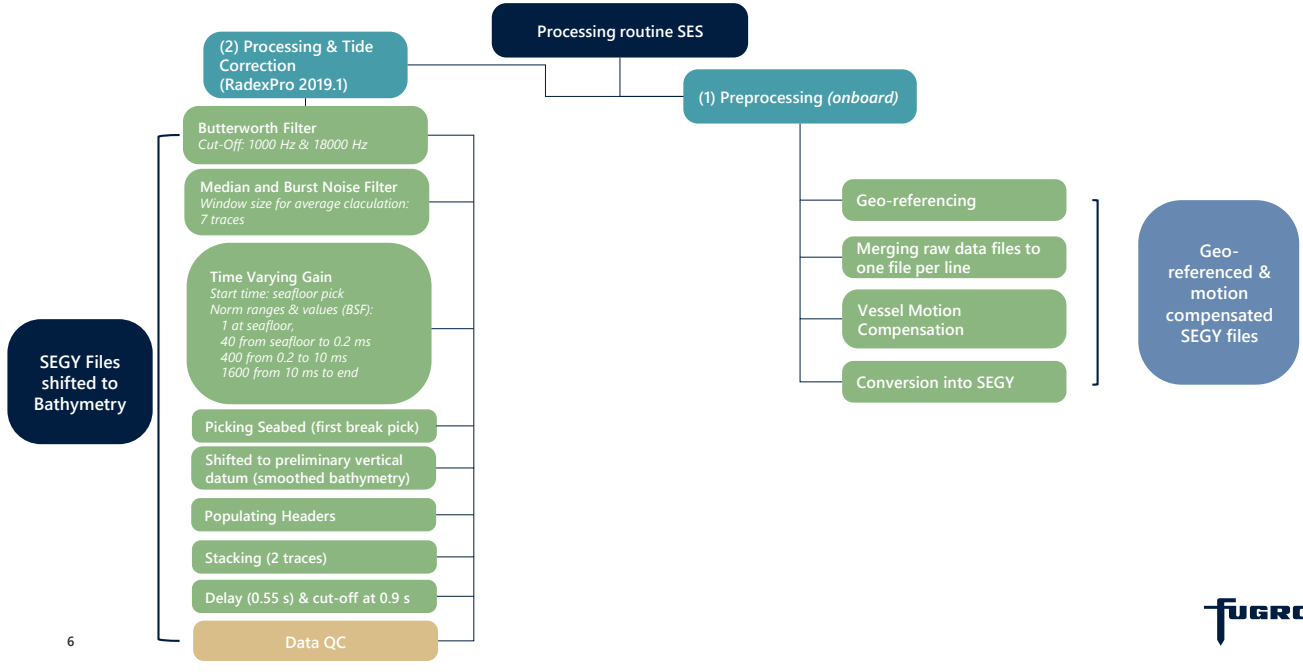
## Data Acquisition - Equipment

- **Multichannel Seismic (Sparker)**
  - Dura-Spark 400+400 by Applied Acoustics
  - Frequency Spectrum: ~ 300 – 2000 Hz
  - Pulse length: 0.5 – 1.5 ms
  - Shot rate: 0.5 s
  - No. channels: 120
  - Depth control: between 0.6 and 0.9 m



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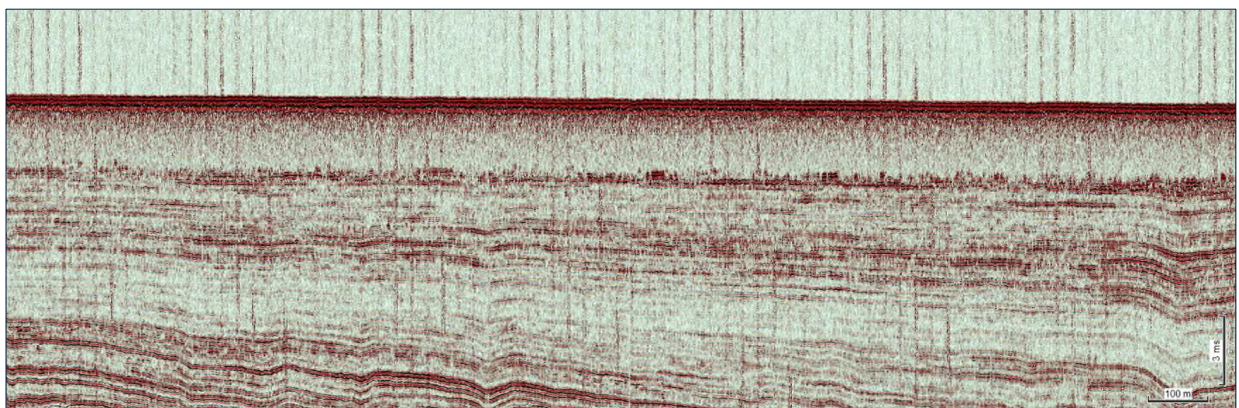
## SBP Data Processing Flow Summary



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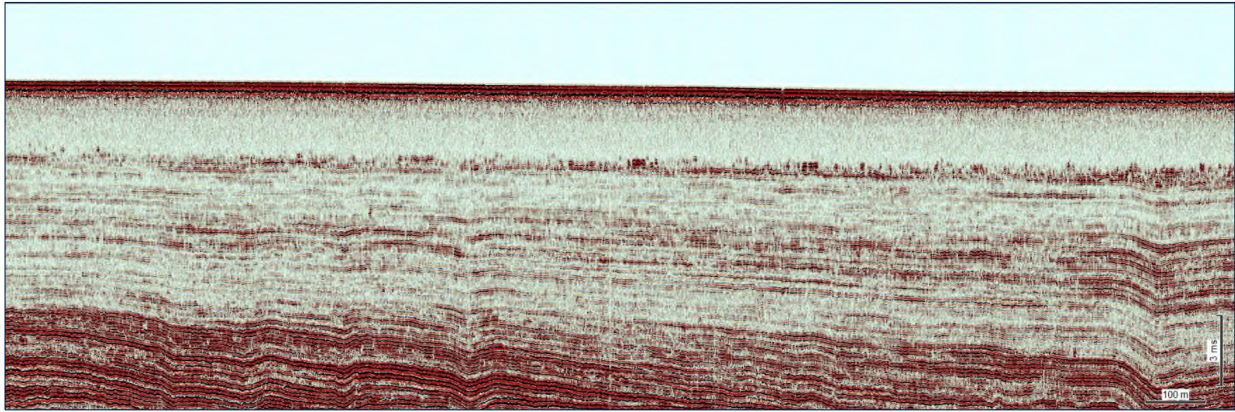
## SBP Data - pre-processed



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## SBP Data – tide corrected



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## Simplified geological history of the area

### Notable periods:

- Saale Glaciation (300,000 - 130,000 years ago) – **yellow line**
  - Multiple glacial cycles, far-reaching ice sheets
- Weichselian Glaciation (115,000 - 11,700 years ago) - **red line**
  - Multiple glacial cycles
  - Less extent, ice did not reach the German North sea
  - Last Glacial Maximum (LGM) around 21,000 years ago
- Holocene (11,700 years ago – present)
  - Sea rise, warming



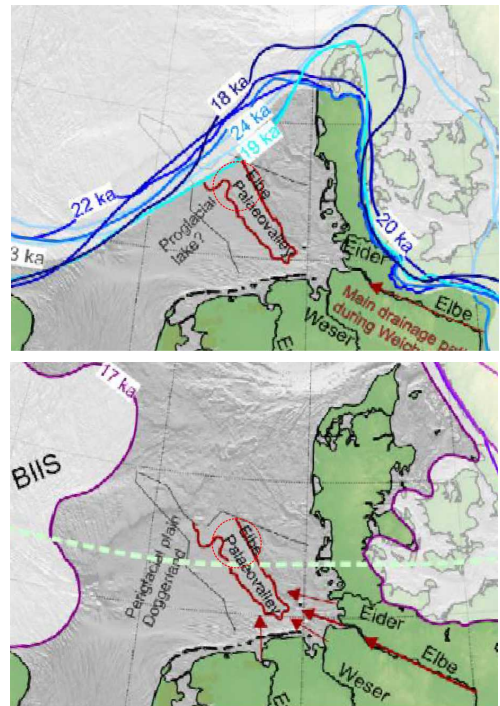
Christian Fischer, Wikipedia  
File:EisrandlagenNorddeutschland.jpg - Wikimedia Commons

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## Our survey area

- At the edge of the last ice sheet
- In Elbe Palaeovalley
- Later lake
  - Glacial runoff
  - Sea transgressions
- Finally energetic North Sea

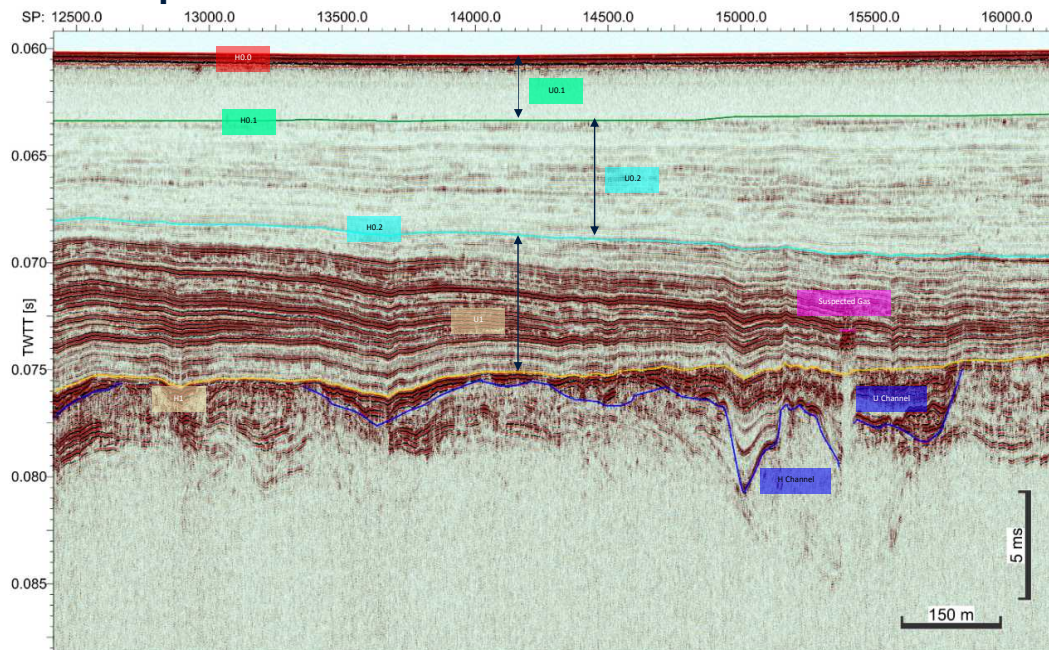


Hughes et al., 2016



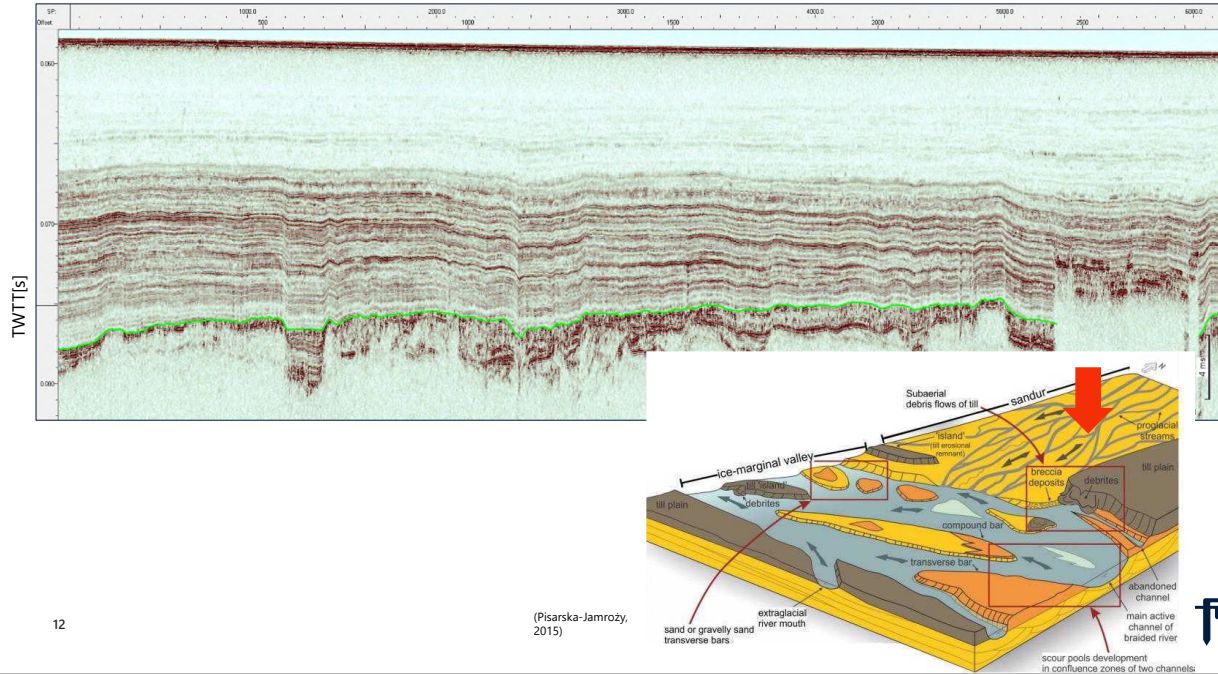
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## SBP Interpretation – Overview



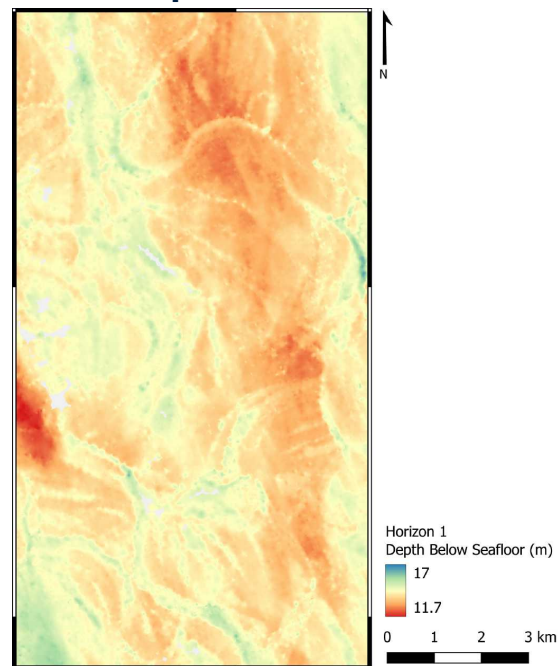
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## SBP Interpretation – H1 (erosional surface)



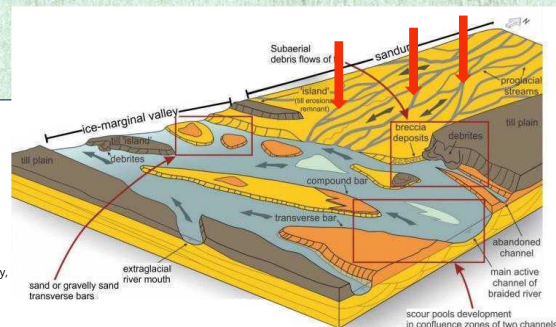
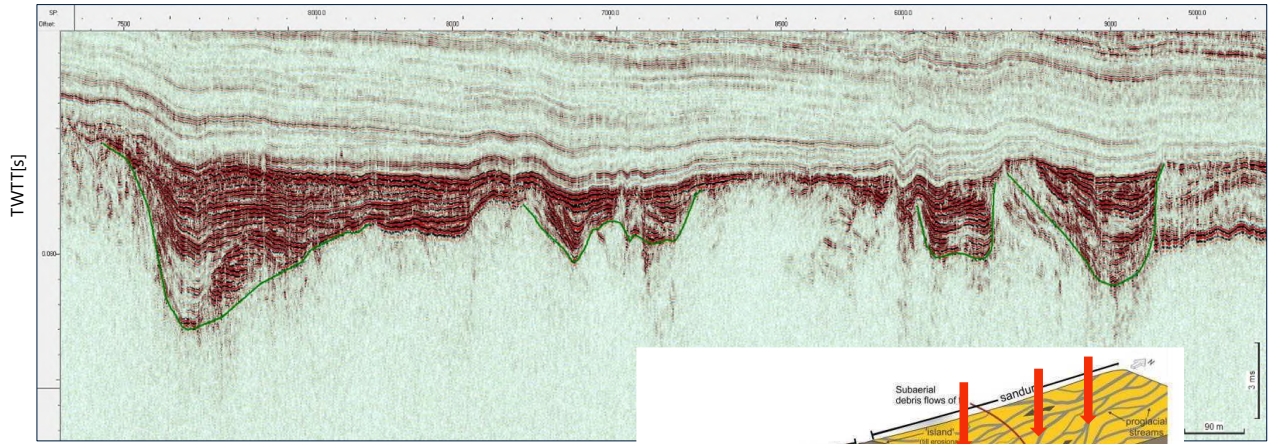
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## SBP Interpretation – H1 (Depth Below Seafloor)



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## SBP Interpretation – Channels

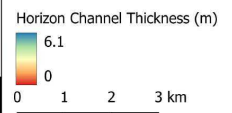
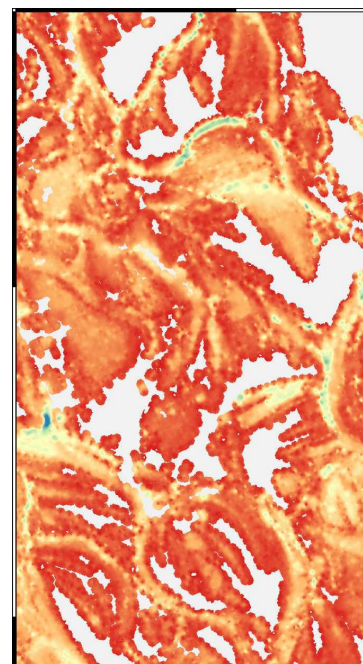
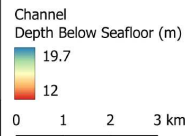
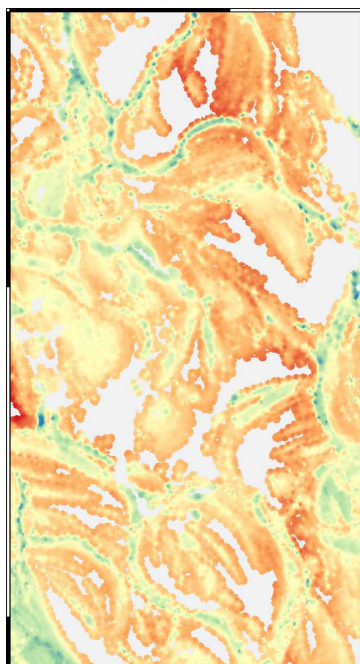


(Pisarska-Jamroz, 2015)



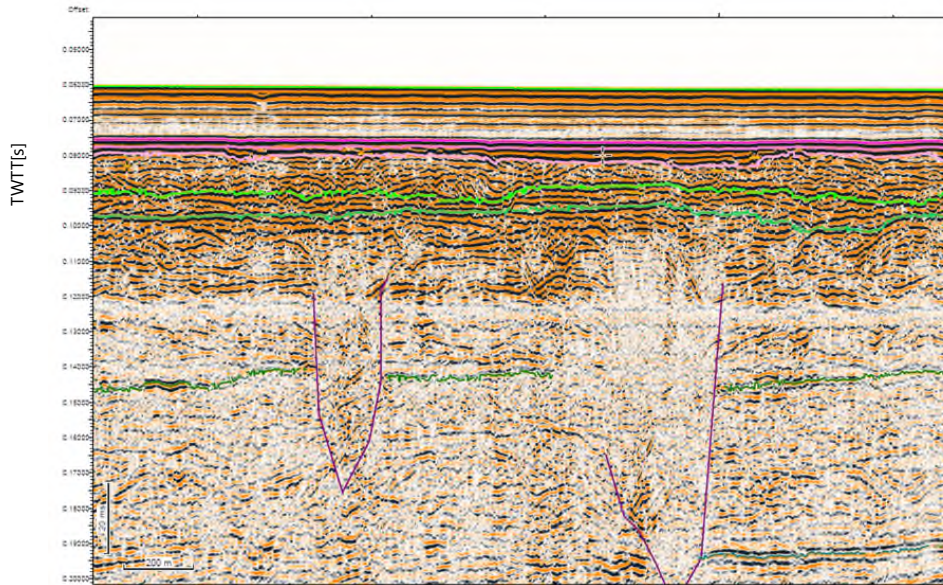
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## SBP Interpretation – Channels



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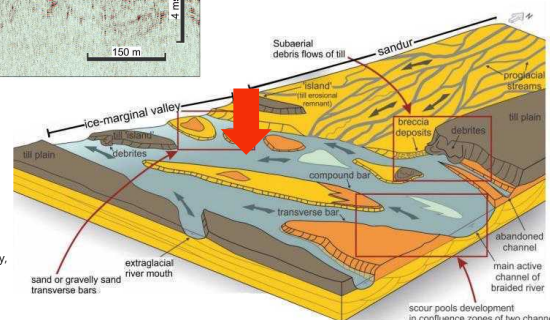
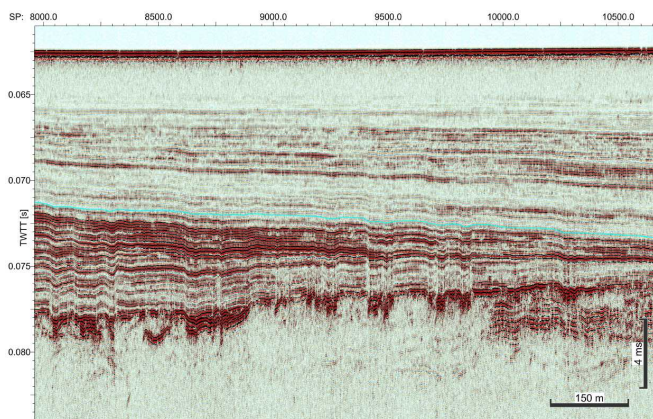
## Bonus – MCS channels from previous epoch



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## SBP Interpretation – H0.2 (lacustrine + marine deposition)

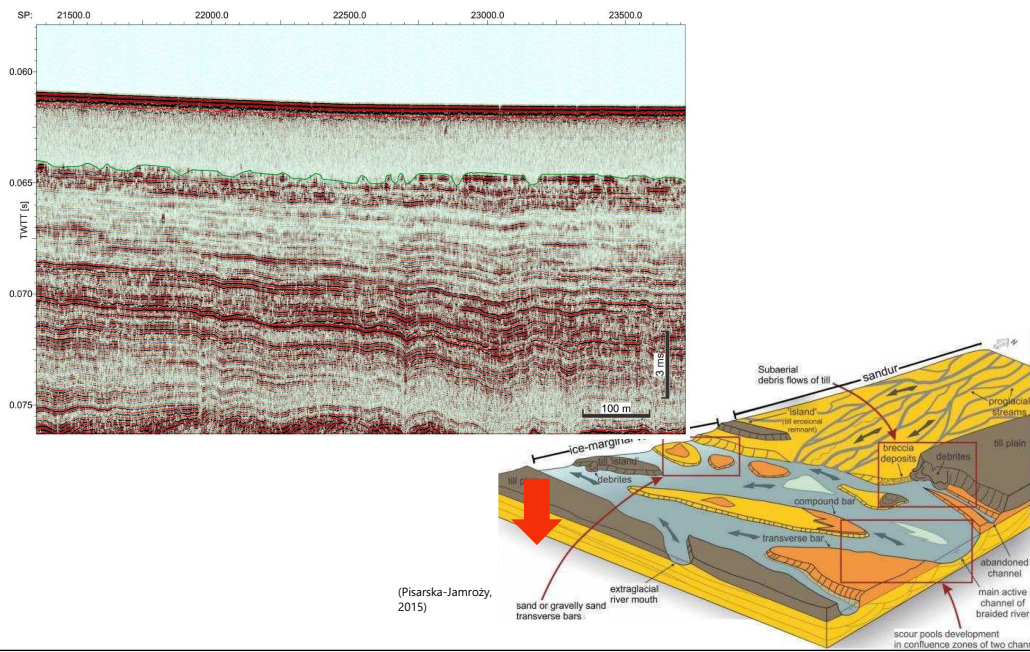


(Pisarska-Jamroz, 2015)



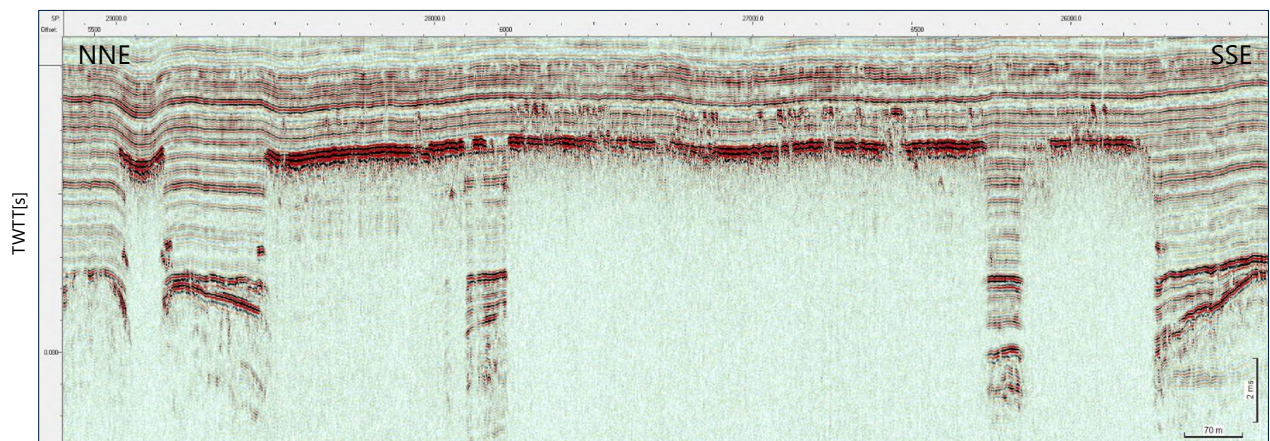
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## SBP Interpretation – H0.1 - Seabed (Marine deposition)



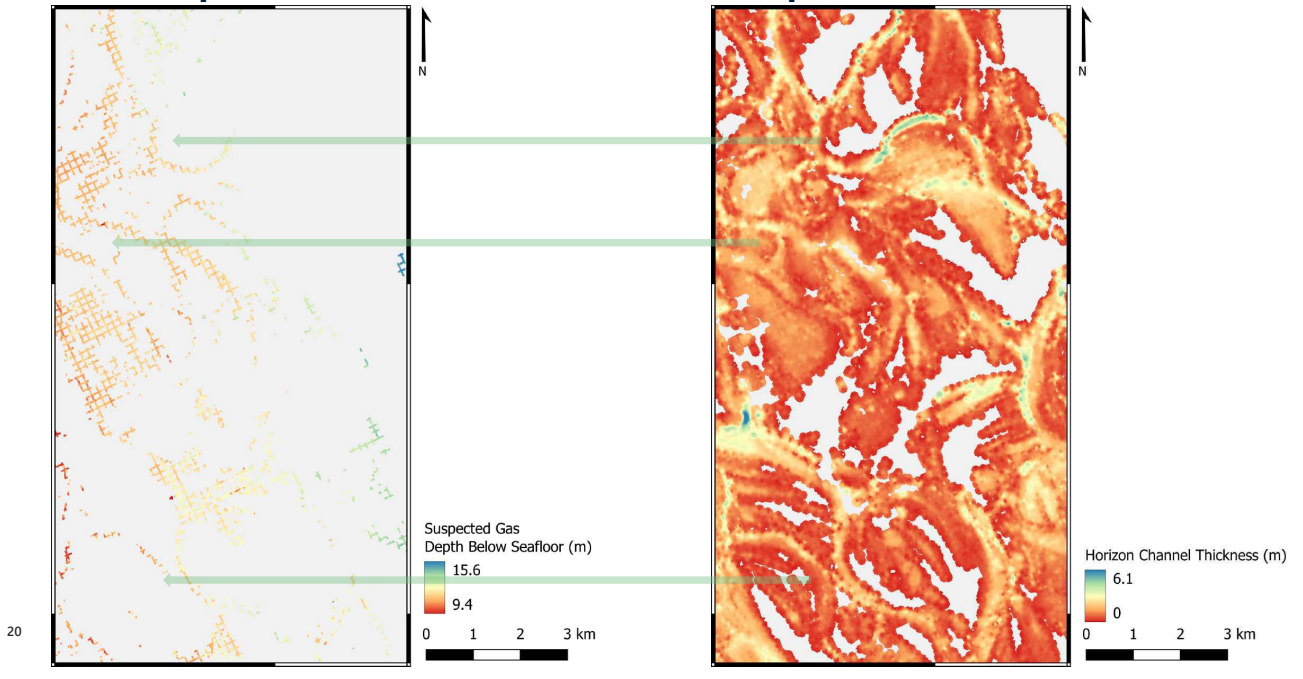
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## SBP Interpretation – Shallow Gas

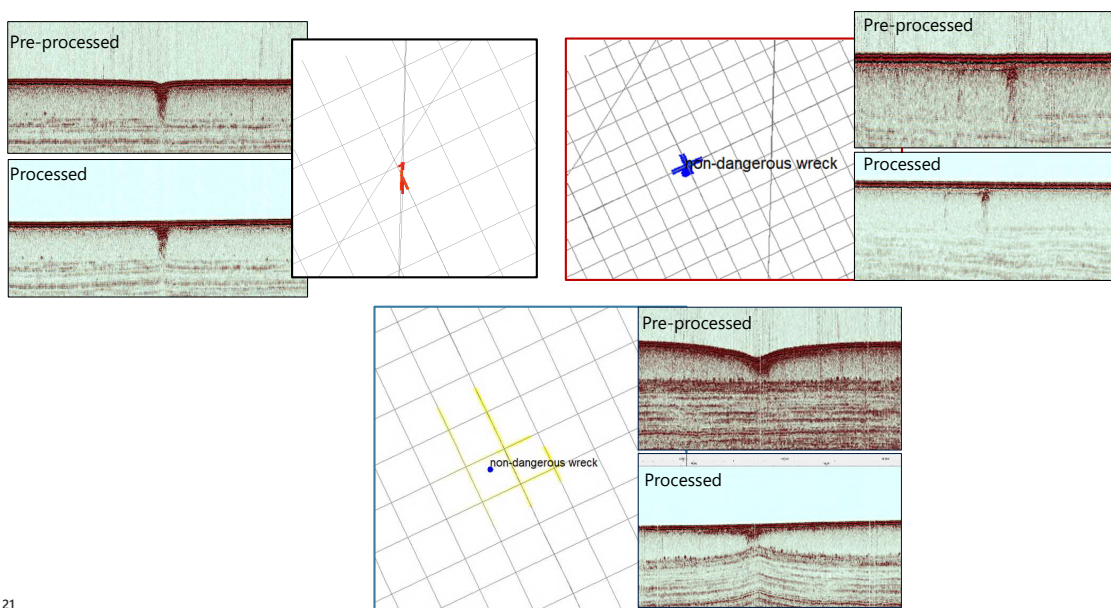


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## SBP Interpretation – Shallow Gas (Depth Below Seafloor)

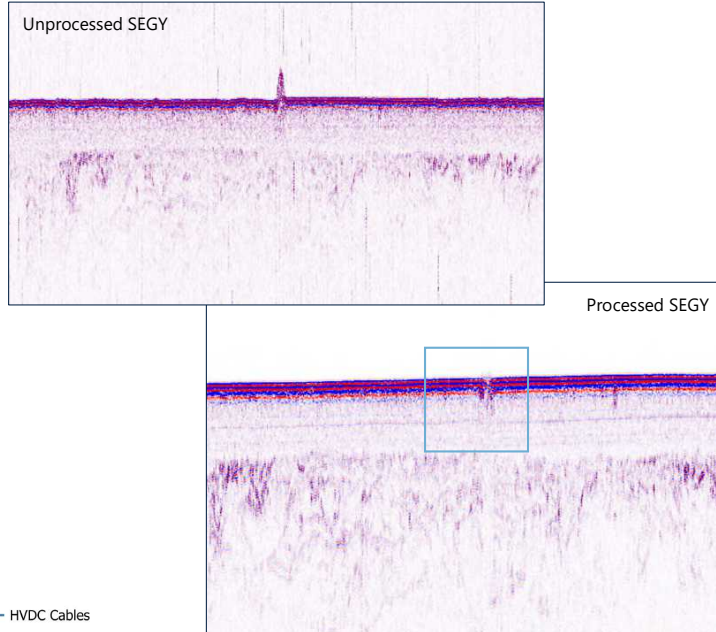
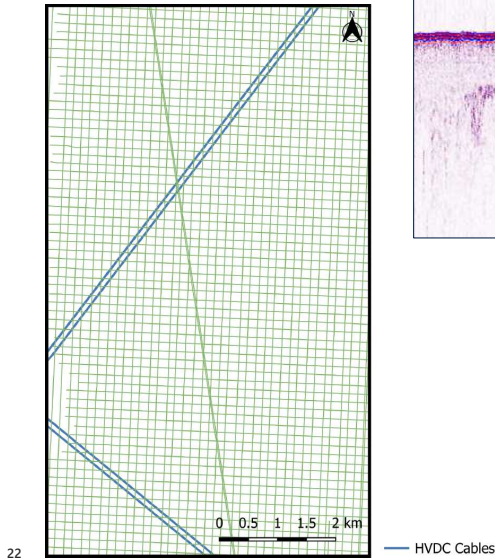


## SBP Interpretation – Wrecks

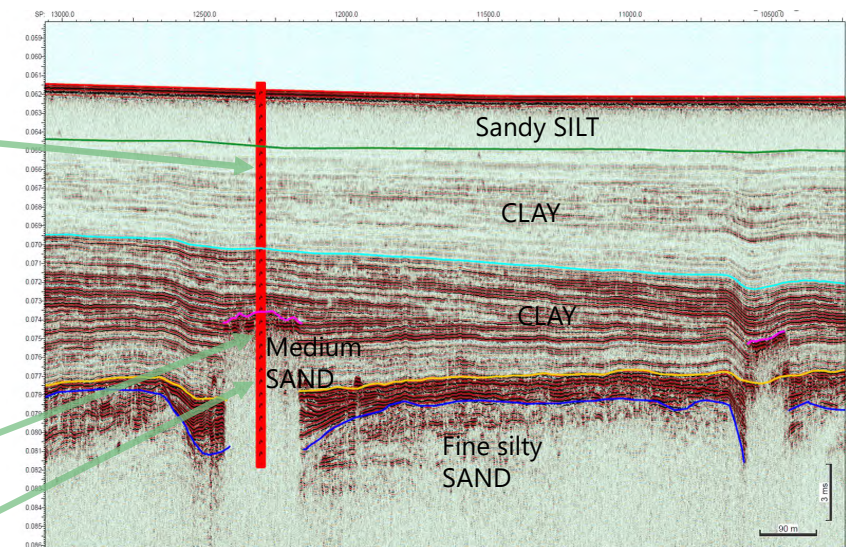
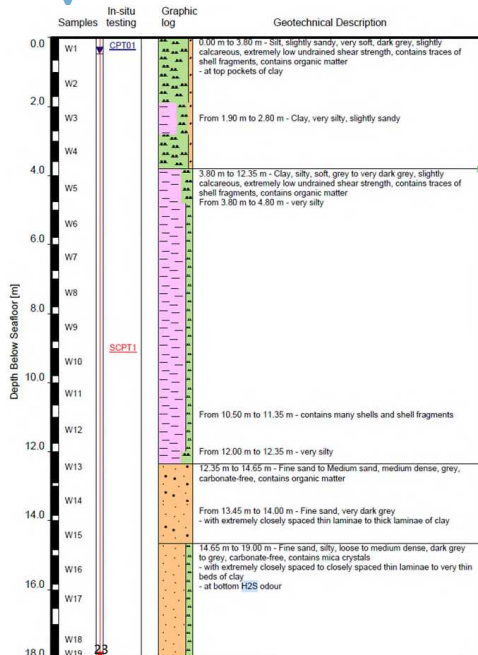


## SBP Interpretation – Infrastructure

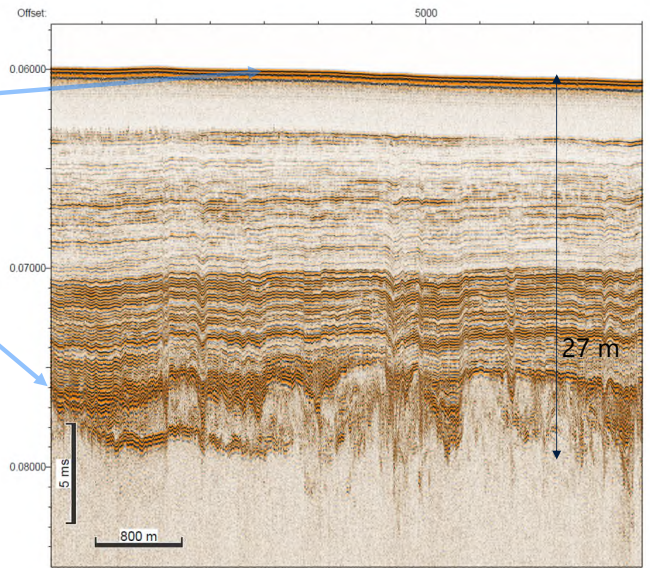
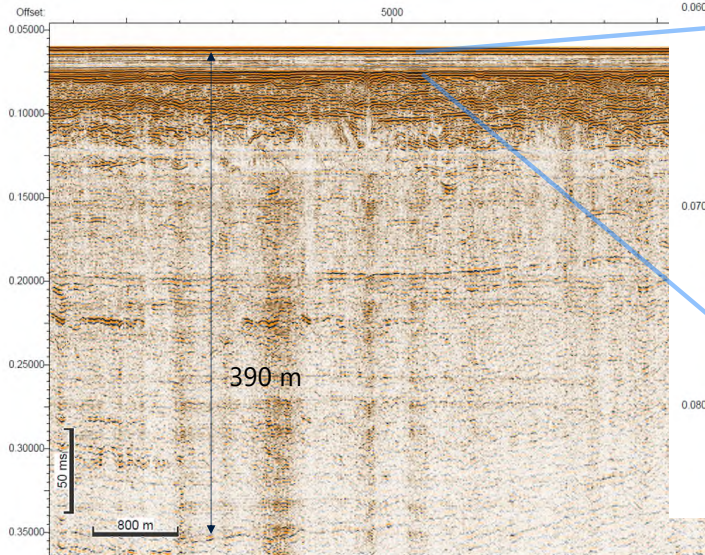
- Infrastructure (HVDC-Cables)



## Ground truthing



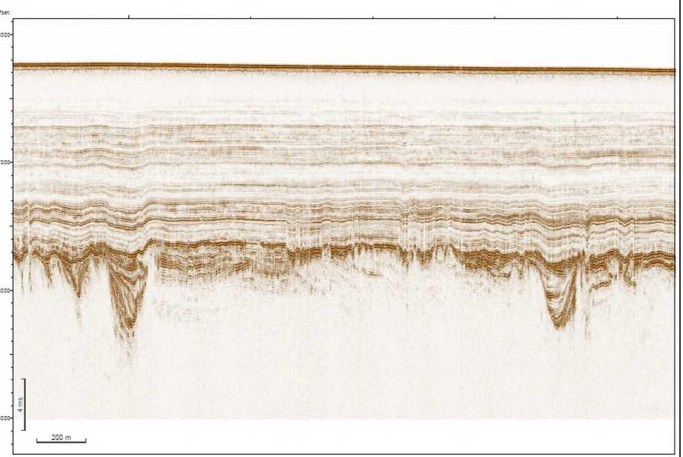
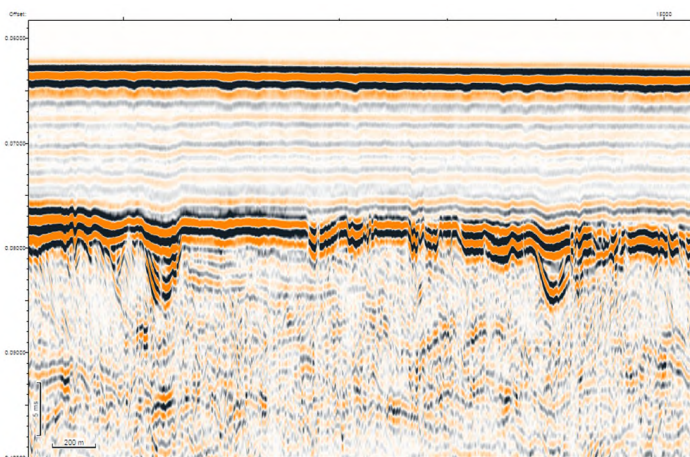
## MCS compared to SBP



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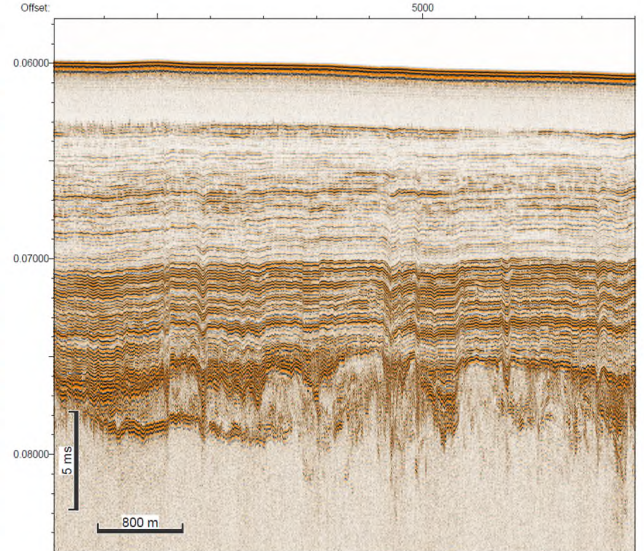
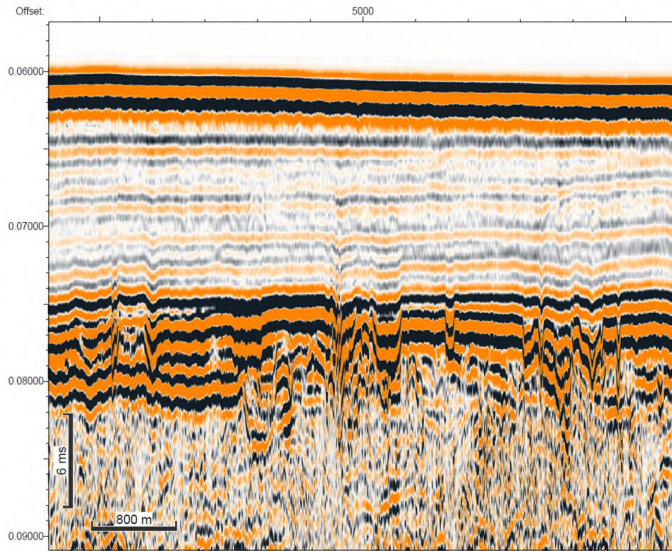
## MCS compared to SBP



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## MCS compared to SBP



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Unlocking Insights  
from Geo-data