GARAH
Mid-Term Meeting
5th February 2020, 14.00-16.00 hours

Peter Britze

GEUS

Geological Survey of Denmark and Greenland

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

Agenda 1 of 3

- 1. Introduction
  - a. Participants
  - b. Purpose of the GARAH project
  - c. Expected impact
- 2. WP Progress
  - 3. WP2 North Sea HC resource estimations
    - a. Regional:
      - i. Conventional resources
      - ii. Unconventional resources

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- b. 3D pilot study
  - i. Conventional resources
  - ii. Unconventional resources
- c. Alternative usages

– 4. WP3 Gas Hydrates in Europe
- a. Listing content of Europe's Gas Hydrates
- b. International collaboration
- c. Building a database

– 5. WP4 GIP
- a. Establishing technical specifications
- b. Coordination of the GARAH database and Share Point development

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- 6. WP1 Project management
  - a. Finances
  - b. Progress according to time plan / Gant Chart
  - c. Project meetings and internal communications
  - d. Cooperation with 3DGEO-EU, HIKE and GIP
  - e. Dissemination and communication

- 3. General Discussions/Questions/Conclusions

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1. Introduction

- a. Participants
- b. Purpose of the GARAH project
- c. Expected impact

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TNO

GEUS

Instituto Geológico y Minero de España

Geoscience for a sustainable Earth brgm

BGR

BGS 1835

GARAH

GeoERA GEO-ENERGY

Consortium

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GeoERA GEO-ENERGY

Hydrocarbon assessment

- A harmonized, scientifically based, geological analysis and assessment of conventional and unconventional hydrocarbon resources will help member states to continue the transition to lower Carbon energy sources. This will contribute to climate commitments, and allow the planning for secure sources of affordable energy. The analysis and assessment of hydrocarbons will focus on two areas:

- (i) in Europe's major petroleum province – the North Sea a "Geological analysis and resource assessment of North Sea petroleum systems",

- (ii) with a pan-European view, "Hydrate assessment in the European continental margin and related risks".

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Expected impact

- The GARAH project idea will result in the identification of new potential areas for hydrocarbon exploration, directly addressing the requirement for identifying secure energy HC sources.
- This will give further information regarding basin development and evolution, and the HC resources will be systematically assessed.
- Outcomes will therefore feed into planning and policy (licensing of areas for exploration) by Member States, commercial exploration strategies and highlight remaining knowledge gaps, which may inform about further academic research or programs of exploration sponsored by member states.
- The generated catalogue of the multiple-use (or sequential-use) potential and impacts of hydrocarbon reservoirs will enable the European community to improve efficient, sustainable, and foster climate friendly use of the subsurface.
- A consistent estimation of hydrocarbon resource will be a first step in assessing and quantifying the hydrocarbon reserves in the main hydrocarbon basin in Europe.
- Our mission is to generate a catalogue of the multiple-use, enabling synergies between various uses and securing a sustainable development, whilst reducing overall climate impact of fossil fuel use.
- The identification of potential hydrate resources in the European margins and provide a unified database and maps detailing potential distribution of gas hydrates (energy source), potential geohazard areas. In addition, we will aim to identify zones could be used to store CO2 as a hydrate (subsurface CO2 storage resource) within the European offshore and onshore areas.
- The results will foster the development of new HC technologies in Europe and will feed into planning, policy (licensing of areas for exploration) by Member States, and commercial exploration strategies.
- The outcomes of this project idea will inform EU Member States of potential frontier plays in a pan-EU perspective, allowing for the currently poorly understood offshore methane hydrate and shale gas/oil resource to be acknowledged in developing legislation and regulation.

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2. WP Progress

- 3. WP2 North Sea HC resource estimations
  - a. Regional:
    - i. Conventional resources
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  - b. 3D pilot study
    - i. Conventional resources
    - ii. Unconventional resources
  - c. Alternative usages

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Mid Term Progress:
WP2 North Sea HC resource estimations:
Conventional Resources

Margaret Stewart, Susanne Nelskamp

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Work Flow and Status – February 2020

Task	Progress
Creation and Dissemination of conventional resource questionnaires	Complete ✓
Creation and Dissemination of conventional resource spreadsheet to capture data	Complete ✓
Contribution to and completion of data reporting	Complete ✓
Definition of conventional data/deliverables to be gathered and availability of data across team	Complete ✓
Collation of agreed data	Ongoing
Creation and consolidation of GIS layers	Ongoing

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GeoERA GEO-ENERGY

Questionnaires and Spreadsheets

CAPTURE:

- Summary of exploration history, main plays, current methods for resource assessments across borders
- Quantitative descriptions of reserves, resources, yet to find – all in same units
- Summary of play types across borders – reservoir, source, seal
- List of exploration wells for each country from 2000 – name, location, company, dates drilled and completed, target formation if possible.

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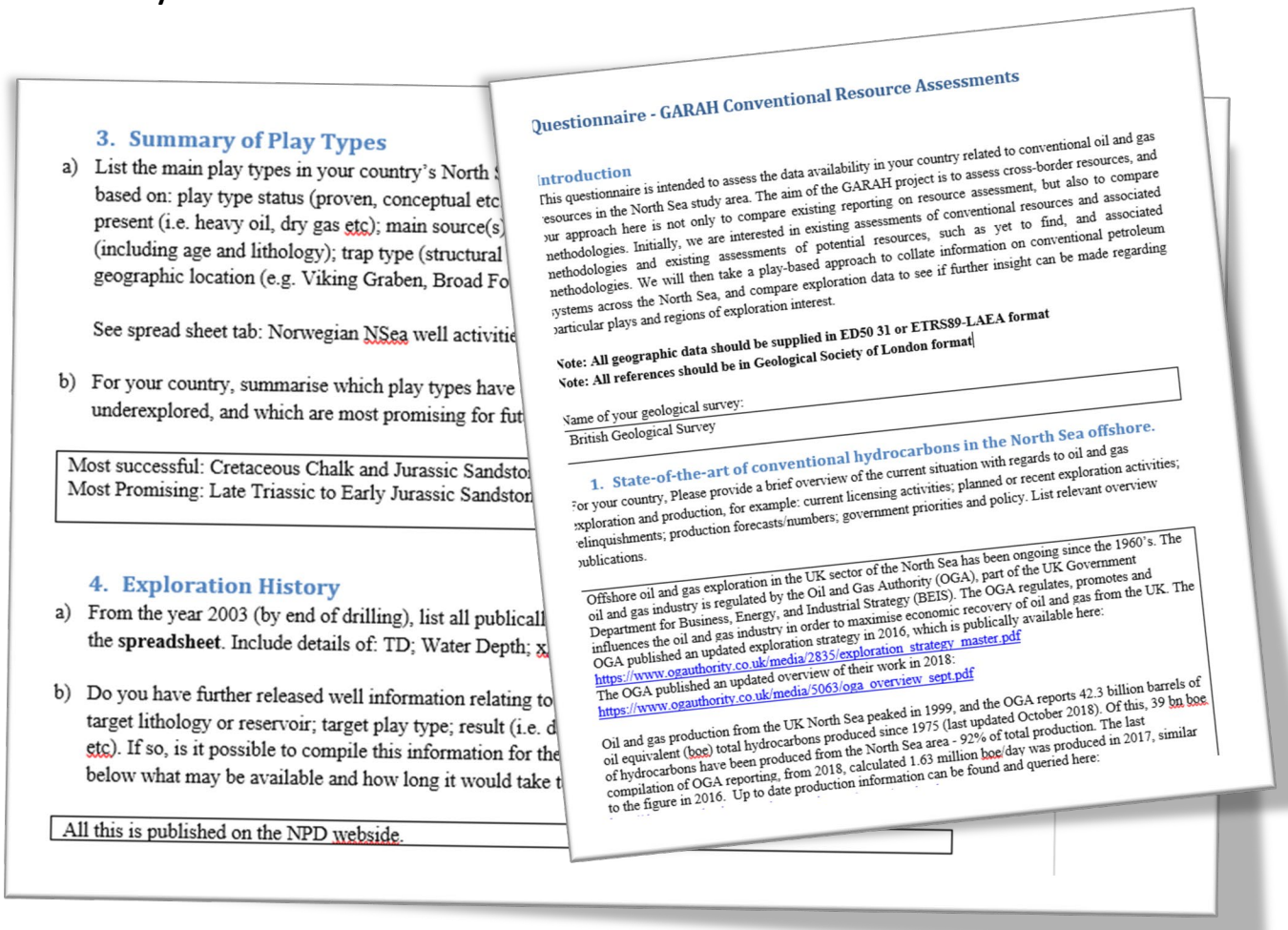
Work Flow and Status – February 2020

Questionnaires returned by January 2020 – variable detail but all completed



3. Summary of Play Types

a) List the main play types in your country's North
based on: play type status (proven, conceptual etc
present (i.e. heavy oil, dry gas etc); main source(s)
(including age and lithology); trap type (structural
geographic location (e.g. Viking Graben, Broad Fo

See spread sheet tab: Norwegian NSea well activitie

b) For your country, summarise which play types have
underexplored, and which are most promising for fut

Most successful: Cretaceous Chalk and Jurassic Sandsto
Most Promising: Late Triassic to Early Jurassic Sandstor

4. Exploration History

a) From the year 2003 (by end of drilling), list all publicall
the **spreadsheet**. Include details of: TD; Water Depth; x

b) Do you have further released well information relating to
target lithology or reservoir; target play type; result (i.e. d
etc). If so, is it possible to compile this information for the
below what may be available and how long it would take t

All this is published on the NPD webside.

Questionnaire - GARAH Conventional Resource Assessments

Introduction

This questionnaire is intended to assess the data availability in your country related to conventional oil and gas resources in the North Sea study area. The aim of the GARAH project is to assess cross-border resources, and our approach here is not only to compare existing reporting on resource assessment, but also to compare methodologies. Initially, we are interested in existing assessments of conventional resources and associated methodologies and existing assessments of potential resources, such as yet to find, and associated methodologies. We will then take a play-based approach to collate information on conventional petroleum systems across the North Sea, and compare exploration data to see if further insight can be made regarding particular plays and regions of exploration interest.

Note: All geographic data should be supplied in ED50 31 or ETRS89-LAEA format
Note: All references should be in Geological Society of London format

Name of your geological survey:
British Geological Survey

1. State-of-the-art of conventional hydrocarbons in the North Sea offshore.

For your country, Please provide a brief overview of the current situation with regards to oil and gas exploration and production, for example: current licensing activities; planned or recent exploration activities; relinquishments; production forecasts/numbers; government priorities and policy. List relevant overview publications.

Offshore oil and gas exploration in the UK sector of the North Sea has been ongoing since the 1960's. The oil and gas industry is regulated by the Oil and Gas Authority (OGA), part of the UK Government Department for Business, Energy, and Industrial Strategy (BEIS). The OGA regulates, promotes and influences the oil and gas industry in order to maximise economic recovery of oil and gas from the UK. The OGA published an updated exploration strategy in 2016, which is publically available here:
https://www.ogauthority.co.uk/media/2835/exploration_strategy_master.pdf
The OGA published an updated overview of their work in 2018:
https://www.ogauthority.co.uk/media/5063/oga_overview_sept.pdf

Oil and gas production from the UK North Sea peaked in 1999, and the OGA reports 42.3 billion barrels of oil equivalent (boe) total hydrocarbons produced since 1975 (last updated October 2018). Of this, 39 bn boe of hydrocarbons have been produced from the North Sea area - 92% of total production. The last compilation of OGA reporting, from 2018, calculated 1.63 million boe/day was produced in 2017, similar to the figure in 2016. Up to date production information can be found and queried here:

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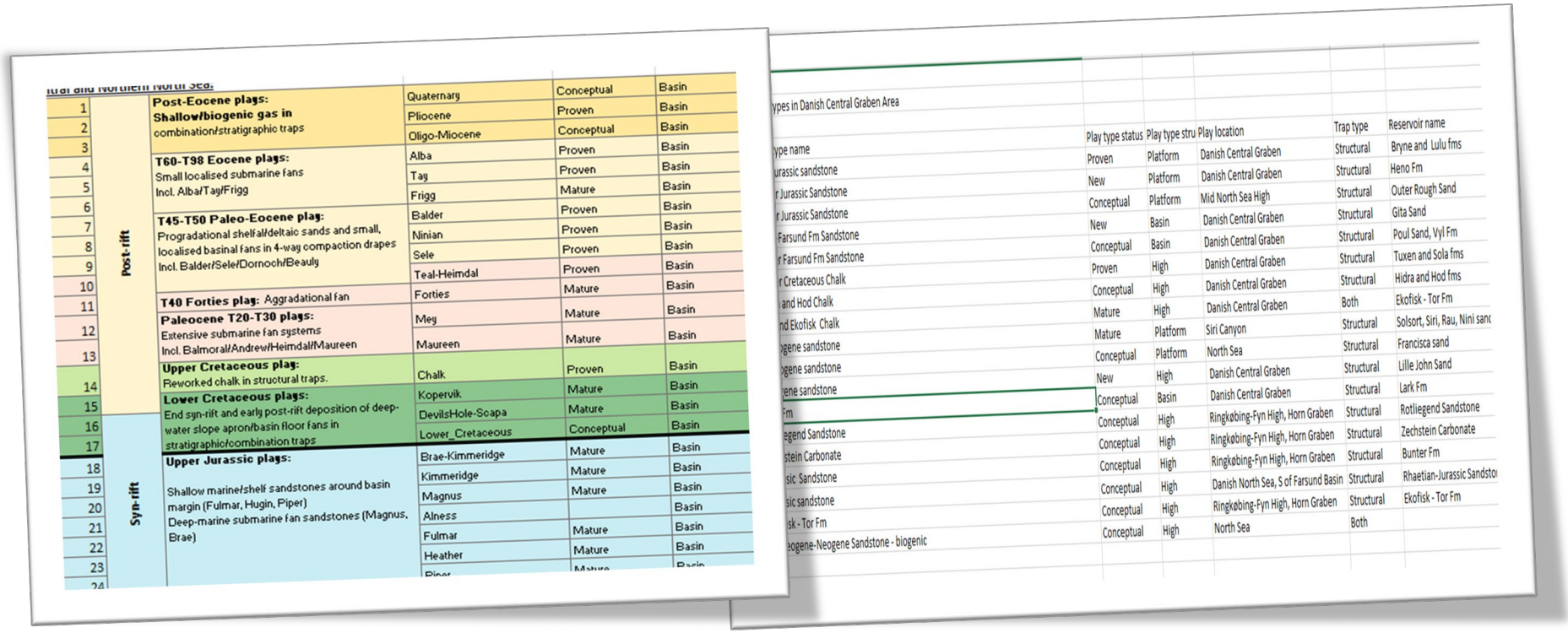
Work Flow and Status – February 2020



1	Post-rift	**Post-Eocene plays:** **Shallow/biogenic gas in** combination/stratigraphic traps	Quaternary	Conceptual	Basin
2			Pliocene	Proven	Basin
3			Oligo-Miocene	Conceptual	Basin
4		**T60-T98 Eocene plays:** Small localised submarine fans Incl. Alba/Tay/Frigg	Alba	Proven	Basin
5			Tay	Proven	Basin
6			Frigg	Mature	Basin
7		**T45-T50 Paleo-Eocene play:** Progradational shelfal/deltaic sands and small, localised basinal fans in 4-way compaction drapes Incl. Balder/Sele/Dornoch/Beauly	Balder	Proven	Basin
8			Ninian	Proven	Basin
9			Sele	Proven	Basin
10			Teal-Heimdal	Proven	Basin
11		**T40 Forties play:** Aggradational fan	Forties	Mature	Basin
12		**Paleocene T20-T30 plays:** Extensive submarine fan systems Incl. Balmoral/Andrew/Heimdal/Maureen	Mey	Mature	Basin
13			Maureen	Mature	Basin
14		**Upper Cretaceous play:** Reworked chalk in structural traps.	Chalk	Proven	Basin
15		**Lower Cretaceous plays:** End syn-rift and early post-rift deposition of deep-water slope apron/basin floor fans in stratigraphic/combination traps	Kopervik	Mature	Basin
16			DevilsHole-Scapa	Mature	Basin
17			Lower_Cretaceous	Conceptual	Basin
18	Syn-rift	**Upper Jurassic plays:** Shallow marine/shelf sandstones around basin margin (Fulmar, Hugin, Piper) Deep-marine submarine fan sandstones (Magnus, Brae)	Brae-Kimmeridge	Mature	Basin
19			Kimmeridge	Mature	Basin
20			Magnus	Mature	Basin
21			Alness		Basin
22			Fulmar	Mature	Basin
23			Heather	Mature	Basin
24			Piper	Mature	Basin

ypes in Danish Central Graben Area

ype name	Play type status	Play type stru	Play location	Trap type	Reservoir name
urassic sandstone	Proven	Platform	Danish Central Graben	Structural	Bryne and Lulu fms
r Jurassic Sandstone	New	Platform	Danish Central Graben	Structural	Heno Fm
r Jurassic Sandstone	Conceptual	Platform	Mid North Sea High	Structural	Outer Rough Sand
Farsund Fm Sandstone	New	Basin	Danish Central Graben	Structural	Gita Sand
r Farsund Fm Sandstone	Conceptual	Basin	Danish Central Graben	Structural	Poul Sand, Vyl Fm
r Cretaceous Chalk	Proven	High	Danish Central Graben	Structural	Tuxen and Sola fms
and Hod Chalk	Conceptual	High	Danish Central Graben	Structural	Hidra and Hod fms
nd Ekofisk Chalk	Mature	High	Danish Central Graben	Both	Ekofisk - Tor Fm
gene sandstone	Mature	Platform	Siri Canyon	Structural	Solsort, Siri, Rau, Nini sand
gene sandstone	Conceptual	Platform	North Sea	Structural	Francisca sand
ene sandstone	New	High	Danish Central Graben	Structural	Lille John Sand
Fm	Conceptual	Basin	Danish Central Graben	Structural	Lark Fm
egend Sandstone	Conceptual	High	Ringkøbing-Fyn High, Horn Graben	Structural	Rotliegend Sandstone
stein Carbonate	Conceptual	High	Ringkøbing-Fyn High, Horn Graben	Structural	Zechstein Carbonate
sic Sandstone	Conceptual	High	Ringkøbing-Fyn High, Horn Graben	Structural	Bunter Fm
sic sandstone	Conceptual	High	Danish North Sea, S of Farsund Basin	Structural	Rhaetian-Jurassic Sandstone
sk - Tor Fm	Conceptual	High	Ringkøbing-Fyn High, Horn Graben	Structural	Ekofisk - Tor Fm
ogene-Neogene Sandstone - biogenic	Conceptual	High	North Sea	Both	

Spreadsheets returned by January 2020 – variable detail but all completed

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Work Flow and Status – February 2020

	Conventional parameters		Available					
		Agree	UK	Denmark	Norway	Netherlan	Germany	Comments
Clastic	Shallow reservoirs (less than 1.5km)	yes	yes but nc	yes	yes	yes but nc	no	
	Bright spots'	yes	no	yes	?	yes	yes	
	HPHT	yes	yes	yes	yes	?	no	what is the definition - 150C; 70MPascal. Need
	High permeability	no, because not practical						
	Low perm (tight)	no, because not practical						there may be opportunities to highligh in ta re
	basement and compare to onshore analogues	yes	yes but nc	to compar	onshore a	? Elbow sp	? Can take a look - central graben shoulder	
both carbonate and cl	geothermal	yes	yes	yes	yes	yes	yes	can do with analogues onshore -
both carbonate and cl	energy storage	yes	yes	yes	yes	yes	yes	also requires link to other works etc.
both carbonate and cl	CCS	yes	yes	yes	yes	yes	yes	link to other studies and regions that may be c
	stratigraphic intervals	yes	yes	yes	yes	yes	yes	use existing maps/outlines for main reservoirs
	infrastructure - platforms, pipelines, depleted fi	yes	yes	yes	yes	yes	? Need to	Does the SPBA have this? Millenium Atlas. Not
Source	principle defined source rocks - distribution (i.e.	yes	yes	yes	we need t	yes	yes for dis	this depends on time/effort/use to EU etc.hov
	coals		yes	yes	yes	yes	yes	this is definite (as won't be covered in unconve
Carbonate	existing and potential							
	porosity and permeability							
	Cretaceous - strat interval same as clastics	yes to all						For all of these it is compliation of existing stu
	Dinantian- strat interval							
	Zechstein - strat interval							
	fractured vs. secondary/primary porosity in chalk fields		?find out	yes		yes		
	salt and salt structures		yes	yes	yes	yes	yes	this is certainly in spba etc

October/November 2019 – definition of data to be collected - complete

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Work Flow and Status – February 2020

Country	Assessment	Type of setting	Assessment class	Parameter	Data type available
NL	Conventional/multiple use	Clastic/carbonates/CCS/Energy storage	Reserves and contingent resources	HC Fields	polygon shape file
NL	Conventional	Clastic/carbonates	Resources	Reservoir distribution	polygon outlines and depth/thickness grids
NL	Conventional	Shallow gas	Resources/conceptual	Bright spot mapping	polygon outlines
NL	Conventional	Shallow gas	Resources/conceptual	Chimneys	?
NL	Conventional	Shallow gas	Resources/conceptual	Shallow reservoirs	?
NL	Conventional	HPHT	Resources	Overpressure distribution	Point map
NL	all	HPHT/Geothermal potential/Unconventi	Resources	Temperature maps	most likely grids for different depth?
NL	all	HPHT/Geothermal potential/Unconventi	Resources	Heat flow map	either grid or point data
NL	Conventional	Basement play	conceptual	Basement highs	distribution polygons
NL	Multiple use	Energy storage	conceptual	Salt diapirs	polygon shape file/depth and thickness grid
NL	Conventional	Source	Resources	Coals	Distribution of carboniferous coal measures,
NL	Conventional	Source	Resources	Base Permian Subcrop map	Polygon outlines, e.g. SPBA
NL	Conventional/Unconventional	Source	Resources/conceptual	Posidonia shale	Thickness, Depth, Maturity, and TOC grids
NL	Conventional/Unconventional	Source	Conceptual	Geverik shale	Depth and maturity grids
NL	all	all	Reserves and contingent resources	wells	point data
NL	Multiple use	Energy storage/CCS	conceptual	Infrastructure	shape files
NL	all	all	conceptual	Major structures	polygon shape file
NL	Multiple use	CCS/Geothermal potential	conceptual	Aquifers	maybe poro/perm model
NL	Conventional	Carbonates	Reserves and contingent resources	Type of reservoir (fractures/prim	n/a
NL	Conventional	Carbonates	Resources	Zechstein Carbonate disctributic	?
NL	all	all	Reserves and contingent resources	Water depth	?
NL	Unconventional	source	conceptual	pressure	hydrostatic pressure gradient

Assessment of data available for GIS – ongoing – TNO have made most progress – results on One Drive.

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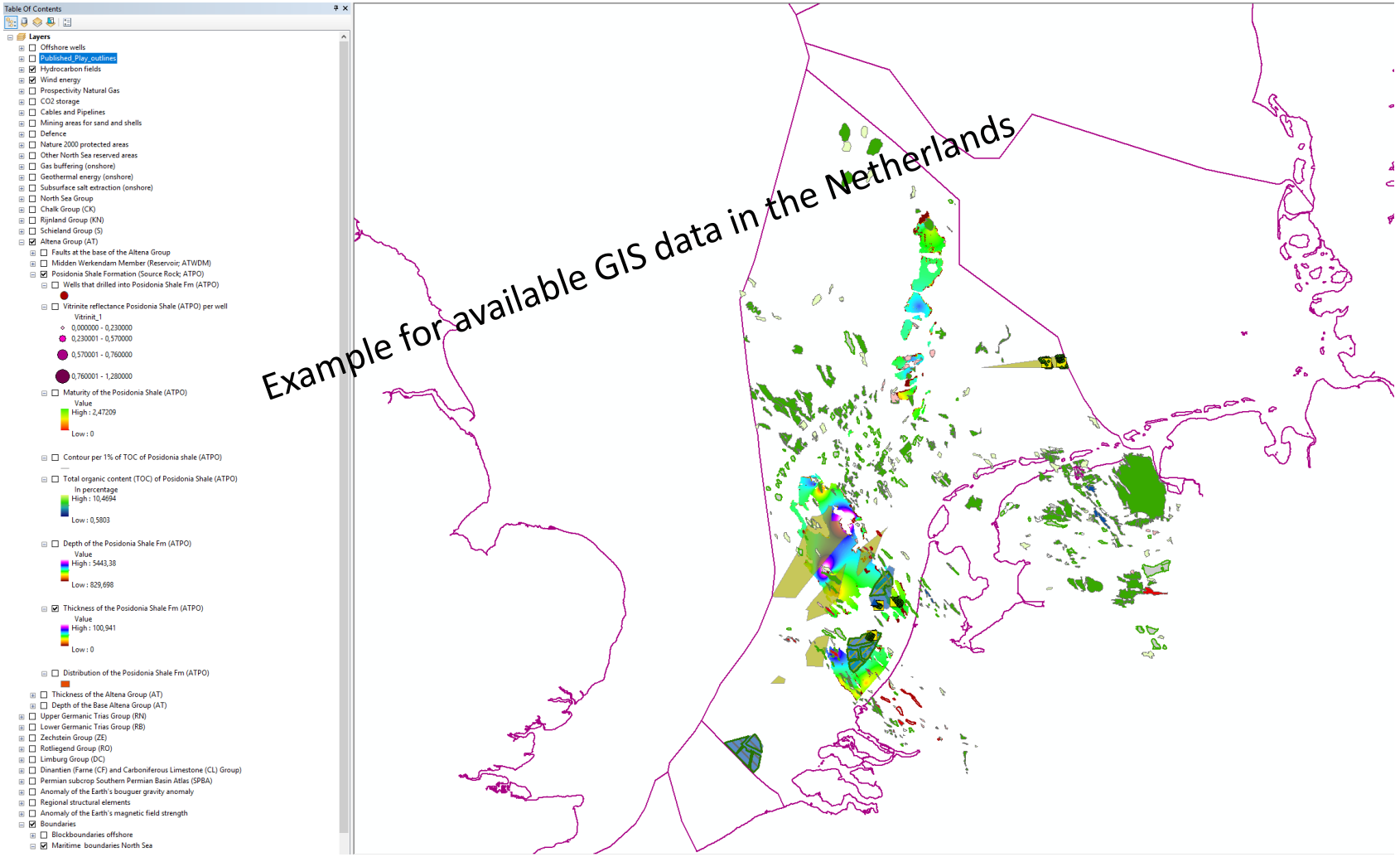

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Contribution to and completion of data reporting	Complete
Definition of conventional data/deliverables to be gathered and availability of data across team	Complete
Collation of agreed data	Ongoing
Creation and consolidation of GIS layers	Ongoing

Next Steps:

- Continued collation of GIS layers
- Decide on internal deadline for final delivery of layers
- Collation and decision on if/how resource assessment to be finalised
- Reporting

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Mid Term Progress: WP2 North Sea HC resource estimations Regional: Unconventional resources

Niels Schovsbo, Peter Britze

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Work Flow and status February 2020

1. Shale resource Screening criteria defined
2. Resource model and Approach defined
3. Screening of North Sea area made
4. Data Gathering and GIS model in progress
5. Resource assessment, Pending

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Shale resource screening

- We have applied commonly accepted criteria for selecting potential shale units and to focus our affords on regional important units.
- Screening include both data and descriptions following

- Reference:
- Schovsbo, N.H., Anthonsen, K.L., Pedersen, C.B., Tougaard, L., 2017. Overview of shale layers characteristics in Europe relevant for assessment of unconventional resources. Delivery T6b of the EUOGA study (EU Unconventional Oil and Gas Assessment) commissioned by JRC-IET.

Applied screening criteria

Geological Properties:	**Value/comment**
TOC content and type	> 2%, Type I-II marine
Thermal maturity	>0.7% Ro, oil mature
Thickness	>20 m
Present day depth	< 7 km
Mineralogy	Brittle preferentially
Pressure regime	Normal to overpressure
Structural complexity	Low to moderate
Geographical Properties:	
Areal distribution	Offshore

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Results -Screening

Unconventional status January 2020							
Country	**Questionnaire Complete?**	**Spreadsheet Complete?**	**Assessment, Offshore**	**Plays, offshore**	**Comments on Questionnaire**	**Comments on Spreadsheet**	**Comments/questions on data**
Netherlands	Not made	yes	None for unconventional appears available	Carboniferous & L. Jurassic	Questionnaire completed	Critical parameters present for two shales	maturity grids delivered
UK	100%	EUOGA values used	none available for offshore, Onshore plays assessed	Mid Carboniferous & Jurassic extension from onshore to offshore areas	Questionnaire completed	No critical parameters for Offshore shales. Suggested to use the EUOGA data for onshore as analogue to offshore	Is map data in GIS relevant for defining play, Volumes available?
Denmark (GEUS)	100%	Yes	Assessment of Alum Shale and methods to be detailed	Alum Shale in the North Sea; Upper Jurassic (Farsund Formation, Bo member in the Farsund Fm) and Lower Jurassic Posidonia Shale in the Danish Central Graben	Geological development described	Critical parameters present for four shales	Maps as GIS polygons to define Volume and maturity for Farsund not present. SPBA and Millennium Atlas available. Well data delivered
Norway (GEUS)	Not made	Analogue values used for neibouring countries	None for unconventional	Upper Jurassic: fms	no		Only regional data such as the Millennium and SPBA Atlas available. Well data delivered
Germany	100%	Yes	None for unconventional	Triassic and lower /upper Jurassic	Questionnaire completed	Critical parameters present for three shales	Polygons for shales delivered. Well data delivered

Results of screening – data and descriptions

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13 shales identified

Screening (CP) index	CP GARAH Equivalent	CP EUOGA equivalent	CP used in assessment	Basin Index	Play ID	Basin	Countries	Shale(s)	Age	Maturity	Exploration	Basin description report	Maps	Area (GIS) analysis preformed of	Map remarks	Remarks
Thermogenic oil and gas unconventional shale basins: Data and maps are sufficiently defined for shales to be assessed																
3001	none	2001	3001	G1	DK_NS_Ca Or_Alum	North Sea	Dk	Alum Shale	Cambrian - Ordovician	Gas	No -Explored Onshore (T1)	yes	yes	Volume from polygons	yes	available
3002	3008	none	3002	G2	DK_CG_UJ C_Bo	DK Central Graben	Dk	Bo Member, Farsund Fm	U Jurassic - L Cretaceous	Oil	Yes - preliminary	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3003	3005	none	3003	G2	DK_CG_UJ C_Fars	DK Central Graben	Dk	Farsund Fm	U Jurassic - L Cretaceous	Oil	Yes - preliminary	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3006	none	none	3006	G3	D_CG_Rh_ Sleen	D Central Graben	D	Sleen Fm	Rhaet-Trias	Oil	No	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3007	3004, 3010	2012	3007	G3	D_CG_LJ_P os	D Central Graben	D	Posidonia Shale	L Jurassic	Oil	No -Explored Onshore (T25c)	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3008	3002	none	3008	G3	D_CG_UJ_ Not	D Central Graben	D	Hot Shale	U Jurassic - L Cretaceous	Oil	No	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3009	none	1064, 2013	3009	G4	NL_CG_Mi s_Gev	NL Central Graben	Nl	Geverik Member	Missisipian	Oil - gas (?)	No -Explored Onshore (T10a)	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
3010	3004, 3007	1065	3010	G4	NL_CG_LJ_ Pos	NL Central Graben	Nl	Posidonia Shale	L Jurassic	Oil	No -Explored Onshore (T25a)	yes	yes	Volume from 3D model	part of 3D GeoERA	awaits final model
Thermogenic oil and gas unconventional shale basins: Uncertain to what degree data exist for the shales to be assessed with reasonable level of certainty																
3004	3007, 3010	none	3004	G2	DK_NS_LJ_ Fjer	DK Central Graben	DK		L Jurassic	gas	no	yes	no	Volume from 3D model	Part of 3D GeoERA	Await final model
3005	3003	none	3003	G5	N_CG_UJC _XX	N Central Graben	N		U Jurassic - L Cretaceous	gas-oil	no	no	yes	Volume from polygons	Maps Millenium Atlas	Ongoing digitalisation
3005	3003	none	3003	G6	N_NS_UJC _XX	N_Mid	N		U Jurassic - L Cretaceous	gas-oil	no	no	yes	Volume from polygons	Maps Millenium Atlas	Ongoing digitalisation
3005	3003	none	3003	G7	N_NS_UJC _XX	N_North	N		U Jurassic - L Cretaceous	gas-oil	no	no	yes	Volume from polygons	Maps Millenium Atlas	Ongoing digitalisation
3011		1071, 1072, 1073, 1077, 1079	1077	G8	UK_Pen_C ar_XX	UK_Pennine	UK	Bowland-Hodder	M Carboniferous	Gas	No -Explored Onshore (T10b)	yes		Volume from polygons		Status unknown
3012		1079	1079	G9	UK_Mid_C ar_XX	UK_Midland Valley	UK	Lmst Coal, Lower Lmst, West Lothian Oil Shale, Gullane fms	M Carboniferous	Gas	No -Explored Onshore (T26)	yes		Volume from polygons		Status unknown
3013		1070, 1074, 1075, 1076, 1078	1070	G10	UK_Weald _Jou_XX	UK_Weald	UK	Kimmeridge Clay, Coralian Clay, Oxford Clay, Upper Lias Clay, Mid Lias Clay, Lower Lias Clay	Jurassic	gas-oil	No -Explored Onshore (T25d)	yes		Volume from polygons		Status unknown

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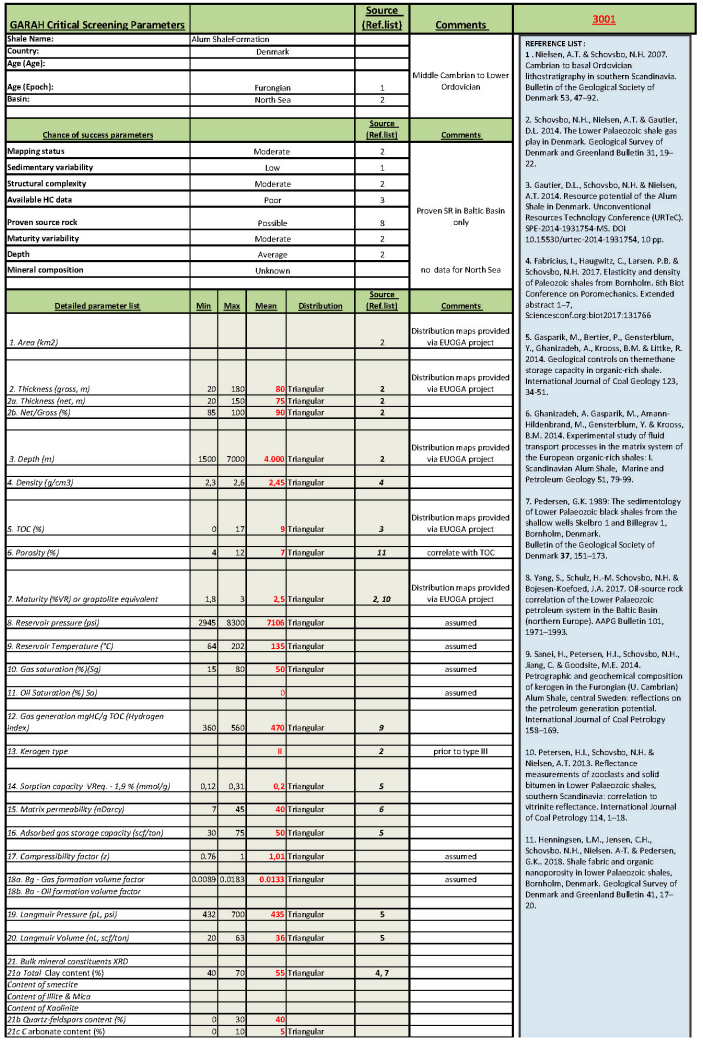
GeoERA GEO-ENERGY

- For Each 13 shales 22 parameters related to Gas, oil saturation, source quality and mineralogy has been gathered to the best extend of data.
- A full reference list covering all used literature used is provided



GARAH Critical Screening Parameters		Source (Ref.list)	Comments
Shale Name:	Alum ShaleFormation		
Country:	Denmark		
Age (Age):			Middle Cambrian to Lower Ordovician
Age (Epoch):	Furongian	1	
Basin:	North Sea	2	

Chance of success parameters		Source (Ref.list)	Comments
Mapping status	Moderate	2	
Sedimentary variability	Low	1	
Structural complexity	Moderate	2	
Available HC data	Poor	3	
Proven source rock	Possible	8	Proven SR in Baltic Basin only
Maturity variability	Moderate	2	
Depth	Average	2	
Mineral composition	Unknown		no data for North Sea

Detailed parameter list	Min	Max	Mean	Distribution	Source (Ref.list)	Comments
1. Area (km2)					2	Distribution maps provided via EUOGA project
2. Thickness (grass, m)	20	180	80	Triangular	2	Distribution maps provided via EUOGA project
2a. Thickness (net, m)	20	150	75	Triangular	2	
2b. Net/Gross (%)	85	100	90	Triangular	2	
3. Depth (m)	1500	7000	4.000	Triangular	2	Distribution maps provided via EUOGA project
4. Density (g/cm3)	2,3	2,6	2,45	Triangular	4	
5. TOC (%)	0	17	9	Triangular	3	Distribution maps provided via EUOGA project
6. Porosity (%)	4	12	7	Triangular	11	correlate with TOC
7. Maturity (%VR) or graptolite equivalent	1,8	3	2,5	Triangular	2, 10	Distribution maps provided via EUOGA project
8. Reservoir pressure (psi)	2945	8300	7106	Triangular		assumed
9. Reservoir Temperature (°C)	64	202	135	Triangular		assumed
10. Gas saturation (%)(Sg)	15	80	50	Triangular		assumed
11. Oil Saturation (%) So)			0			assumed
12. Gas generation mgHC/g TOC (Hydrogen index)	360	560	470	Triangular	9	
13. Kerogen type			II		2	prior to type III
14. Sorption capacity VReq. - 1,9 % (mmol/g)	0,12	0,31	0,2	Triangular	5	
15. Matrix permeability (nDarcy)	7	45	40	Triangular	6	
16. Adsorbed gas storage capacity (scf/ton)	30	75	50	Triangular	5	
17. Compressibility factor (z)	0.76	1	1,01	Triangular		assumed
18a. Bg - Gas formation volume factor	0.0089	0.0183	0.0133	Triangular		assumed
18b. Bo - Oil formation volume factor						
19. Langmuir Pressure (pL, psi)	432	700	435	Triangular	5	
20. Langmuir Volume (nL, scf/ton)	20	63	36	Triangular	5	
21. Bulk mineral constituents XRD						
21a Total Clay content (%)	40	70	55	Triangular	4, 7	
Content of smectite						
Content of Illite & Mica						
Content of Kaolinite						
21b Quartz-feldspars content (%)	0	30	40			
21c Carbonate content (%)	0	10	5	Triangular		

3001

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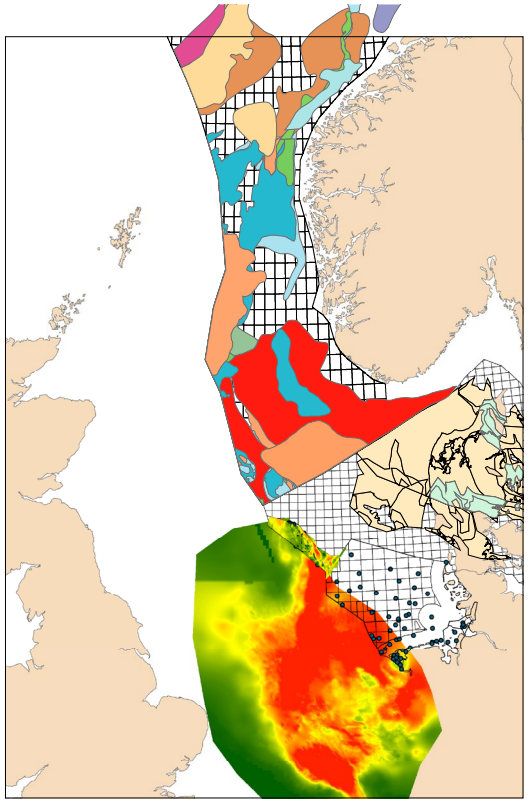
GeoERA GEO-ENERGY

Data Gathering and GIS model *in progress*

- Data for defining relevant volumes needed for Assessment to be made has been identified:
- Central Graben area:
- The 3D GeoEra model

- Uk and N area:
- Analogues maps detailing Thickness, maturity, source quality is currently been digitalized.

- Data sources for N include Millennium and SPBA Atlas available. Well data delivered



Example of map view

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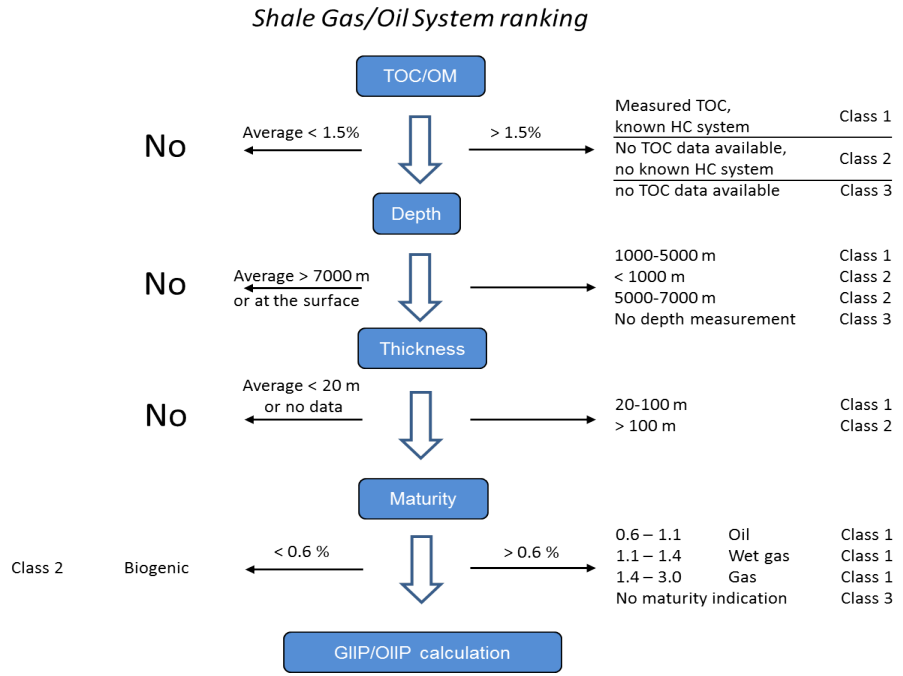
Resources model to be implemented

- The EUOGA model as developed in a previous unconventional assessment study of onshore European basins will be followed.
- This approach uses a monte Carlos simulation preceded by a Shale gas/oil System Ranking



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GARAH - Geological Analysis and Resource Assessment of selected Hydrocarbon systems

WP2 – Task
3D basin and petroleum system modelling in the North Sea Central Graben: a cross-border Dutch, German and Danish pilot study
Mid-Term Progress

Rüdiger Lutz, Jashar Arfai, Susanne Nelskamp, Anders Mathiesen, Stefan Ladage

BGR, TNO, GEUS

02.2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

Status Task 3-D BPSM

1. Cross-border Pilot Study Area finalized
2. Source rocks and 3-D BPSM parameters finalized
3. Horizons harmonized finalized
4. Cross-border geological model finalized
5. Erosion modelling in Progress
6. Simulations for unconventionals Pending
7. Simulations for conventionals Pending

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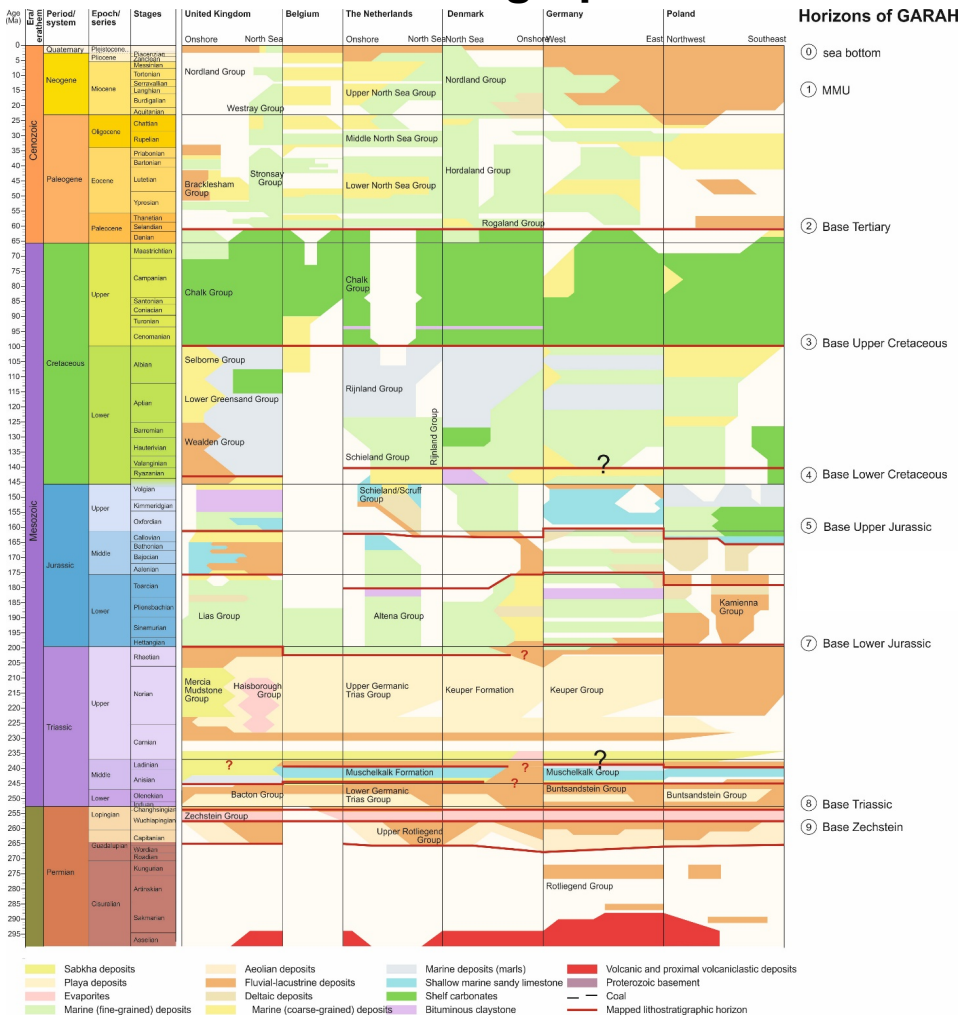
GeoERA GEO-ENERGY

Cross-border stratigraphic chart

9 Input Horizons for 3-D BPSM



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Initial input maps

	Age [Ma]	Horizon	-	Depth Map	Erosion Map	Layer	-	Event Type	Facies Map	No. of Sublayers	Max. Time Step [Ma]
1	0.00	Horizon_0		Seafloor		Neogene		Deposition	Map_Neogene_Facies_1_17	1	10.00
2	15.97	Horizon_1		MMU_DE_NL_DK_fill		Palaeogene&Lower Neogene		Deposition	Map_Palaeogene&Lower Neogene_Facies_1_18	1	10.00
3	65.00	Horizon_2		Base_Tertiary_DE_NL_DK_fill		Upper Cretaceous		Deposition	Map_Upper Cretaceous_Facies_1_19	1	10.00
4	98.90	Horizon_3		Upper_Cretaceous_DE_NL_DK_fill		Lower Cretaceous		Deposition	Map_Lower Cretaceous_Facies_1_20	1	10.00
5	142.00	Horizon_4		Base_Cretaceous_DE_NL_DK_fill		Upper Jurassic		Deposition	Map_Upper Jurassic_Facies_1_21	1	10.00
6	165.00	Horizon_5		Upper_Jurassic_DE_NL_DK_fill		Lower Jurassic		Deposition	Map_Lower Jurassic_Facies_1_22	1	10.00
7	200.00	Horizon_6		Base_Jurassic_DE_NL_DK_fill		Triassic		Deposition	Map_Triassic_Facies_1_23	1	10.00
8	251.00	Horizon_7		Base_Lower_Triassic_no_diapirs_fill		Zechstein		Deposition	Map_Zechstein_Facies_1_24	1	10.00
9	258.00	Horizon_8		Base_Zechstein_DE_NL_DK		Basement		Deposition	Map_Basement_Facies_1	1	10.00
10	380.00	Horizon_18		Basement							

Input data

- **Nine depth converted maps including the sea floor from the current Petrel project (provided by Maryke)**
- **A 2000 m thick basement is assigned to the model for the pre-Zechstein formations**
- **Model contains nine layers, cell size 250 m x 250 m**
- **Salt shapes are constructed using the top-Zechstein depth map**
- **Salt movement is modelled using the facies piercing tool**

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GeoERA GEO-ENERGY

Age assignment including erosion events

	Age [Ma]	Horizon	-	Depth Map	Erosion Map	Layer	-	Event Type	Facies Map	No. of Sublayers	Max. Time Step [Ma]
1	0.00	Horizon_0		Seafloor							
2						Neogene		Deposition	Map_Neogene_Facies_1_17	1	10.00
3	11.20	MMU									
4						Erosion_31		Erosion			10.00
5	15.97	Horizon_1		MMU_DE_NL_DK	Neogene_Erosion						
6						Palaeogene&Lower Neogene		Deposition	Map_Palaeogene&Lower Neogene_Facies_1_18	1	10.00
7	61.60	Horizon_2		Base_Tertiary_DE_NL_DK							
8						Upper Cretaceous		Deposition	Map_Upper Cretaceous_Facies_1_19	1	10.00
9	83.50	Sub-Herzynian									
10						Erosion_27		Erosion			10.00
11	98.90	Horizon_3		Upper_Cretaceous_DE_NL_DK	SubHercyn_UCret_Erosion_NL_D_DK						
12						Lower Cretaceous		Deposition	Map_Lower Cretaceous_Facies_1_20	1	10.00
13	122.00	Late-Cimmerian			Late_Cimm_Non_Erosion_D						
14						Erosion_56		Erosion			10.00
15	142.00	Horizon_4		Base_Cretaceous_DE_NL_DK	Late_Cimm_Upper Jurassic_LCretDK_Erosion_NL_D_DK						
16						Upper Jurassic		Deposition	Map_Upper Jurassic_Facies_1_21	1	10.00
17	158.00	Mid-Cimmerian									
18						Erosion_17		Erosion			10.00
19	165.50	Horizon_5		Upper_Jurassic_DE_NL_DK	Lower_Middle_Jurassic_Erosion_MidCimm_NL_D_DK						
20						Lower Jurassic		Deposition	Map_Lower Jurassic_Facies_1_22	1	10.00
21	201.30	Horizon_6		Base_Jurassic_DE_NL_DK	Triassic_Erosion_MidCimm_NL_D_DK						
22						Triassic		Deposition	Map_Triassic_Facies_1_23	1	10.00
23	251.00	Horizon_7		Base_Lower_Triassic_no_diapir							
24						Zechstein		Deposition	Map_Zechstein_Facies_1_24	1	10.00
25	258.00	Horizon_8		Base_Zechstein_DE_NL_DK							
26						Basement		Deposition	Map_Basement_Facies_1	1	10.00
27	380.00	Horizon_18		Basement							

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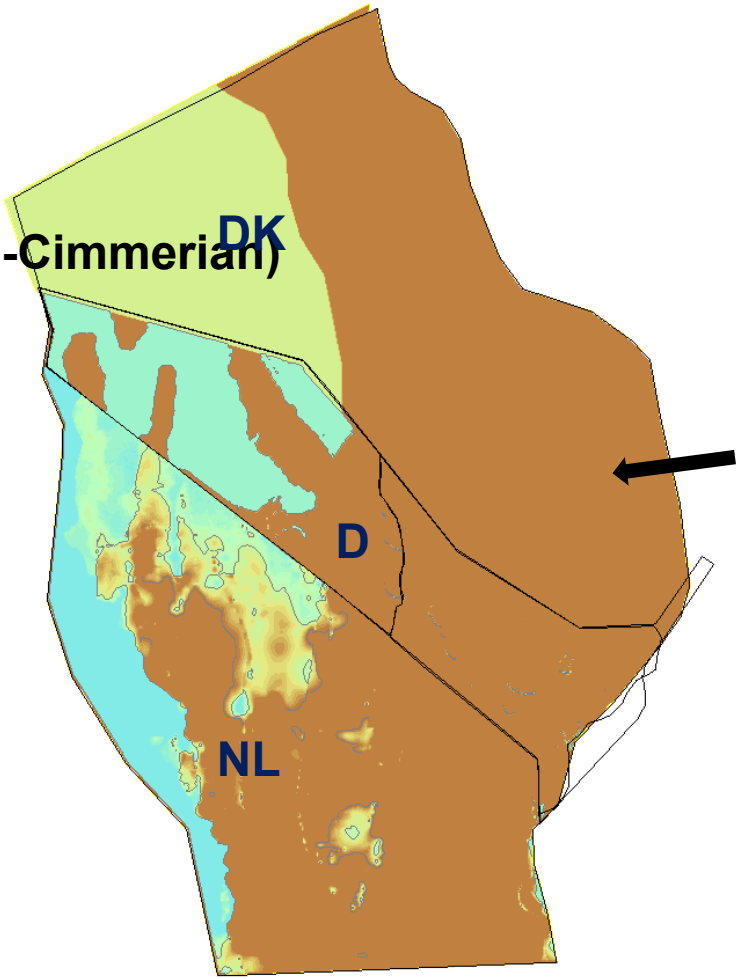
GeoERA GEO-ENERGY

3-D pilot study area - combined erosion maps



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Source rock definition

Age	Source name	Layer	Fraction mode	Fraction	Fraction map	Thickness mode
DK	**Farsund (Bo Member)**	Upper Jurassic	Value	0		Map
DK	**Bryne**	Upper Jurassic	Value	100		Map
D	**Farsund_Bo**	Upper Jurassic	Value	0		Map
D	**Posidonia**	Lower Jurassic	Value	30		Map
NL	**Posidonia**	Lower Jurassic	Value	0		Map (from NLOG 2012)

Thickness value	Thickness map	Lithology	Kinetics
75	DK_Farsund_SR_UniTCK	Shale (organic rich, 3% TOC)	Pepper&Corvi(1995)_TII(B)
15	DK_Bryne_SR_UniTCK	Shale (organic rich, 3% TOC)	Pepper&Corvi(1995)_TIII(D/E)
25	D_Bo_SR_UniTCK	Shale (organic rich, 3% TOC)	Pepper&Corvi(1995)_TII(B)
15	D_Posidonia_SR_UniTCK_max	Shale (organic rich, 3% TOC)	Pepper&Corvi(1995)_TII(B)
	NL_ATPO_SR_TCK	Shale (organic rich, 3% TOC)	Pepper&Corvi(1995)_TII(B)

Kinetics	TOC mode	TOC value	TOC map	HI mode	HI value	HI map
Pepper&Corvi(1995)_TII(B)	Value	5		Value	400	
Pepper&Corvi(1995)_TIII(D/E)	Value	70		Value	300	
Pepper&Corvi(1995)_TII(B)	Value	5		Value	400	
Pepper&Corvi(1995)_TII(B)	Value	5		Value	500	
Pepper&Corvi(1995)_TII(B)	Map (from TNO project)		ATPO_TOC	Value	500	

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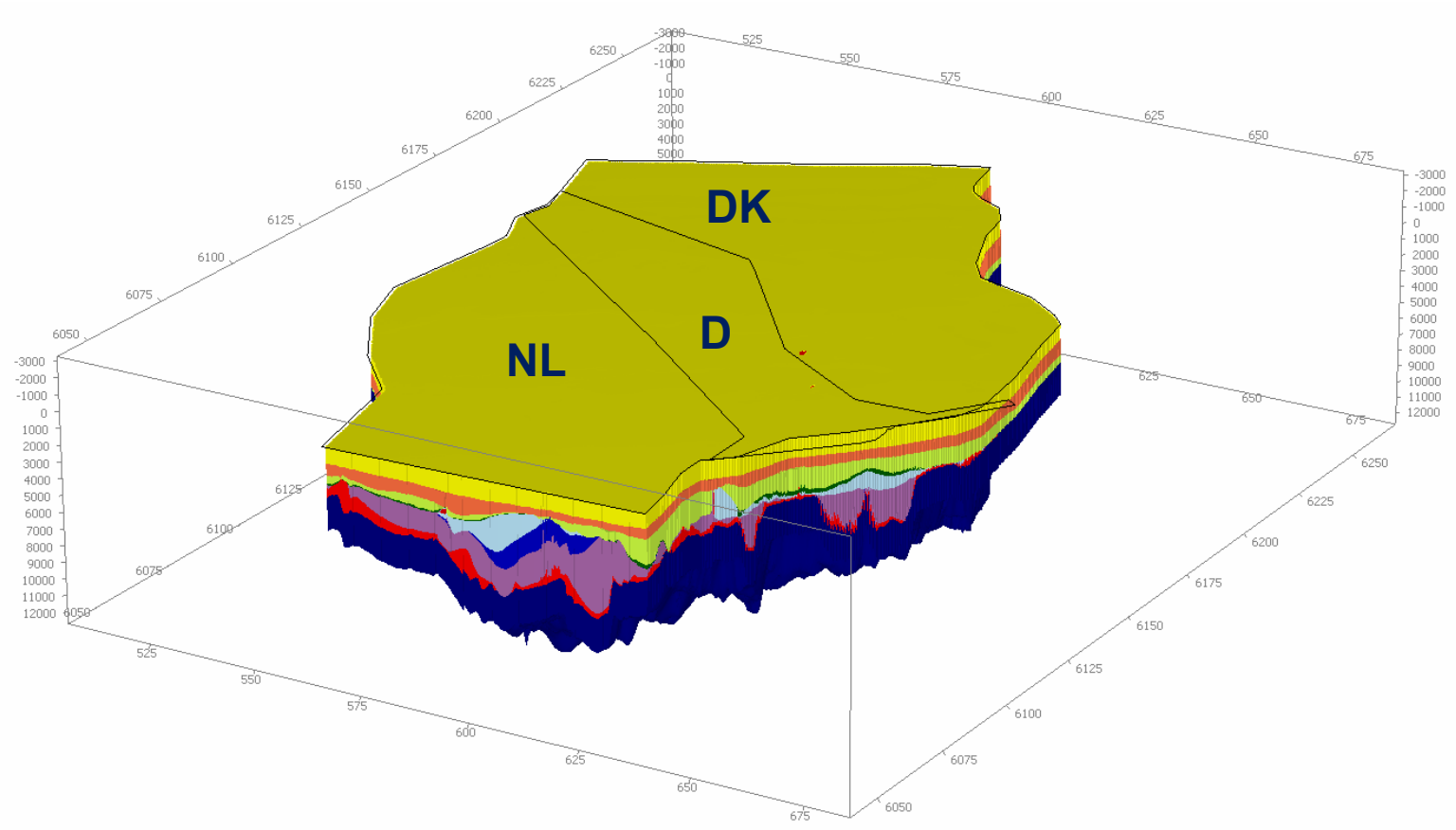
GeoERA GEO-ENERGY

3-D pilot study area – basin model



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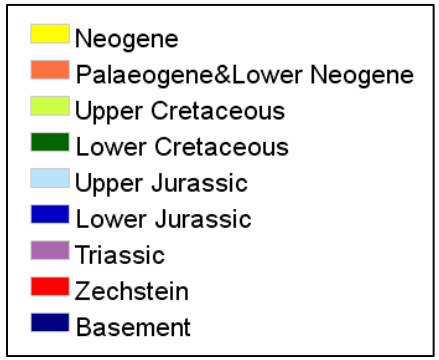
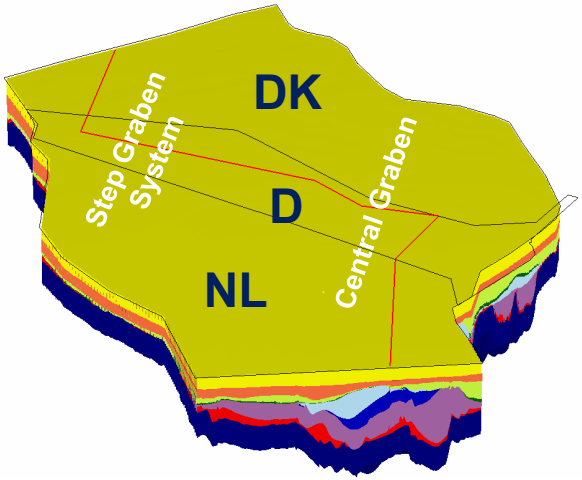
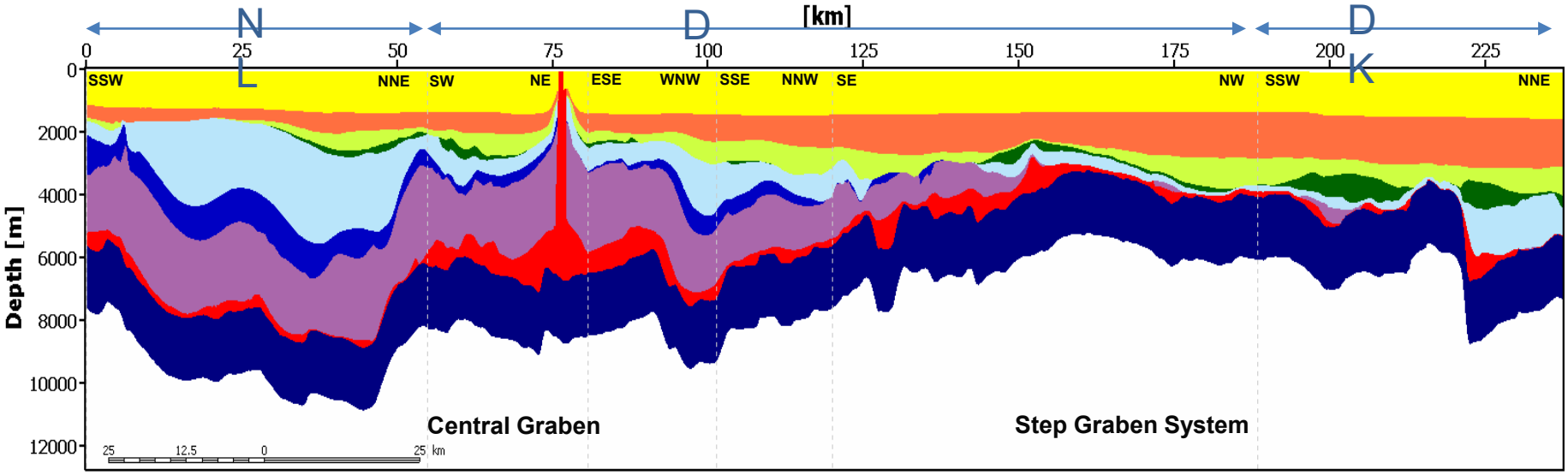
3D model & 2D cross section







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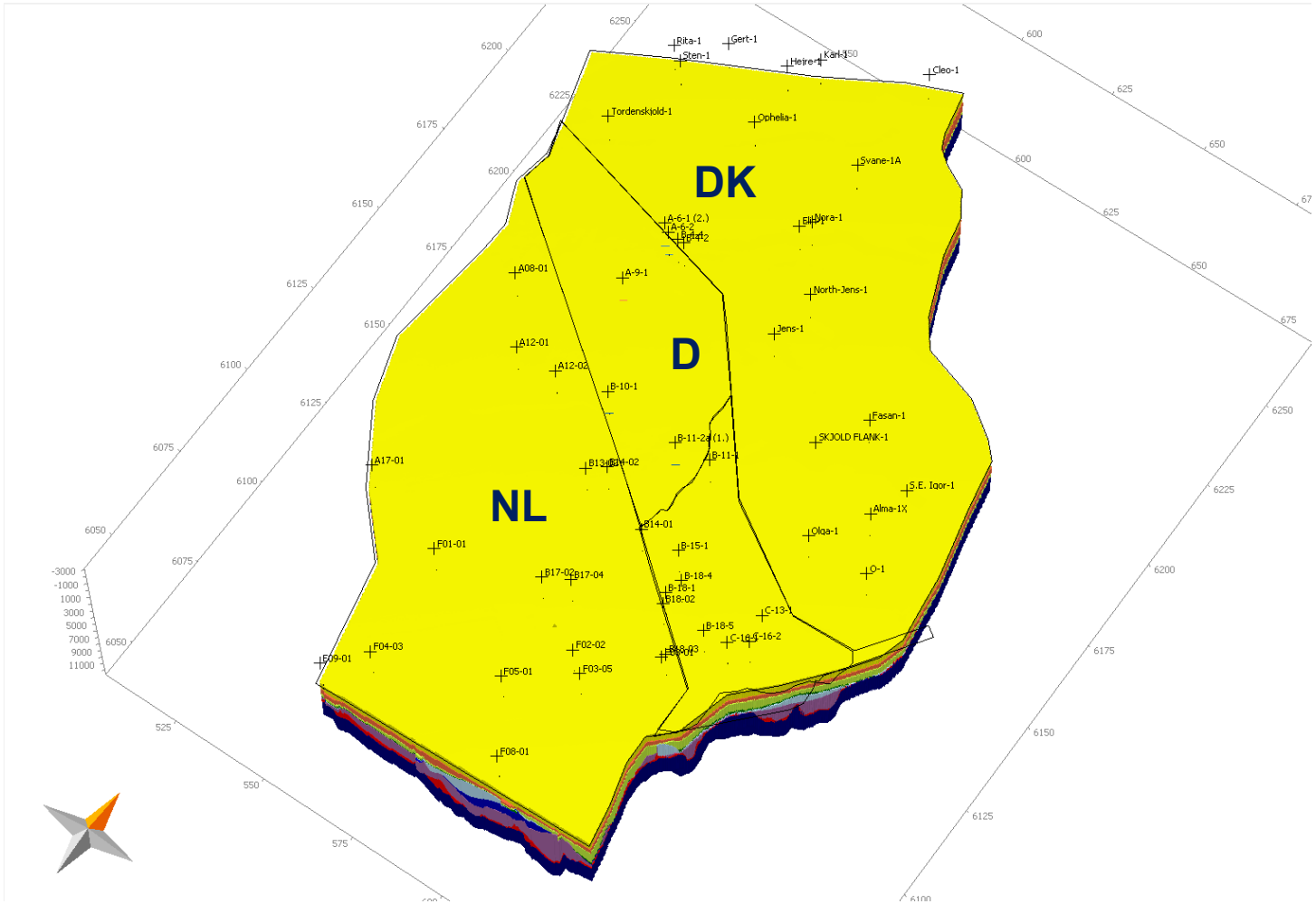
GeoERA GEO-ENERGY

Wells with calibration data



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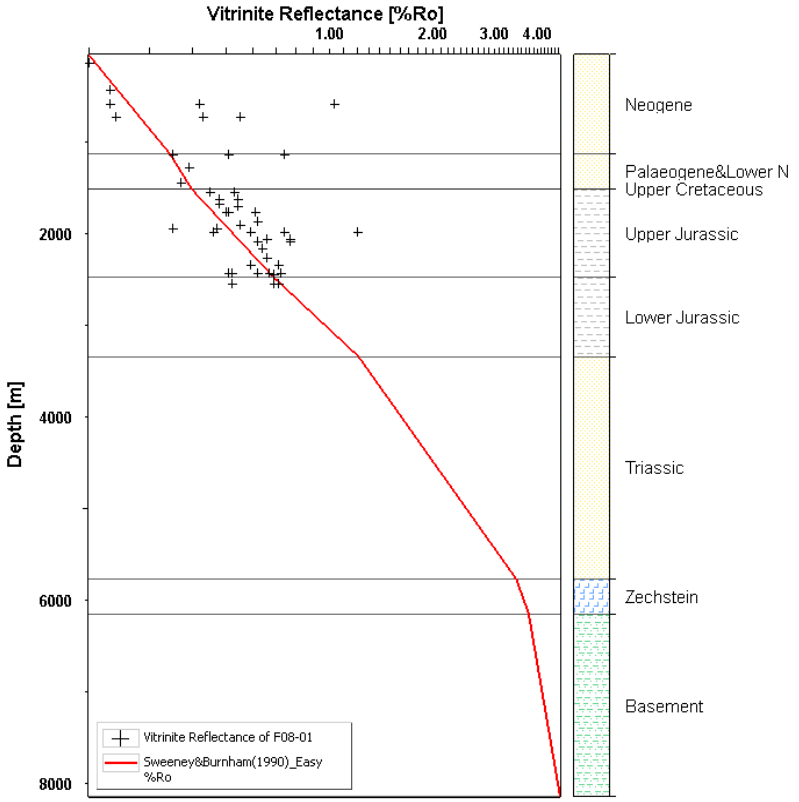
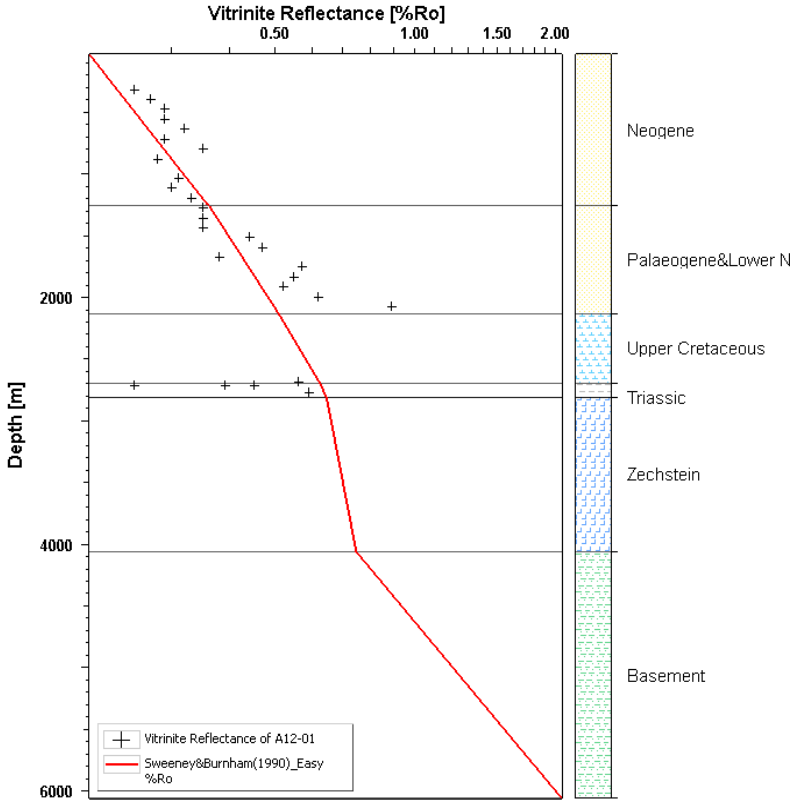
Calibration - Vitrinite Reflectance





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2. WP Progress continued

- 4. WP3 Gas Hydrates in Europe
  - a. Listing content of Europe's Gas Hydrates
  - b. International collaboration
  - c. Building a database

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Mid term Progress:

WP3 Addressing knowledge gaps in the hydrate assessment in the European continental margins

IGME, GEUS, BRGM, NERC – BGS, GEOINFORM

Ricardo León

WP3 Progress – February 2020

Task	Progress
3A. Collection of data sources to be implemented in the hydrate related GIS-database.	Complete
Data review & Characterization method agreed	Complete
3B. Definition of the data model structure and data loading.	Ongoing

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

3A. Collection of data sources to be implemented in the hydrate related GIS-database

Deliverable	**Progress**
D3.1: Report of available hydrate related data. This deliverable will be a report containing a list of the available hydrate related-data in a pan-European scope of interest to be incorporated into the GIS-database. The location (source), accessibility/use, size, typology and state will be specified	Complete

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3A. Collection of data sources to be implemented in the hydrate related GIS-database

REPORT D3.1 of GARAH Project

835 information layers of information (10.75 Gb)

- data of pan-European scope coming from public and free databases such as EMODnet, PERGAMON or MIGRATE
- data of regional scope coming from scientific organizations

Name	Description	Source	Importance	Format of data	Size (Mb)	Georeferenced	metadata available	Meta-Standarised	Quality	GA
Marine_Gas_Hydrate_Deposits	Polygon SHP - EMODnet Geology	EMODnet Geology	high	Shapefile	0.248	yes	yes	yes	high	
Metadata_EMODnet_Geology_WP7_Minerals.pdf	Description of the Metadata from EMODnet	EMODnet Geology	high	PDF	0.244	no				
					1.077					
Gebco_Arctic_xyz.rar	Data source	Gebco Atlas 2003	high	RAR		no	yes	no	high	
IBCAO_Ver3_RR_2012-03-16.tif	Data source	IBCAO 2008	high	tiff		yes	yes	yes	high	
gebco_bathy	Digital bathymetry model	Gebco Atlas 2003	high	raster		yes	yes	yes	high	
gebco_shade	Hillshade model	Gebco_bathy	high	raster		yes	yes	yes	high	
ibcao_bathy	Digital bathymetry model	IBCAO 2008	high	raster		yes	yes	yes	high	
ibcao_shade	Hillshade model	ibcao_bathy	high	raster		yes	yes	yes	high	
					7.8					
Countries_Lines	Line SHP - hillshade	ESRI	low	shapefile		yes	yes	yes	high	
Study_Area	Polygone SHP of the AOI	PERGAMOMON	low	shapefile		yes	yes	yes	high	
					0.878					
gscof_5816_e_2008_mn01.pdf	Geological map of the Arctic	Geological Survey of Canada, 2008	low	PDF		no	yes	no	high	
gscof_5816_e_2008_mn02.pdf	Legend of the Geological map of the Arctic	Geological Survey of Canada, 2008	low	PDF		no	yes	no	high	
gscof_5816_e_2008_mn03.pdf	Lithologies of the Geological map of the Arctic (part 1)	Geological Survey of Canada, 2008	low	PDF		no	yes	no	high	
gscof_5816_e_2008_mn04.pdf	Lithologies of the Geological map of the Arctic (part 2)	Geological Survey of Canada, 2008	low	PDF		no	yes	no	high	
gscof_5816_e_2008_mn05.pdf	Lithologies of the Geological map of the Arctic (part 3)	Geological Survey of Canada, 2008	low	PDF		no	yes	no	high	
AAG_2003_icelandhf.pdf	Article about Mantle plumes	AAG, 2003	low	PDF		no	yes	no	high	
Hustof_etal_2009_Svalbard.pdf	Gas hydrate reservoir (fram Strait - NW Svalbard)	Earth and Planetary Science Letters 284 (12-24)	low	PDF		no	yes	no	high	
Jakobsson_etal_2008_IBCAO_GRL_2008.pdf	Bathymetry of Arctic Ocean (IBCAO)	Geophysical Research Letters, vol. 35 L07602	low	PDF		no	yes	no	high	
Mienert_etal_2005.pdf	Gas hydrate stability (Storegga Slide, Norway)	Marine and Petroleum Geology 22 (233-244)	low	PDF		no	yes	no	high	
Petersen_etal_2010.pdf	3D seismic imaging of gas chimney (Arctic sediment drift)	Marine and Petroleum Geology 27(9) 1981-1994	low	PDF		no	yes	no	high	
Rajan_etal_2012_Svalbard.pdf	Gas migration in NW-Svalbard	Marine and Petroleum Geology 32 (36-49)	low	PDF		no	yes	no	high	
Vannest_etal_2005_et.pdf	Geothermal gradients in W Svalbard margin	Terra Nova vol. 17 (6), 510-516	low	PDF		no	yes	no	high	
Wessel_&_Smith_1998.pdf	Global Inventory of Natural Gas Hydrate Ocurrence	USGS, 1998	low	PDF		no	yes	no	high	
dsdpsites.sbx	Point SHP - DSDP sites location	IODP	high	shapefile		yes	yes	yes	high	
odpsites.sbx	Point SHP - ODP sites location	IODP	high	shapefile		yes	yes	yes	high	

International colaboration

- Public and free databases such as:
  - EMODnet,
  - PERGAMON or
  - MIGRATE

Institutions:

- GSI, Geological survey of Ireland
- OGS,Istituto Nazionale di Oceanografia e di Geofisica ...
- NOC National Oceanographic Center
- University of Southamptom

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

3B. Definition of the data model structure and data loading

Actions:

Data model structure. Complete

Data loading. Ongoing. It will finish in June 2020

Deliverable	**Deadline**
D3.2: Hydrate related GIS-database	(M27) Sept. 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

GARAHydrates – Data Model Structure

GEOLOGICAL & GEOCHEMICAL EVIDENCES-INDICATORS

GasHydrate_Site_Evidences & Indicators: Points

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiNa	Text, 254	Identification code of the evidence - PK
Lat_DD	Double14,6	Latitude in decimal degrees (WGS84)
Long_DD	Double14,6	Longitude in decimal degrees (WGS84)
WaterDepth	Double14,6	Seafloor depth
GeoSettin	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
Data_Sourc	Text, 50	Institution/Company if Owner of Data. Project, database or publication where data have been collected
Cruise	Text, 254	Oceanographic Cruise where data have been recovered or observed
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
E_I	Text, 50	E = Direct Evidence ; I = Indirect Indicator
FF_Type	Text, 50	Type of evidence o indicator – constrains- NN- LV_FF_Type
Descripti	Text, 250	Description of the evidence - free text
Sedi_Type	Text, 50	Sediment type – LV_
D_Indi_mtp	Double 10,4	Depth of the top of the evidence below seabed in meters
D_Indi_mbt	Double 10,4	Depth of the bottom of the evidence below seabed in meters
Size	Text, 50	Size (volume, km2, tons, etc)
DOI	Text, 254	DOI of main data publication
Reference	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

GasElement: Table

FIELDNAME	FORMAT	DESCRIPCION
ID_INDINA	Text, 254	Internal identifier – PK
EXP	Text, 254	Expedition number
SITE	Text, 254	Site number
HOLE	Text, 254	Hole number
CORE	Text, 254	Core name
TYPE	Text, 254	H-advanced piston core, X-extended core barrel , R-rotary core barrel
SECT	Text, 254	Section number
A_W	Text, 254	Number of Section: A-Archive half , W-Working half
TOP_OFFSET	Double	Top offset
BOTTOM_OFF	Double	Bottom offset
TOP_DEPTHA	Double	Top depth (mm), core depth below seafloor, overlap if long. Method-A
BOTTOM_DCA	Double	Bottom depth (mm), core depth below seafloor, overlap if long. Method-A
SAMPLE_TYP	Text, 254	HS - headspace analysis, VAC - vacutainer analysis
METHAN_PPM	Double	Methane. Parts per million by volume
ETHANE_PPM	Double	Ethane. Parts per million by volume
ETHENE_PPM	Double	Ethene. Parts per million by volume
PROPAN_PPM	Double	Propane. Parts per million by volume
PROPEN_PPM	Double	Propene. Parts per million by volume
ISO_BU_PPM	Double	Iso Butane. Parts per million by volume
N_BUTA_PPM	Double	n Butane. Parts per million by volume
NO_PE_PPM	Double	Iso Pentane. Parts per million by volume
N_PEN_PPM	Double	n Pentane. Parts per million by volume
ISO_HE_PPM	Double	Iso Hexane. Parts per million by volume
N_HEXA_PPM	Double	n Hexane. Parts per million by volume
IS_HEP_PPM	Double	Iso Heptane. Parts per million by volume
N_HEPT_PPM	Double	n Heptane. Parts per million by volume
N2_PPM	Double	Nitrogen. Parts per million by volume
O2_PPM	Double	Oxygen. Parts per million by volume
CO2_PPM	Double	Carbon dioxide. Parts per million by volume
H2S_PPM	Double	H_2S. Parts per million by volume
XENON_PPM	Double	Xenon. Parts per million by volume
ETHYLEN_PPM	Double	Ethylene. Parts per million by volume
PROPYLE_PPM	Double	Propylene. Parts per million by volume
METHODOLOG	Text, 254	NGA-TCD. Natural Gas Analysis by Thermal Conductivity Detector NGA-FID. Natural Gas Analysis by Flame Ionization Detector NGA-GC. Natural Gas Analysis by Gas Chromatography
PROCEEDING	Text, 254	
Comments	Text, 254	Comments

GasHydrate_Areal_Evidences : Polys

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiNa	Text, 254	Identification code of the evidence - PK
MpArea	Double14,6	Cartographical area of the evidence in km2
GeoSettin	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 254	Local site where the evidence is located
Data_Sourc	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
FF_Type	Text, 50	Type of evidence _FF_Type = "Gas Hydrate"
Descripti	Text, 250	Description of the evidence - free text
Sedi_Type	Text, 50	Sediment type – LV_
D_Evi_mtp	Double 10,4	Depth of the top of the evidence below seabed in meters
D_Evi_mbt	Double 10,4	Depth of the bottom of the evidence below seabed in meters
D_Evi_TWTt	Double 10,4	Depth of the top of the evidence below seabed in seconds TWT
D_Evi_TWbt	Double 10,4	Depth of the bottom of the evidence below seabed in seconds TWT
Size	Text, 50	Size (volume, km2, tons, etc)
DOI	Text, 254	DOI of main data publication
Reference	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

A

GEOPHYSICAL INDICATORS

GasHydrate_Local_Geophy_Indicators: Points

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiNa	Text, 254	Identification code of the evidence - PK
Lat_DD	Double14,6	Latitude in decimal degrees (WGS84)
Long_DD	Double14,6	Longitude in decimal degrees (WGS84)
WaterDepth	Double14,6	Seafloor depth
GeoSettin	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
Data_Sourc	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
Cruise	Text, 254	Oceanographic Cruise where the evidence has been recovered or observed
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
FF_Type	Text, 50	Type of evidence – constrain- NN- LV_FF_Type
Descripti	Text, 250	Description of the evidence - free text
D_Indi_mtp	Double 10,4	Depth of the top of the evidence below seabed in meters
D_Indi_mbt	Double 10,4	Depth of the bottom of the evidence below seabed in meters
D_IndiTWTt	Double 10,4	Depth of the top of the evidence below seabed in seconds TWTT
D_IndiTWTb	Double 10,4	Depth of the bottom of the evidence below seabed in seconds TWTT
DOI	Text, 254	DOI of main data publication
Reference	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

B

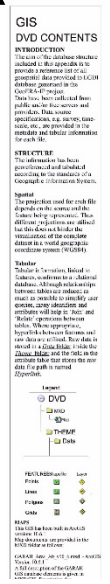
GasHydrate_Areal_Geophy_Indicators: Polys

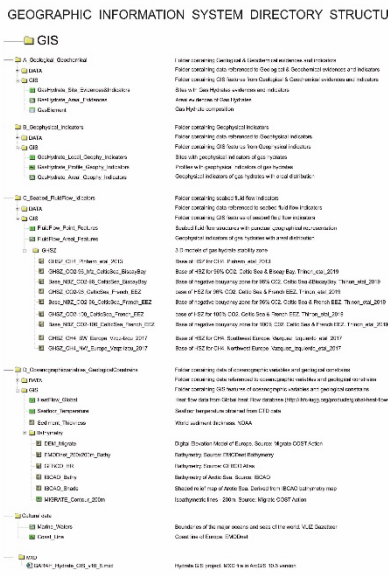
FIELDNAME	FORMAT	DESCRIPCION
ID_IndiNa	Text, 254	Identification code of the evidence - PK
MpArea	Double 14,6	Cartographical area of the evidence in km2
GeoSettin	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
Data_Sourc	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
Cruise	Text, 254	Oceanographic Cruise/es in which the evidence is supported
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
FF_Type	Text, 50	Type of evidence – constrain- NN- LV_FF_Type
Descripti	Text, 250	Description of the evidence - free text
D_IndiTWTt	Double 10,4	Depth of the top of the evidence below seabed in seconds TWTT
D_IndiTWTb	Double 10,4	Depth of the bottom of the evidence below seabed in seconds TWTT
Size	Text, 50	Size (volume, km2, tons, etc)
DOI	Text, 254	DOI of main data publication
Reference	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

GasHydrate_Profile_Geophy_Indicators: Lines

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiNa	Text, 254	Identification code of the evidence - PK
MpLength	Double 14,6	Cartographical length in km of the indicator
GeoSettin	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
Data_Sourc	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
Cruise	Text, 254	Oceanographic Cruise where the evidence has been recovered or observed
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
FF_Type	Text, 50	Type of evidence – constrain- NN- LV_FF_Type
Descripti	Text, 250	Description of the evidence - free text
D_Indi_mtp	Double 10,4	Depth of the top of the evidence below seabed in meters
D_Indi_mbt	Double 10,4	Depth of the bottom of the evidence below seabed in meters
D_IndiTWTt	Double 10,4	Depth of the top of the evidence below seabed in seconds TWTT
D_IndiTWTb	Double 10,4	Depth of the bottom of the evidence below seabed in seconds TWTT
DOI	Text, 254	DOI of main data publication
Reference	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text
Scan_URL	Text, 254	URL with image data
Terms_OF_U	Text, 254	Term Of use

GEOGRAPHIC INFORMATION SYSTEM DIRECTORY STRUCTURE





C

OCEANOGRAPHIC VARIABLES & GEOLOGICAL CONSTRAINS

HeatFlow_Global: Points

FIELDNAME	FORMAT	DESCRIPCION
OBJECTID	Number	Feature ID. An internally generated identification number for each feature. Automatically generated within shape file.
shape	Geometry	points
Data_Numbe	Text, 254	Number arbitrary
Codes*	Text, 254	Codes based on Lee and Uyeda 1965
Site_Name	Text, 254	Code from "AAPG Datapages" (Jessop et al 1975)
Latitude	Num (Double) (0,0)	Latitude
Longitude	Num (Double) (0,0)	Longitude
Elevation	Text, 254	Elevation
minD	Text, 254	Minimum depth for the heat flow calculation
maxD	Text, 254	Maximum depth for the heat flow calculation
No__Temps	Number	Number of temperatura point used in the calculation
Gradient	Gradient	Temperatue gradient
No__Cond	Number	0, Estimated by roc type or existing data. Blank , lack of info
Conductivi	Num (Double) (0,0)	Average conductivity
No_Heat_Pr	Text, 254	Number of samples used in the calculation
Heat_Flow	Num (Double) (0,0)	Heat flow in mE/m2
No__sites	Number	Different of 1 if grouping has occurred. Blank in subitems. More information in Jessop et al (1975)
Year_of_Pu	Text, 254	Year of publication
Reference	Text, 254	Source of data
Comments	Text, 254	Methods, Geographical setting, or additional references
Add_Refer	Text, 254	Additional references

D

Seafloor_Temperature: Points

FIELDNAME	FORMAT	DESCRIPCION
ID_OceName	Text, 254	Identification name of data - PK
Lat_DD	Double 15,6	Latitude in decimal degrees (WGS84)
Long_DD	Double 15,6	Longitude in decimal degrees (WGS84)
WaterDepth	Double 15,6	Seafloor depth
Measure_Depth	Double 15,6	Water depth of the temperature measured (m)
Temp	Double 15,6	Temperature (ºC)
Data_Source	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected

Sediments_Thickness: Raster

FIELDNAME	FORMAT	DESCRIPCION
Longitude	Num (Double) (15,6)	Longitude coordinates in decimal degrees (GCS WGS84)
Latitude	Num (Double) (15,6)	Latitude coordinates in decimal degrees (GCS WGS84)
Z_VALUE	Num (Double) (15,6)	Value of the sediment thickness in meters

FLUID FLOW SEABED INDICATORS

FluidFlow_Seafloor_Poly_Features: Polys

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiName	Text, 254	Identification code of the evidence - PK
MpArea	Double 15,6	Cartographical area of the evidence in km2
GeoSetting	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
FF_Type	Text, 50	Type of evidence – constrain- NN- LV_FF_Type
Description	Text, 250	Description of the evidence - free text
Data_Source	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
DOI	Text, 254	DOI of main data publication
References	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

FluidFlow_Seafloor_Point_Features: Points

FIELDNAME	FORMAT	DESCRIPCION
ID_IndiName	Text, 254	Identification code of the evidence - PK
Lat_DD	Double 15,6	Latitude in decimal degrees (WGS84)
Long_DD	Double 15,6	Longitude in decimal degrees (WGS84)
WaterDepth	Double 15,6	Seafloor depth
GeoSetting	Text, 50	Geographical / Geological Setting – Constrains NN, LV
LocalSite	Text, 50	Local site where the evidence is located
FF_Type	Text, 50	Type of evidence – constrain- NN- LV_FF_Type
Description	Text, 250	Description of the evidence - free text
Data_Source	Text, 254	Institution/Company if Owner of Data. Project, database or publication where data have been collected
CName	Text, 50	Contact name
Email	Text, 50	Contact Email
DOI	Text, 254	DOI of main data publication
References	Text, 254	References to data. Author, Year & Title. Link to PDF in data repository
Comments	Text, 254	Comments -- Free text

GHSZ: Raster

FIELDNAME	FORMAT	DESCRIPCION
Longitude	Num (Double) (15,6)	Longitude coordinates in decimal degrees (GCS WGS84)
Latitude	Num (Double) (15,6)	latitude coordinates in decimal degrees (GCS WGS84)
Z_VALUE	Num (Double) (15,6)	Value of the continuous variable (BGHSZ, thickness, etc ..) in meters

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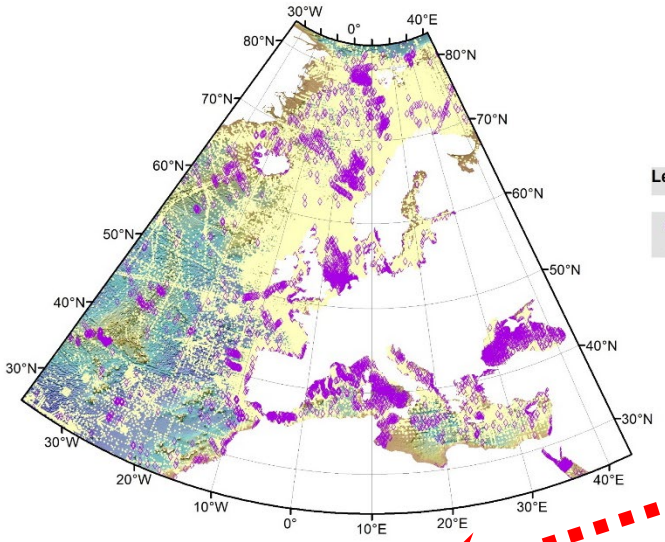
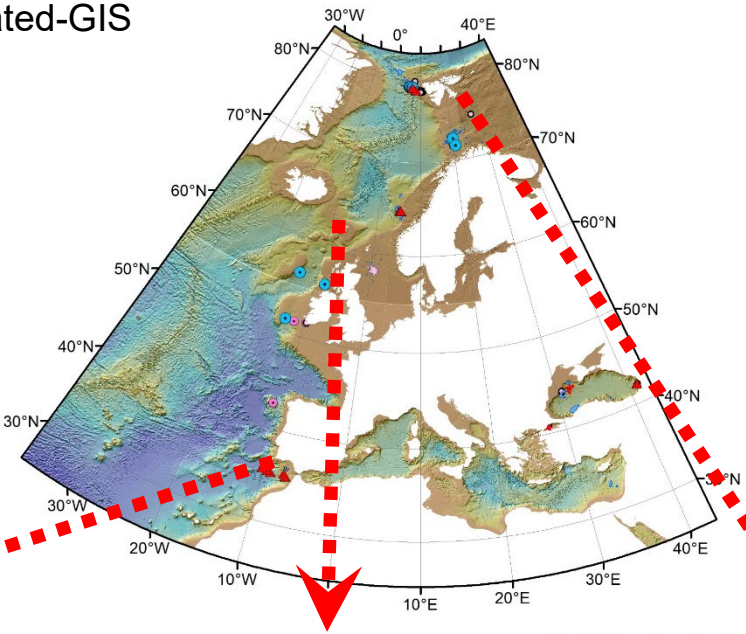
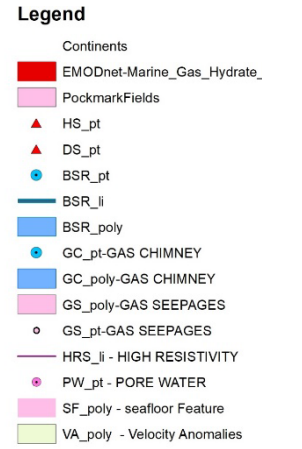
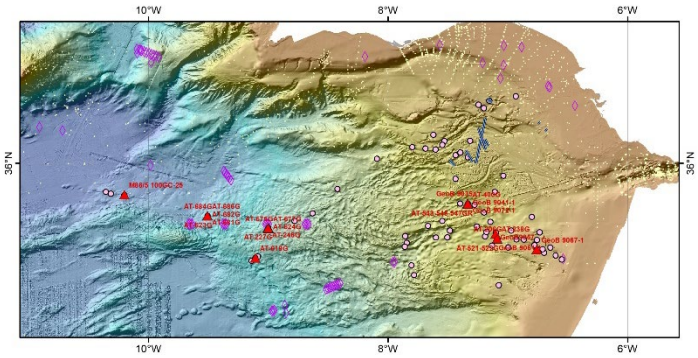
GeoERA GEO-ENERGY

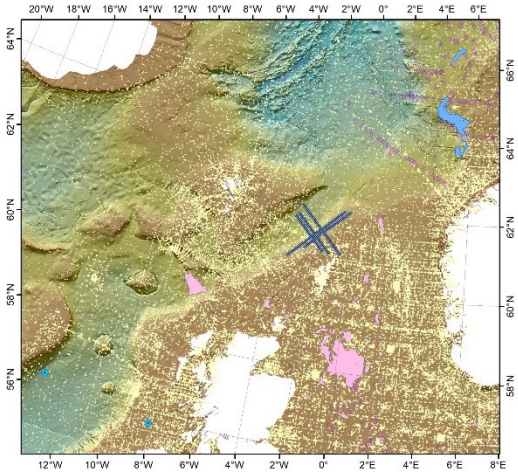
TASK 3 B. Development of the Gas hydrate related-GIS

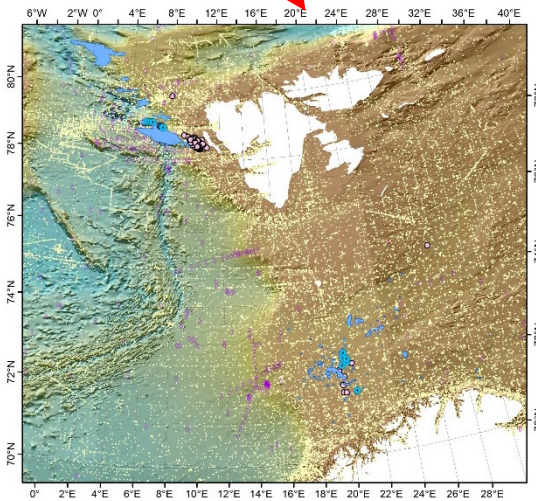












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Next steps

Actions/Tasks/Deliverables	**Deadline**
Data loading (task 3B)	June 2020
Deliverable D3.2: Hydrate related GIS-database	(M27) Sept. 2020
Task 3C. Integration of results	Dec. 2020
D3.3: Gas Hydrate overview report	(M33) March 2021

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2. WP Progress continued

– 5. WP4 GIP

- a. Establishing technical specifications
- b. Coordination of the GARAH database and Share Point development

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Status tasks Knowledge data base

- Identify and discuss requirements with the Information Platform (IP) team finalized
- Determination of requirements and standards finalized
- Preparing and creating the online platform finalized
- Local data implementation in progress
- IP data implementation and prototyping Pending
- Data validation and testing Pending

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Establishing technical specifications

Coordination of the GARAH database and Share Point development

- New WP lead: Uffe Larsen
  - GARAH contact-person to GIP
  - Transferring shape files into the EGDI database
  - Registration of the metadata.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

2. WP Progress continued

- 6. WP1 Project management
  - a. Finances
  - b. Progress according to time plan / Gant Chart
  - c. Project meetings and internal communications
  - d. Cooperation with 3DGEO-EU, HIKE and GIP
  - e. Dissemination and communication

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Status tasks Project coordination

- Administrative & Operational Management in progress
- Project Data Management Plan finalized
- Communication in progress
- Dissemination and Exploitation Plan finalized
- Annual progress reports 2018 finalized
- Mid term report finalized

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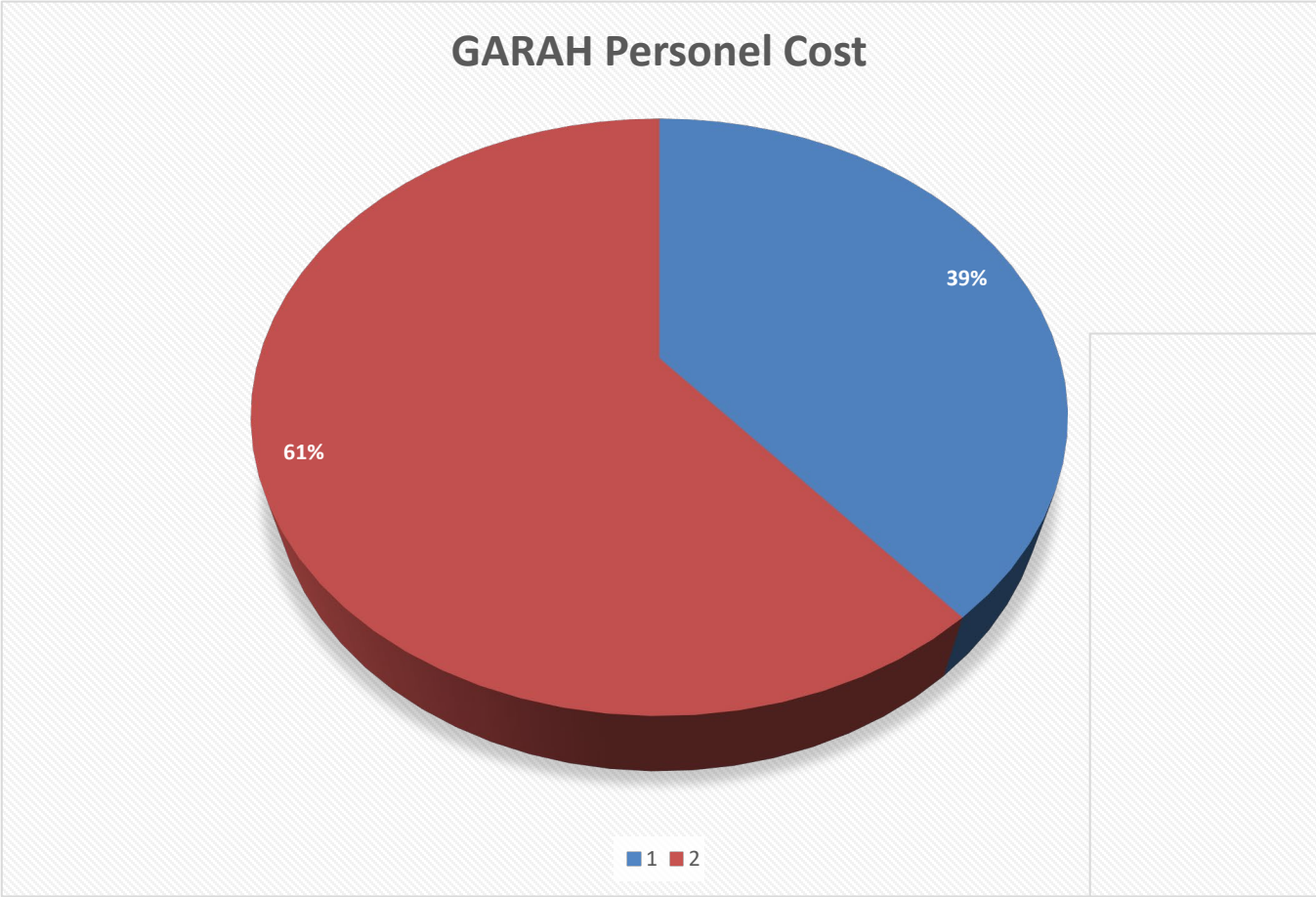
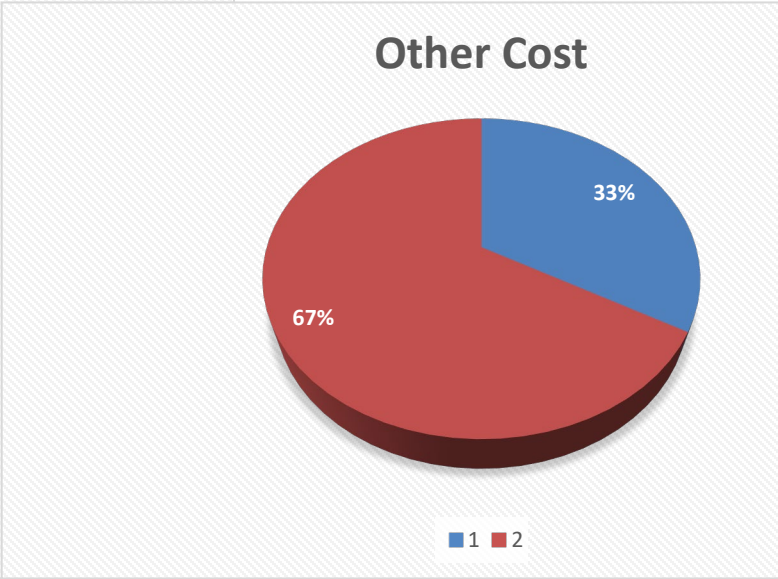
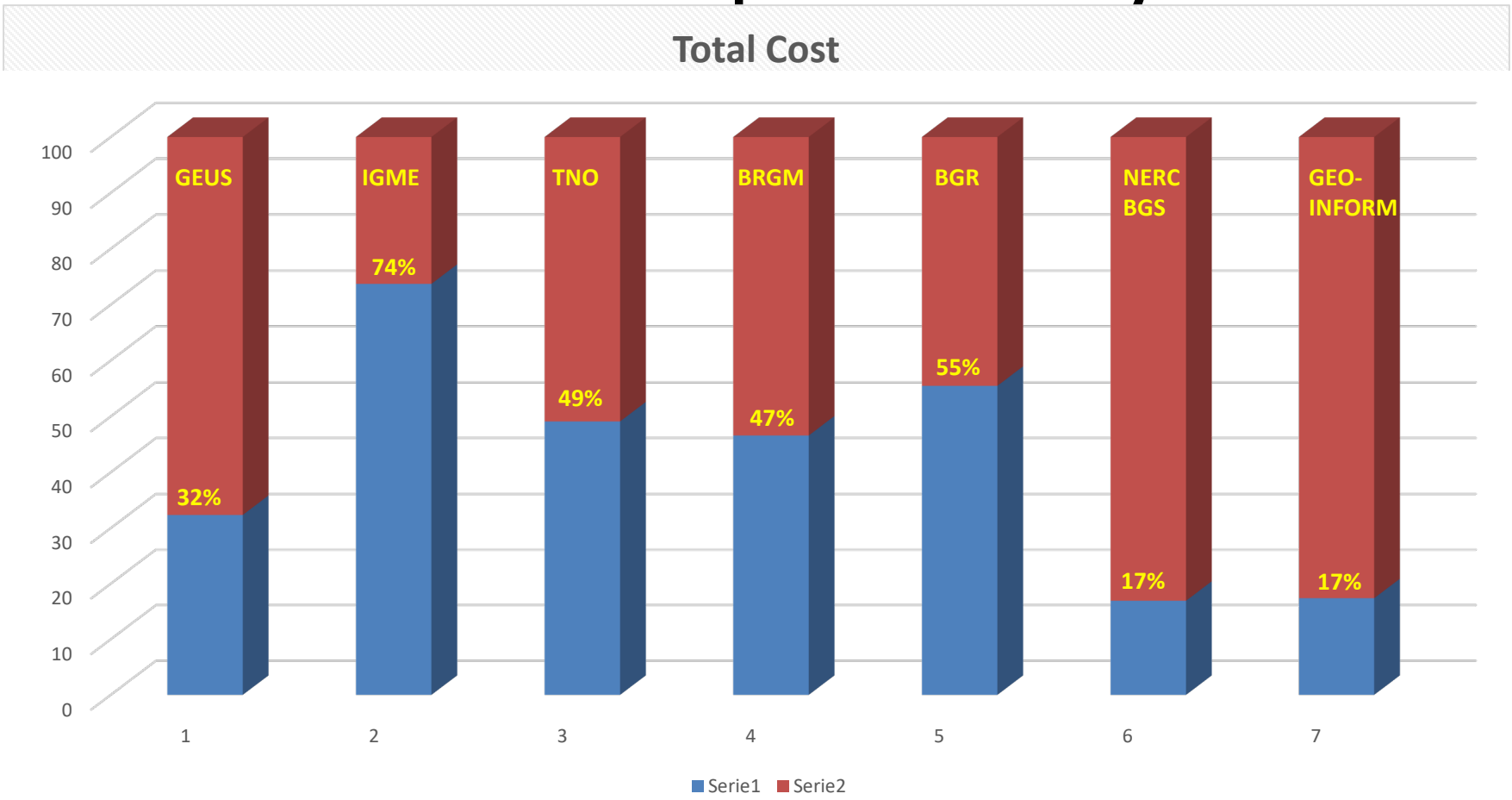
Finances Total





This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

Finances per Survey



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Progress - time plan / Gant Chart

Gantt Chart	2018		2019				2020				2021	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
WP1												
Annual Project Meetings	X				X				X			X
WP Meetings (X), Skype (*)	X		*		X		*		X		*	
Board Meetings	X				X				X			X
Progress reporting			X				X				X	
Final report											Report	
Deliverables	D1.1	D1.2 D4.1	D1.3, D2.1 D3.1				D1.4	D2.4		D3.2, D4.2, D4.3	D1.5, D2.2, D2.3, D3.3	D1.6, D1.7, D2.6
Milestones	MS1	MS2, MS3			MS4			MS5	MS6	MS7	MS8, MS9, MS10, MS11	MS12, MS13, MS14, MS15
WP2												
Task 2A - DB	Harmonize DB		Report									
Task 2B- Petrol. System	Appraisal		Data collation and characterisation of PS								Report	
Task 2C - "EUOGA" assessments North Sea		Appraisal	Resource assessments								Report	
Task 2D - Pilot Study 3D assessment		Appraisal	Unconventional assessment				Report					
		Appraisal					Conventional assessment				Report	
Task 2E - Alternatives + Hazards	Appraisal								Generate Catalogue			Report
WP3												
Task 3A - Collection of data sources	Data collection and classification		Report									
Task 3B - Data Model structure and loading			Harmonize Gas Hydrates related DB						Input IP			
Task 3C - Results								Integration			Report	
WP4												
Task 4A - Requirements and standards	Synthesis	Report										
Task 4B - Online platform		Development										
Task 4C - Data implementation			Implementation					Prototyping		Report	Validation	Report
WP4 - Data input to IP (D4.5)			Data supply				Data supply		Data supply		Data supply	

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Deviations from time plan

Description of the deviation (indicate also WP and/or Project partner where the deviation occured)	Description of corrective measures adopted:	Does the deviation have an impact on project outputs?	Are changes to workplan / budget / … needed? If yes, please specify:
WP2: D2.1 “State of the art report”; delivery date 28.2.2019 (M8)	New delivery date 25.04.2019 (M10)	No	No
WP2: D2.4 “Task 2D - Pilot Study 3D assessment, Unconventional”; delivery date 31.3.2020 (M21)	New delivery date 30.09.2020 (M27)	No	No
WP1: D1.4 “Project Progress and Monitoring Report”; Delivery date 31.12.2019 (M18)	Change title of 1.3 to “Midterm Project Progress Report” New delivery date 31.01.2020 (M19)	No	No

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Project meetings, communications

- The GARAH project management board has bi-monthly SKYPE or WEBEX meetings, where the progress in the GARAH study is discussed and assessed.
- On work package level, several informal SKYPE meetings, together with emails has formed the basis for close communication.
- Until now, the group had WP and Board meetings in Madrid (Oct. 2018) and Edinburgh (Oct. 2019).

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Cooperation

- Close cooperation between 3DGEO-EU and GARAH on a 3D pilot study area in the North Sea.

Several joint workshops with other partners have been convened:

- • Tech workshop with 3DGEU-EU, September 2018
- • Tech workshop in Vienna, March 2019
- • Tech workshop with 3DGEU-EU and HIKE, September 2019
- Several meetings and SKYPE meetings with GIP.

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Dissemination and communication

Please select activity	Subcategory	Date	Target audience	Number of people reached	Short name of project participant	Author(s)
PUBLICATIONS	SCIENTIFIC PUBLICATION	17-06-2019	SCIENTIFIC COMMUNITY		npa	Niels H. Sch
MEETINGS	Meeting with international body	03-07-2018	EU INSTITUTION	200	many	
MEETINGS	Meeting with other GeoERA projects	01-09-2018	SCIENTIFIC COMMUNITY	15	TNO, BGR,GEUS,PGI	
MEETINGS	Meeting with other GeoERA projects	01-03-2019	SCIENTIFIC COMMUNITY	75	many	
MEETINGS	Meeting with other GeoERA projects	01-09-2019	SCIENTIFIC COMMUNITY	15	TNO, BGR,GEUS,PGI	
MEETINGS	Internal project meeting	oct-2018	SCIENTIFIC COMMUNITY	20	TNO, IGME, BRGM, BGR, BGS, GE	
MEETINGS	Internal project meeting	oct-2019	SCIENTIFIC COMMUNITY	20	TNO, IGME, BRGM, BGR, BGS, GE	
MEDIA	ONLINE MEDIA		GENERAL PUBLIC		many	
EVENTS	CONGRESS	sep-19	SCIENTIFIC COMMUNITY	100+	BGR, TNO, GEUS	Arfai, Ja
MEETINGS	Meeting with international body	nov-18	SCIENTIFIC COMMUNITY	50	MIGRATE COST	R. León
MEETINGS	Meeting with international body	29-01-2019	SCIENTIFIC COMMUNITY	20	MIGRATE COST	R. León
EVENTS	WORKSHOP	sep-19	SCIENTIFIC COMMUNITY	50	GDR Hydrates , Brest	A. Burnol
EVENTS	**CONGRESS**	sep-19	SCIENTIFIC COMMUNITY	100	IAS 2019, Rome	R. León

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3. General Discussions/Questions/Conclusions

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166