JPI OCEANS

# MiningImpact

*Environmental Impacts & Risks of Deep-Sea Mining*


**Phase 1** Jan 2015 – Dec 2017 (25 partners / 11 countries)
~14.5 Mio€ (funding: ~11.2 Mio€, incl. ship time)

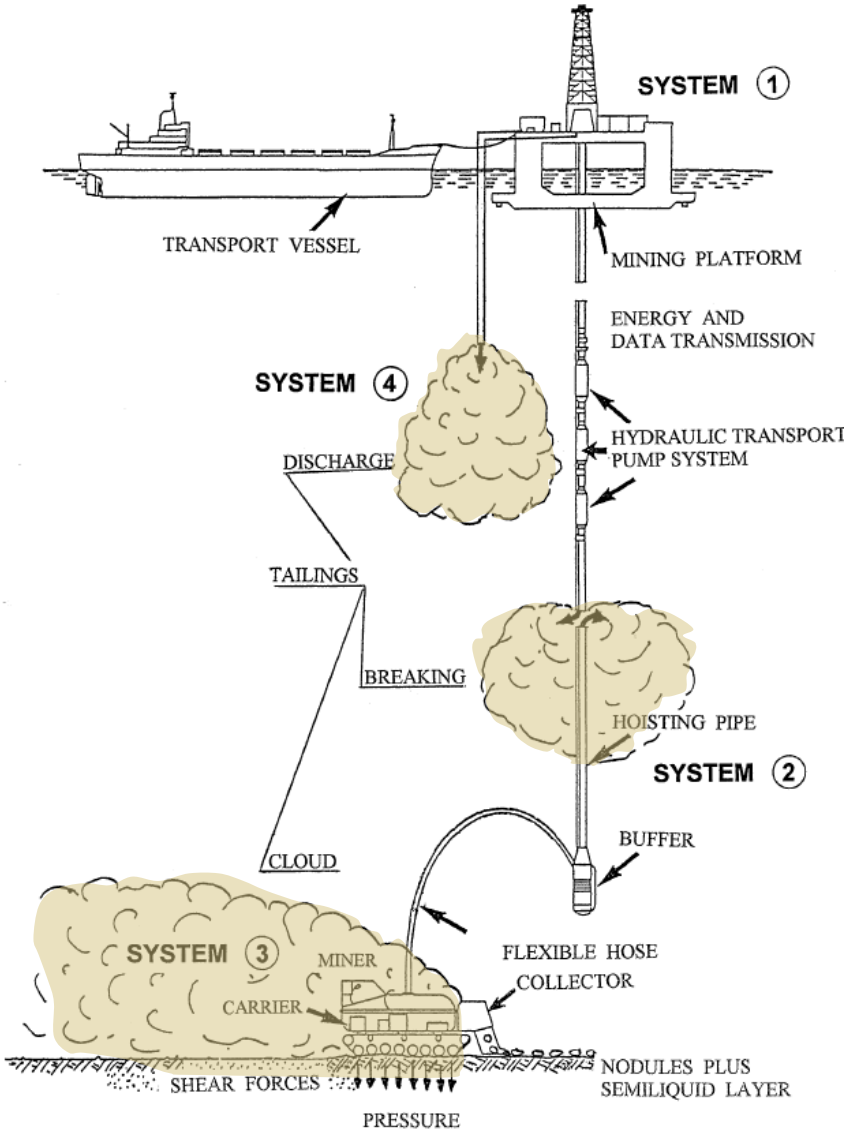
**Phase 2** Aug 2018 – Feb 2022 (30 partners / 9 countries + ISA)
~17 Mio€ (funding: ~11 Mio€, incl. ship time)

**Coordinator: Matthias Haeckel, GEOMAR**

Belgium: UGent, RBINS
France: IFREMER
Germany: GEOMAR, MPI, SGN, JUB, UBremen, AWI, BGR, UBielefeld, CAUKiel
Italy: UNIVPM
Norway: DNVGL, NIVA, UNEP GRIDA, UResearch, NTNU, SNF, IRIS, UiB
Poland: ULodz, USzczecin
Portugal: UAveiro, IMAR, CIIMAR, UAlgarve, IPMA
Romania: Geoecomar
Sweden: UGothenburg
The Netherlands: NIOZ, UUtrecht, TUDelft
United Kingdom: USOU, NHM, NOCS, HWU
The International Seabed Authority

Federal Ministry of Education and Research
belspo
DEPARTEMENT ECONOMIE WETENSCHAP & INNOVATIE
Vlaamse overheid
dgpm Direção-Geral de Política do Mar
FCT Fundação para a Ciência e a Tecnologia
The Research Council of Norway
NWO Netherlands Organisation for Scientific Research
FORMAS

# Impacts of polymetallic nodule mining




Oebius et al. (2001) DSR II 48

- Removal of nodules & 10 cm of seafloor
- Generation of sediment plume that will resettle & blanket the seafloor
- Discharge of sediment waste from surface platform / riser pipe


- Loss of habitat
- Loss of species & genetic diversity
- Loss of ecosystem structure & functions
- Change of surface sediment characteristics & processes

# Key Conclusions MI1

1. Deep-sea ecosystems associated with polymetallic resources support a highly diverse fauna
2. Deep-sea faunal communities show a high variability on small and large spatial scales, but their connectivity over relevant scales for reference zones and for conservation remains unknown
3. Temporal variations of faunal abundances remain unknown due to the lack of long-term ecological time series
4. Loss of seafloor integrity by removal of nodules and surface seafloor reduces population densities and ecosystem functions (e.g. nutrient remineralization, microbial growth, bioturbation activity)
5. Disturbance impacts last for at least many decades (e.g. biogeochemical processes will take >50 years to recover)
6. Sediment plumes will likely blanket the seafloor up to several tens of kilometers outside the mined area

→ Minimizing the large-scale impacts will require careful adaptive spatial planning of mining operations and development of low-impact equipment

→ Environmental management plans need to address current uncertainties of the sediment plume dispersal and spatial variability of the abyssal ecosystem that exists also on local scale

Boetius & Haeckel (2018) Science 359

# Outreach activities

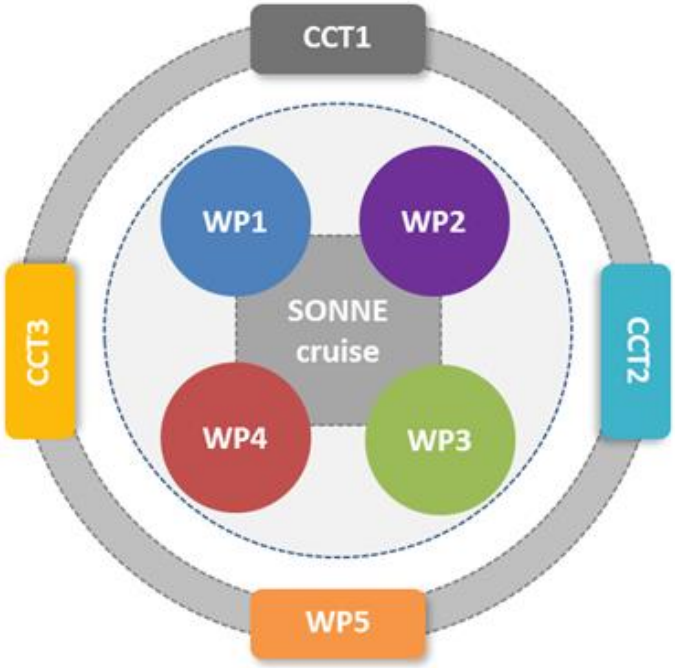



- **European Maritime Day (May 2016)**
- **Panel discussion UN World Ocean Day (June 2016)**
- **Side event at the ISA (July 2016)**
- **Discussion panel at EU Parliament (Nov 2016)**
- **BMBF Year of the Oceans 2016/17**
- **Video installations of artist Armin Linke 2017/18**
- **Stakeholder Events at the NHM London (Oct 2017) + RBINS (Sep 2018)**

- **TV documentaries: Arte, Leschs Kosmos, ZDF KiKa**
- **Interviews for radio stations, newspapers, journals, web blogs**
- **Presentations for general public (e.g. Kiel Week)**

# Key Objectives MI2

- Develop + test monitoring concepts and strategies for deep-sea mining operations
- Develop standardization procedures for monitoring and definitions for indicators of a good environmental status
- Investigate potential mitigation measures, such as spatial management plans of mining operations and means to facilitate ecosystem recovery
- Develop sound methodologies to assess the environmental risks and estimate benefits, costs and risks
- Explore how uncertainties in the knowledge of impacts can be implemented into appropriate regulatory frameworks




WP1 Biodiversity, connectivity, resilience

WP2 Fate and toxicity of the sediment plume

WP3 Biogeochemistry + ecosystem functioning

WP4 Data and sample management

WP5 Project dissemination and coordination

CCT1 Plume monitoring + habitat mapping

CCT2 Disturbance effects in time and space

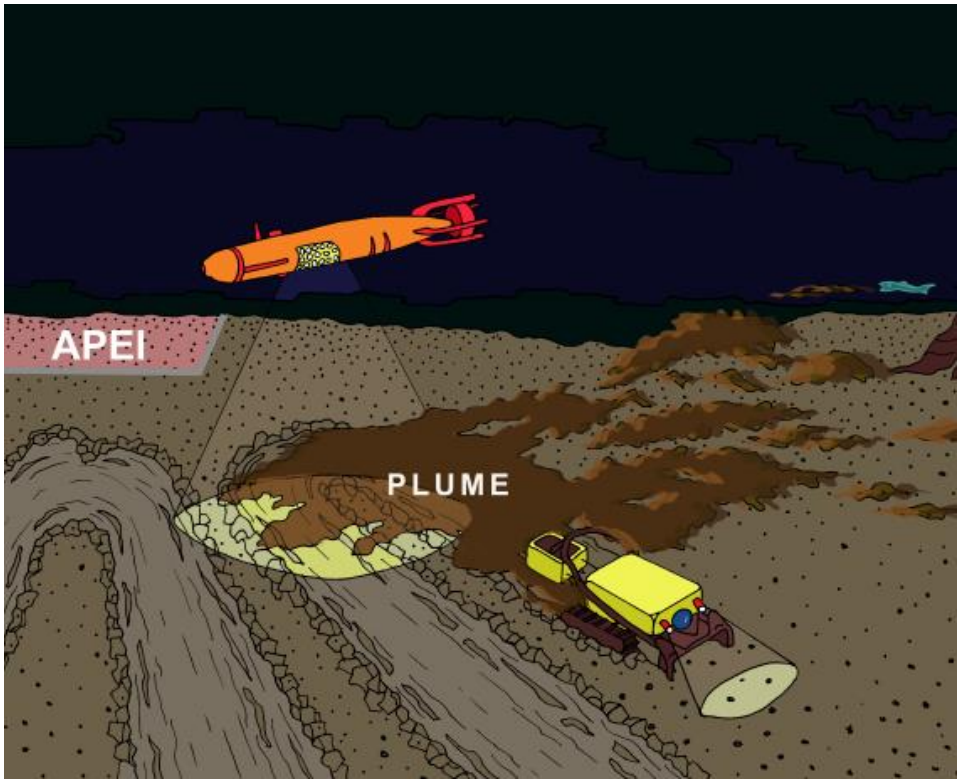
CCT3 ERA & policy recommendations

**MiningImpact 2 will conduct**

**an independent scientific assessment of the collector trial of DEME-GSR**

**Monitoring program is not part of GSR's obligation to monitor their trial.**

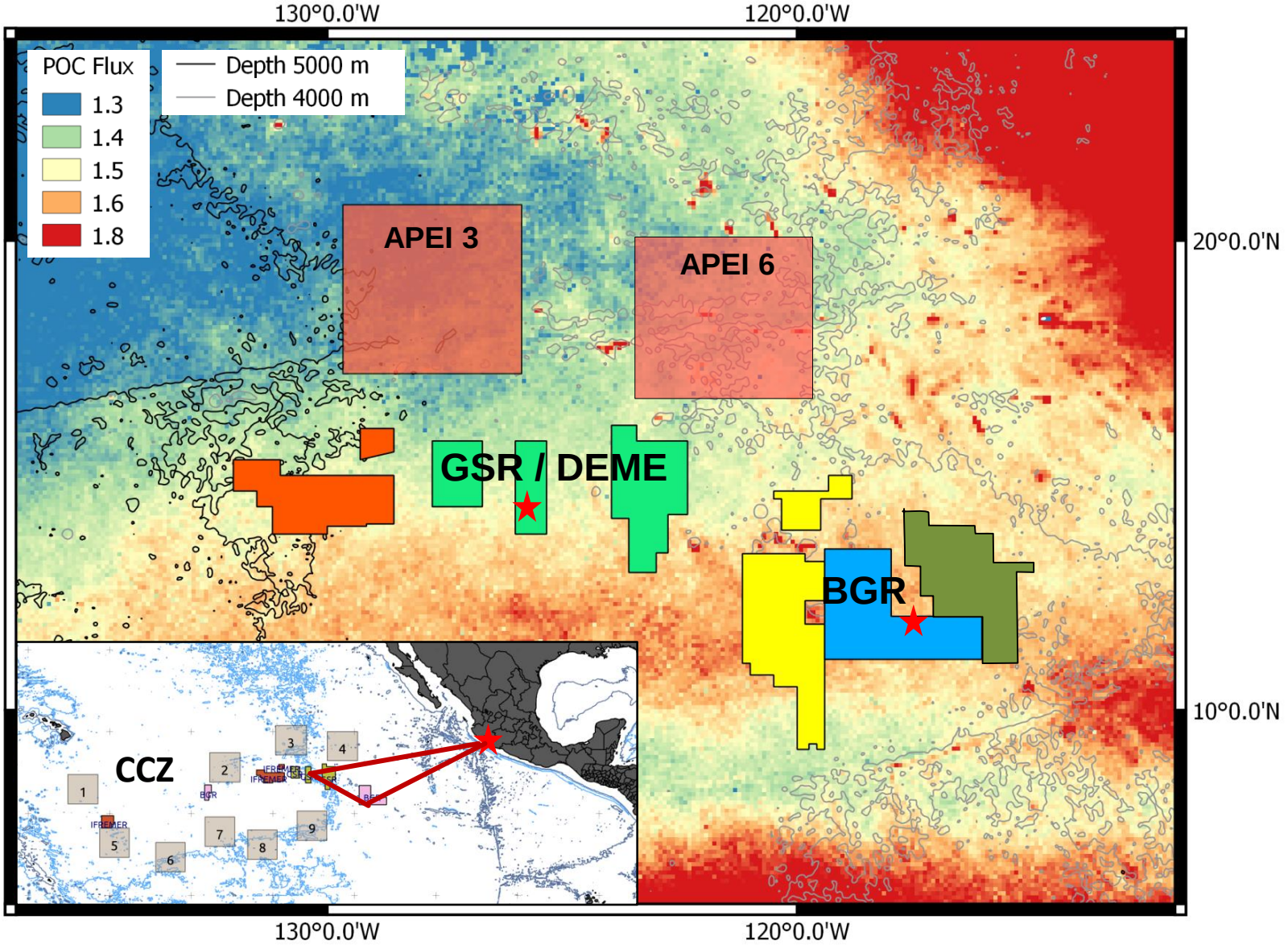
**All project data will be published in open-access databases (PANGAEA).**



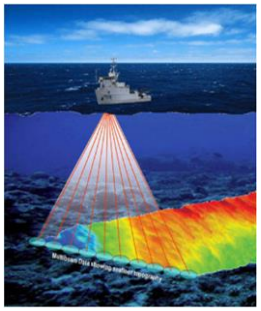
# German + Belgian license areas in the CCZ

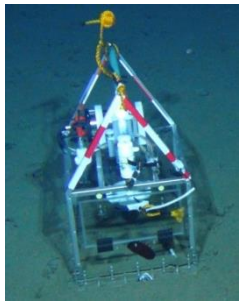
## SO268: 17 Feb – 22 May 2019

## follow-up cruise: early 2021



# SO268 Monitoring Plan



- ROV Kiel 6000 (+ 2 elevators) and AUV Abyss
- CTD/water sampler for deployments in the water column and plume sampling
- GC, TV-MUC, BC, in situ pumps to sample sediments and fauna
- 4 benthic landers with ADCPs, OBSs, turbidity sensors, time-lapse cameras, hydrophones
- 6 Moorings + 4 sediment traps
- ROV-operated in situ experimentation (benthic chambers, microprofiler, PC etc)
- Parasound + Multibeam (EM 122 + EM 710) systems and underwater positioning systems



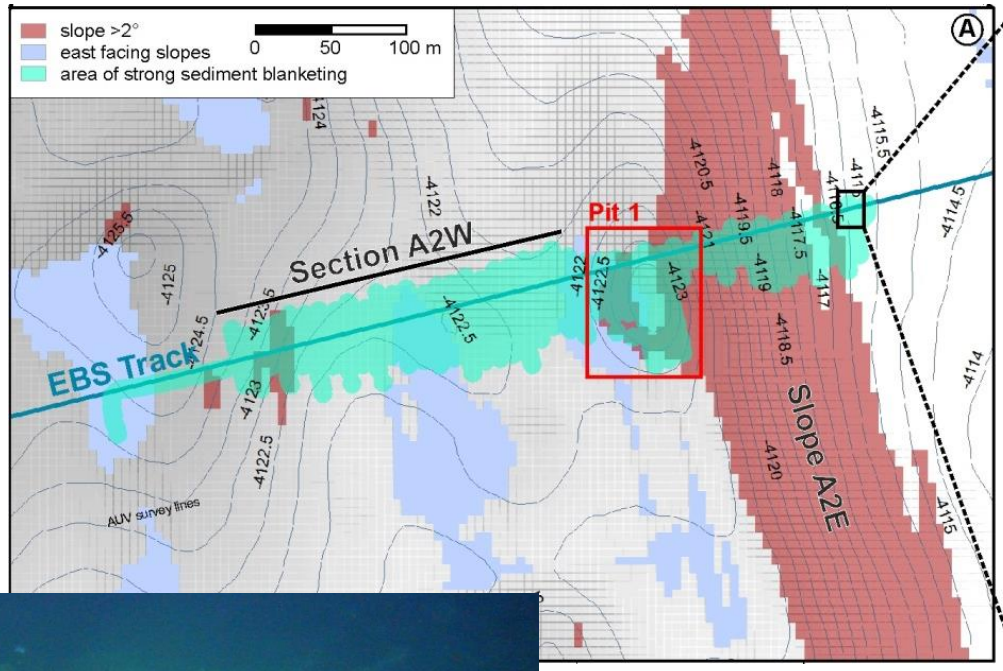

# SO268 Monitoring Plan

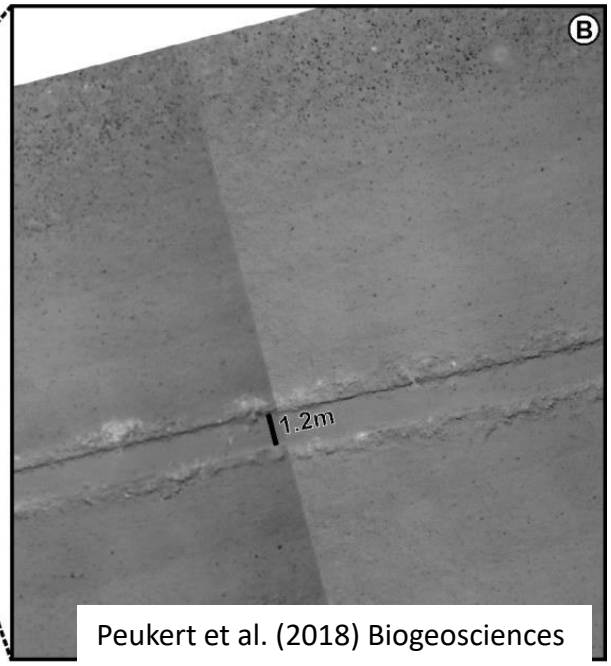
Understand fate of particles and effective footprint in space and time

⇒ requires multiple-year time-series of bottom currents

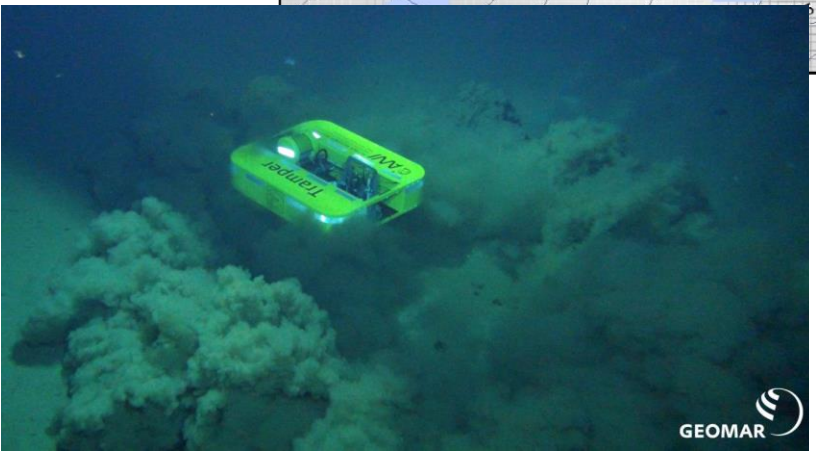
⇒ characterization of particle size distributions, aggregation, settling velocities

⇒ develop appropriate numerical models




Peukert et al. (2018) Biogeosciences



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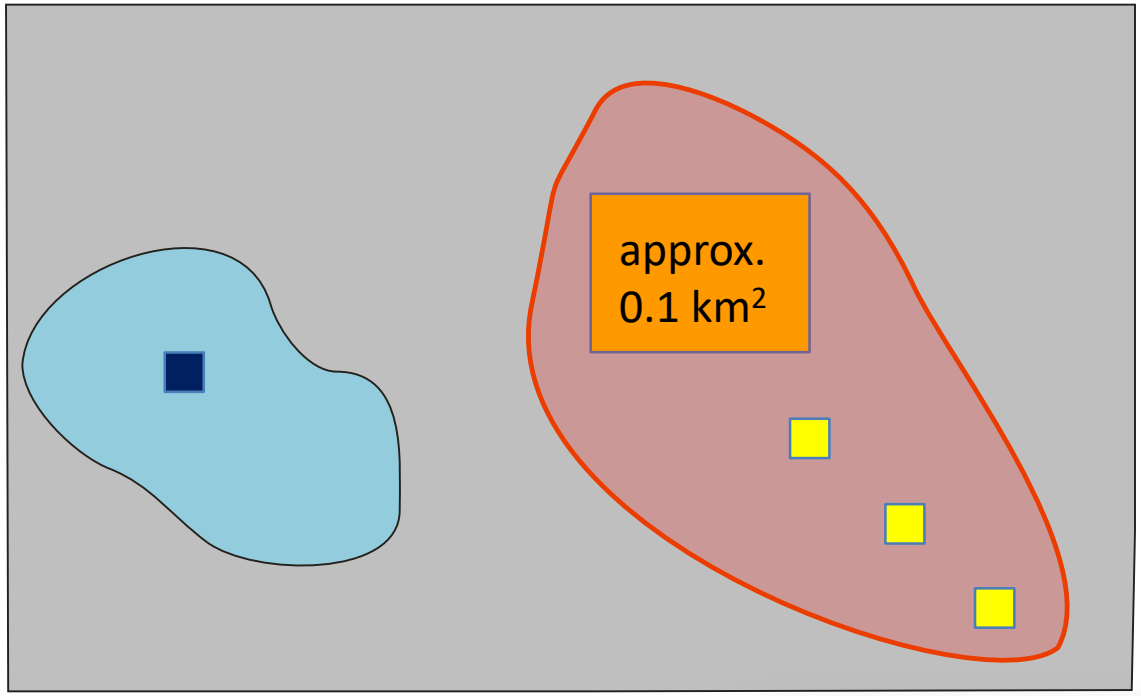
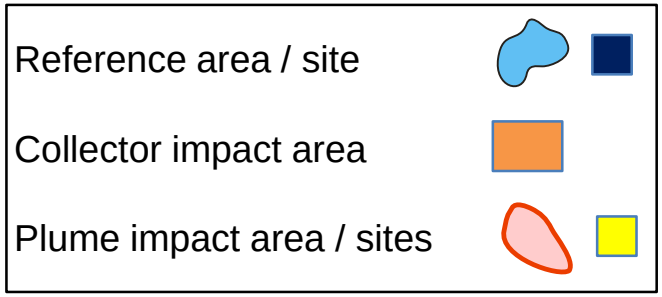
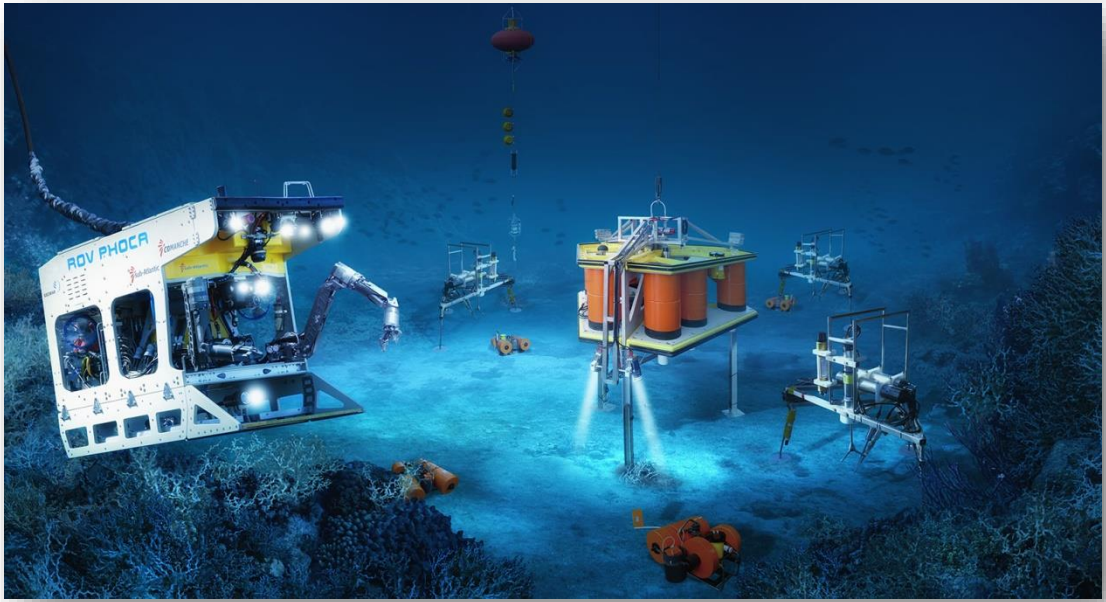



**Array of >50 optical/acoustic sensors will be deployed on ~20 different platforms (landers, moorings, tripods) guided by numerical simulations and existing baseline data**



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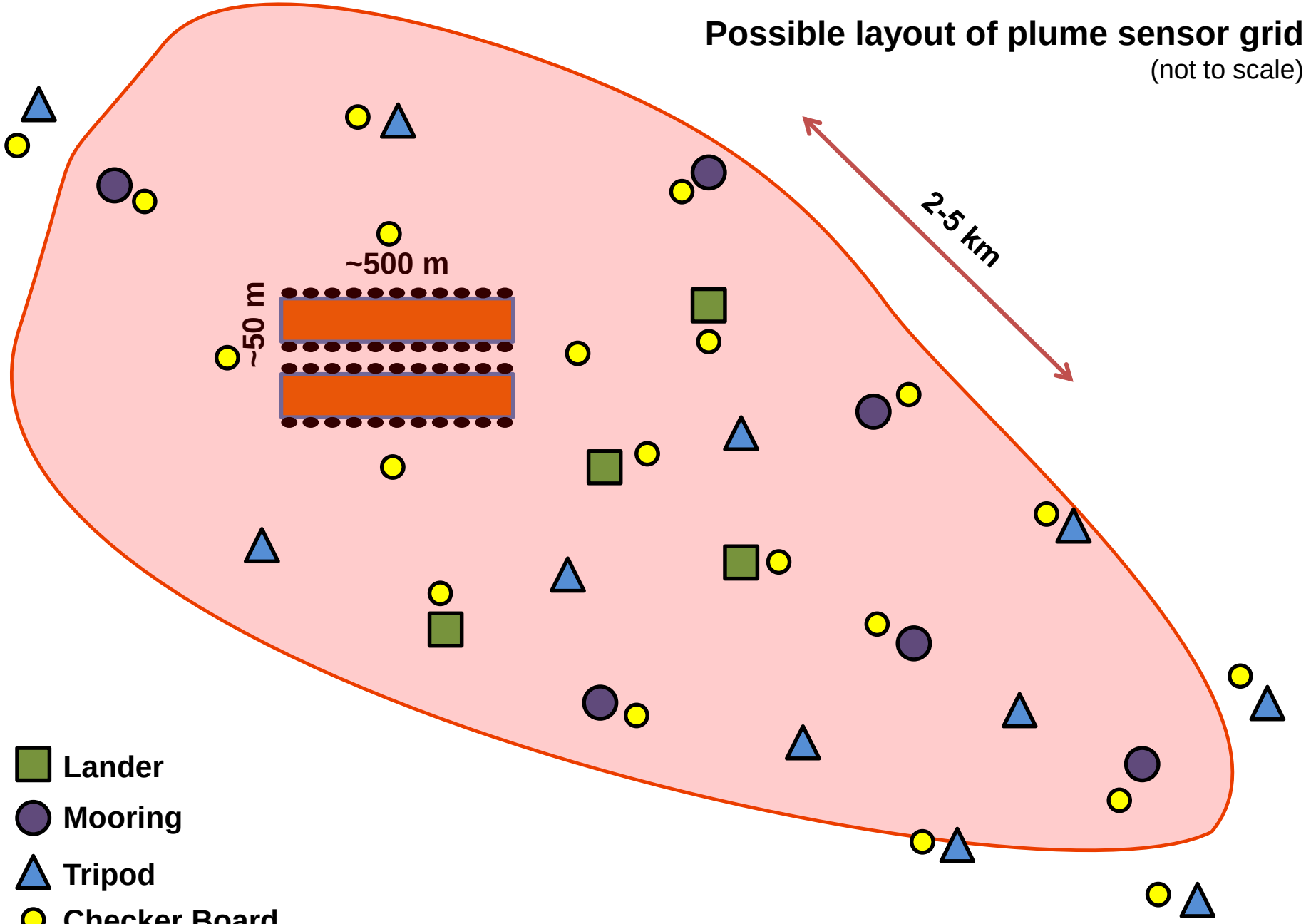
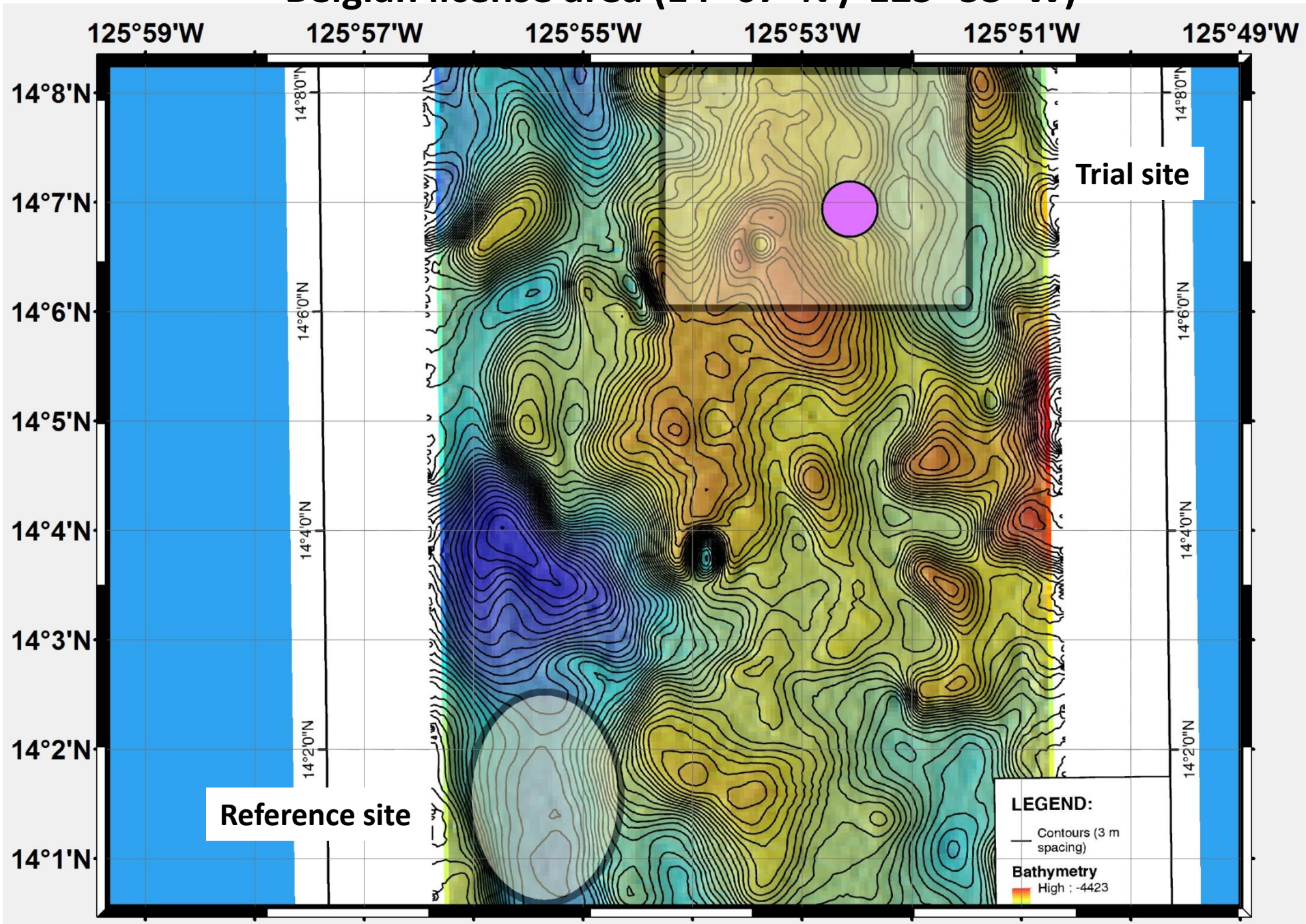
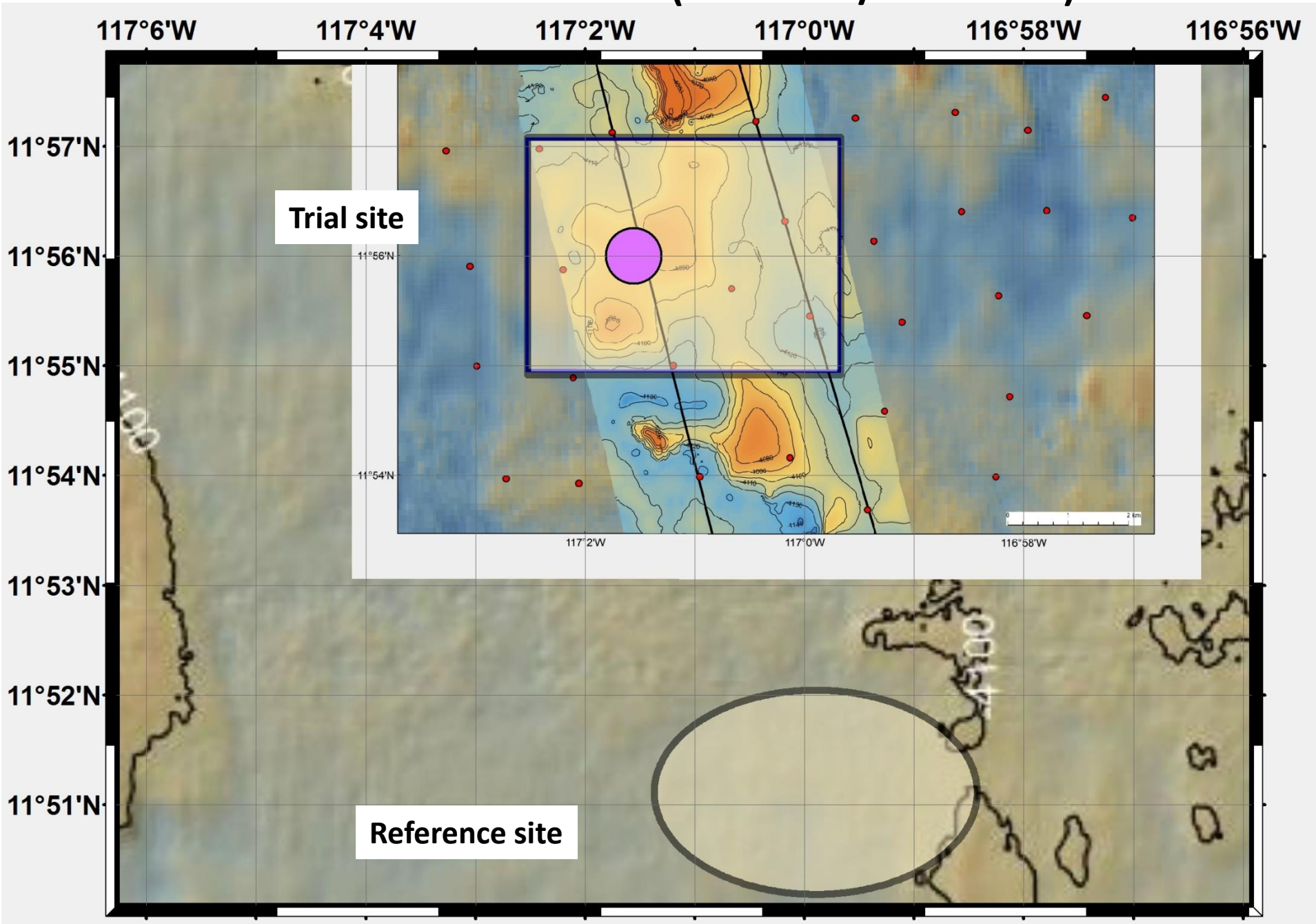


# Belgian license area (14° 07‘ N / 125° 53‘ W)



# German license area (11° 56‘ N / 117° 1‘ W)



# Preliminary Cruise Schedule

| Plan A2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| February | | March | | April | | May | |
| 1 | | 1 | ecotox/foodweb | 1 | | 1 | |
| 2 | | 2 | | 2 | | 2 | |
| 3 | | 3 | | 3 | arrive BE claim | 3 | |
| 4 | | 4 | | 4 | put down sensors | 4 | |
| 5 | | 5 | | 5 | | 5 | |
| 6 | | 6 | leave GER for BE claim | 6 | start trial + plume BE | 6 | |
| 7 | | 7 | arrive BE claim | 7 | | 7 | |
| 8 | | 8 | baseline ref | 8 | | 8 | pickup sensors |
| 9 | | 9 | | 9 | end trial | 9 | restoration experiment |
| 10 | | 10 | | 10 | | 10 | |
| 11 | | 11 | | 11 | end plume monitor | 11 | |
| 12 | | 12 | baseline trial | 12 | impact assessment BE a | 12 | leave GER for BE claim |
| 13 | | 13 | | 13 | | 13 | arrive BE claim |
| 14 | | 14 | | 14 | | 14 | impact assessment BE b |
| 15 | | 15 | | 15 | | 15 | |
| 16 | | 16 | | 16 | pickup sensors | 16 | |
| 17 | Manzanillo | 17 | ecotox/foodweb | 17 | leave BE for GER claim | 17 | |
| 18 | | 18 | | 18 | arrive GER claim | 18 | leave BE claim |
| 19 | arrive GER claim | 19 | | 19 | put down sensors | 19 | |
| 20 | baseline ref | 20 | | 20 | | 20 | |
| 21 | | 21 | | 21 | | 21 | |
| 22 | | 22 | put down sensors | 22 | start trial + plume GER | 22 | Manzanillo |
| 23 | | 23 | leave BE claim | 23 | | 23 | |
| 24 | baseline trial | 24 | | 24 | | 24 | |
| 25 | | 25 | | 25 | end trial | 25 | |
| 26 | | 26 | | 26 | | 26 | |
| 27 | | 27 | Manzanillo | 27 | end plume monitor | 27 | |
| 28 | | 28 | harbour | 28 | impact assessment GER | 28 | |
| | | 29 | harbour | 29 | | 29 | |
| | | 30 | Manzanillo | 30 | | 30 | |
| | | 31 | | | | 31 | |

**DEME-GSR (GSRNOD19)** 14/17 Feb – 1 May (San Diego)