The Significance of Submerged Landscapes and Underwater Cultural Heritage

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THE UNIVERSITY of York

SeArch Conference
Bruges
24 November 2014

SPLASHCOS

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

DISPERSE

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Underwater Cultural Heritage

What is it?

Why is it important?

How should it be researched and managed?

How can it be funded?

Broadly two types of Underwater Heritage

- Shipwrecks and submerged harbours
  - History of maritime trade, migration, marine power and naval technology over 5 millennia

  Estimated 3 million shipwrecks on the seabed

- Submerged prehistoric landscapes
  - History of human dispersal, social and economic foundations of the modern world
  - <6000 to >1 million years

  Estimated 20 million km^2 of drowned landscape

Continental Shelf Archaeology CSA

Continental Shelf Prehistoric Research CSPR

Both are global in scope. Both are ‘terrestrial’ as well as ‘underwater’

UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage

Quoted extract “

1. (a) ‘Underwater cultural heritage’ “means all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years such as:

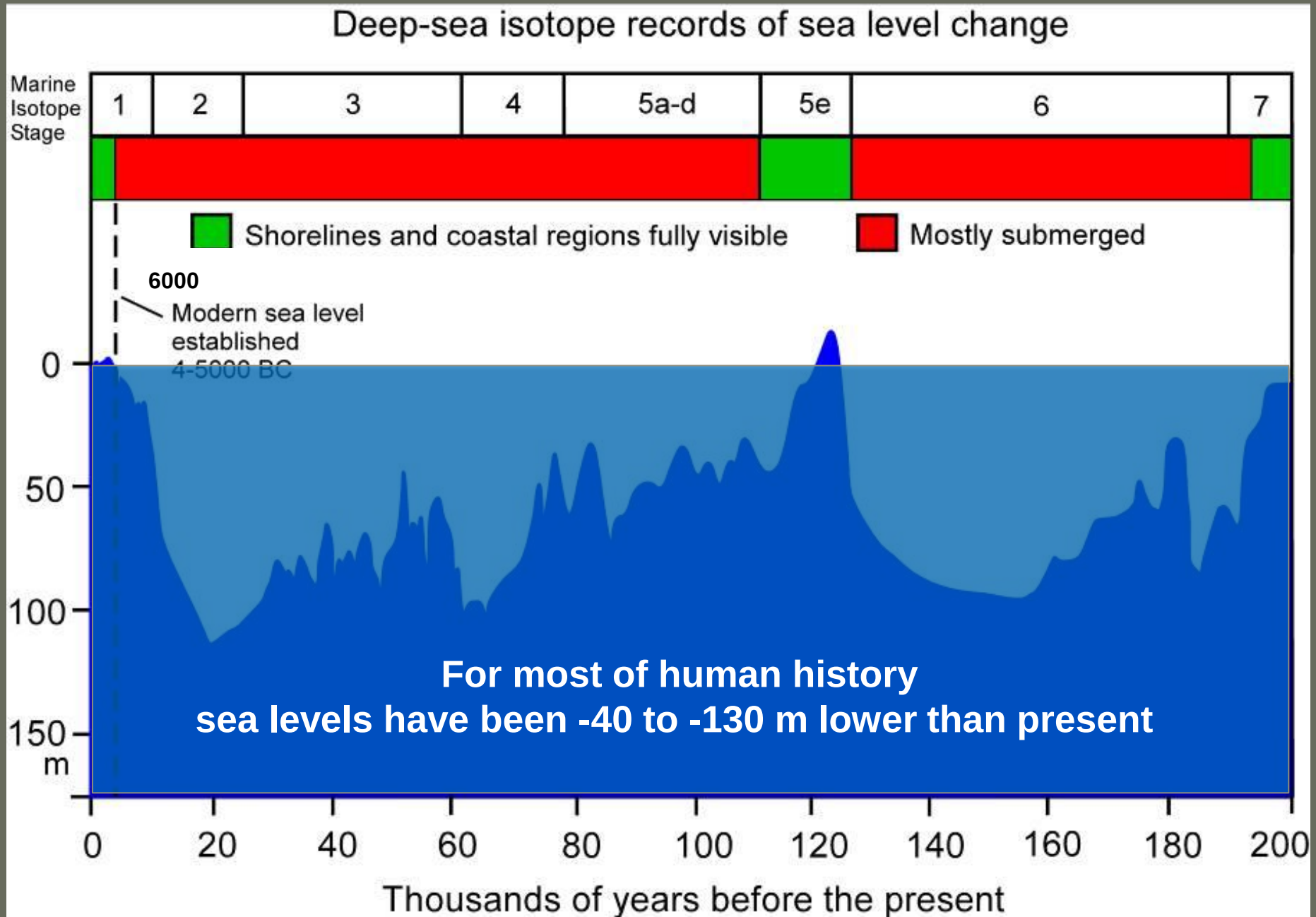
    (i) sites, structures, buildings, artefacts and human remains, together with their archaeological and natural context;

    (ii) vessels, aircraft, other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural context; and

    (iii) objects of prehistoric character”

The Convention encourages preservation, research and public access

The sea-level story and human history



Continental Shelf Prehistoric Research

Coastal regions included some of the most attractive centres for human settlement at all periods during the past 2 million years (early hominins, hunter-gatherers, farmers, urban societies) .
Coastal lowlands benefit from:

- Concentrations of water supplies –river estuaries, high water tables, springs
- Greater ecological diversity
- Higher fertility for plant and animal life on land
- Protection from climatic extremes
- Marine resources at shore edge and offshore if you have boats
- Easy pathways of movement and dispersal
- Gateway to inland riverine systems
- Mostly submerged

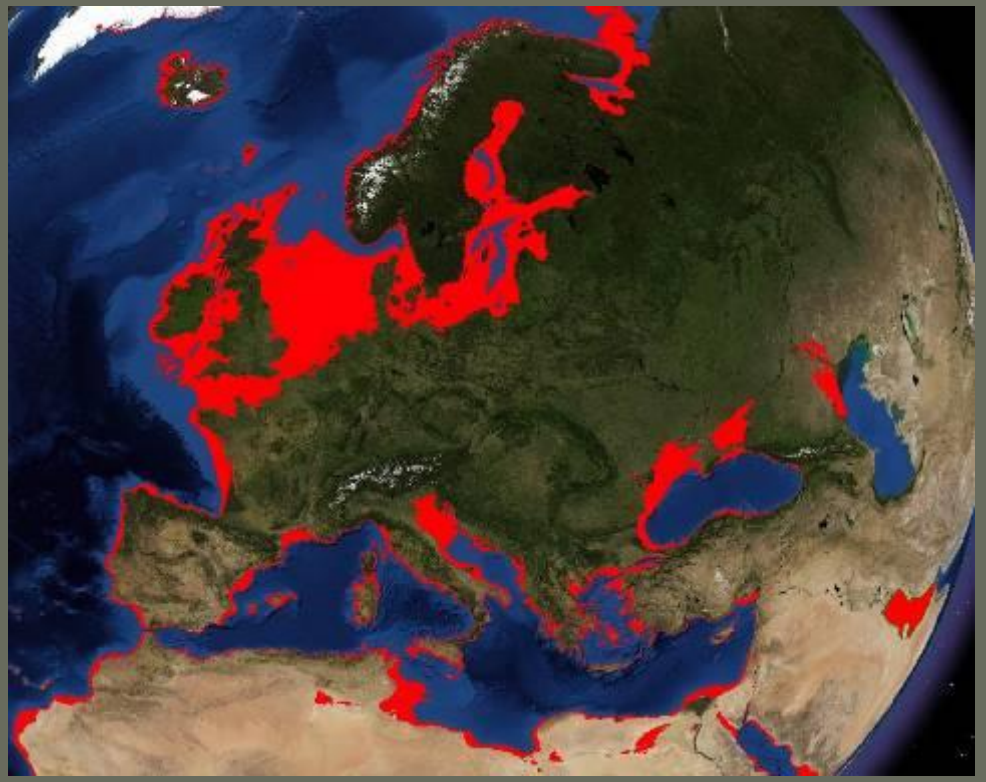
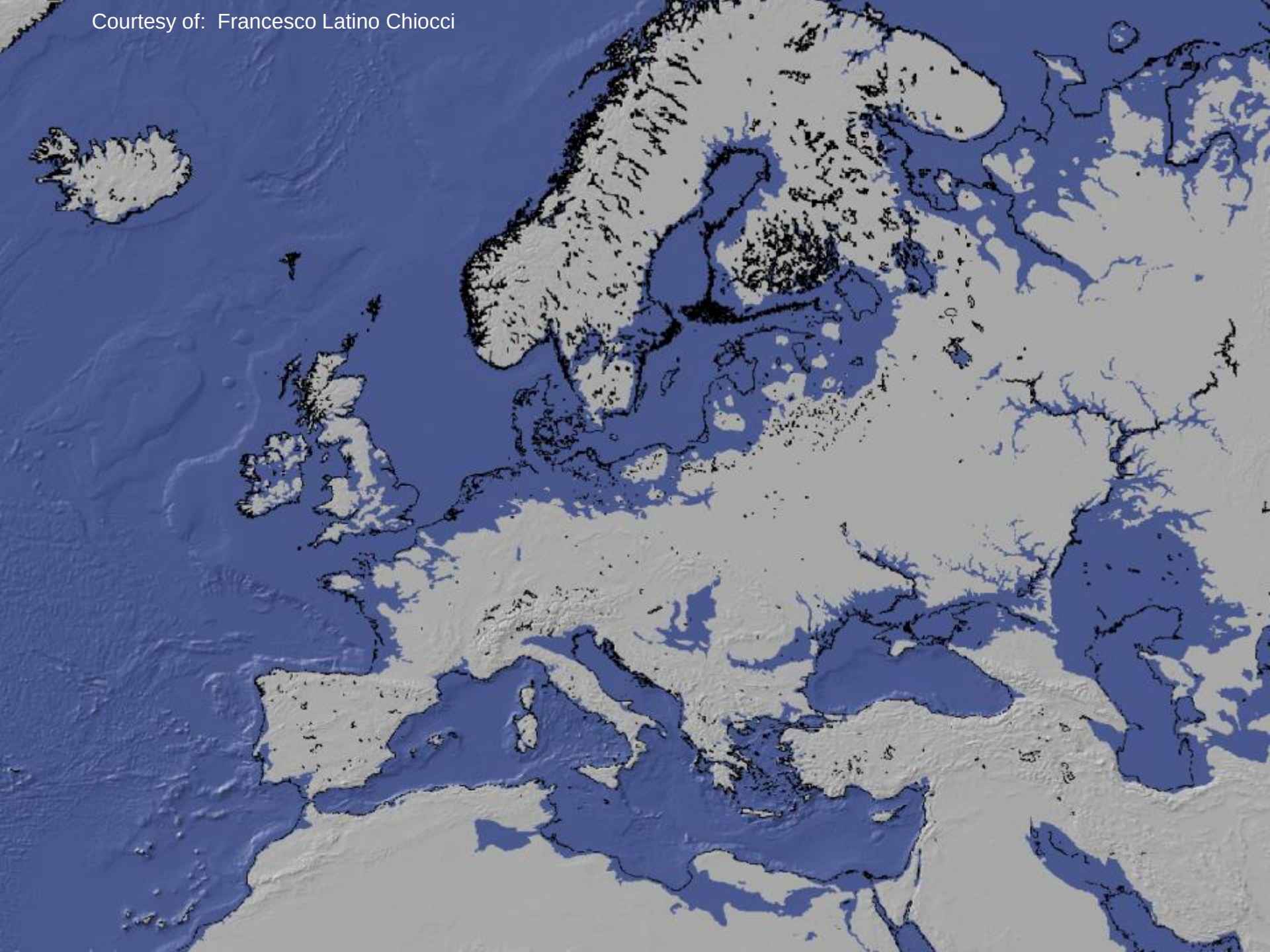
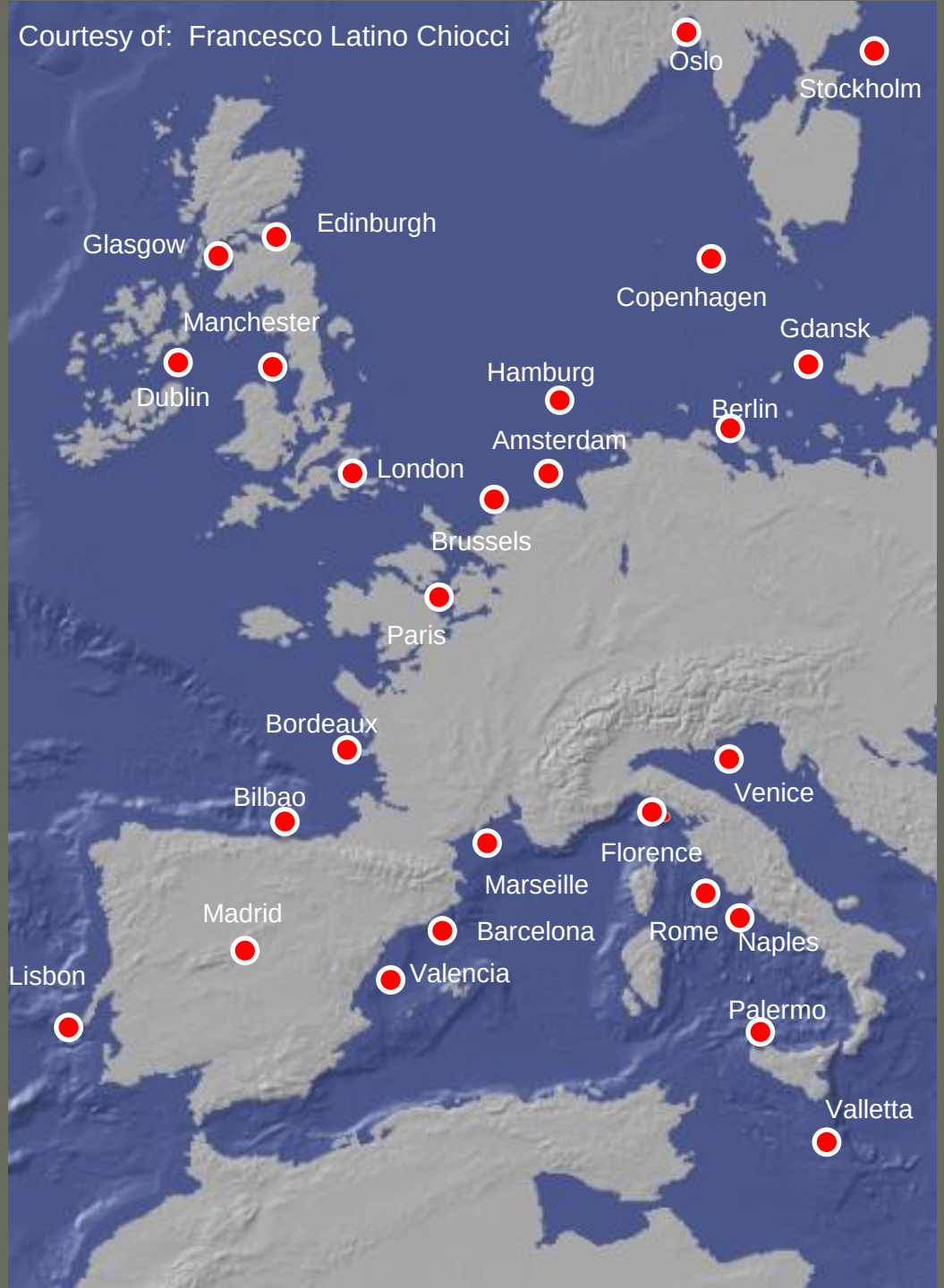


Image courtesy of Simon Fitch, Ben Geary
University of Birmingham
Data from USGS Ned & ETOPO2

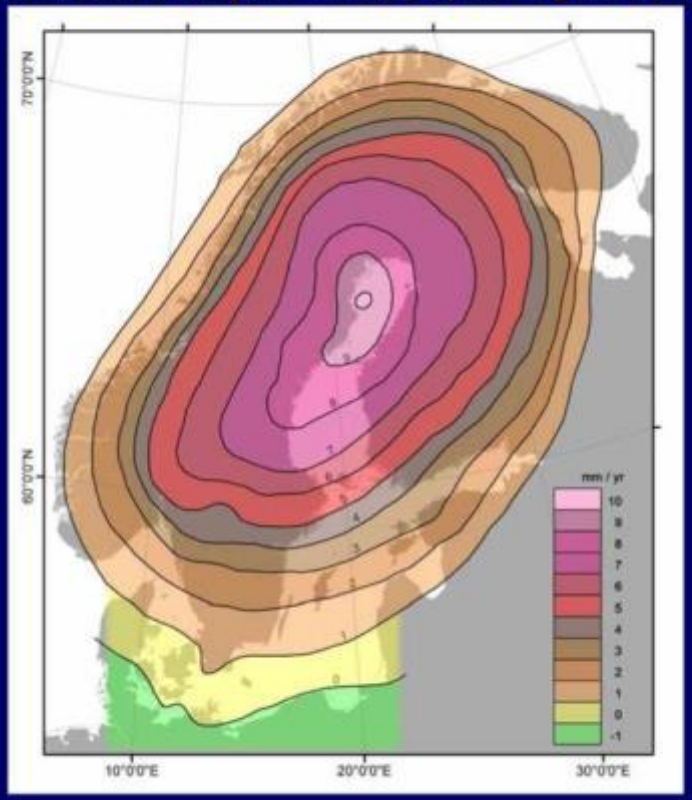

Courtesy of: Francesco Latino Chiocci



What would Europe look like if all the ice caps were to melt, with a further sea level rise of 130m above present sea level?

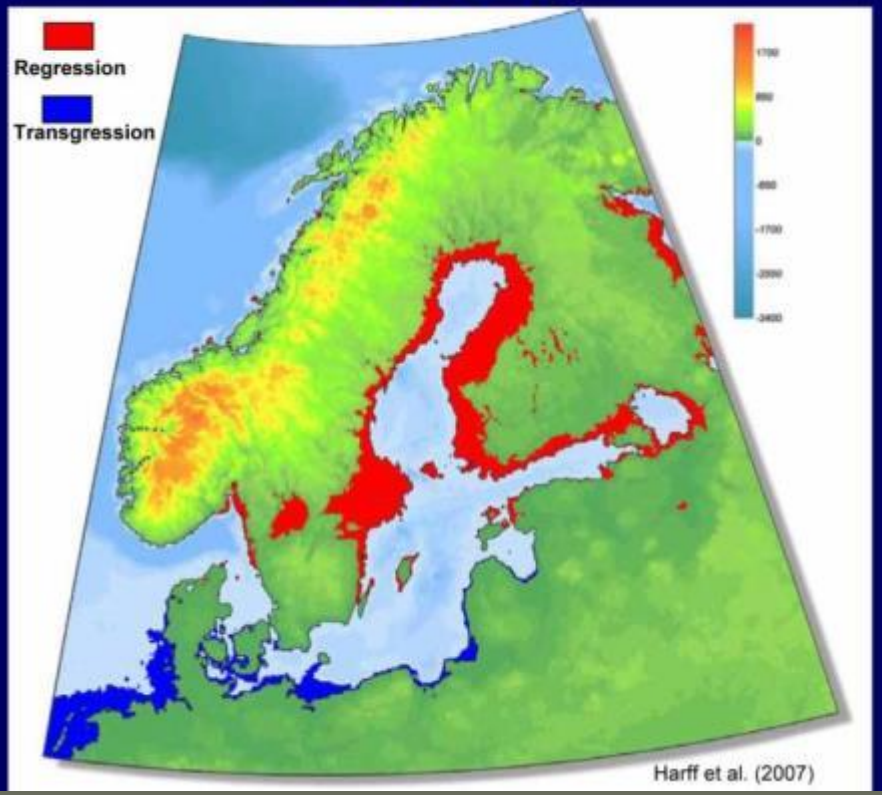
What would the archaeologists of the future conclude from the ruins of the 21st century?

Glacio-isostatic adjustment (GIA) during the 20th century

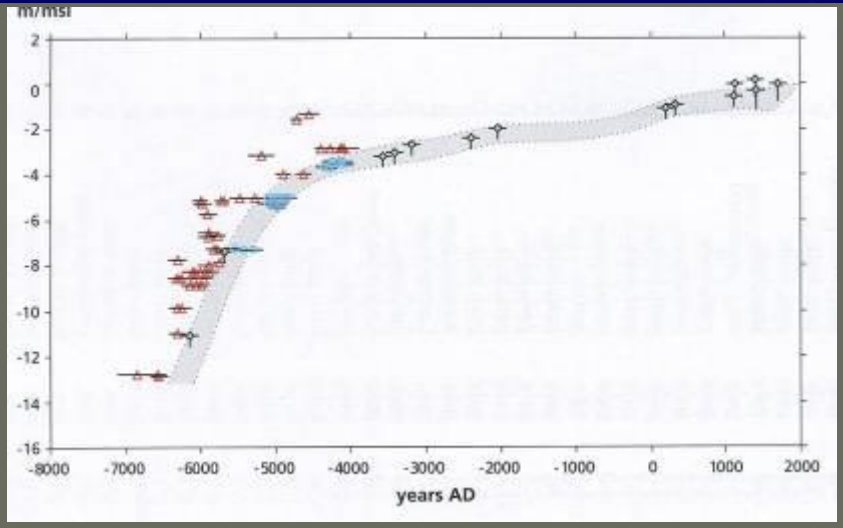


Harff and Meyer (2008)

Areas of transgression and regression of the Baltic Sea since 8000 cal. BP



Harff et al. (2007)



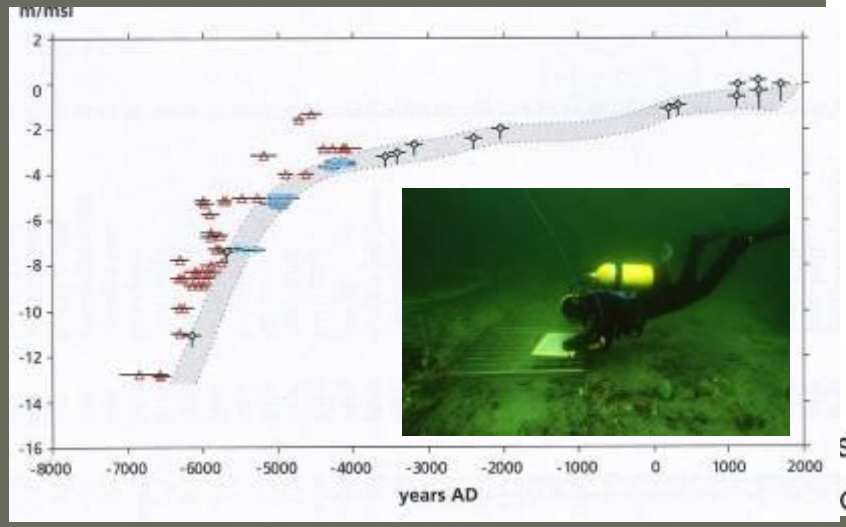
Harff & Lueth (eds.) 2008. SINCOS – Sinking Coasts, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea. DAI, Frankfurt a.M.

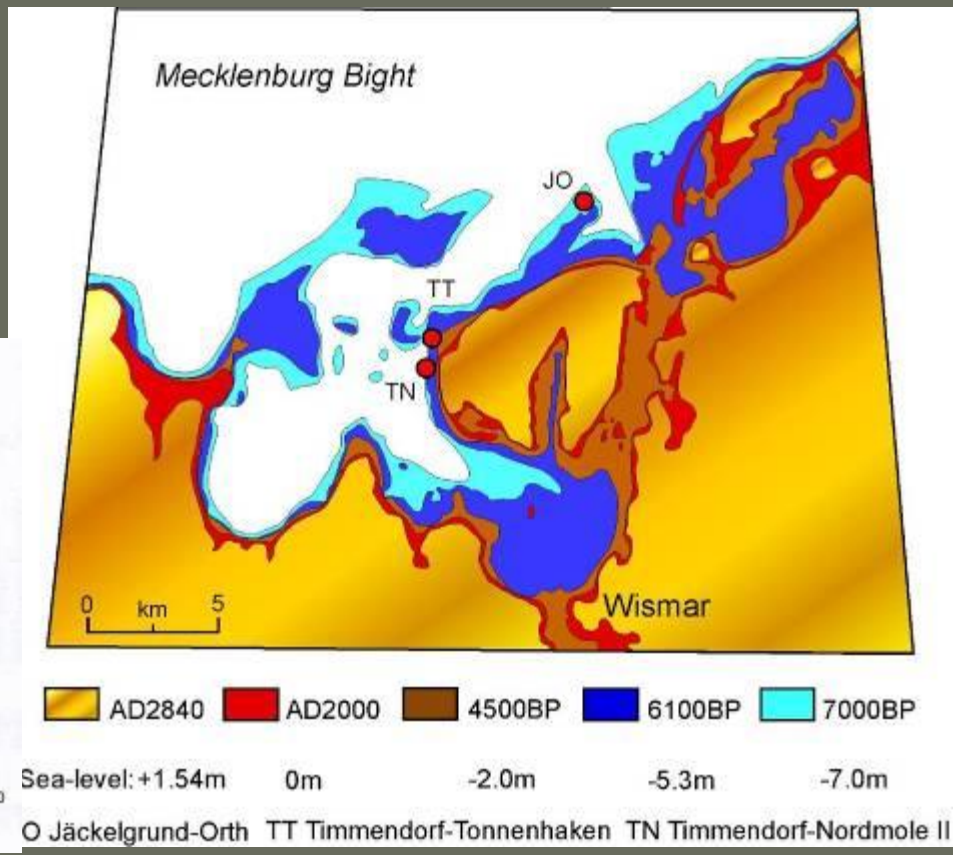
SINCOS

Future sea-level change

- Submerged archaeological sites have given precision to an 8000-year sea-level curve in the Wismar Bay

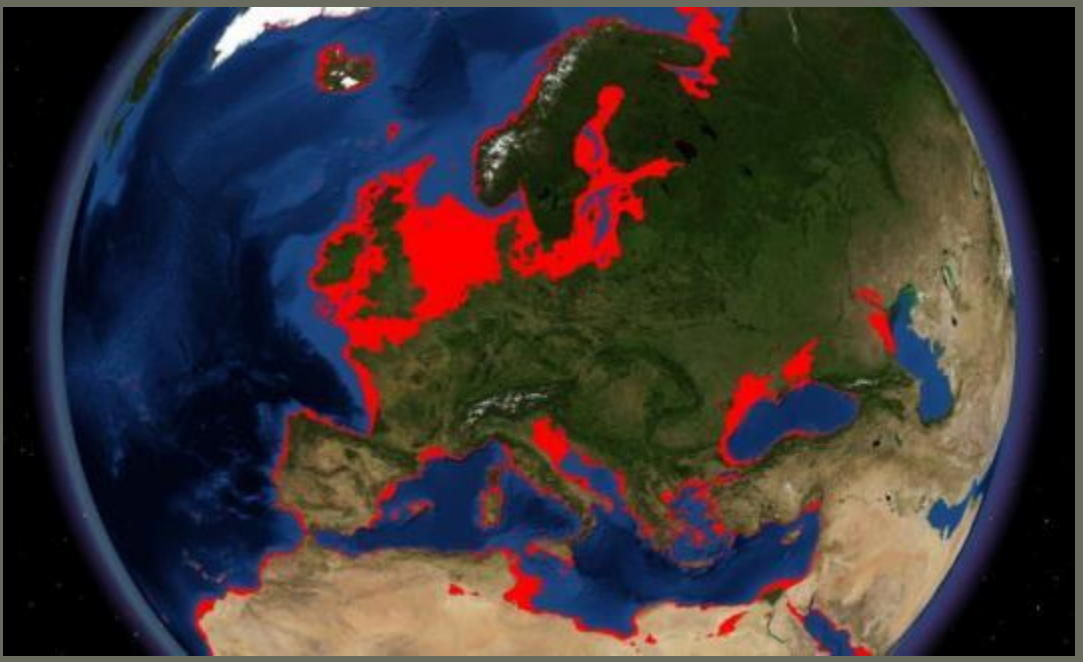
- Submergence of further 2m of the present coastal zone will continue in this century

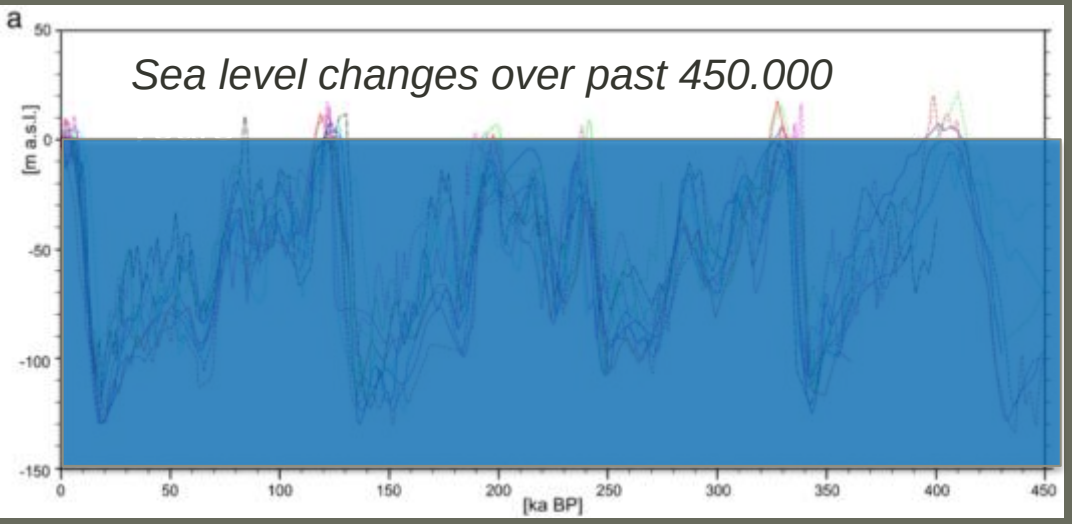




Harff & Lueth (eds.) 2008. SINCOS – Sinking Coasts, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea. DAI, Frankfurt a.M.

The Scientific Problem





Continental Shelf (0-130 m)

- Sea level persistently low for most of past 1 million years
- The land is going up and down as well as the sea
- Mostly dry for most of European and World prehistory with some of the most important evidence
- Mostly drowned by sea-level rise of 130m ending 6000 years ago
- Focus of intensifying industrial exploitation and natural destruction

The Practical Problem

- What have archaeologists done about it?
- Until recently very little
  - Belief that nothing survives
  - Lack of funding and technology
  - Even if the evidence survived it wouldn’t make any difference

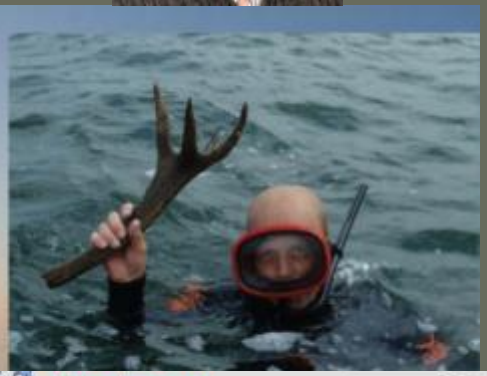
- What has changed?
  - Accumulation of underwater finds
  - Changed view of world prehistory
  - National and international legislation on underwater heritage
  - New sources of funding including industrial cooperation

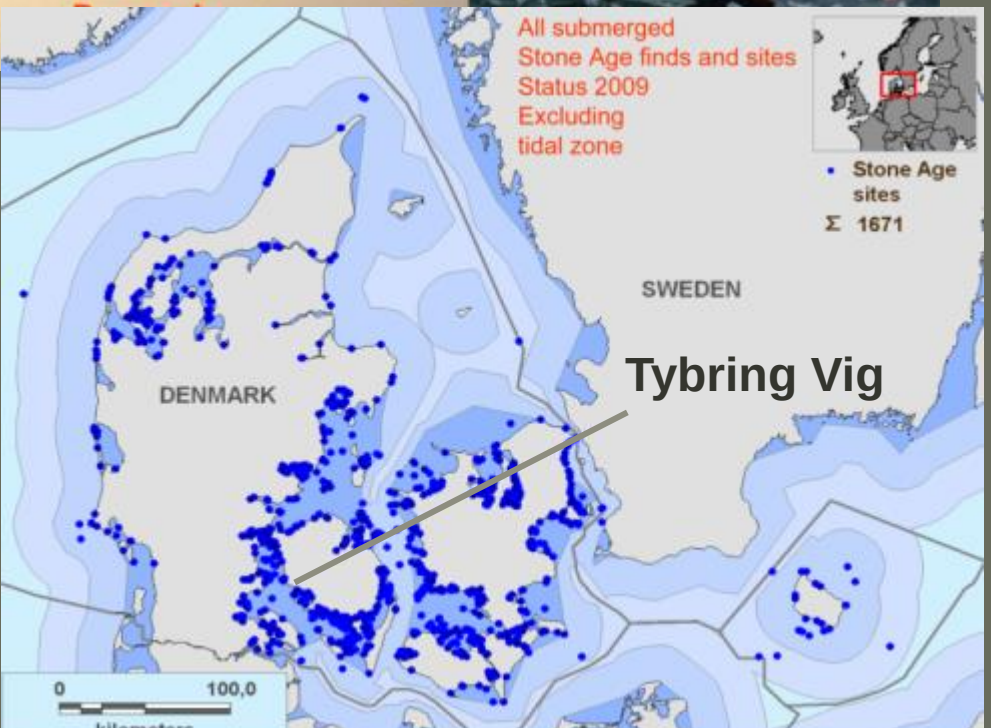
Anders Fischer

Ole Grøn

KULTURARV

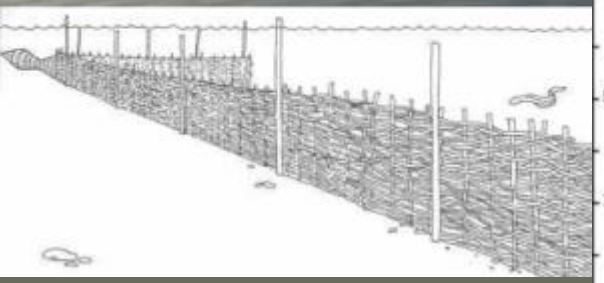
Submerged prehistory,

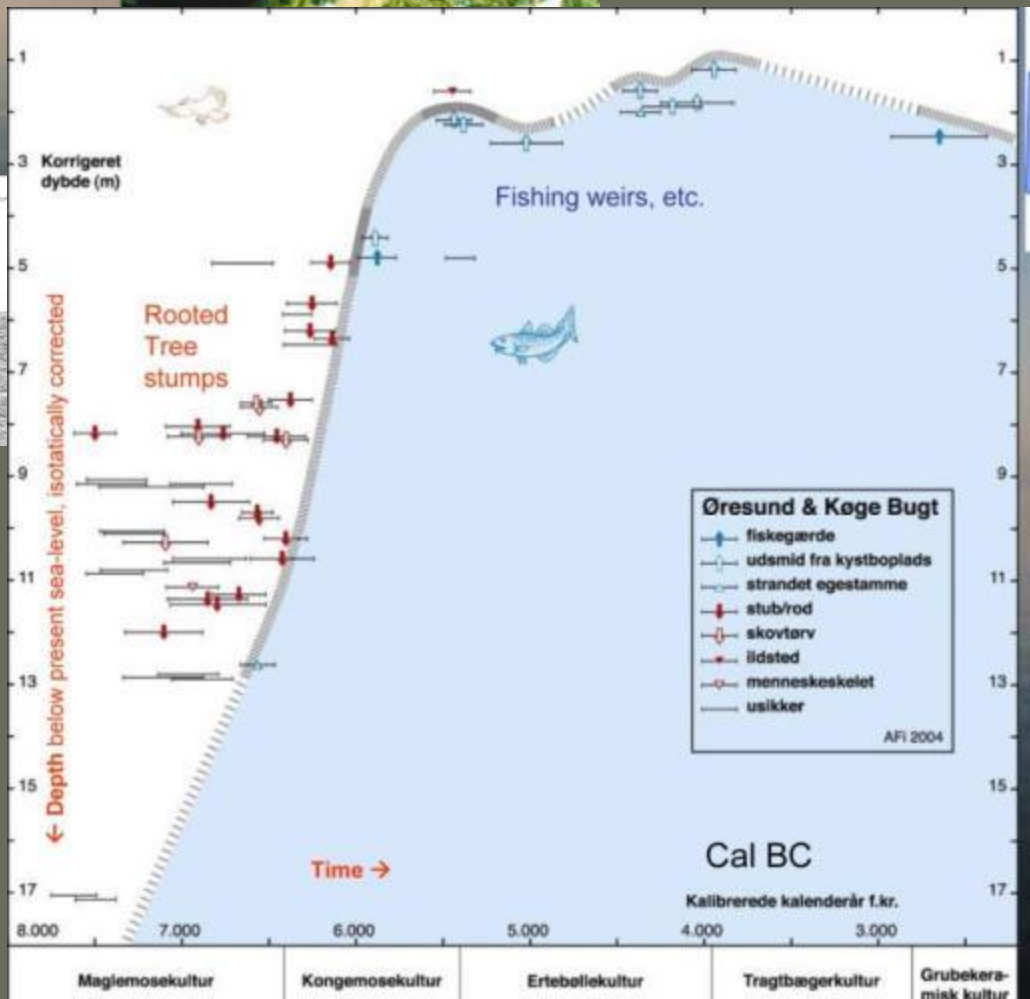




Wood constructed fish weirs

- Below sea-level at time of deposition
- Produced from fresh hazel rods of only few years of biological age





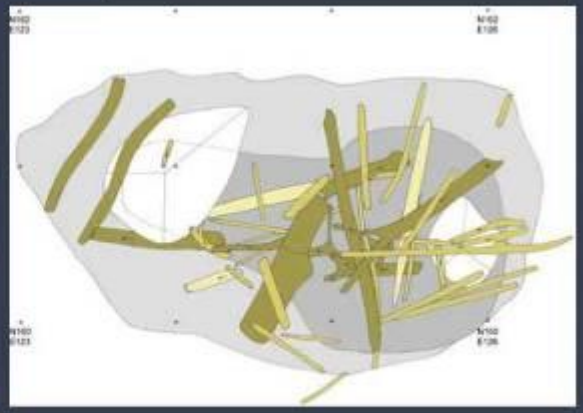
Fischer 2005

Relative sea-level rise in Øresund:
-20 to 0 m
8500-3500 BP

DAI Römisch-Germanische Kommission

Timmendorf-Nordmole Pit

- Wooden beams from the shelter, collapsed into the pit

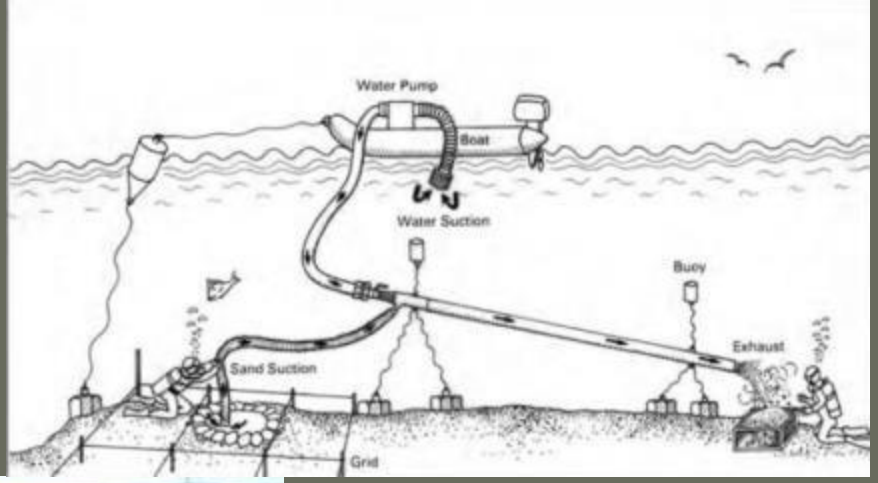


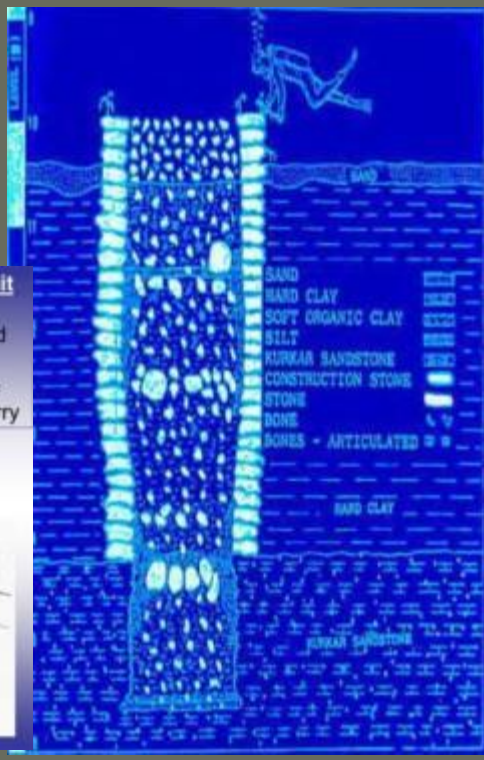
Truncated blade knife with preserved handle of hazel wood and two layers of lime bast binding

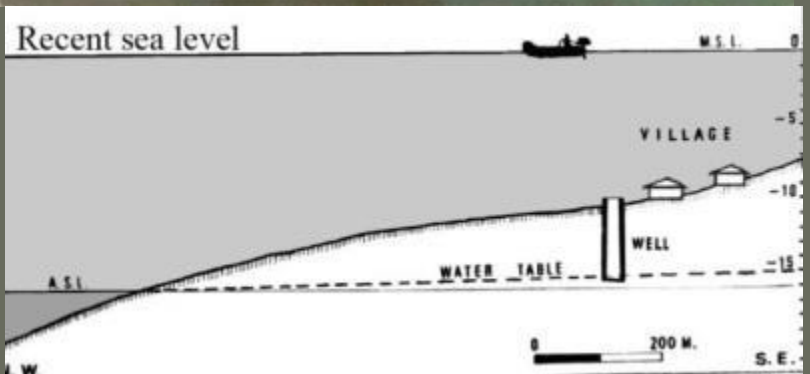
SINCOS

ATLIT YAM

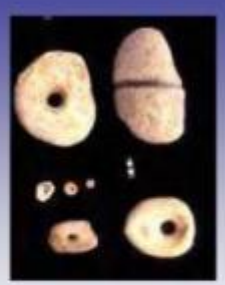
PPNB 9000 years







Trigger fish (*Balistes carolinensis*)



Ancient stone weights used for fishing

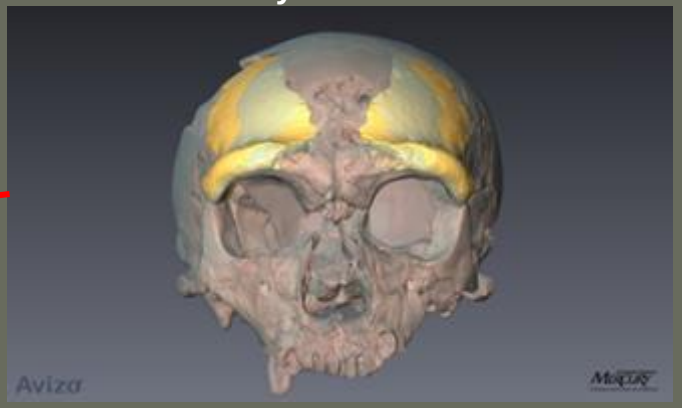
Galili, E., et al.. 1993. Atlit-Yam: a prehistoric site on the sea floor off the Israeli coast. *Journal of Field Archaeology* 20: 133–157.

Doggerland

Original graphic from B.J. Coles, 1998. Doggerland: a speculative survey. Proceedings of the Prehistoric Society 64:45-81.

North Sea Palaeolandscapes Project: Vince Gaffney et al. (See following slide)

Ice Age woolly mammoth skull dredged from seabed by Dutch trawler fishermen



Neanderthal skull fragment. Hublin, J.-J., et al.. 2009. Out of the North Sea: the Zeeland Ridges Neandertal. *Journal of Human Evolution* 57: 777–785.

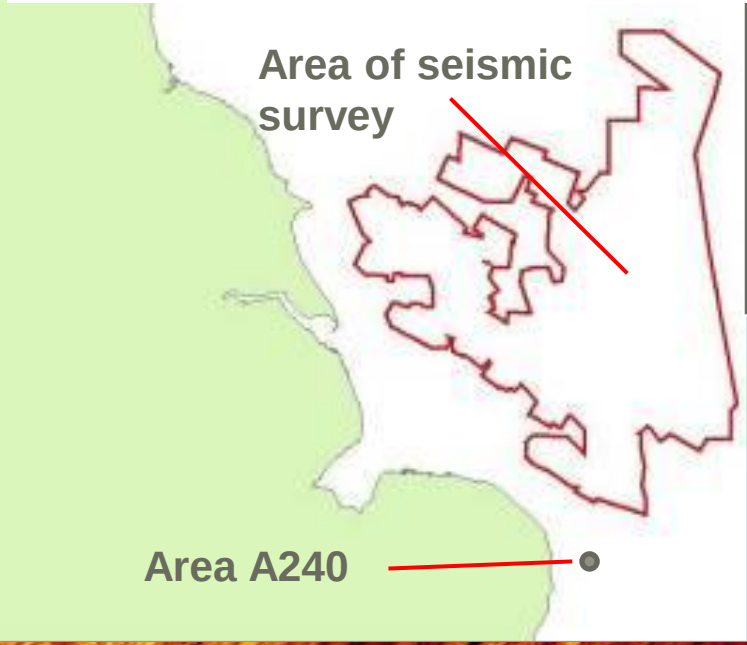
ICE SHEET
VIKING
BERGEN HILLS
SHETLAND HILLS
Norwegian Trench
ICE SHEET
Dee
Tweed
ICE SHEET
DOGGER HILLS
Outer Silver Pit lake
Elbe
Ouse
Rhine
Thames
Channel River

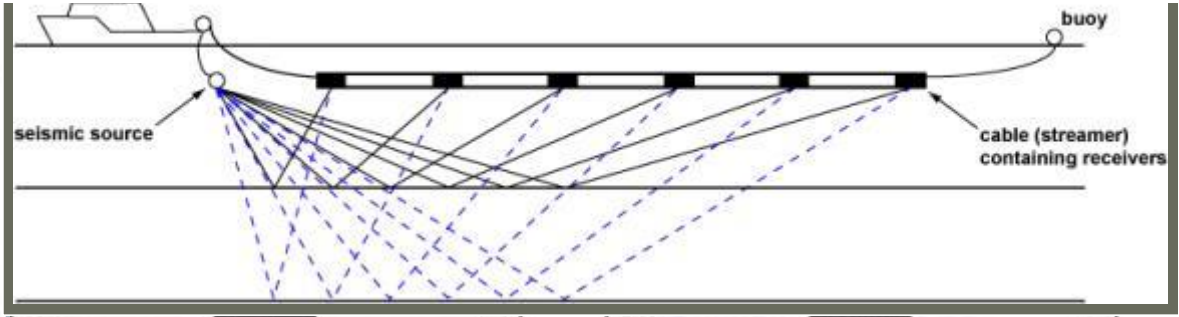
DOGGERLAND
Hypothetical maximum extent of land.
Later Devensian/Weichselian

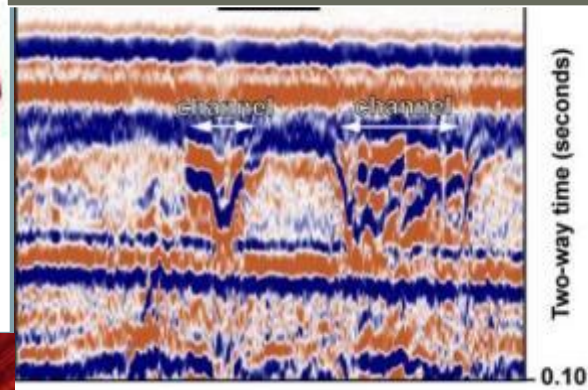
0 250
kilometres

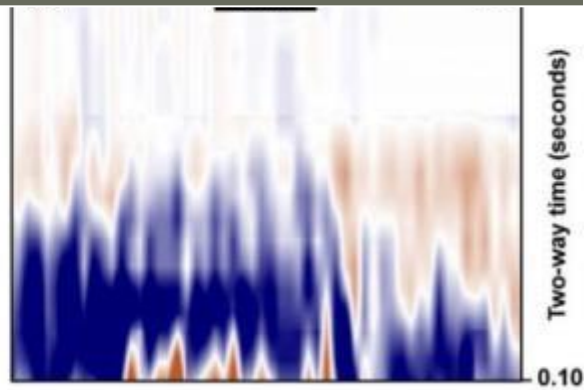
North Sea Palaeolandscapes Project: Vince Gaffney et al. seismic records from the North Sea oil and gas industry (University of Birmingham)

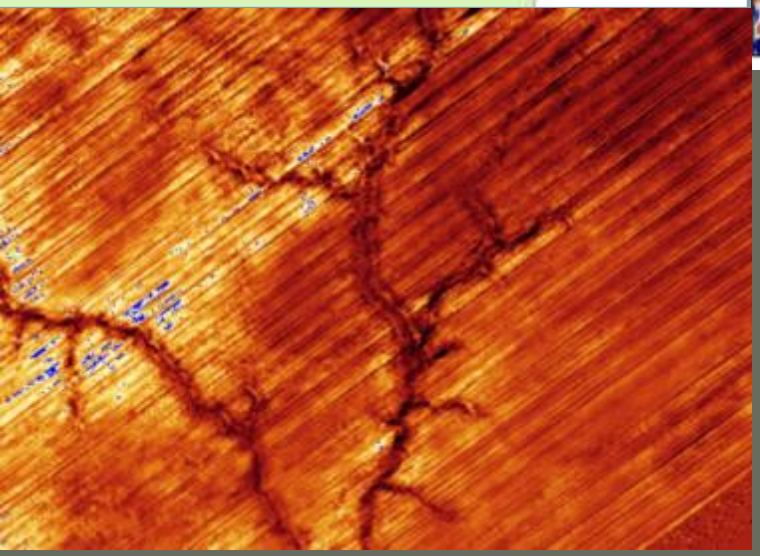
Area A240: Wessex Archaeology and English Heritage







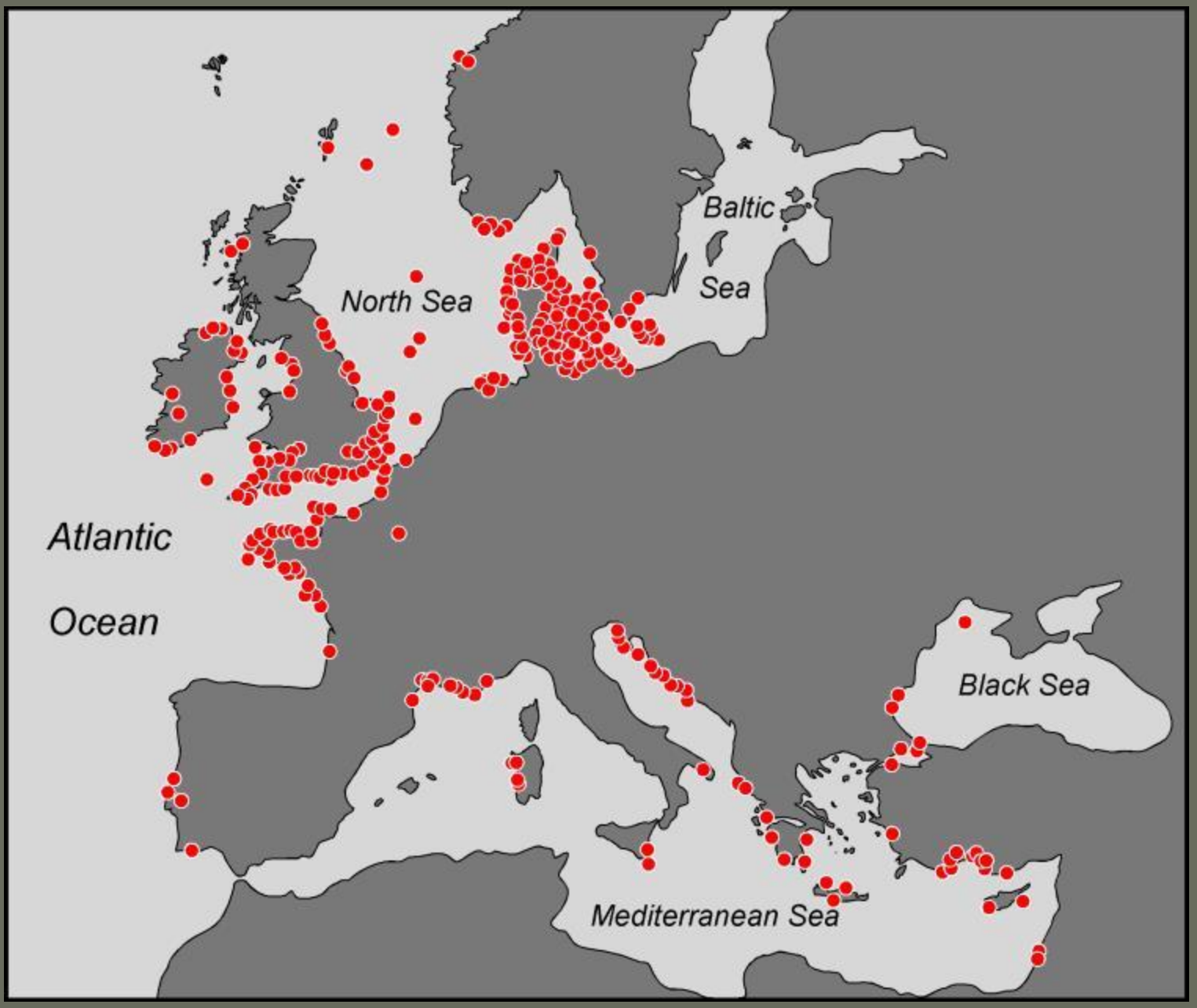




Gaff ney, V., et al. (eds) 2007. *Mapping Doggerland: Th e Mesolithic Landscapes of the Southern North Sea*. Oxford, Archaeopress.

A240 Handaxes, courtesy of Rijksmuseum van Oudheden (RMO)/National Museum of Antiquities, Leiden

Is any evidence left to be discovered?



> 2500 submerged prehistoric archaeological sites and finds

A single dot may represent many finds

Map produced courtesy of Hauke Joens and the SPLASHCOS network

THE UNIVERSITY of York

H.C.M.R

cost
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

COST Action TD0902 SPLASHCOS: **2009-2013** www.splashcos.org

Submerged Prehistoric Archaeology and LAndscapeS of tHe COntinental Shelf

Chair: Geoff Bailey, University of York; Vice-Chair: Dimitris Sakellariou, Hellenic Centre for Marine Research

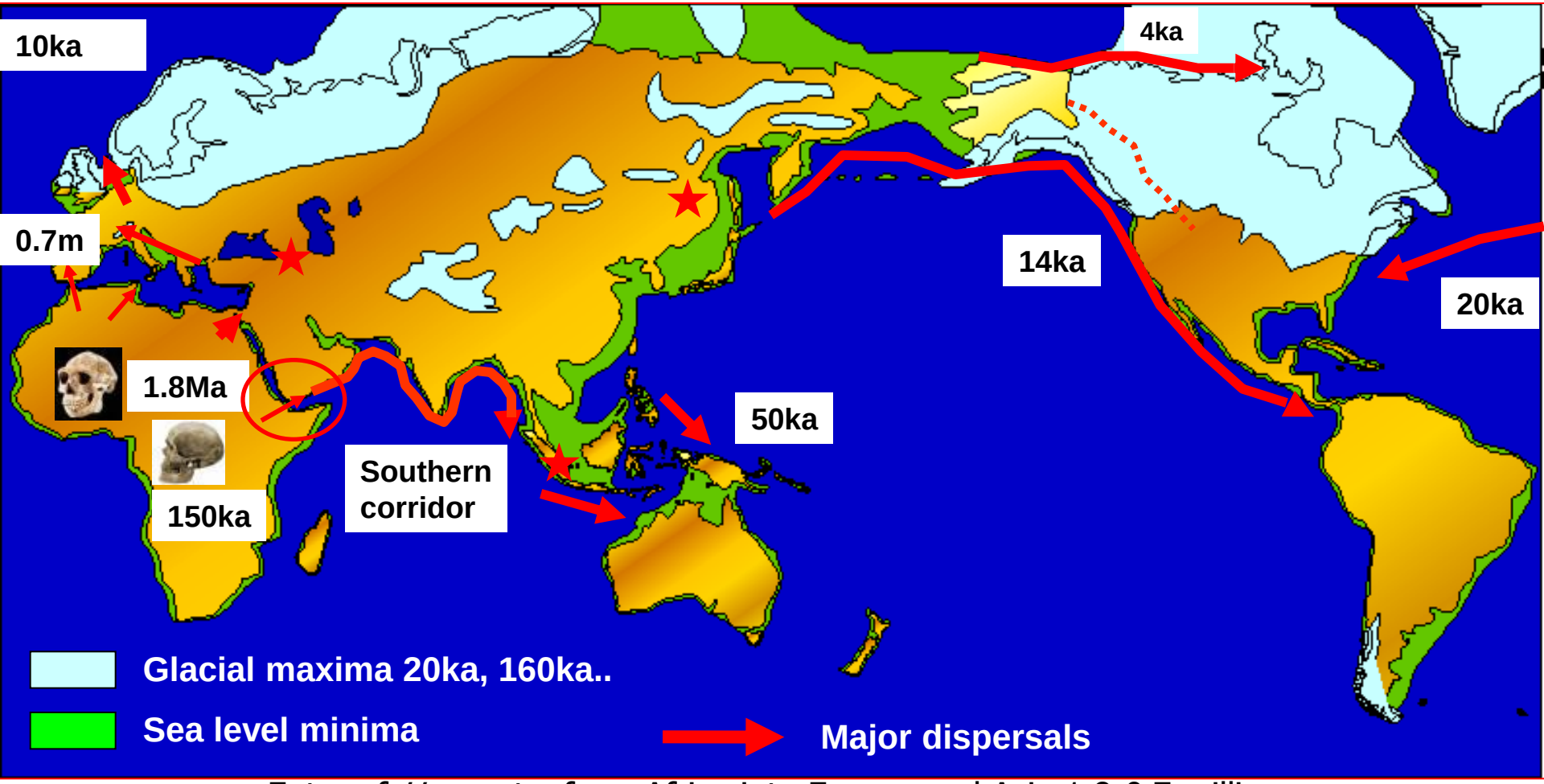
- €0.5 million
- Research coordination and planning; 25 European States; >100 members
- Archaeologists, marine geoscientists, heritage managers, industry representatives
- 8 workshops and meetings; 6 training schools for Early Stage Researchers
- Website with reports on techniques, facilities, collaboration with industry, outreach
- Publications
- Stimulated 23 projects and €20 million – Inter-Reg, FP7, ERC, national, bilateral
- Critical mass on threshold of creating new discipline
- Databases linked to EMODNET and Geo Seas web portals

Horizon 2020

- €80 billion
  - €13 billion: pure research ERC, €2-3 million per grant, 5 years. Applicant decides
  - €67 billion : policy relevant research - societal benefit, economic benefit, employment. EU Commission decides calls

European MARINE BOARD
Advancing Seas & Oceans Science

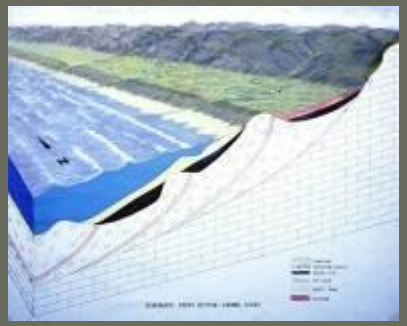
Implications of Sea Level Change – What's Missing?



- Entry of *H. erectus* from Africa into Europe and Asia 1.8-0.7 million years
- Expansion of *H. sapiens* from Africa into Australia, the Americas and Europe between 150 ka and 40 ka, extinction of Neanderthals 26ka
- Expansion into de-glaciated NW Europe between 13-10ka
- Were these driven by early developments in seafaring and fishing, particularly after 100,000? Or 'coastal' more generally?
- What about that submerged shelf?

What other developments took place when sea level was lower than present?

- Pre-agricultural colonization of the Mediterranean Islands 13,000
- Earliest Near Eastern agriculture 12,000 years (Atlit Yam)
- Mediterranean farming dispersal 8,800
- Earliest Minoan and Bronze Age civilizations 5,500 (Pavlopetri)



Images courtesy of Dimitris Sakellariou and Ehud Galili

Rotterdam Harbour success story

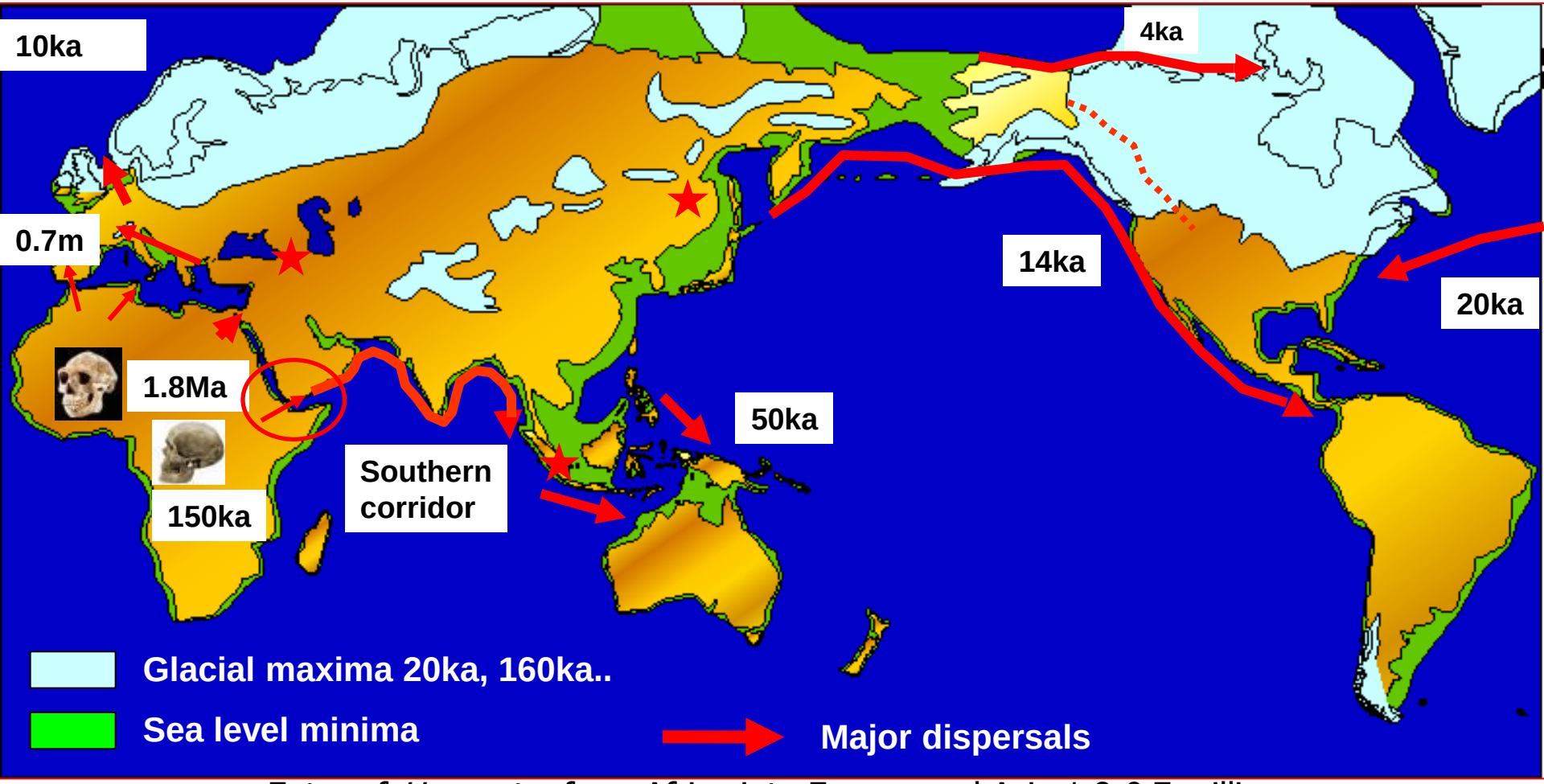
- Collaboration between PoR (Port of Rotterdam Authority), Dutch Heritage Agency, Rotterdam Archaeology Department, Deltares geoscientists
- 240 million cubic metres of sediment removed
- €3 million (out of €3 billion) budgeted by PoR for CSPR
- Early planning – WG of archaeologists, engineers, decision makers, geologists
- Mapping of submerged landscape
- Targeting of potential sites with acoustics and coring
- Innovative technology for excavation
- Discovery of archaeological sites (needle in haystack)
- **Sustainable management in action**

Key Points

- Most of human prehistory lies on the seabed
-
- Research is expensive and requires scientific, archaeological, governmental and industrial collaboration on an international scale

- Selling points for fundable collaboration:
  - **preservation of the underwater cultural heritage**
  - **Improved models of sea level change**

Implications of Sea Level Change – What's Missing?



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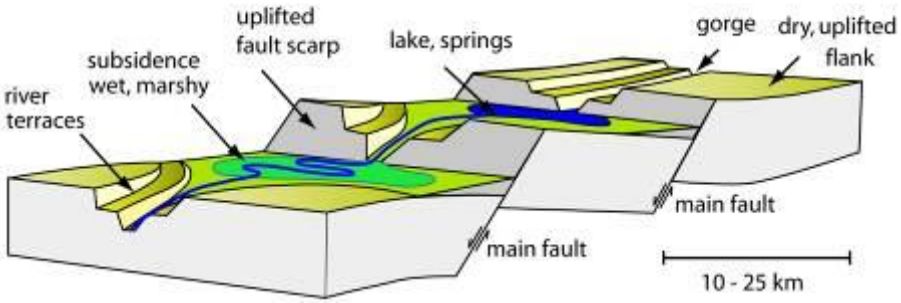
ERC Advanced Grant DISPERSE: 2011-2016

Dynamic Landscapes, Coastal Environments and Human Dispersals

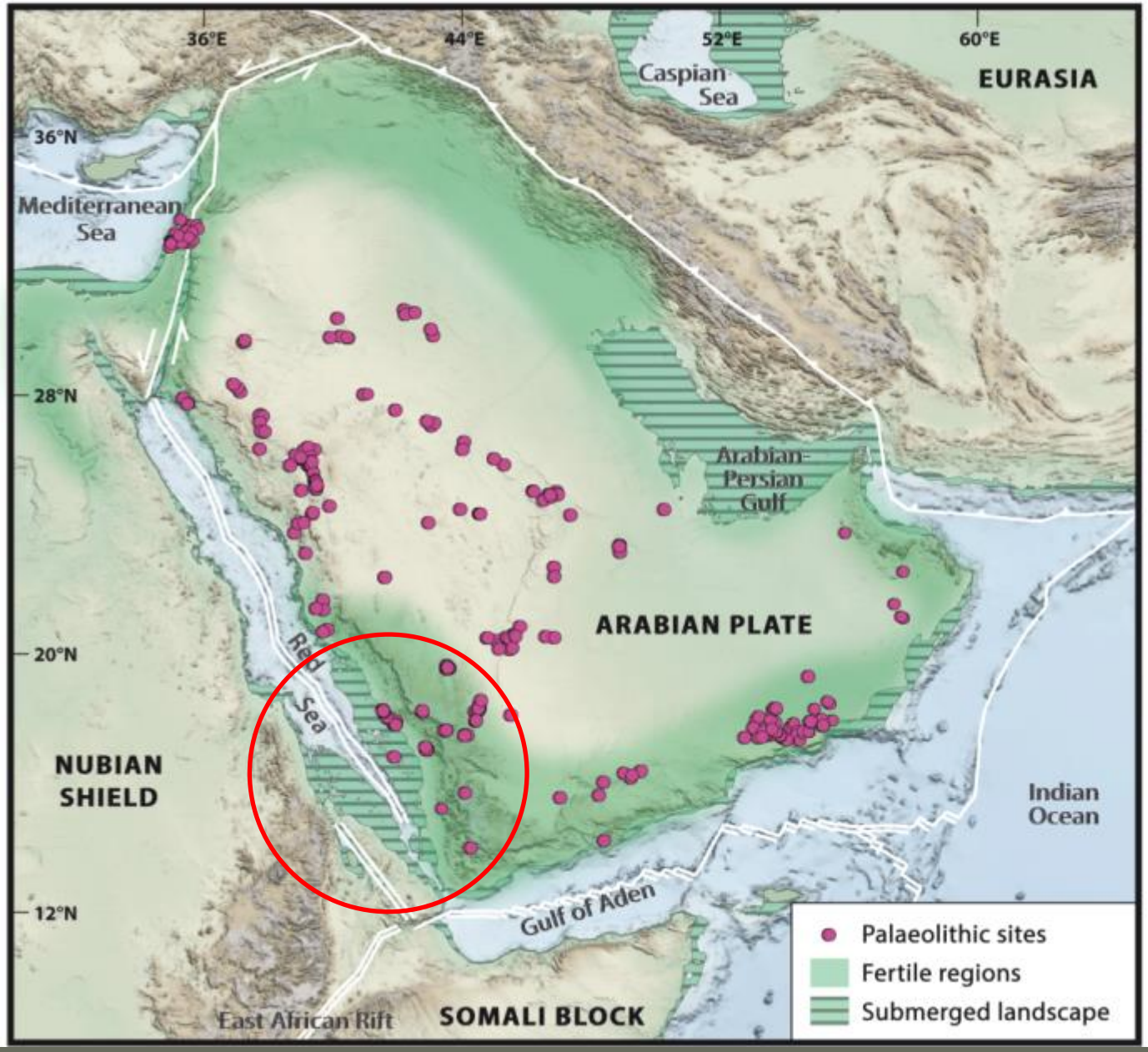
Geoff Bailey (PI), Geoffrey King, IPGP, France (co-PI)
Maud Devès (IPGP), Niklas Hausmann, Robyn Inglis, Matt Meredith-Williams, Isabelle Winder (York); Abdullah Alsharekh, Saud Al Ghamdi, KSU, KSA; Nic Flemming, Garry Momber, Claudio Vita-Finzi (NOC & NHM, UK); Eelco Rohling, Kurt Lambeck, ANU, Australia; Dimitris Sakellariou, HCMR, Greece

€2.55 million



NATIONAL MUSEUMS OF KENYA
WHERE HERITAGE LIVES ON

الهيئة العامة للسياحة والآثار
Saudi Commission for Tourism & Antiquities
تنمية مسؤولة



GEBCO - Topography+Bathymetr

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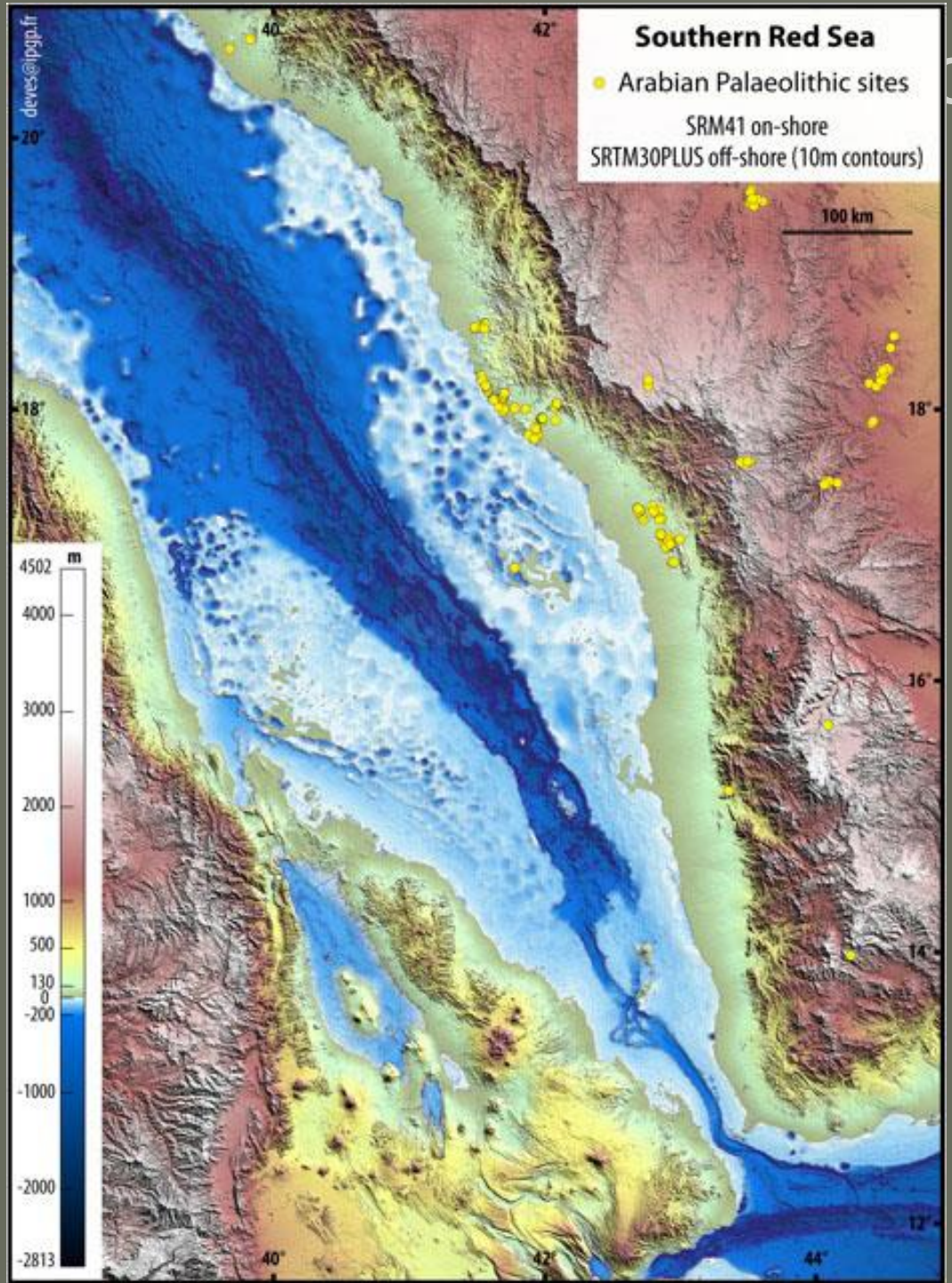
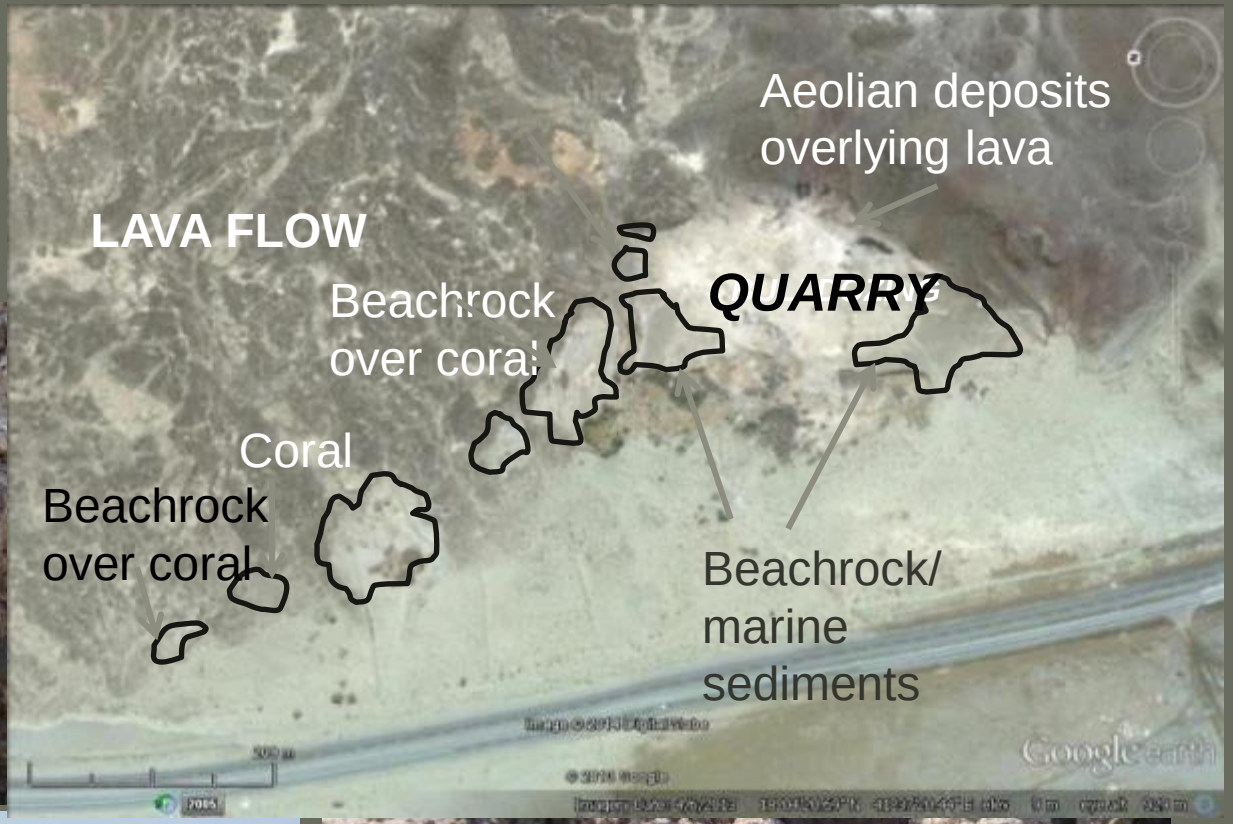

Southern Red Sea
Arabian Palaeolithic sites
SRM41 on-shore
SRTM30PLUS off-shore (10m contours)
100 km
deves@ipgp.fr
m
4502
4000
3000
2000
1000
500
130
0
-200
-1000
-2000
-2813
40°
42°
44°
20°
18°
16°
14°
12°

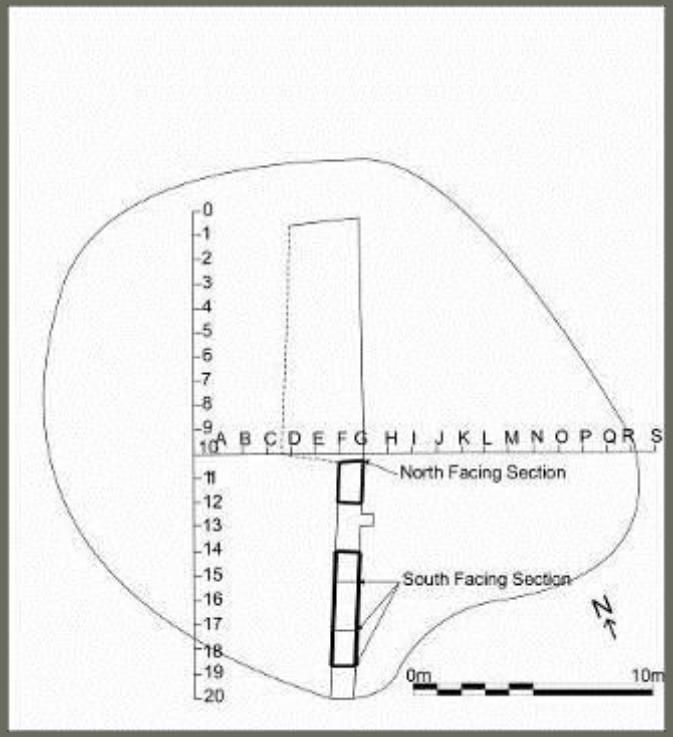
Jebel Akwa
0.44±0.26mya

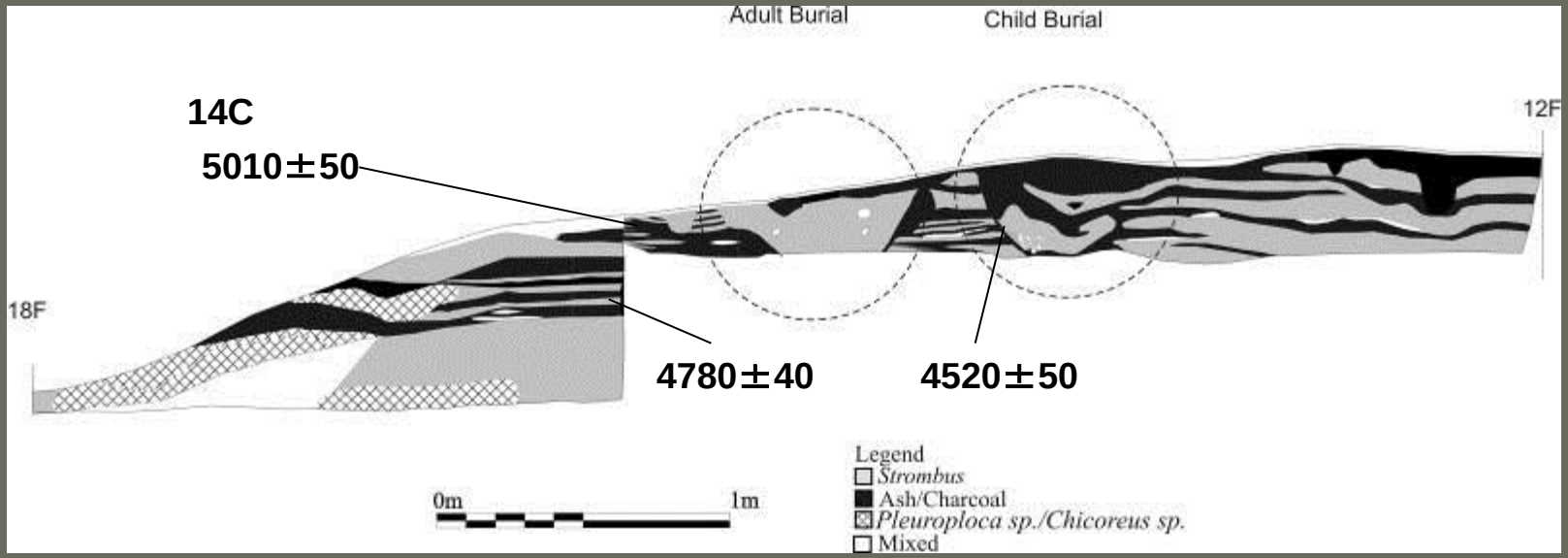
Wadi Jizan
0.8±0.3mya

Wadi Dhahaban
8m coral terrace
MIS 5e 130 ka

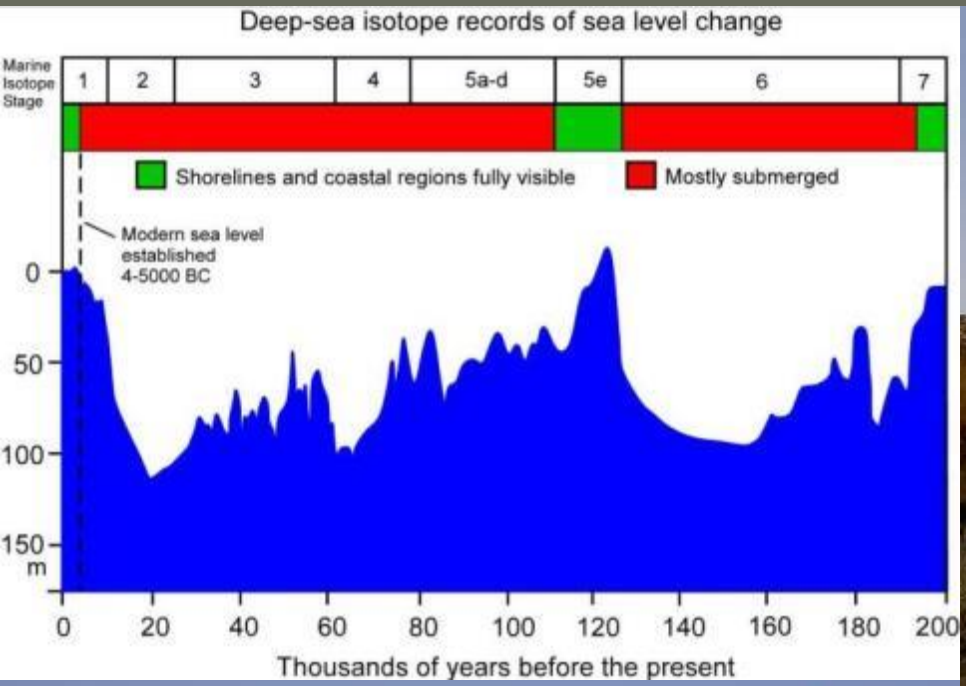


Use Holocene shoreline and sites as benchmark


A B C D E F G H I J K L M N O P Q R S
North Facing Section
South Facing Section
N
0m
10m


Adult Burial
Child Burial
14C
5010±50
12F
18F
4780±40
4520±50
0m
1m
Legend
Strombus
Ash/Charcoal
Pleuroploca sp./Chicoreus sp.
Mixed

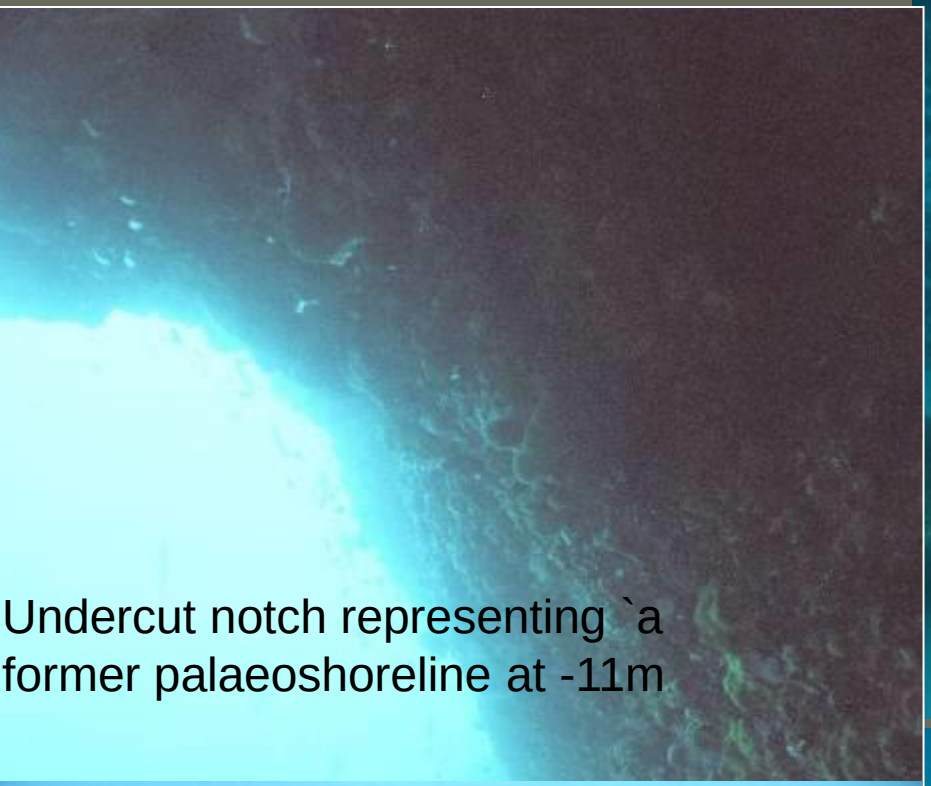
Where are the earlier shell mounds?




Dharran May 2005 Saudi Aramco HQ
Geoff Bailey
Nic Flemming
Abdullah Al-Sharekh

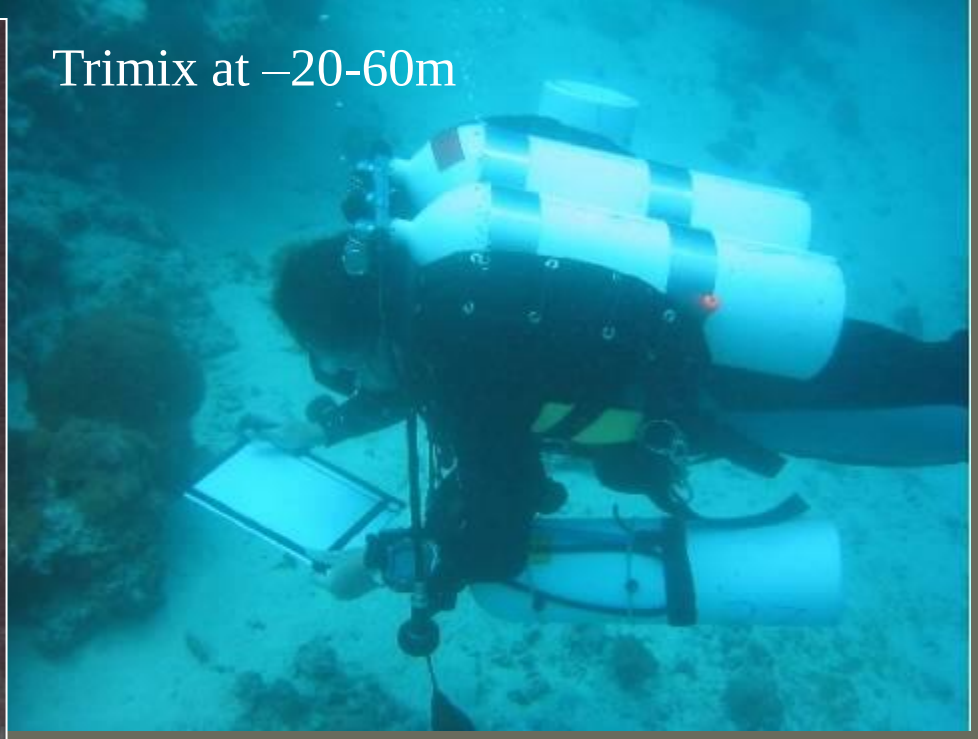

Farasan Islands May 2006 The Midyan
JEDDAH جدة

Experimental deep diving using trimix technology



Undercut notch representing `a former palaeoshoreline at -11m

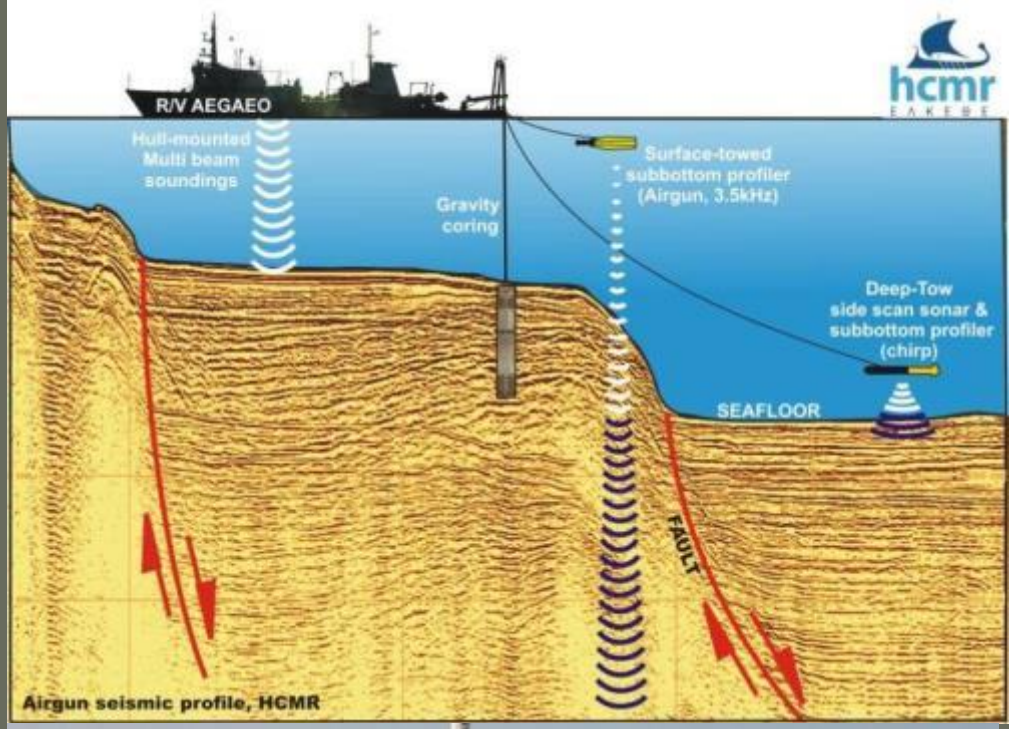
Palaeoshoreline at –20m



Trimix at –20-60m

Trimix at –60m

Shallow diving 2008 -2009, 2014: near-shore submerged landscape; test excavations in underwater caves



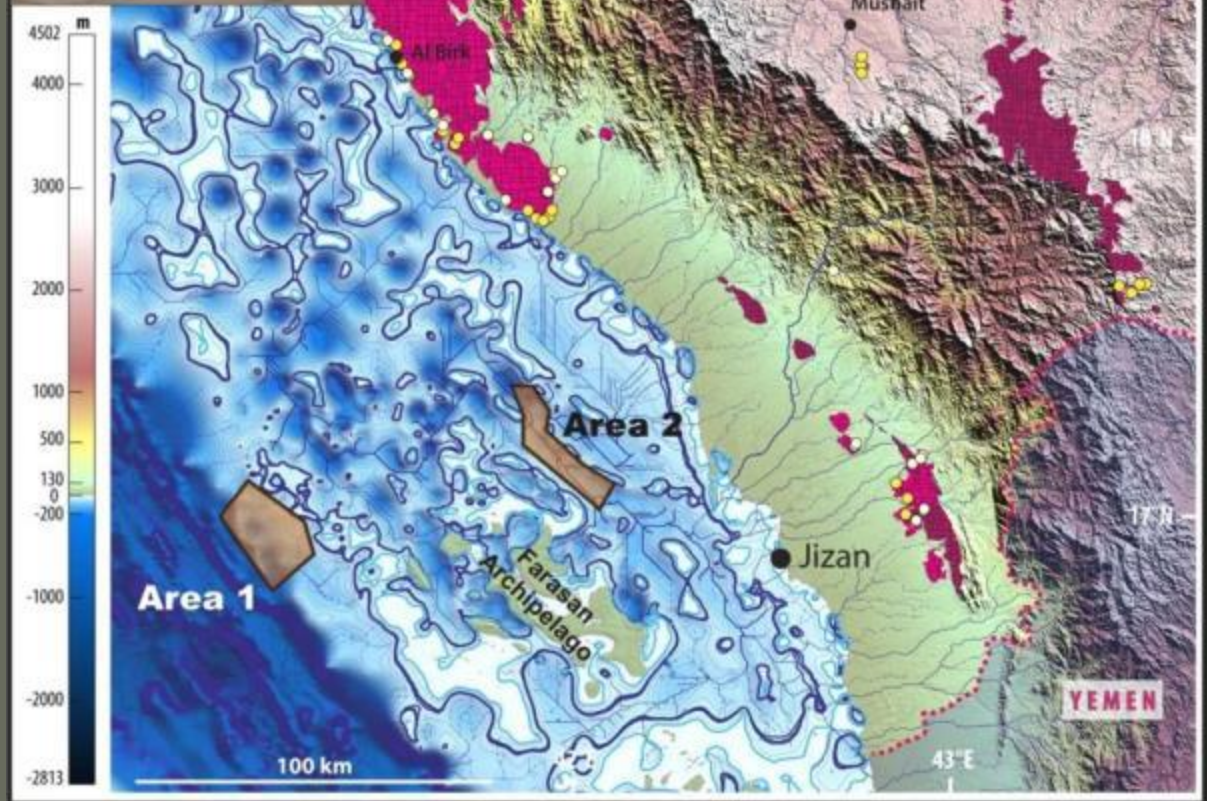
G. Bailey, D. Sakellariou , A. Alsharekh, S. Al Nomani, P. Georgiou, M. Kallergis, S. Kalogirou, L. Manousakis, P. Mantopoulos, M. Meredith-Williams, G. Momber, I. Morfis, I. Pampidis, I. Panagiotopoulos, N. Rasul, P. Renieris, G. Rousakis, V. Stasinos, S. Stavrakakis, R. Bantan

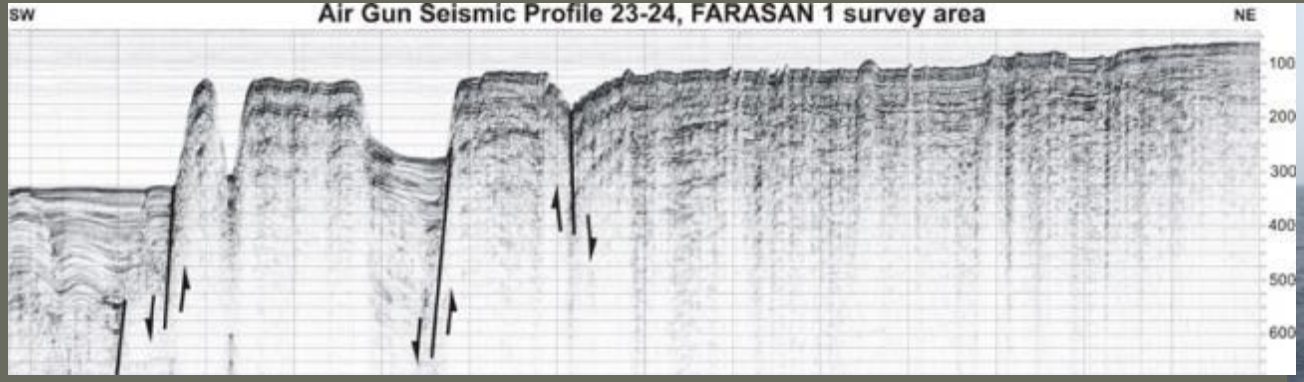
Jizan region topography and bathymetry

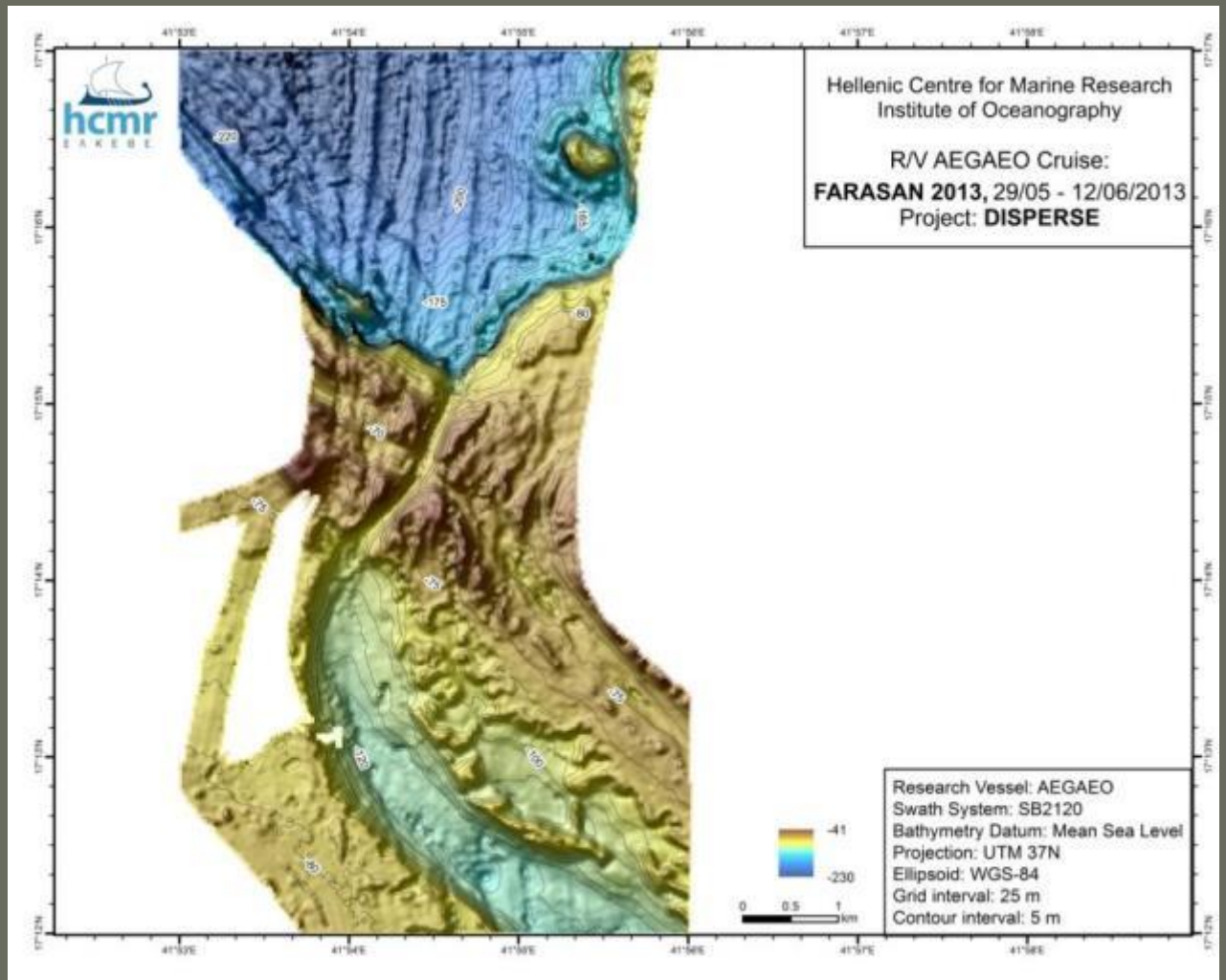
Topography (SRTM41)
Bathymetry (SRTM30PLUS)
New Palaeolithic sites (DISPERSE 2012)
CASP sites (Zarins et al. 1980, 1981)

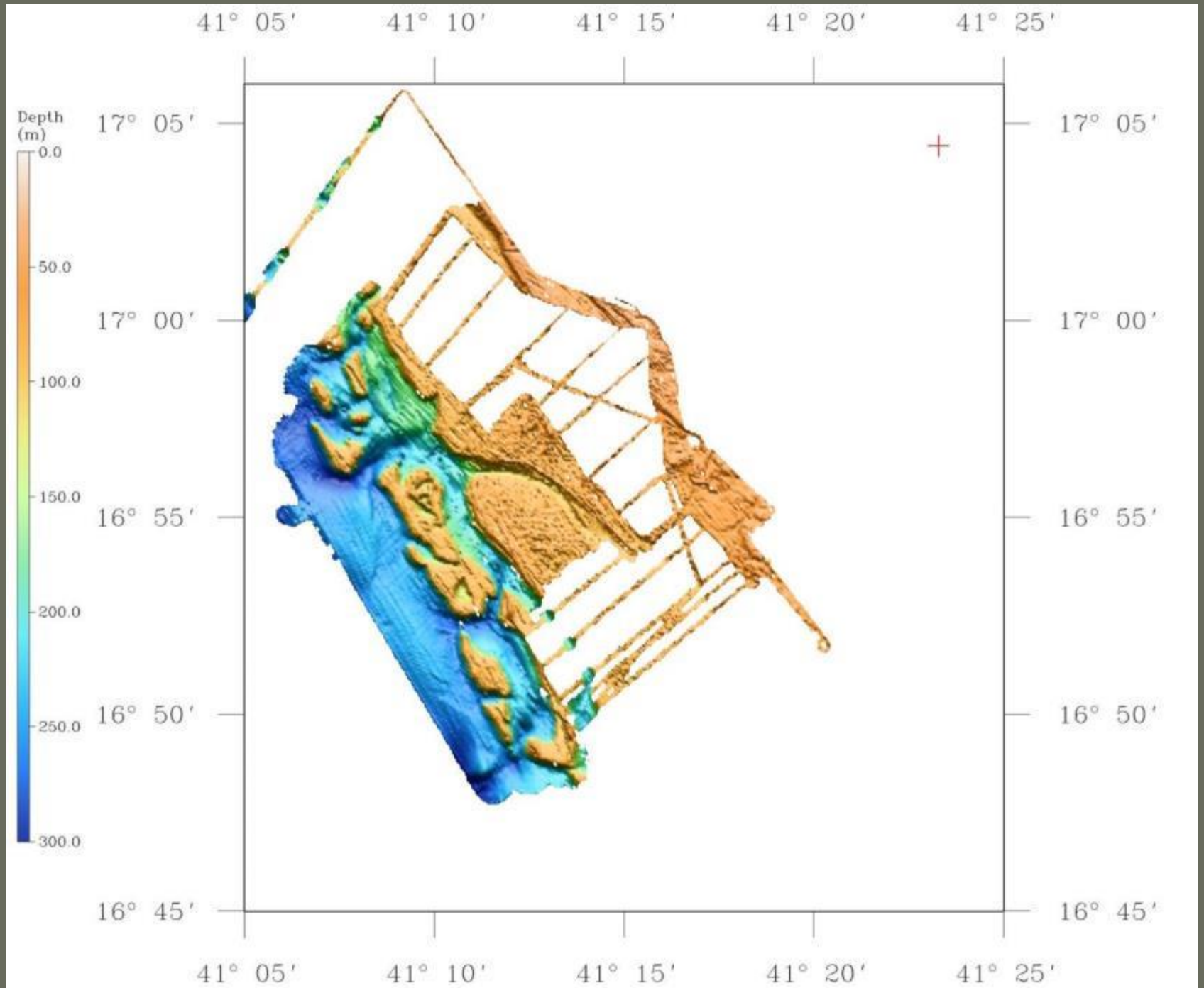
Quaternary Volcanics
Oligo-Miocene and Pliocene Volcanics and Intrusives
Modelled River network

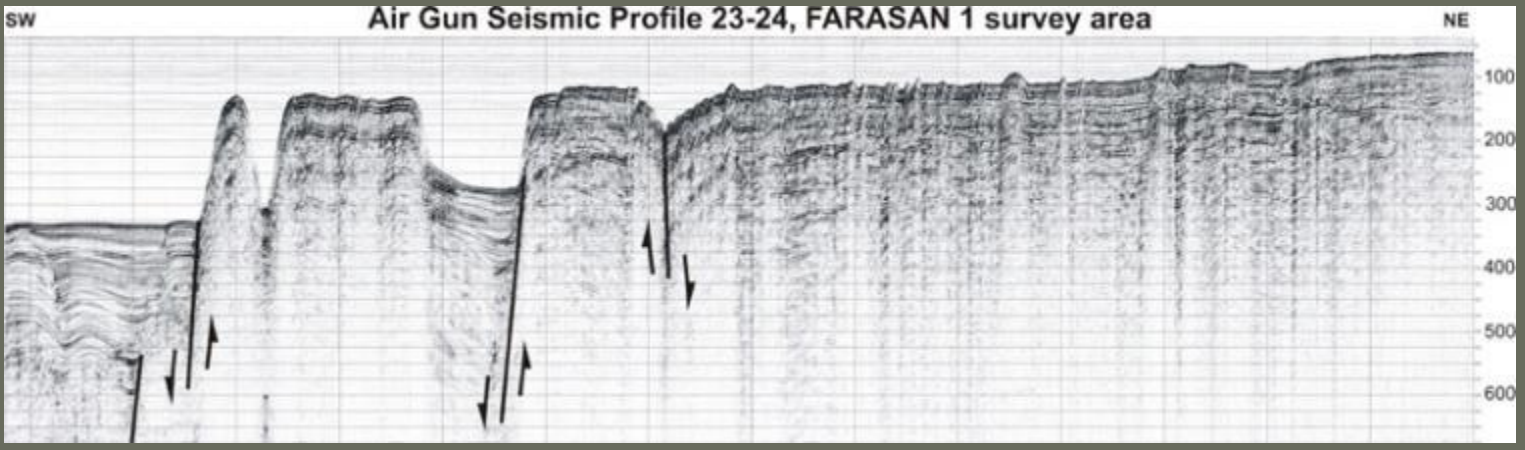
Contours bathymetry (10m)
Light blue <-100m emerged at low sea stand
-6m shoreline
-17,-18,-19,-20m shoreline
80-90 ka and/or 12ka

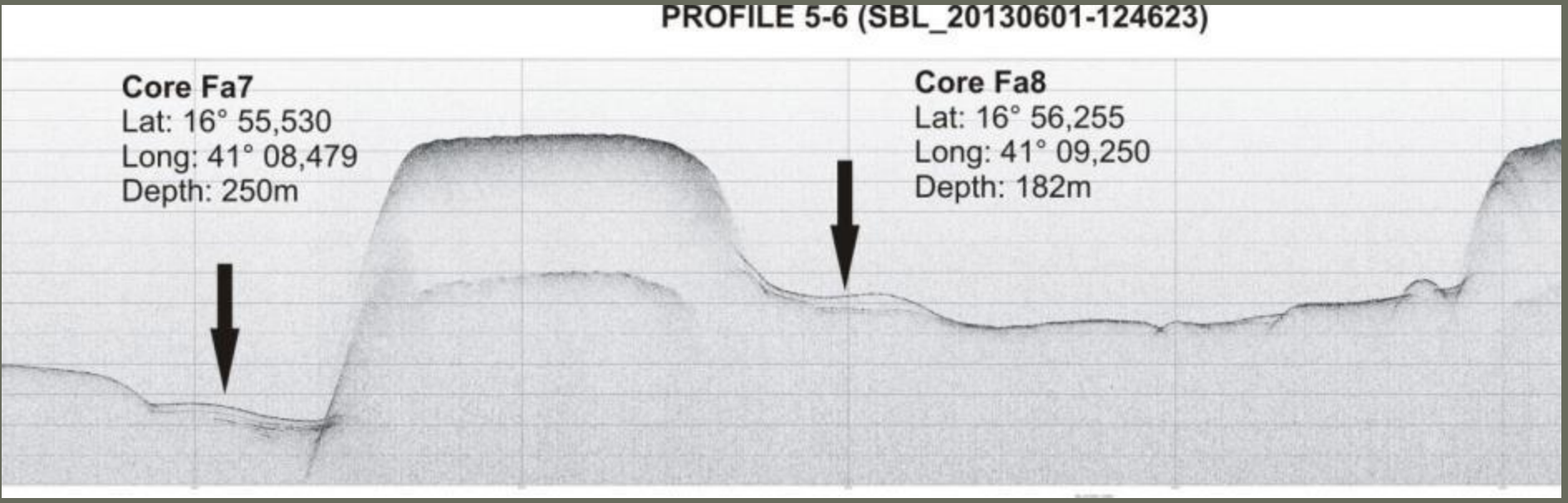



SW
Air Gun Seismic Profile 23-24, FARASAN 1 survey area
NE
100
200
300
400
500
600


hcmr
EAKEBE
Hellenic Centre for Marine Research
Institute of Oceanography
R/V AEGAEO Cruise:
FARASAN 2013, 29/05 - 12/06/2013
Project: DISPERSE
Research Vessel: AEGAEO
Swath System: SB2120
Bathymetry Datum: Mean Sea Level
Projection: UTM 37N
Ellipsoid: WGS-84
Grid interval: 25 m
Contour interval: 5 m
-41
-230
0 0.5 1 km


41° 05′
41° 10′
41° 15′
41° 20′
41° 25′
17° 05′
17° 00′
16° 55′
16° 50′
16° 45′
Depth (m)
0.0
50.0
100.0
150.0
200.0
250.0
300.0


SW
Air Gun Seismic Profile 23-24, FARASAN 1 survey area
NE
100
200
300
400
500
600


PROFILE 5-6 (SBL_20130601-124623)
Core Fa7
Lat: 16° 55,530
Long: 41° 08,479
Depth: 250m
Core Fa8
Lat: 16° 56,255
Long: 41° 09,250
Depth: 182m

Jizan region topography and bathymetry

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80-90 ka and/or 12ka

Conclusions

- Define important research problems that cannot be solved in any other way
- Seek large-scale collaboration, both international and multi-disciplinary
- Collaborate with commercial companies to reduce costs
- Collaborate with government agencies in management
- Combine work on land and offshore
- Develop predictive models for site location
- Develop understanding of submerged land forms
- Develop understanding of underwater taphonomy - how inundation transforms features of the palaeolandscape and the archaeological record

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Saudi British Bank
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Institutions & Organizations

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Ministry of Petroleum and Mineral Resources
Saudi Geological Survey
Saudi Border Guard
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National Oceanography Centre, UK
Hampshire and Wight Trust for Underwater Archaeology
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King Saud University
King Abdulaziz University
KAUST

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Jamal Omar
Prof Saad Al Rashid
Dr Faisal Al Tamaihi
Dr Ali Al Muhana
Captain Abdullah Al Ahmari
Admiral Abdulrahman Al Shihiri
Lt Fahad Al Swish
Abdulrahman Mohammed Abdulhak
Hussein Aldajani
Sir Sherard-Cowper Coles
Sir John Jenkins