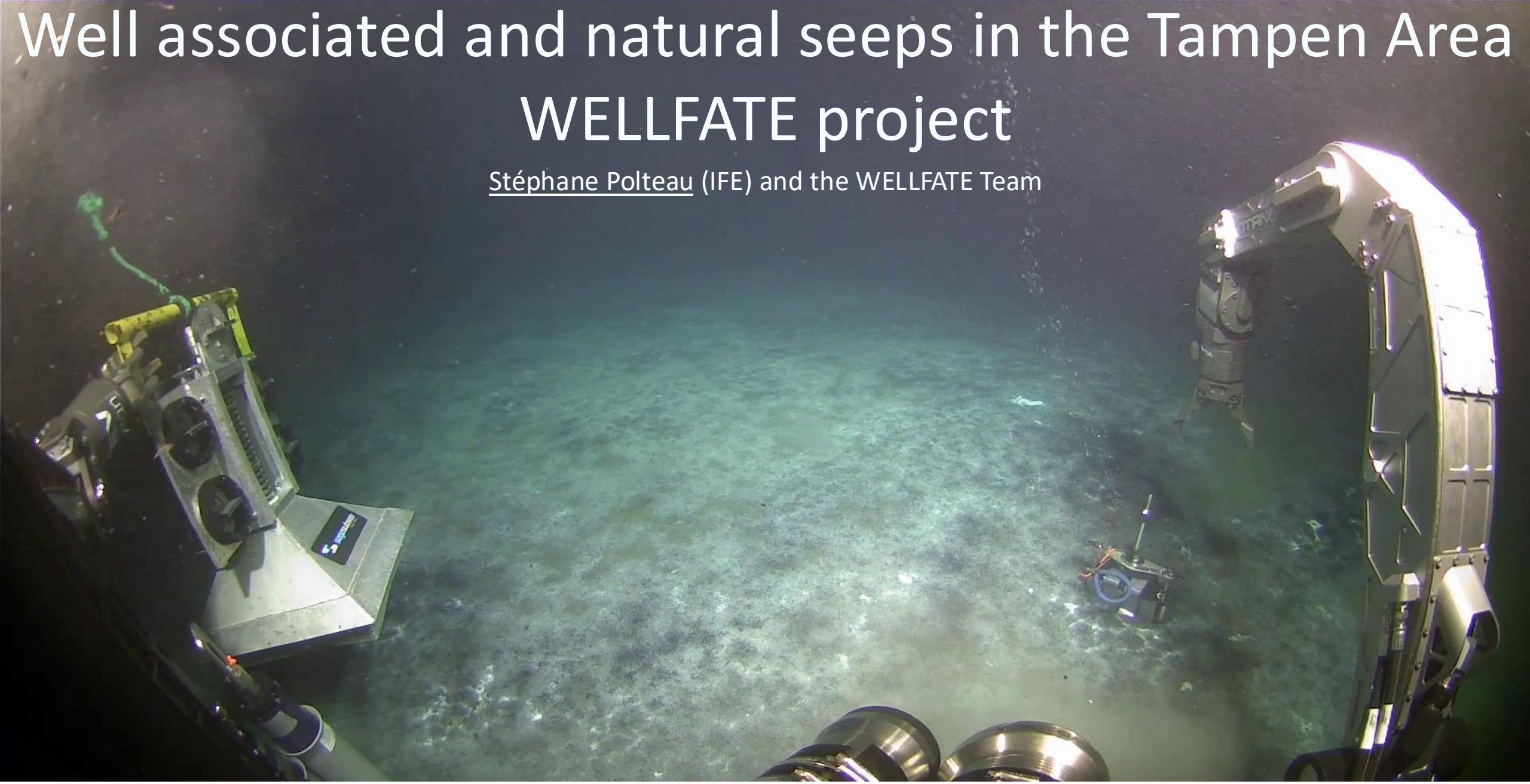
Well associated and natural seeps in the Tampen Area
WELLFATE project

Stéphane Polteau (IFE) and the WELLFATE Team



The Research Council of Norway

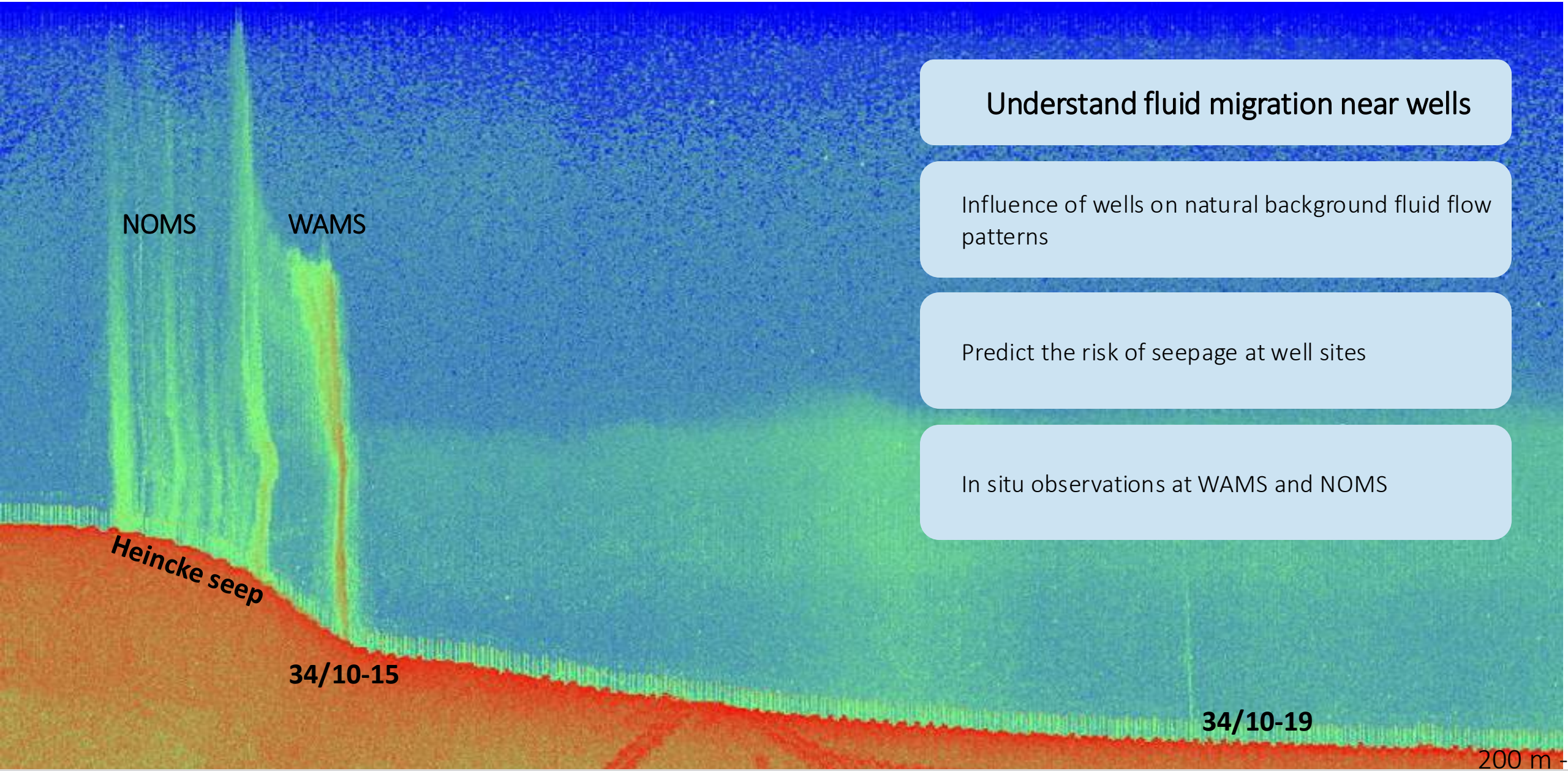
Nearly 2,000 exploration wells P&A

Ca. 2250 wells in operation on NCS

EU methane regulations

nrk.no – 13.09.2020 | 14.09.2020

Aims of WELLFATE



Understand fluid migration near wells

Influence of wells on natural background fluid flow patterns

Predict the risk of seepage at well sites

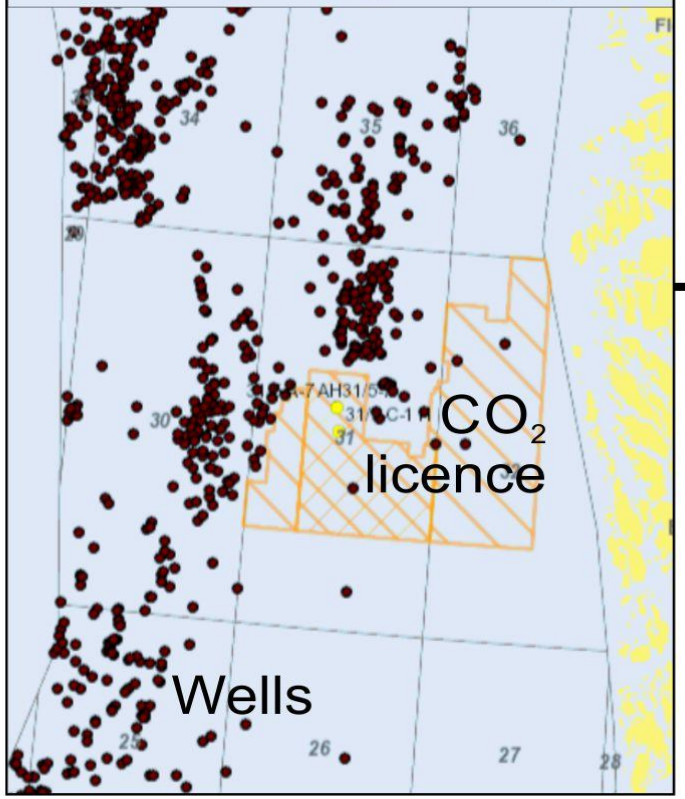
In situ observations at WAMS and NOMS

NOMS: Naturally occurring methane seep | WAMS: Well-associated methane seep | Image courtesy of SODIR (Mattingsdal and Jensen, 2023)

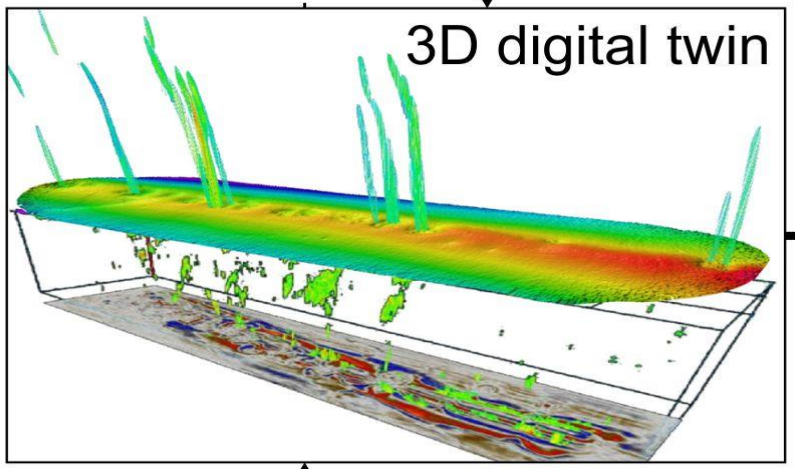
Management, dissemination and communication

WP5
Recommendations

WP1
Database compilation
and survey design

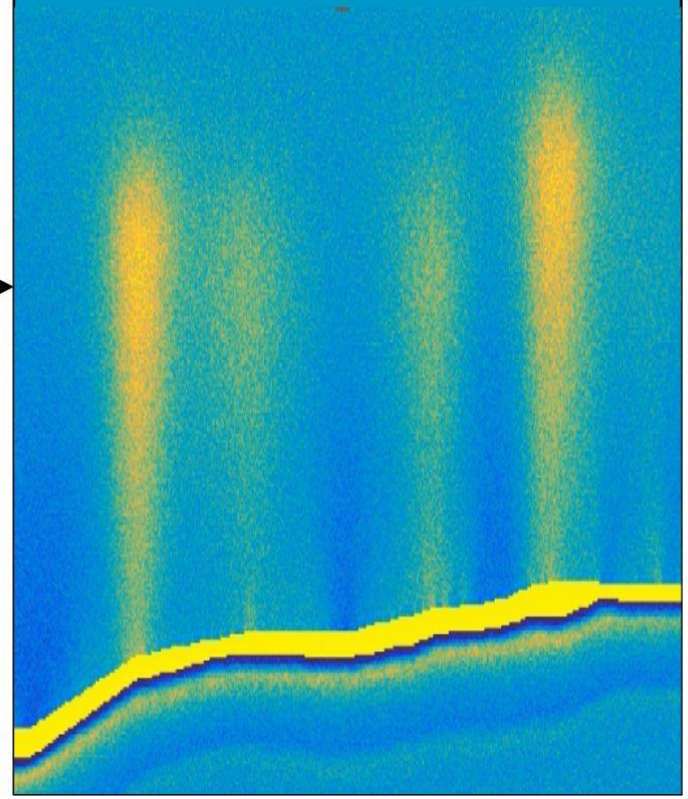


WP2
Imaging of water column
and subsurface



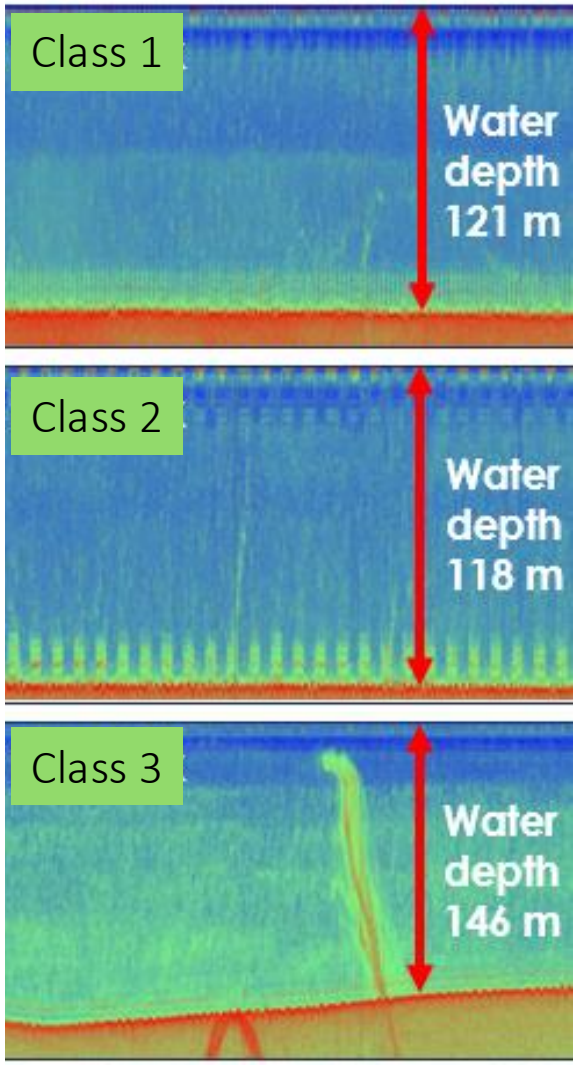
WP3
Site characterization

WP4
Integration
Modelling

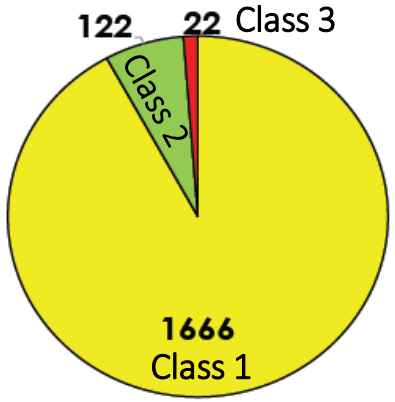


WELLFATE 2024 | Tampen

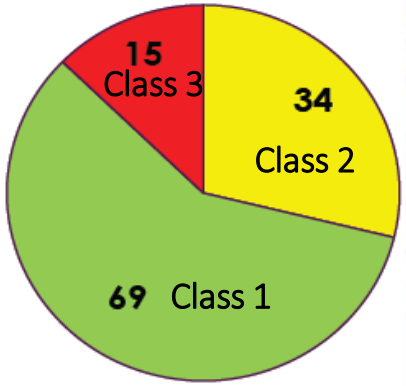
Preben Thomsen, MSc (UiO)



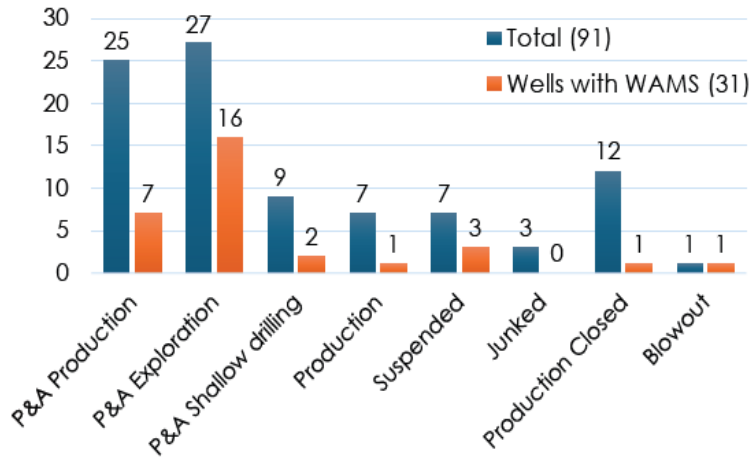
Classes of flares



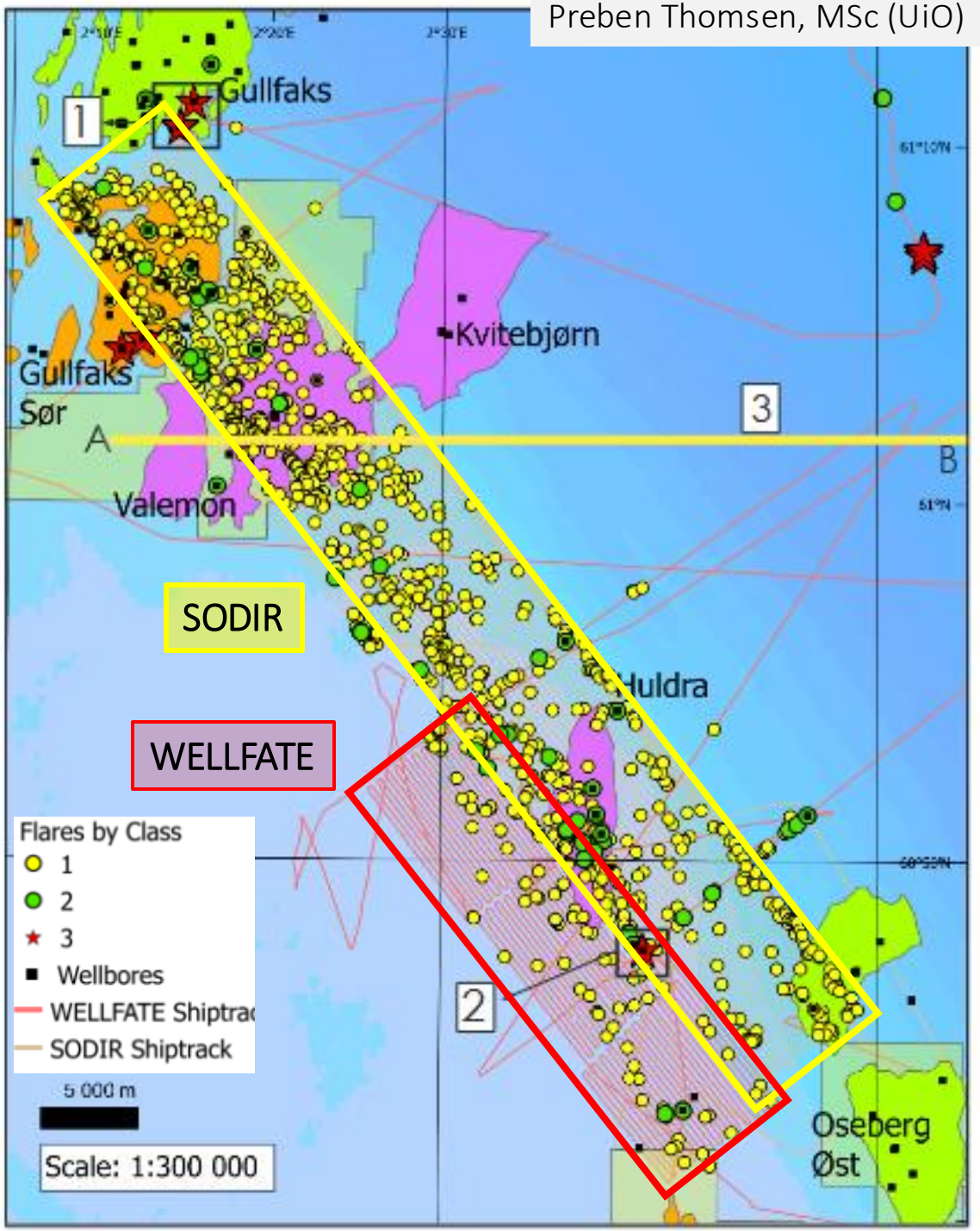
1810 flares



118 WAMS



30% wells with WAMS

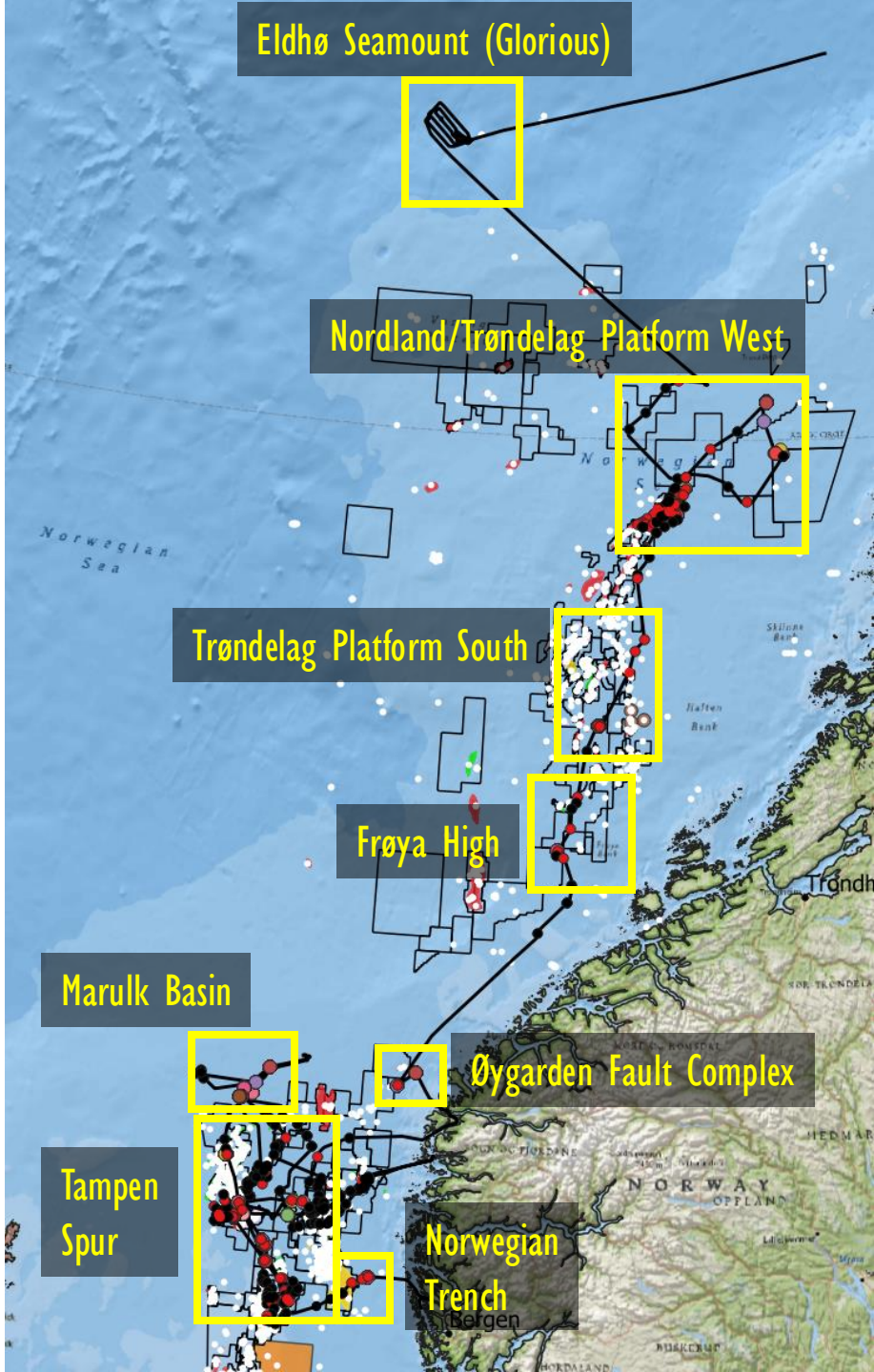


WELLFATE 2025

Mob in Tromsø: 19 June | Demob in Bergen: 9 July

Aurora ROV from RevOcean

Seabed lander



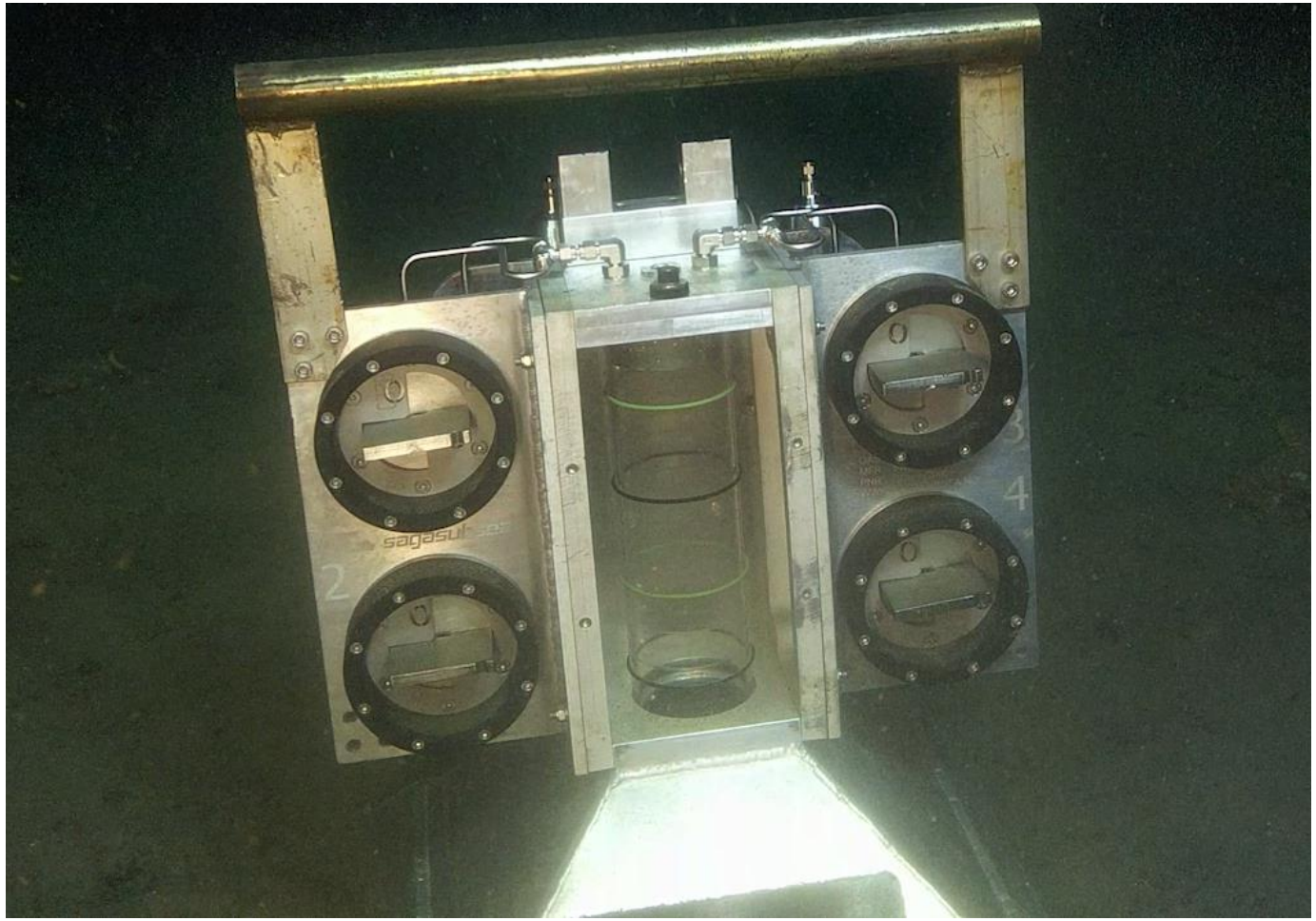
Overview Operations

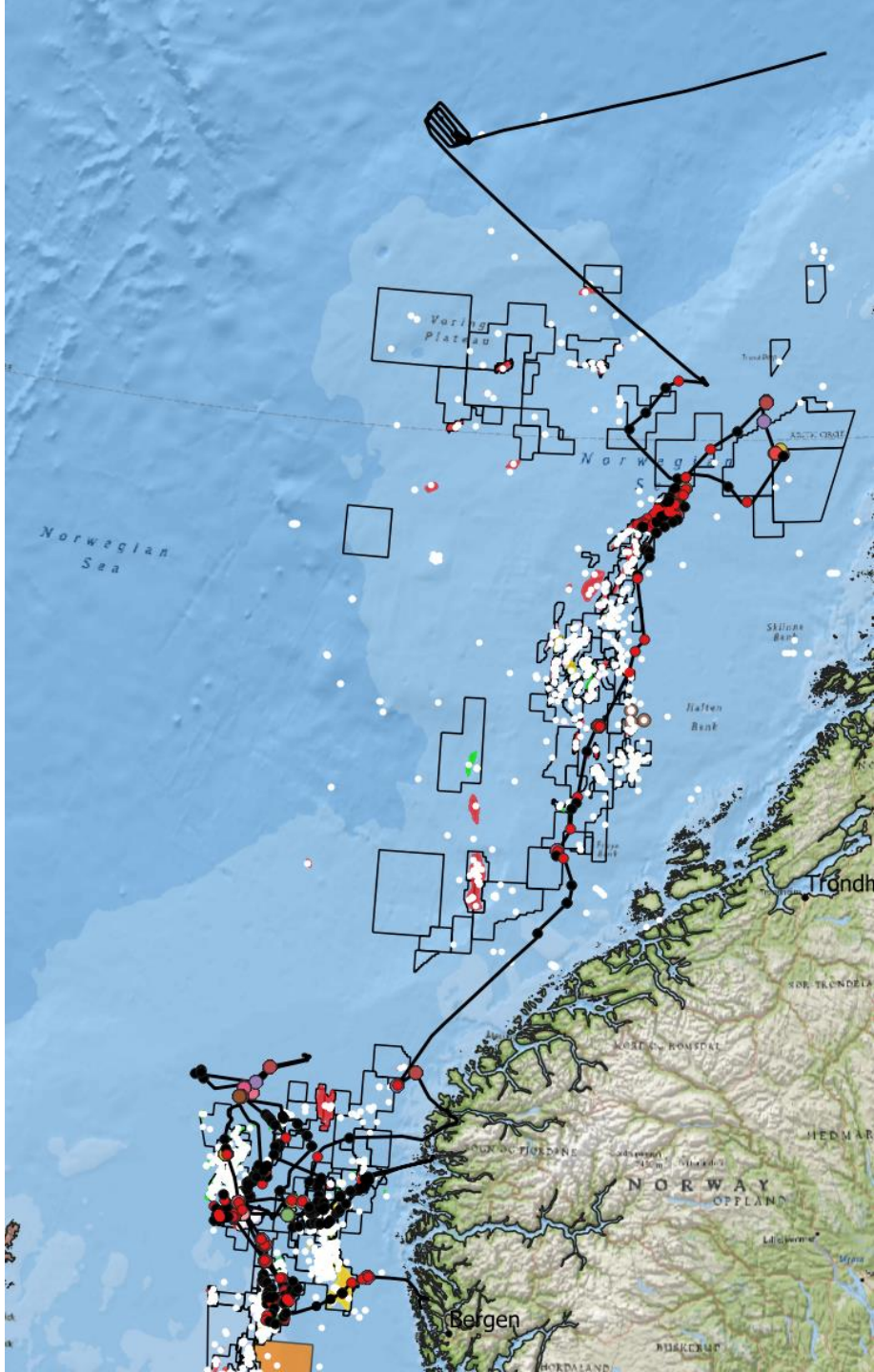
Surveyed wells using water column data

241 wells (including NPD22, WELLFATE2024, EXTREME24)

30.3% of exploration wells with WAMS

Sampled and measured gas fluxes at 14 natural sites and 21 wells

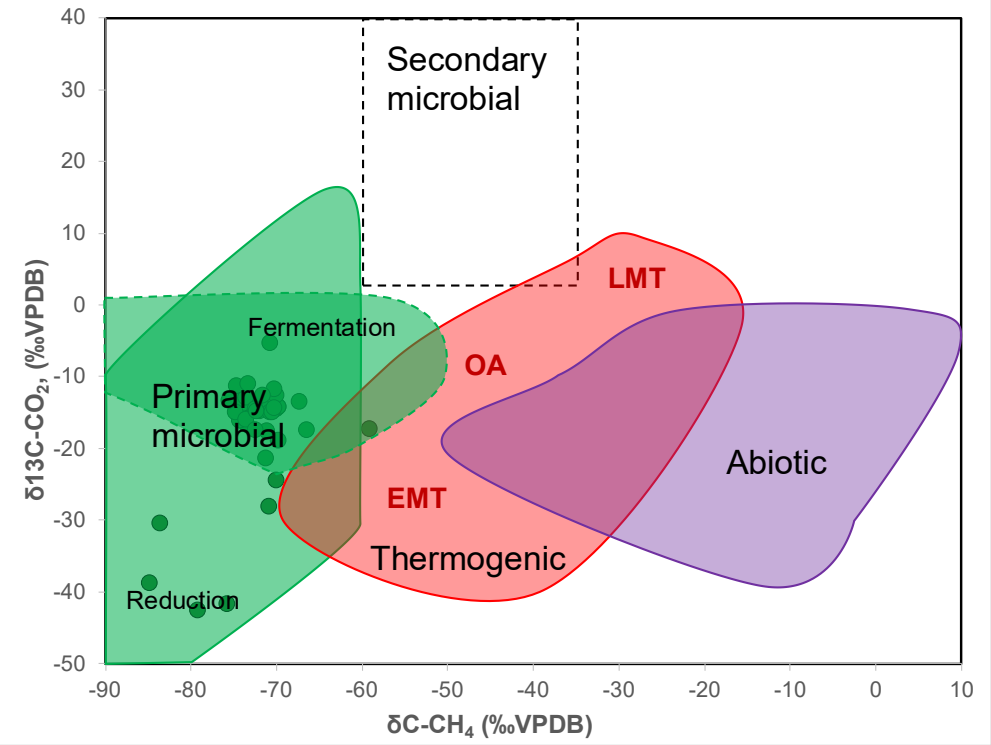


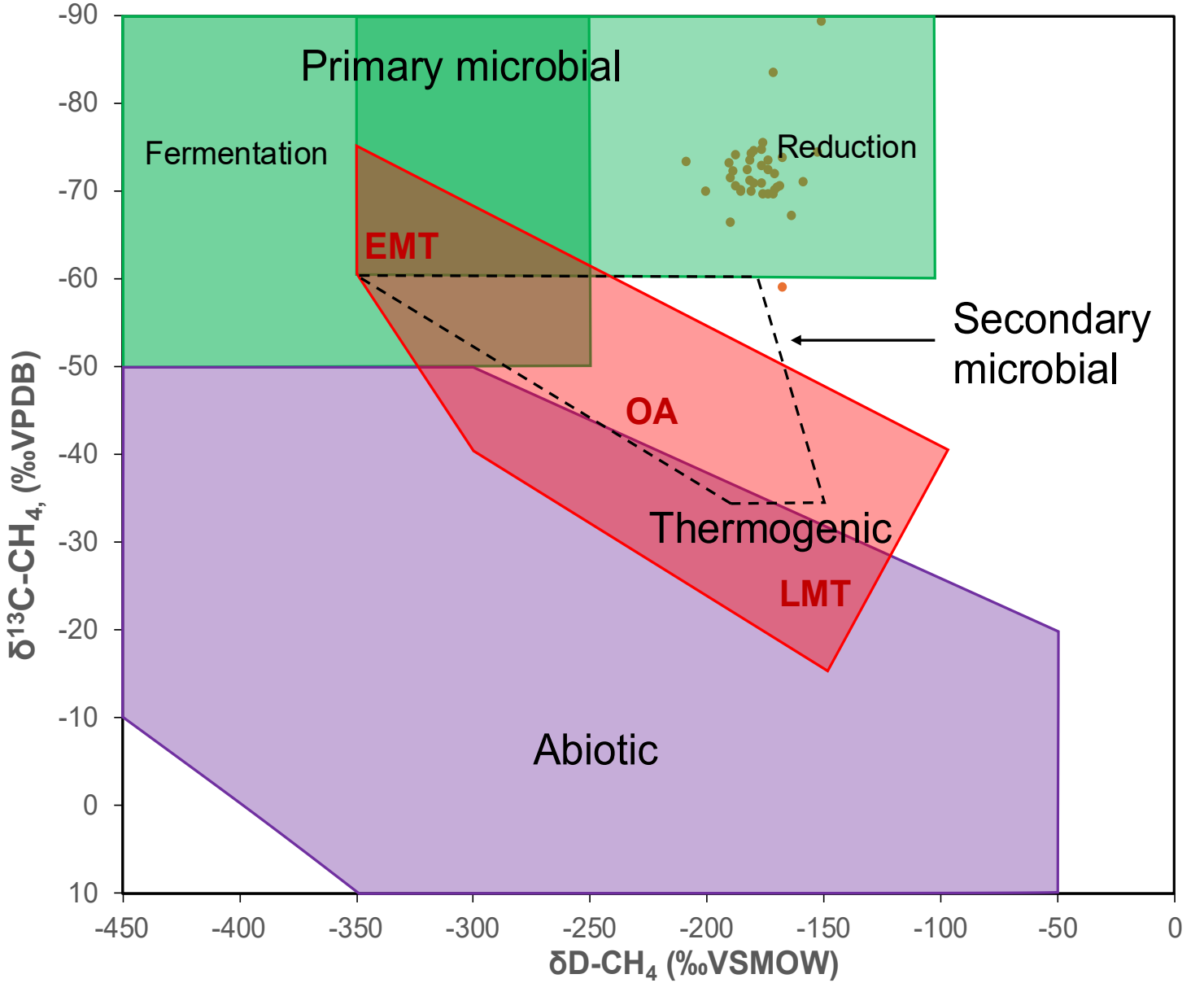


Microbial Gas | Shallow Origin

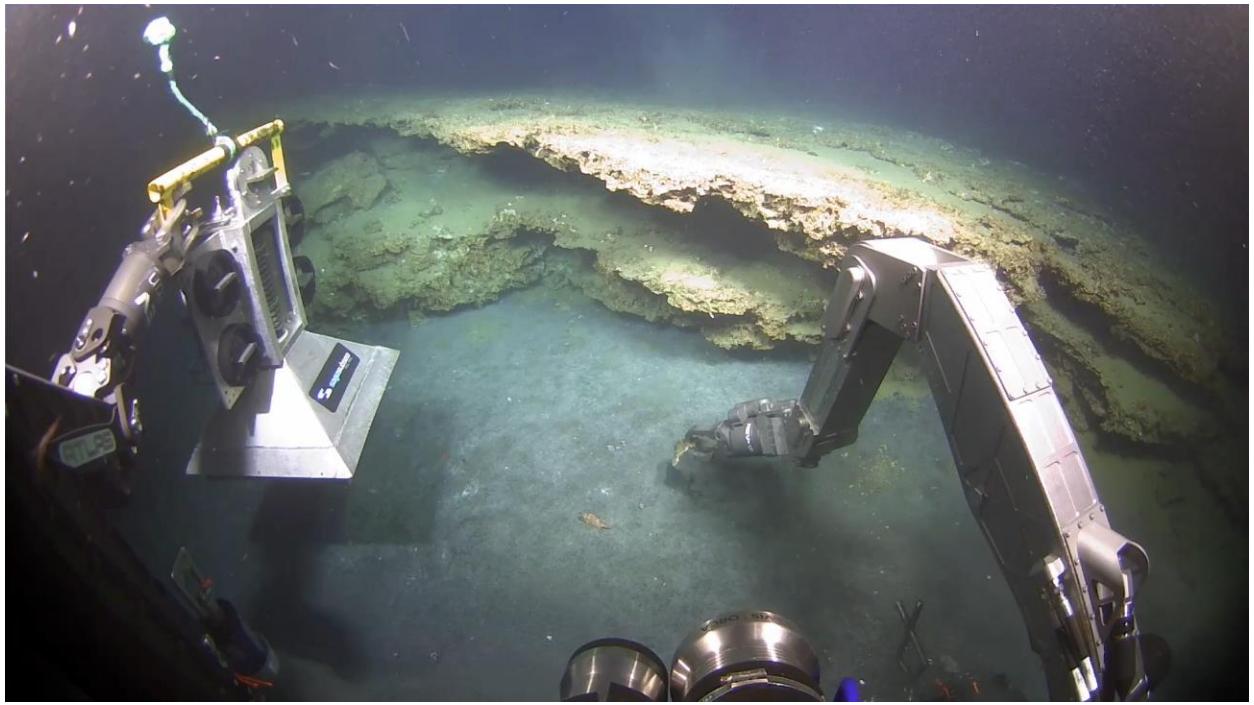
CH_4 and CO_2 with microbial signature

WAMS and NOMS





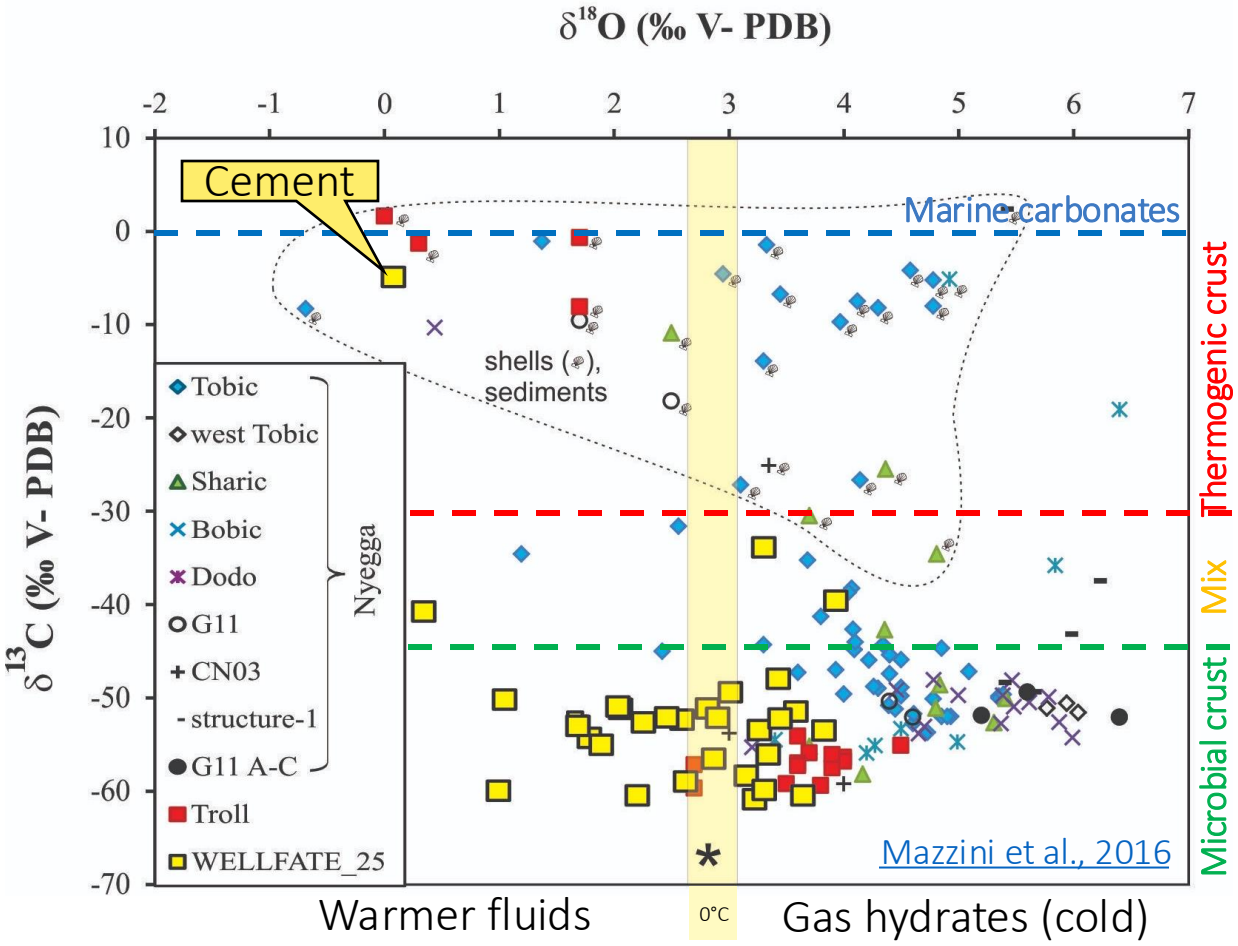
Carbonate Crust at Natural Sites



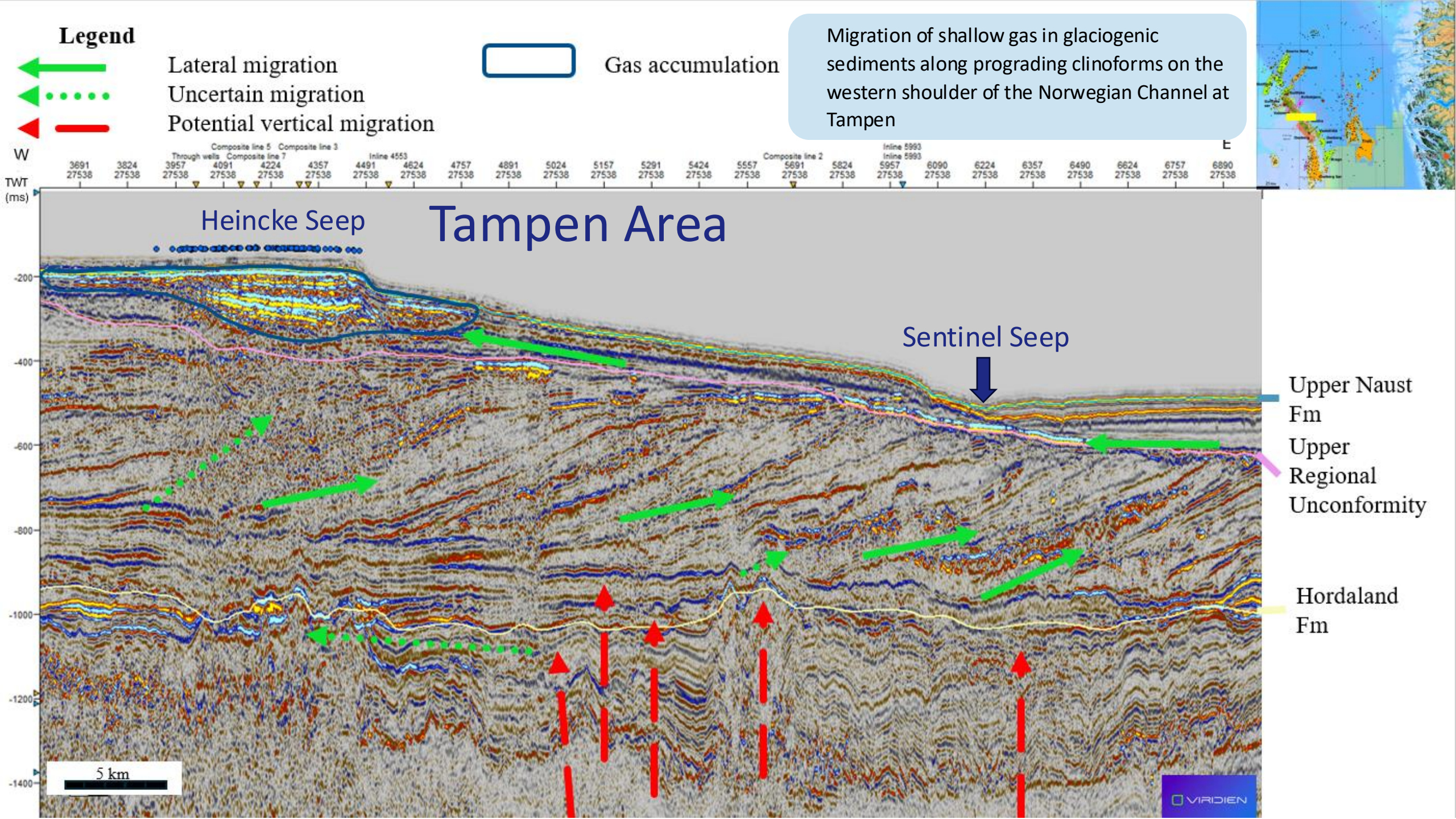
Long-lived methane seeps (1000s of years) – Dating?

$\delta^{13}C$: carbon with microbial source (except three samples enriched in ^{13}C)

$\delta^{18}O$: warmer precipitation temperatures than Nyegga (and partly Troll)



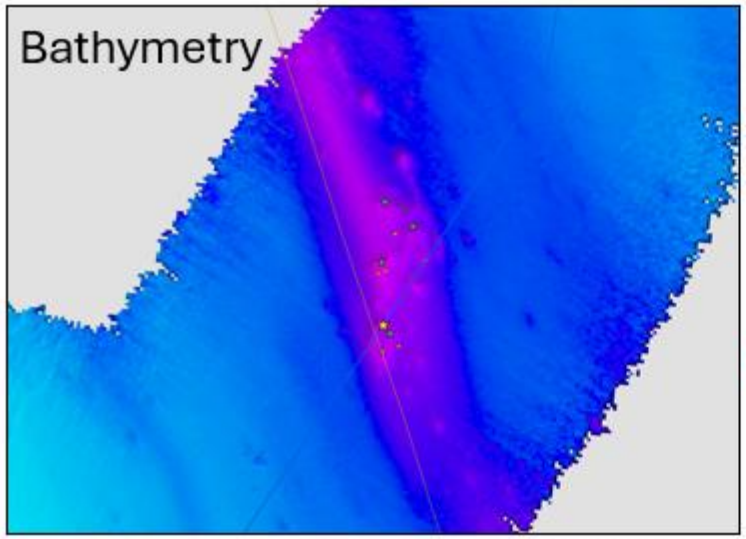
*assuming carbonate precipitating in equilibrium with seafloor water with $\delta^{18}O_{water}$ = +0.3‰ SMOW
May speculate some small amount of fluid from GH dissociation

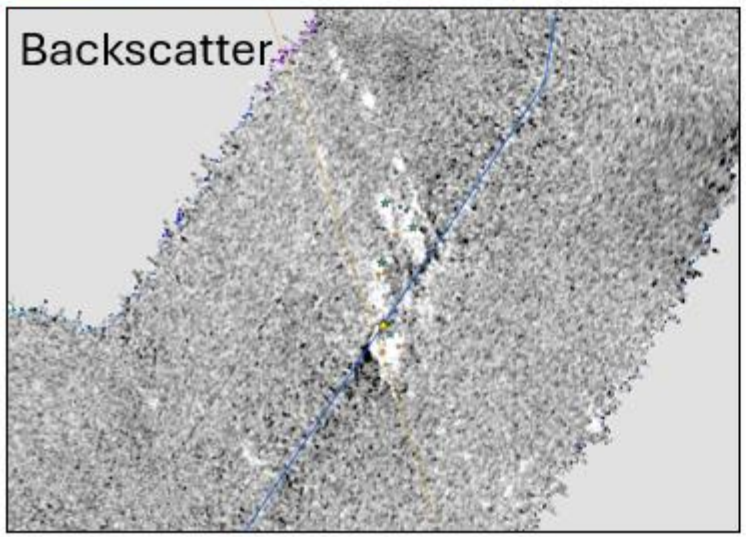

Legend
Lateral migration
Uncertain migration
Potential vertical migration
Gas accumulation
Migration of shallow gas in glaciogenic sediments along prograding clinoforms on the western shoulder of the Norwegian Channel at Tampen
W
E
TWT (ms)
Heincke Seep
Tampen Area
Sentinel Seep
Upper Naust Fm
Upper Regional Unconformity
Hordaland Fm
5 km
VIRIDIEN

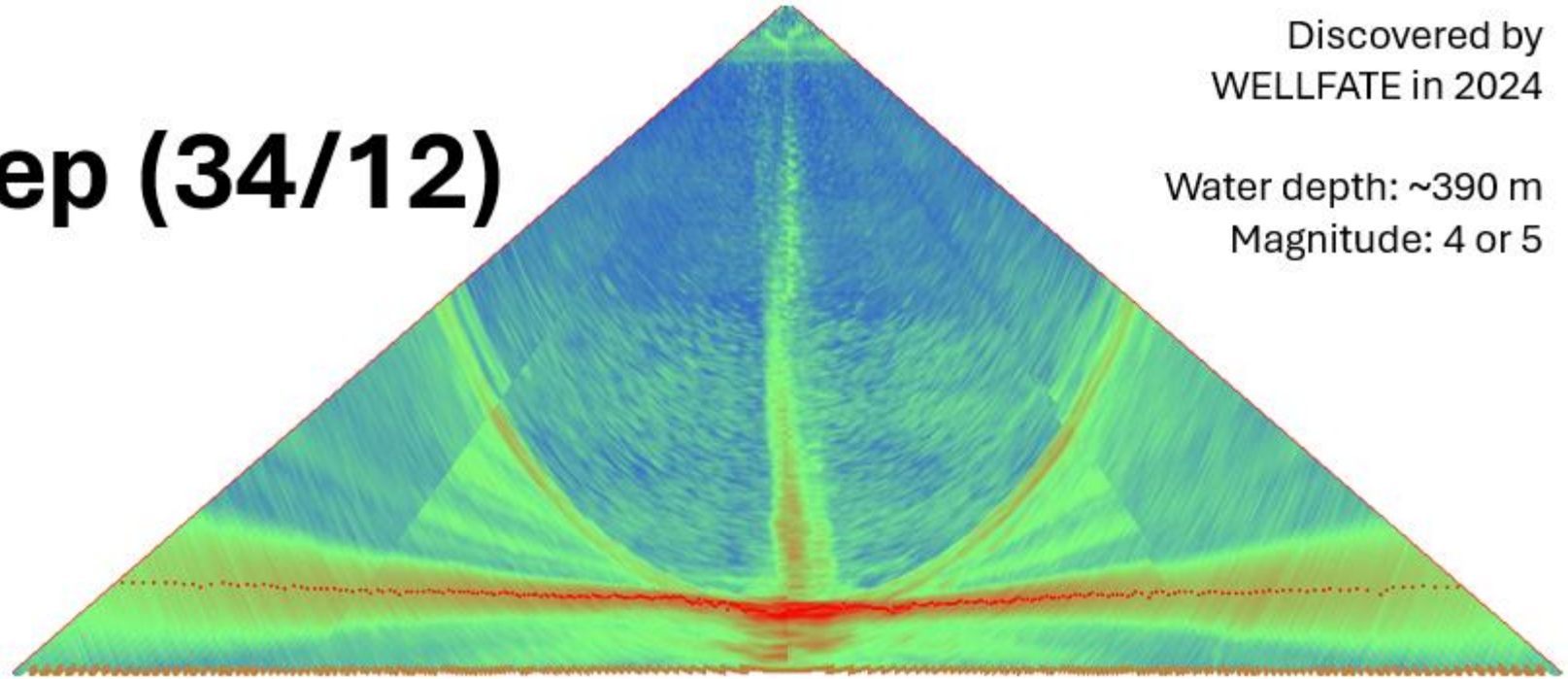
The Sentinel seep (34/12)

Discovered by
WELLFATE in 2024

Water depth: ~390 m
Magnitude: 4 or 5

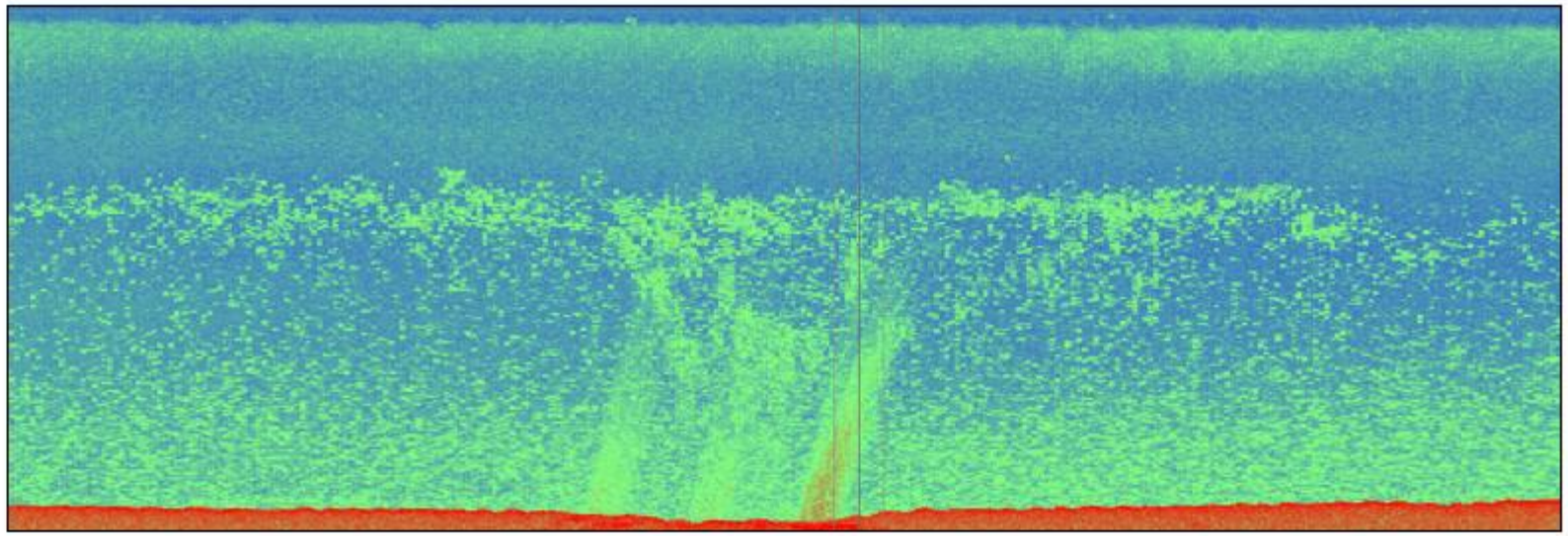




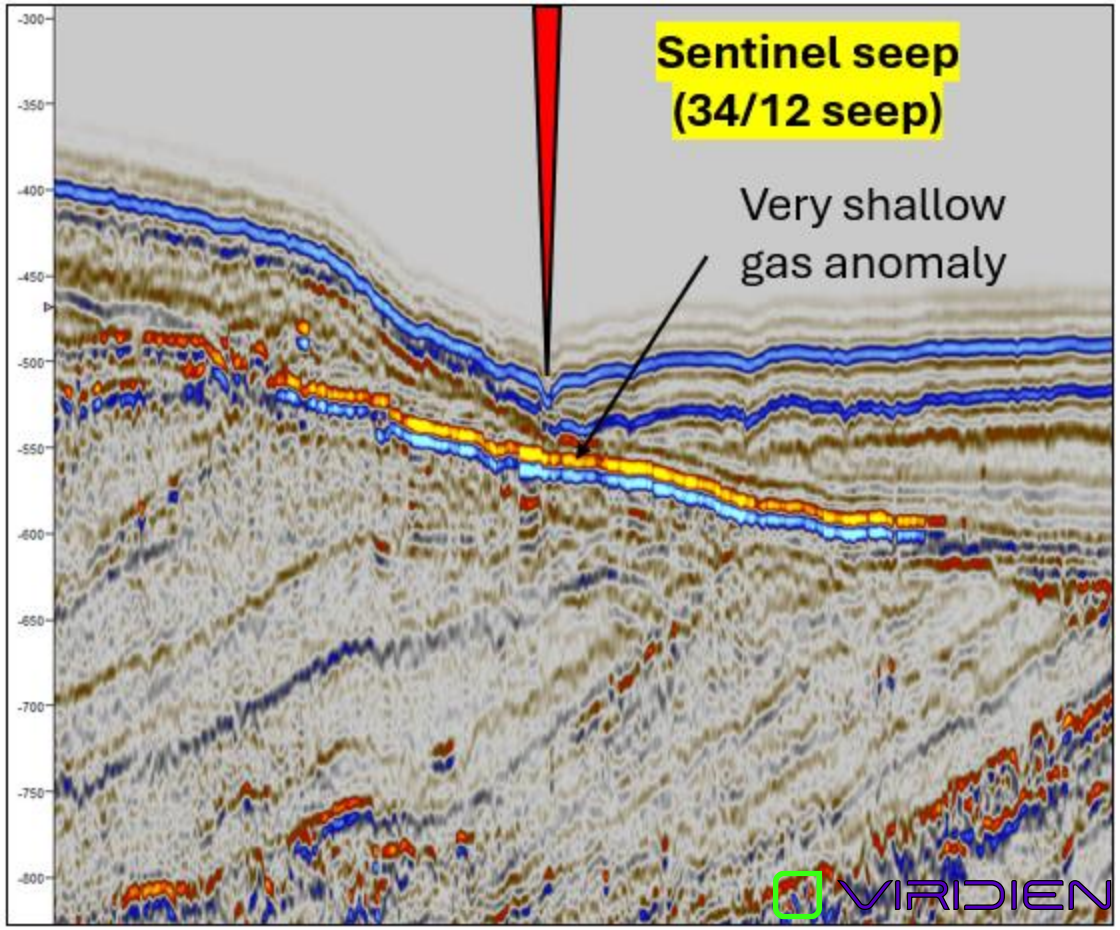


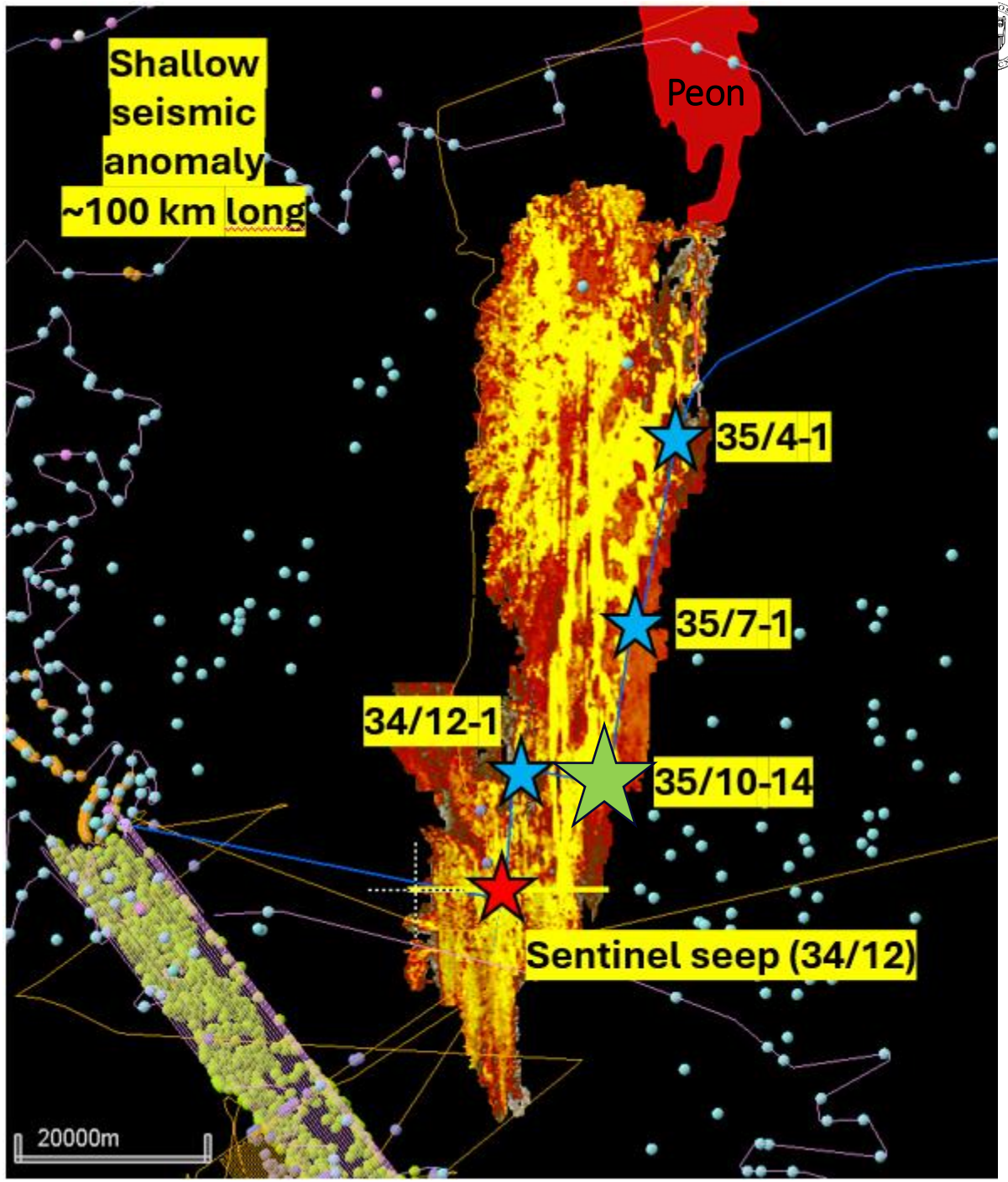
Dive 21

Gas sample: 05-GasS-15

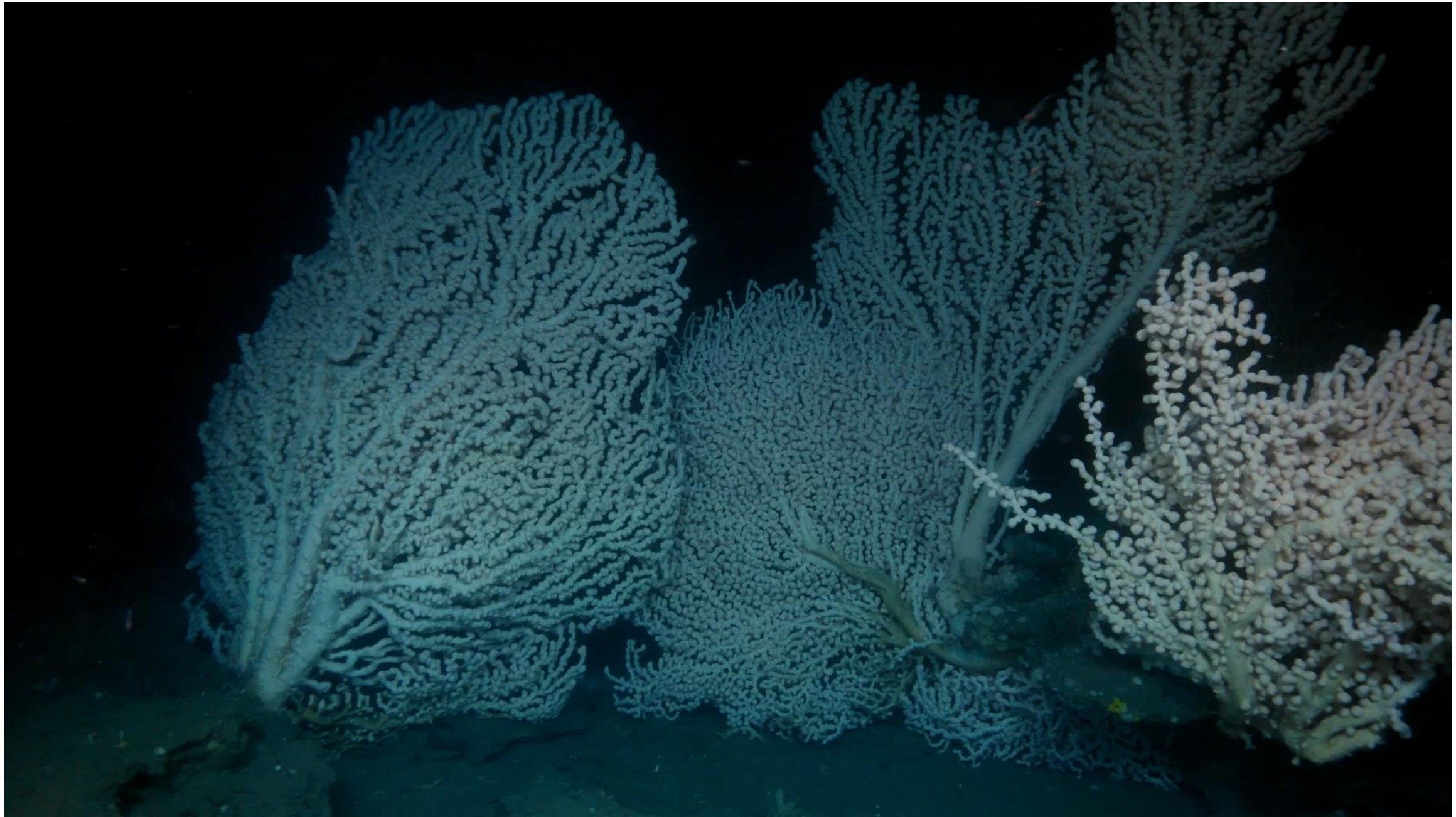


The Sentinel seep and shallow seismic anomaly Dive #21

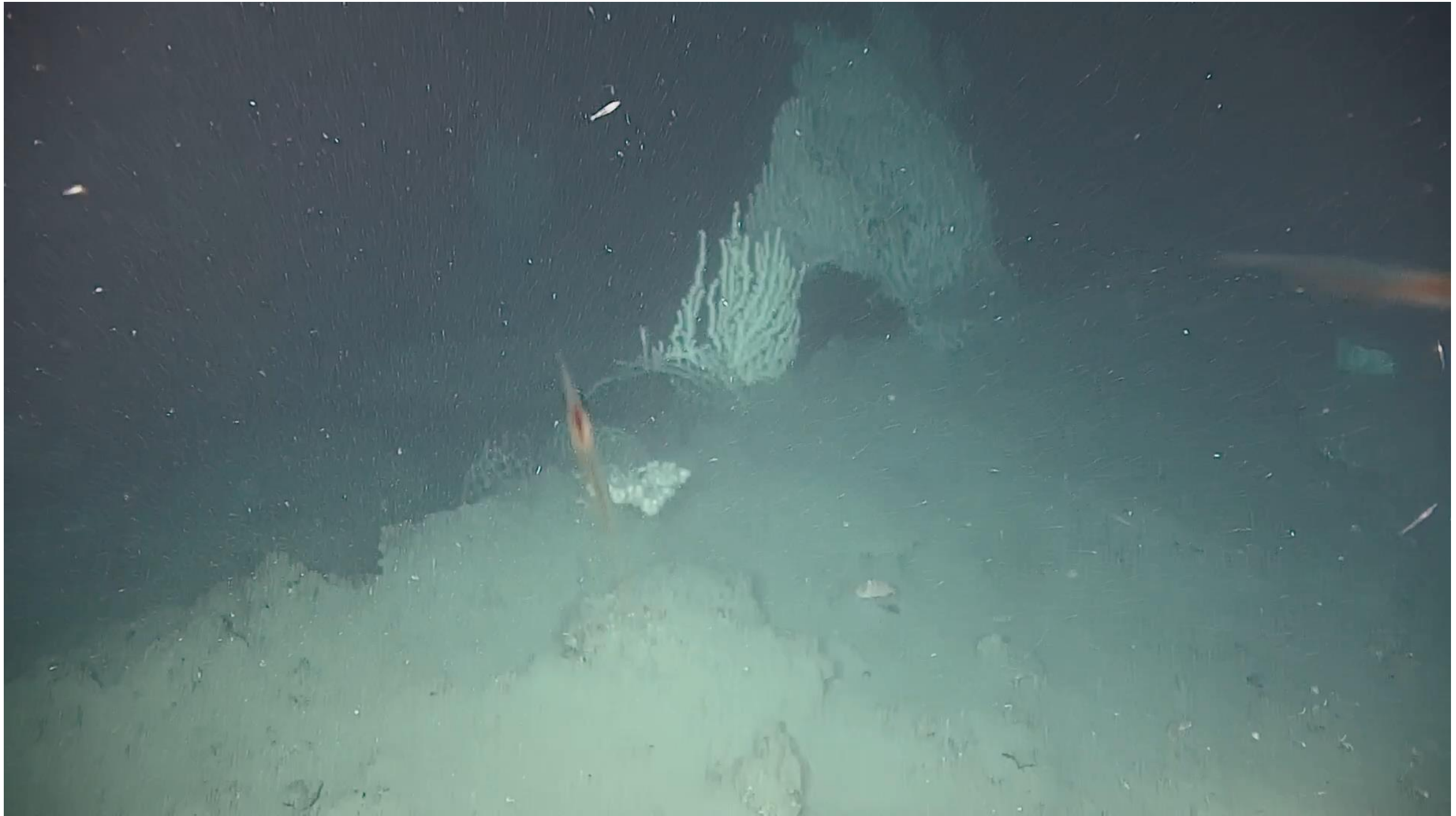




Dive #21 | Sentinel Seep Site 34/12

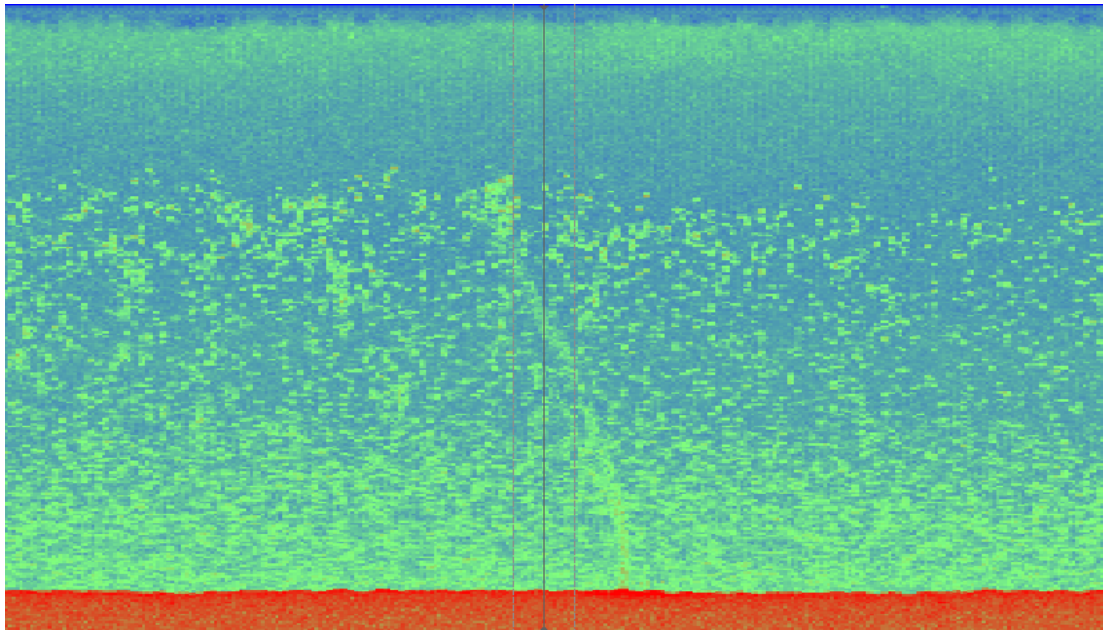


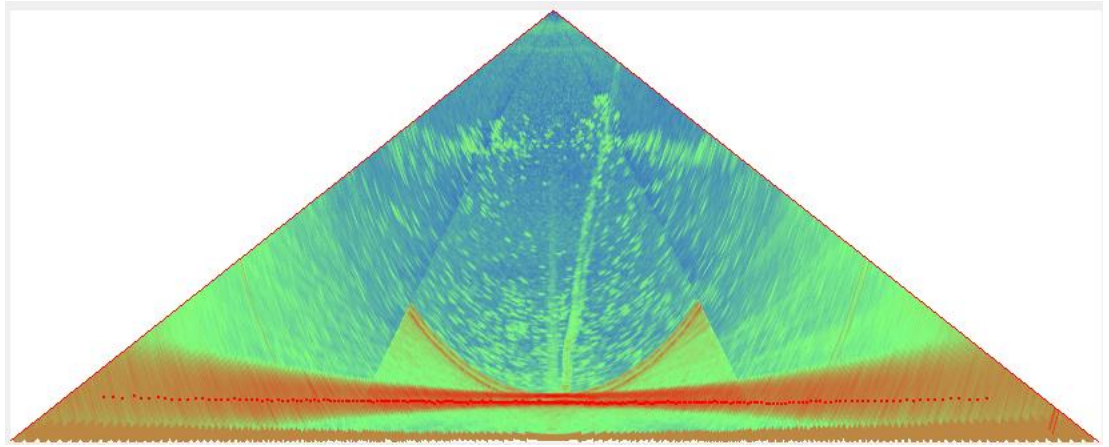
Dive #21 | Sentinel Seep Site 34/12



Dive #28 | 35/10-14

- Type: Exploration
- Status: Plugged ?
- Drilling Operator: Equinor Energy AS
- Completed Date: 29.10.2024
- Content: Dry
- Water Depth: 376
- PL1185 (Equinor, Vår, Sval, AkerBP)

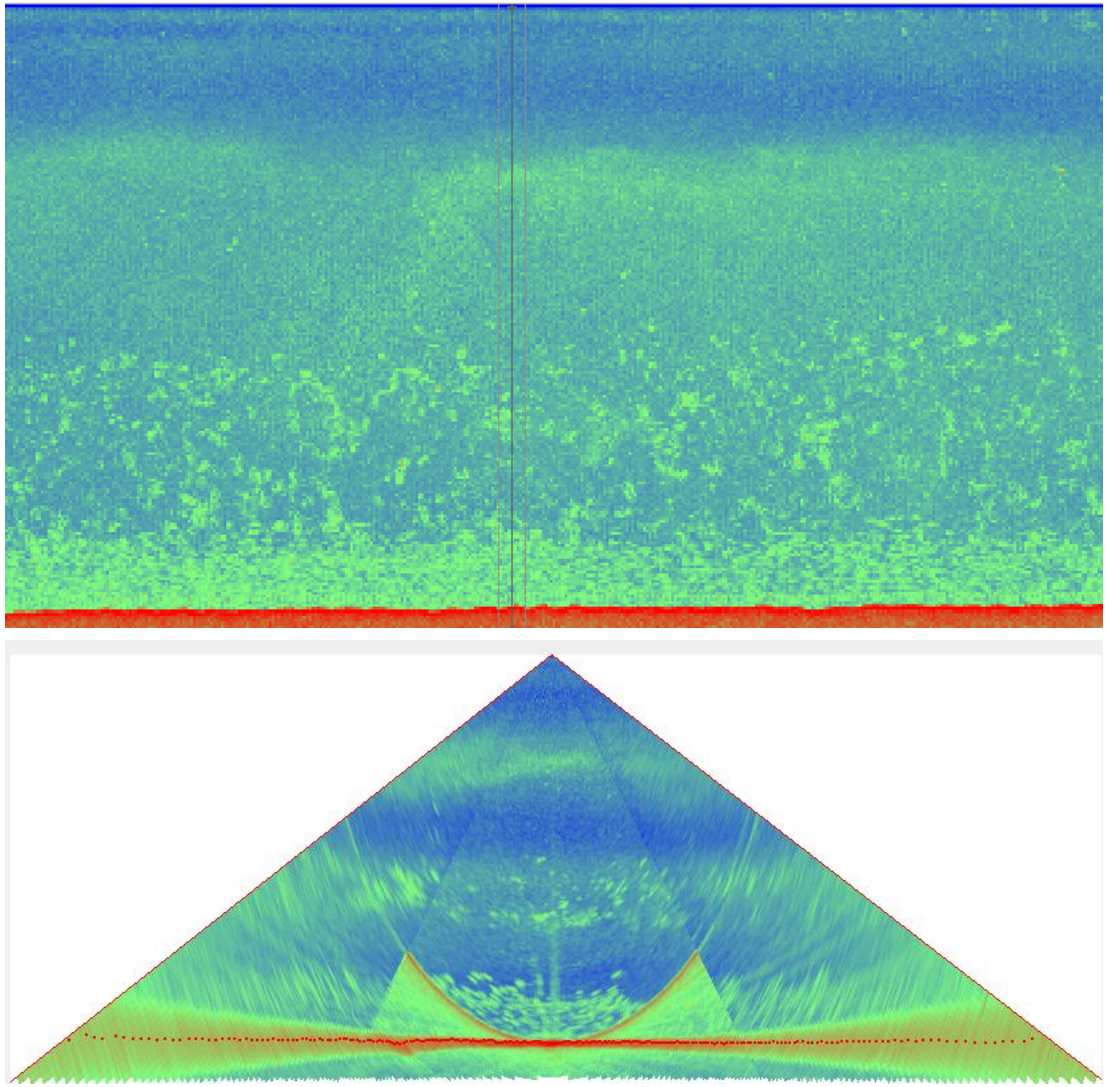




Magnitude 3

Dive #39 | 34/7-27

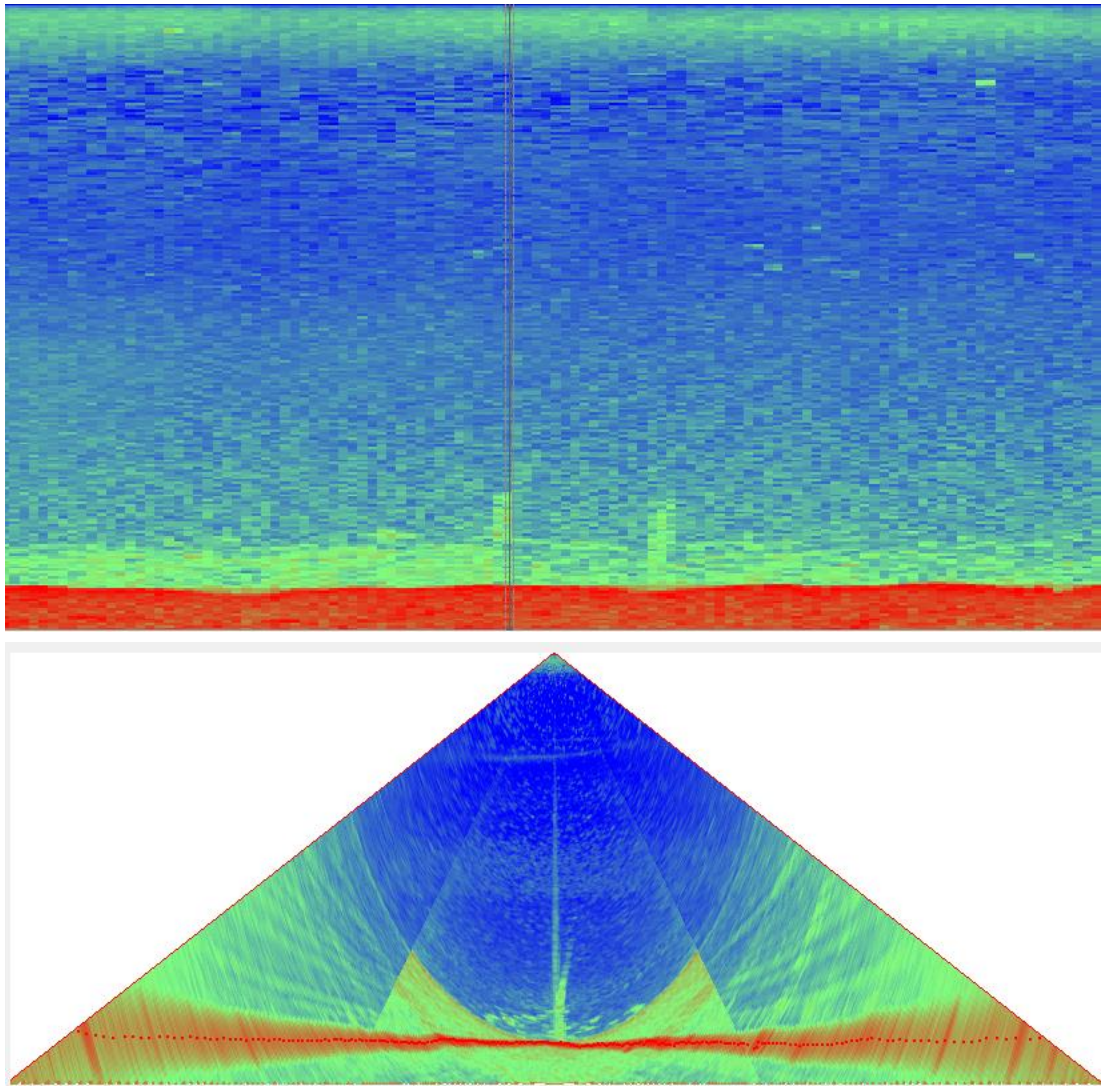
- Type: Exploration
- Status: P&A
- Drilling Operator: Mobil Exploration Norway INC
- Completed Date: 07.10.1998
- Content: Dry
- Water Depth: 311
- PL089 (Equinor, Petoro, Vår, Inpex, Harbour)



Magnitude 1

Dive #09 | 6608/11-6

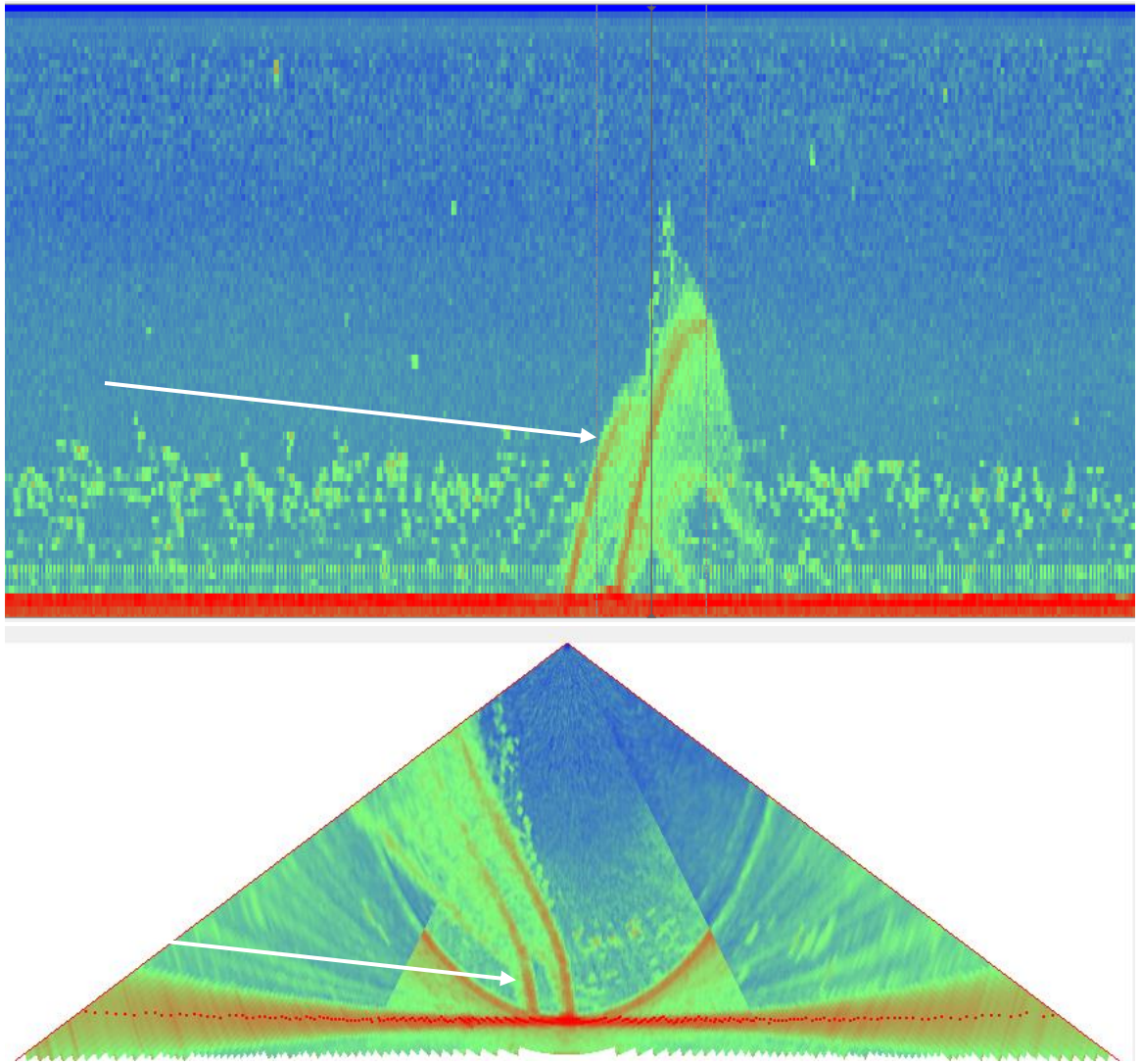
- Type: Exploration
- Status: P&A
- Drilling Operator: StatoilHydro ASA
- Completed Date: 06.08.2008
- Content: Dry
- Water Depth: 357
- After setting the 9 5/8" casing at 1300 m, gas was observed between the 18 3/4" and 30" housing. The gas was sampled by the ROV and isotope analysis indicated that the gas was of a thermogenic origin rather than a shallow microbial or biogenic origin
- PL128 (Equinor, Petoro, DNO)



Magnitude 2

Dive #32 | 34/10-52 S

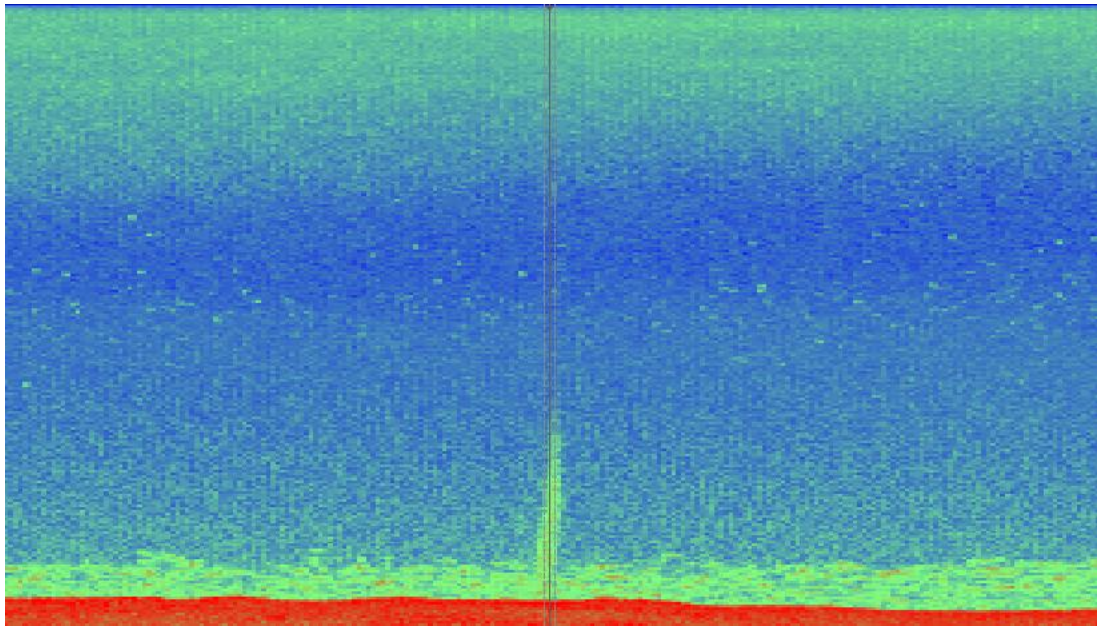
- Type: Exploration
- Status: P&A
- Drilling Operator: StatoilHydro Petroleum AS
- Completed Date: 10.11.2009
- Content: Dry
- Water Depth: 134
- PL050 (Equinor, Petoro, OMV)

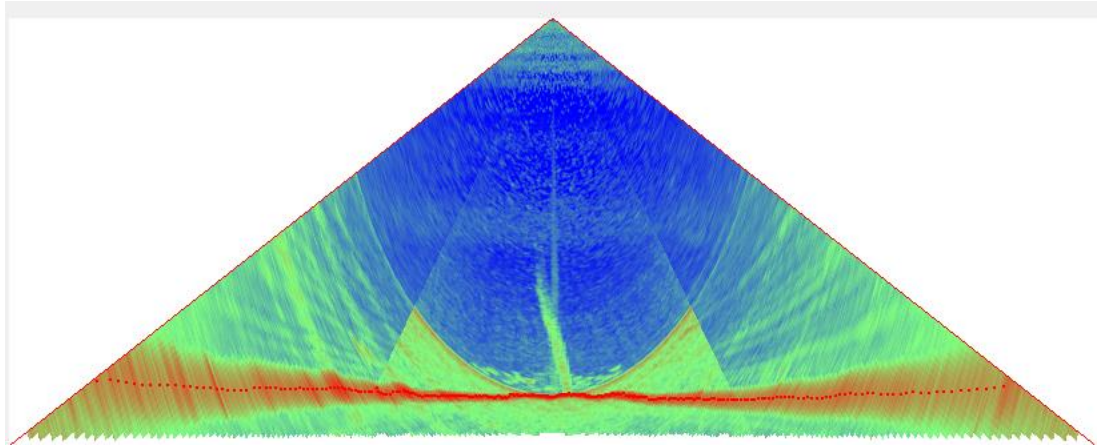


Magnitude 5

Dive #10 | 6608/11-4

- Type: Exploration
- Status: P&A
- Drilling Operator: Statoil ASA (old)
- Completed Date: 23.05.2004
- Content: Oil
- Water Depth: 342
- PL128 (Equinor, Petoro, DNO)

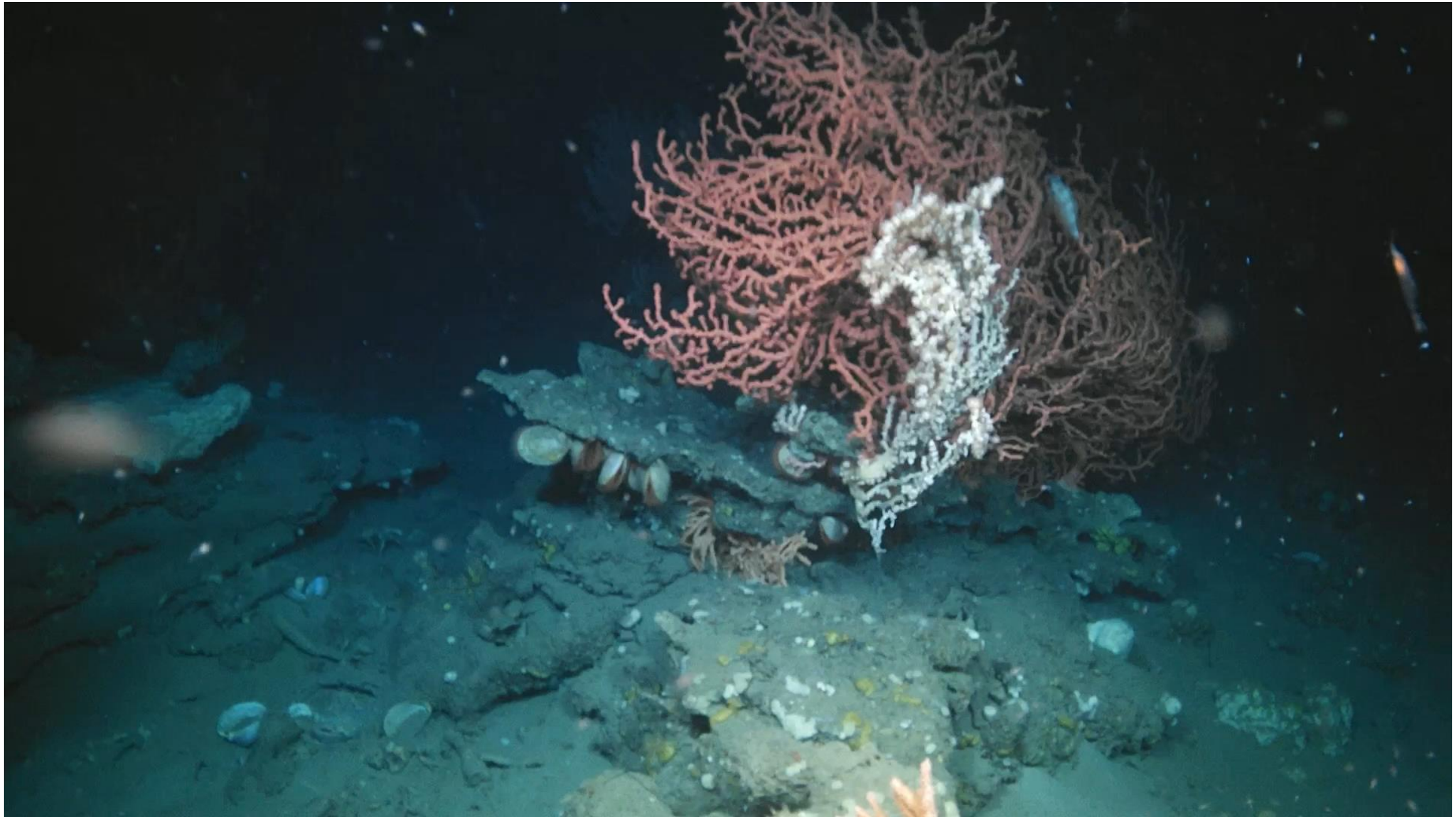




Magnitude 4

Dive #10 | Corals 15 m Away from 6608/11-4

Dive #07 | Natural Site 6609/3



Modeling and Recommendations

Modeling

Fully coupled fluid-flow and geomechanics

Constrained by 3D geophysical data

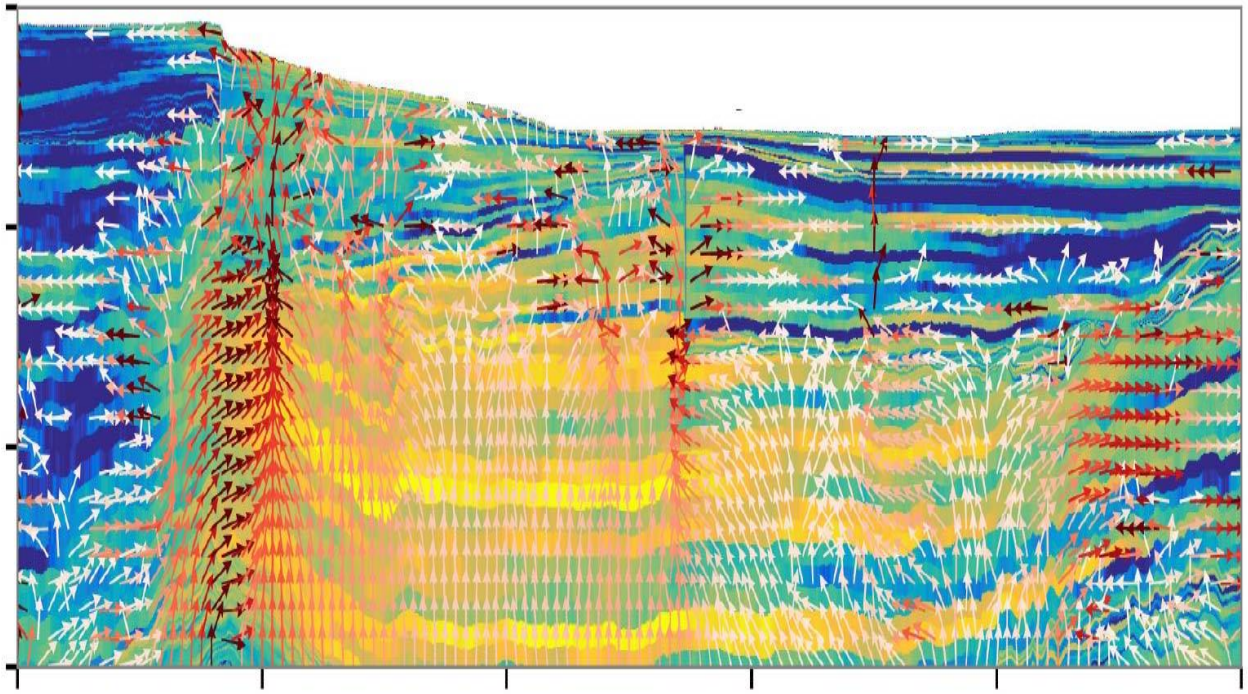
Simulations with and without wells

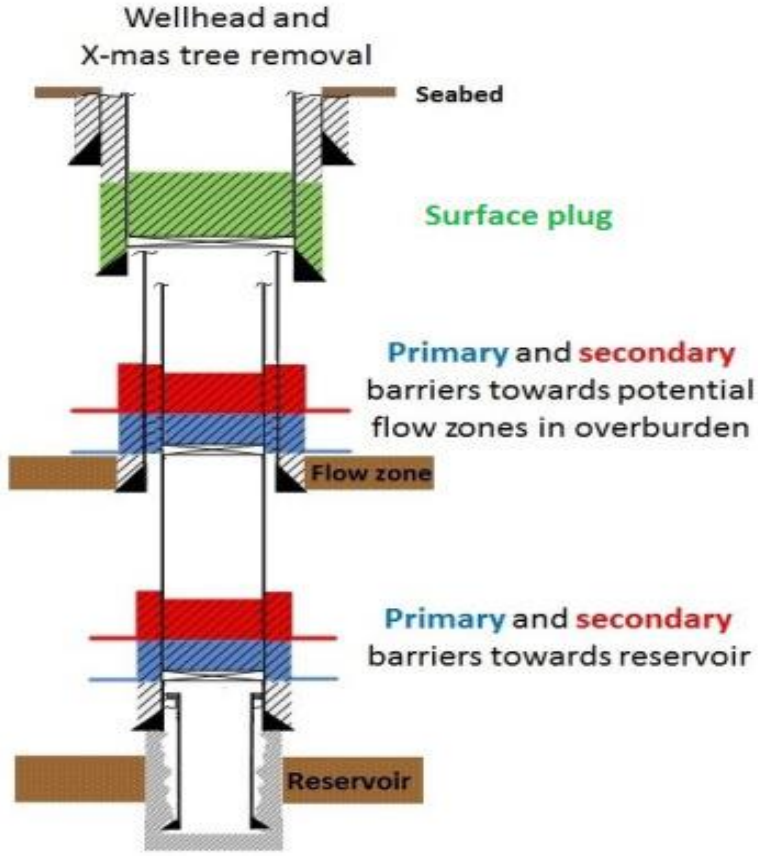
Recommendations

Review drilling and well completion reports

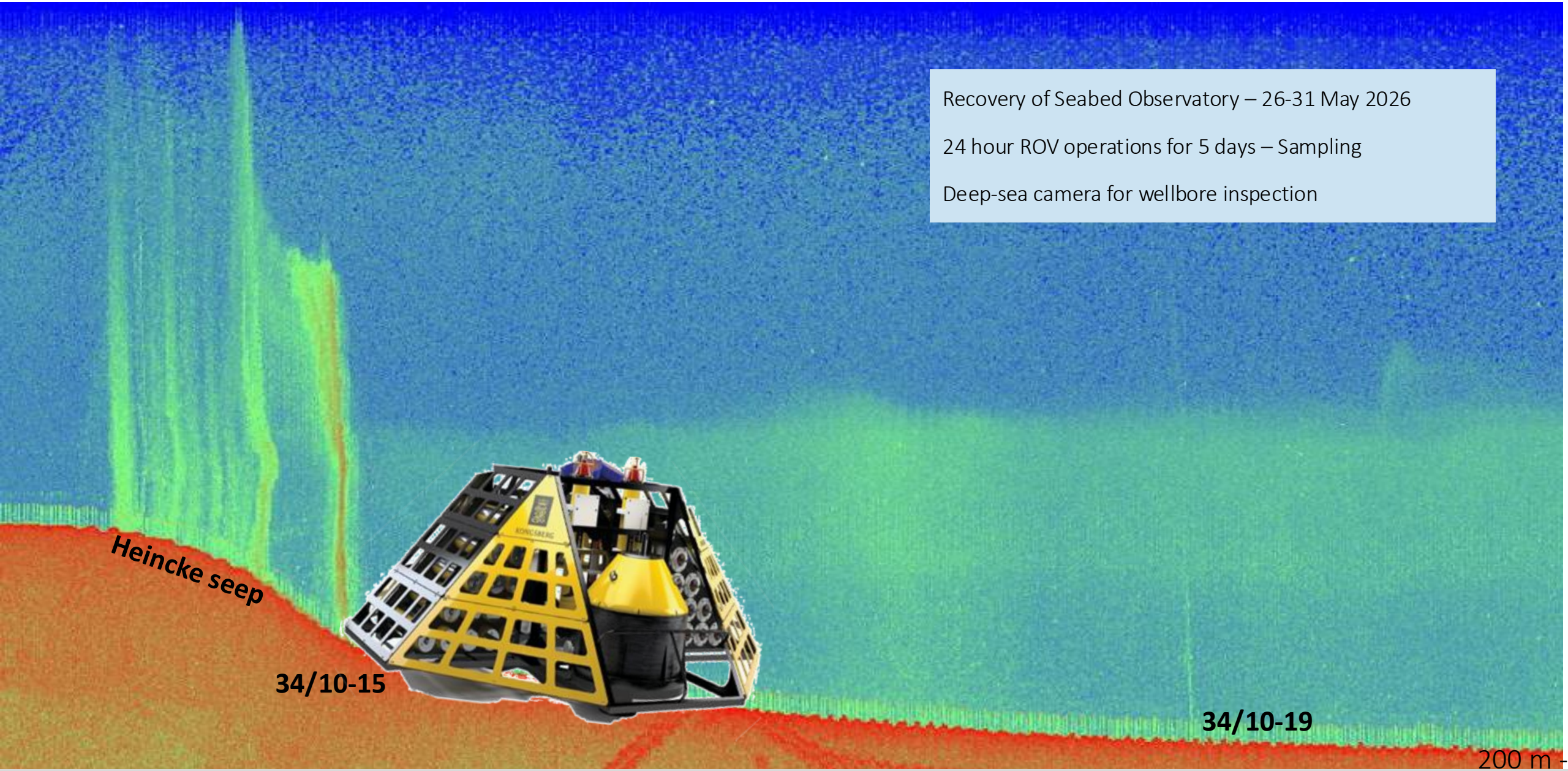
Well schematics, placement of plugs and types of cement

Possibly relate WAMS to P&A approach





WELLFATE26 Survey



NOMS: Naturally occurring methane seep | WAMS: Well-associated methane seep | Image courtesy of SODIR (Mattingsdal and Jensen, 2023)