



ISPRA

Istituto Superiore per la Protezione
e la Ricerca Ambientale



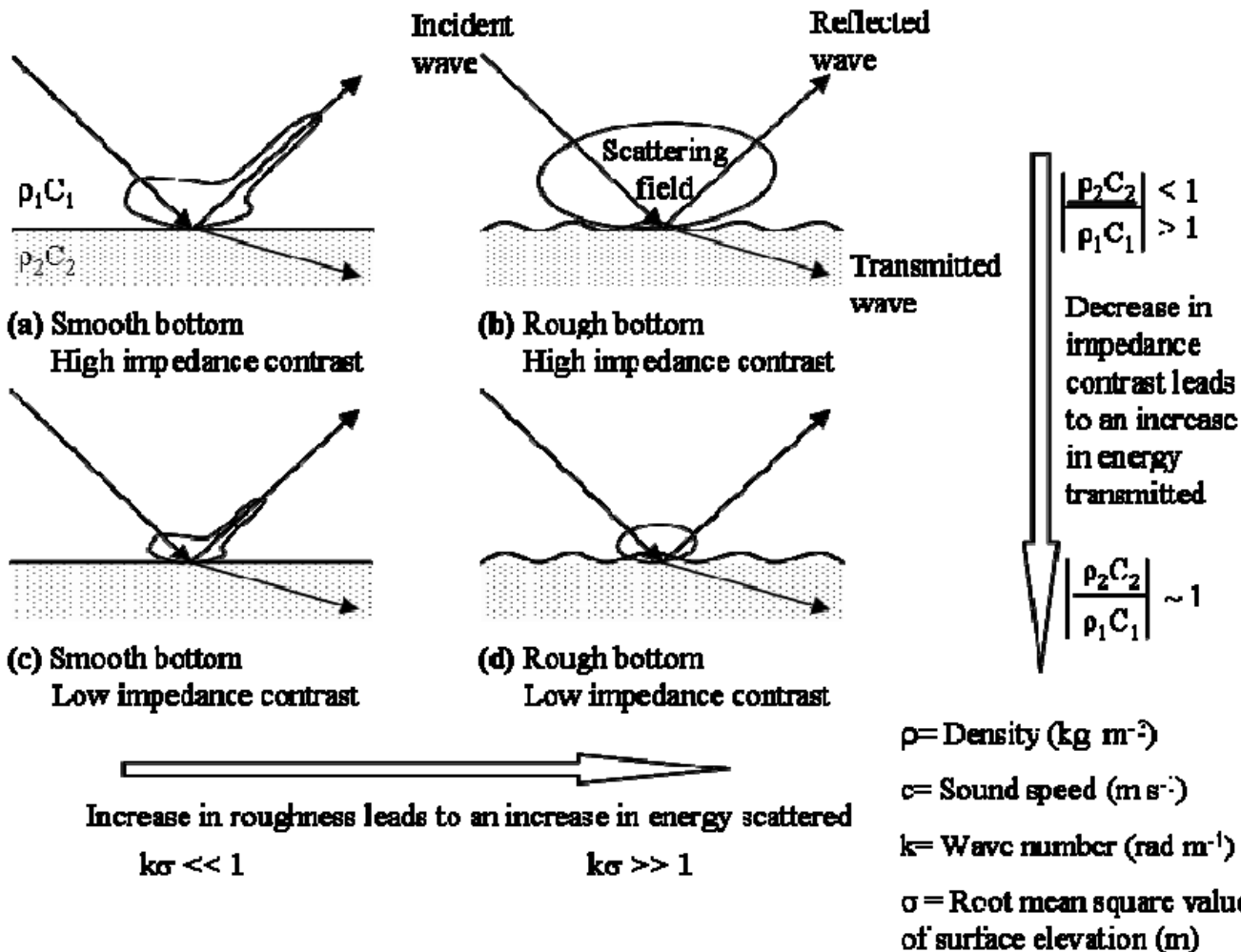
Relazioni tra caratteristiche tessiturali e misure geofisiche

Giovanni De Falco

IAMC – CNR, Oristano



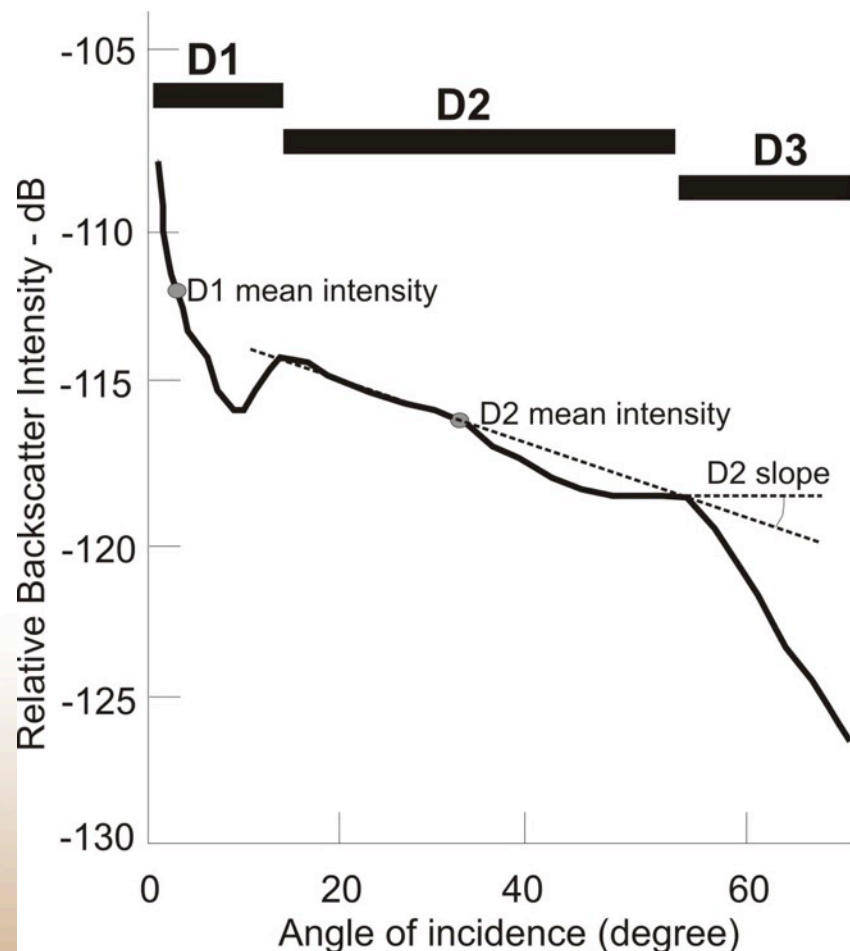
Backscatter intensity is a measure of sound that is scattered back toward the transmitter by acoustic reflection and scattering, both at the sediment–water interface and from within the sediment (*Jackson et al., 1986; Jackson and Briggs, 1992; Nishimura, 1997; Urick, 1983*).



The angular response is a measure of the variation of backscatter strength along the across-track direction.

Backscatter strength near nadir > Backscatter strength in the outer swath (differences between acoustic reflection – nadir - and scattering -outer swath)

(Hughes-Clarke et al., 1997; Parnum et al., 2004, Ferrini and Flood, 2006).



SEDIMENT
MAPPING

- **Backscatter strength vs. sediment grain size and seabed roughness:**
 - (i) Correlation Backscatter strength/Coarse Grains (>4 mm);*
 - (ii) Modeling seabed roughness based on Backscatter strength*
 - (iii) Correlation Backscatter/grain size, porosity, sulphur content in silt-clay sediments.*
- **Backscatter Angular Response vs. sediment type (grain size and bedforms)**

Goff et al. 2004

Ferrini and Flood,
Mar. Geol., 2006

Sutherland et al.,
2007, ECSS

Hughes-Clarke,
1997

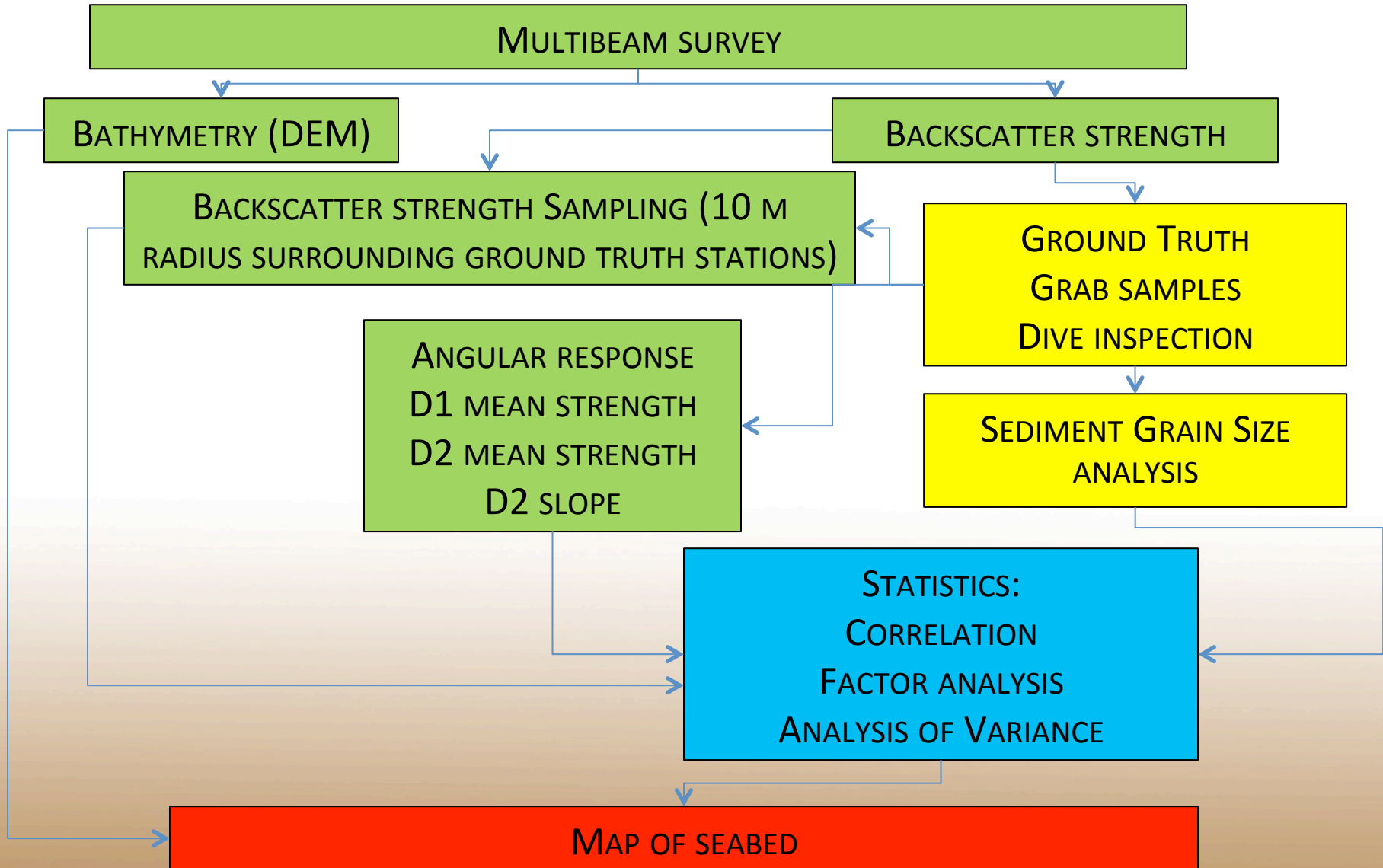
HABITAT
MAPPING

- **Backscatter strength vs. benthic habitat:**
 - (i) Benthic fauna associated to different sediment types*
 - (ii) Mapping of Seagrass and Rhodolit*
- **Terrain analysis vs. macroalgae and sessile invertebrates distribution**
- **Backscatter Angular Response vs. habitat type (seagrass, Rhodolit)**

Kostylev et al.,
2001, MEPS
Siwabessy et al.,
2006,
Parnum, 2008

Holmes et al.,
2008, CSR

Parnum, 2008
Siwabessy et al.,
2006,





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journal homepage: www.elsevier.com/locate/csr



ELSEVIER



Workshop

Le analisi granulometriche nei sedimenti marini

Relationships between multibeam backscatter, sediment grain size and *Posidonia oceanica* seagrass distribution

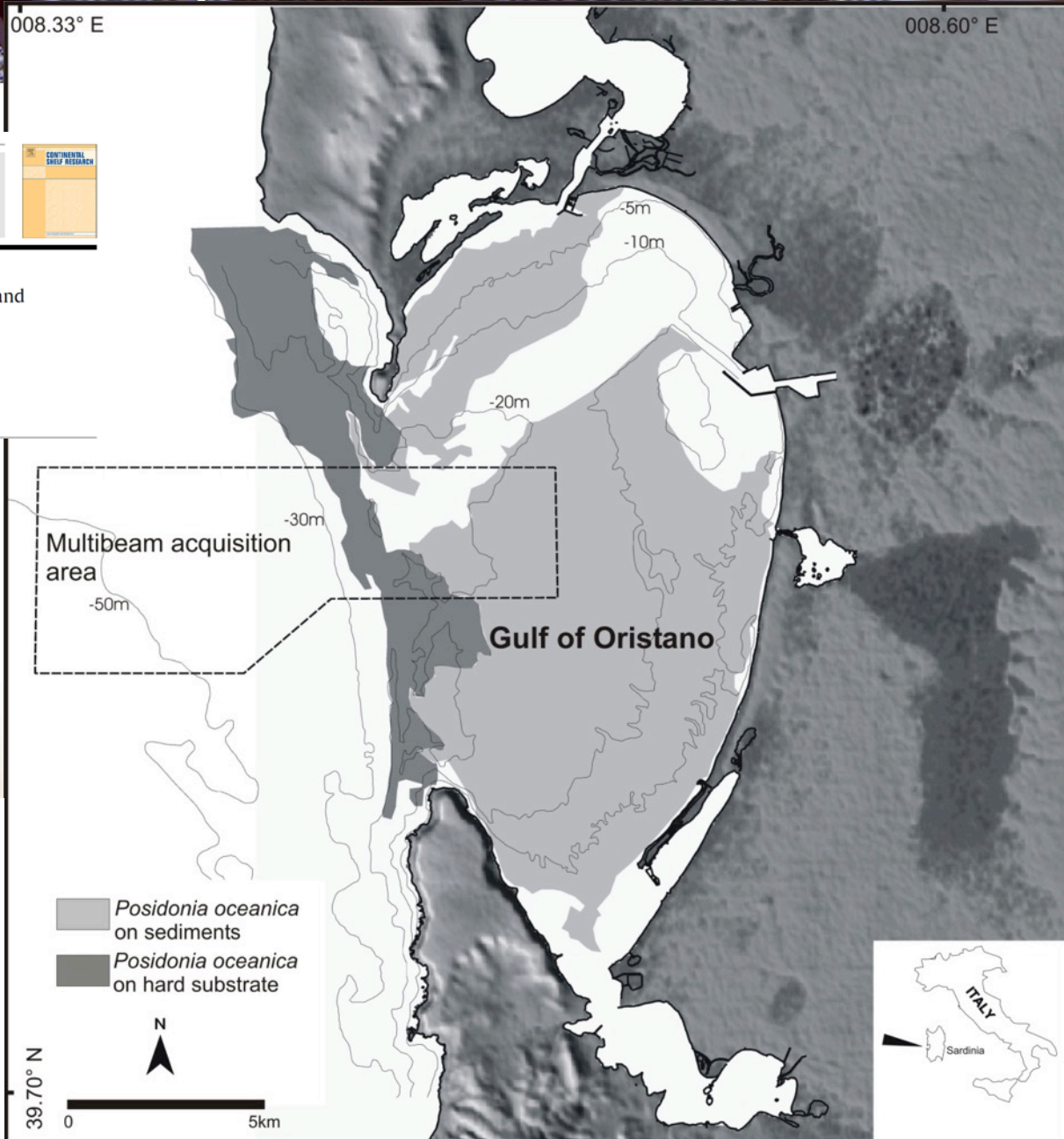
Giovanni De Falco^{a,*}, Renato Tonielli^b, Gabriella Di Martino^b, Sara Innangi^b,
Simone Simeone^c, Iain Michael Parnum^d

^a Istituto per l'Ambiente Marino Costiero, IAMC-CNR, UO Oristano, Località Sa Mardini, 09072 Torregrande, Oristano, Italy

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^c Fondazione IMC, Centro Marino Internazionale ONLUS, Località Sa Mardini, 09072 Torregrande, Oristano, Italy

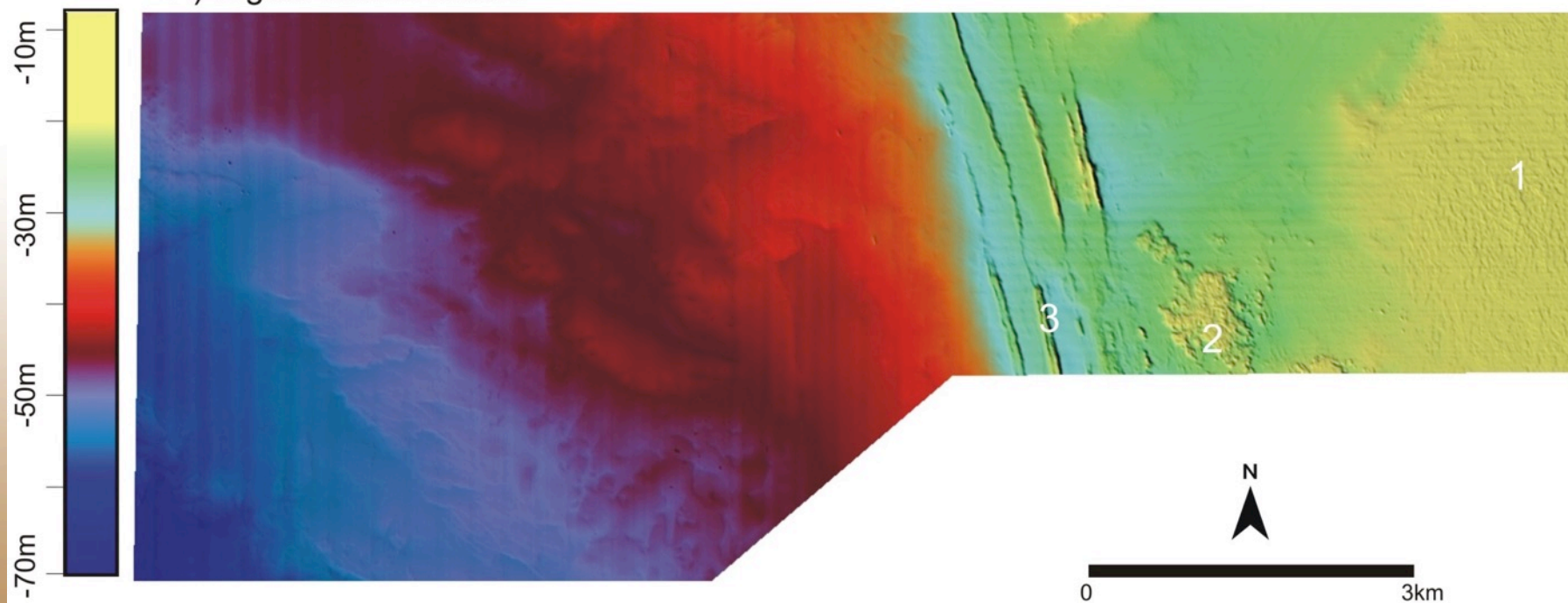
^d Centre for Marine Science and Technology, Curtin University, GPO Box U1987, Perth, WA 6845, Australia





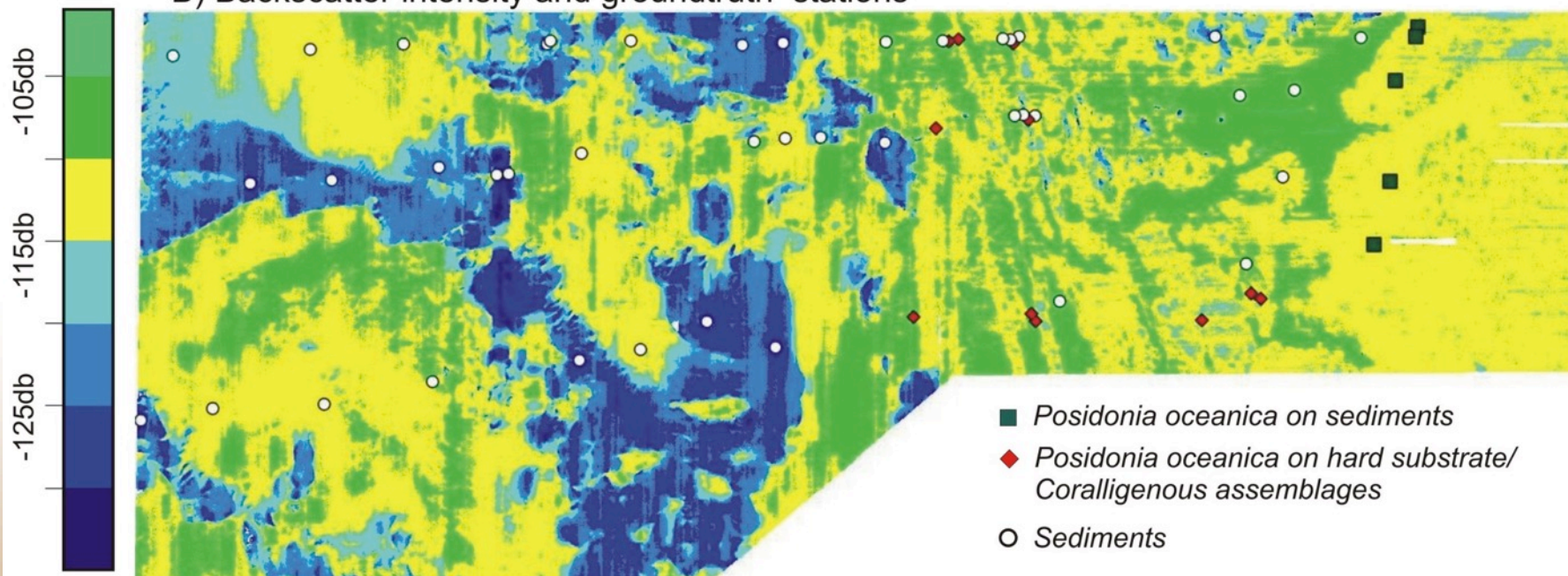
Bathymetry

A) Digital Terrain Model

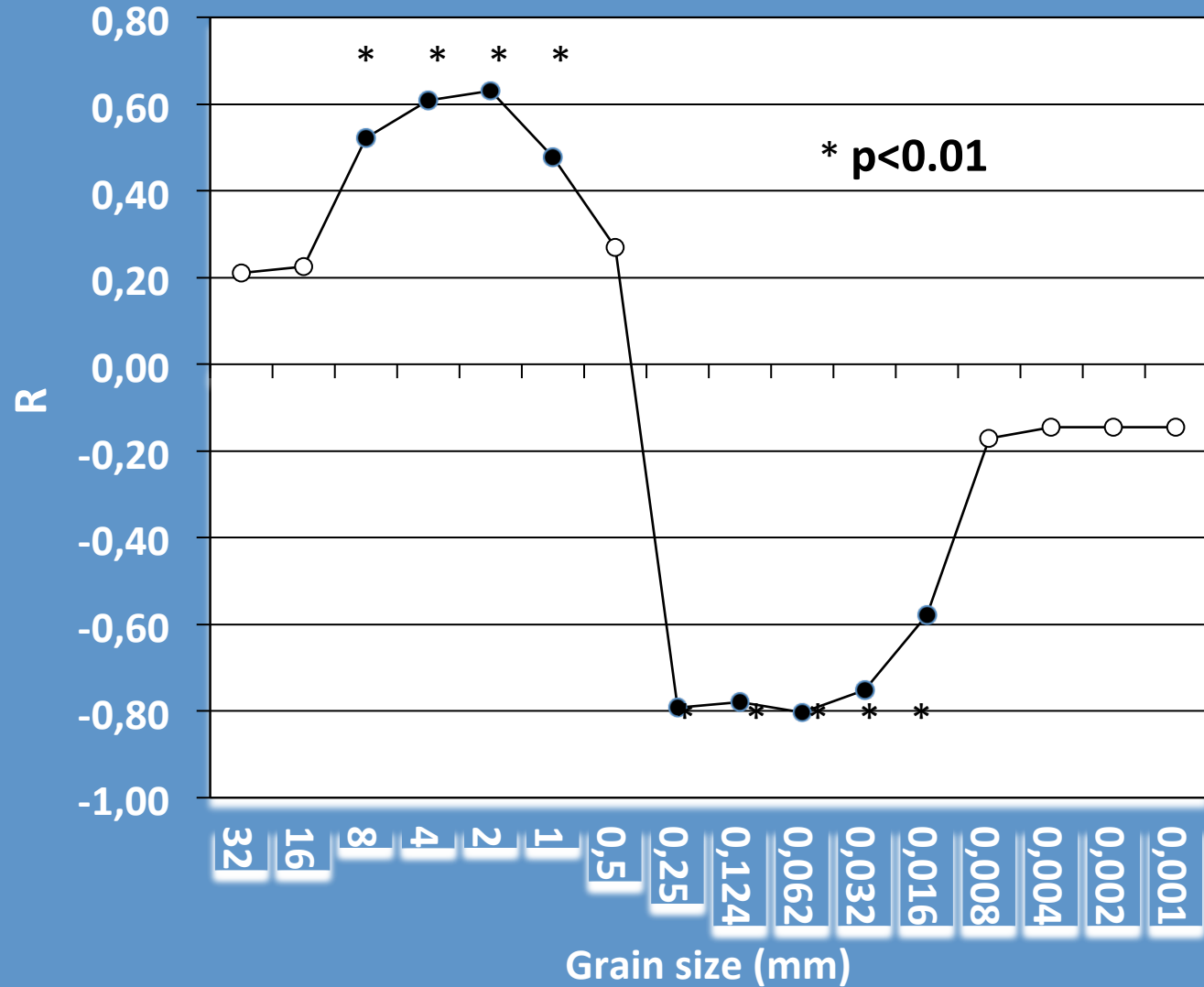


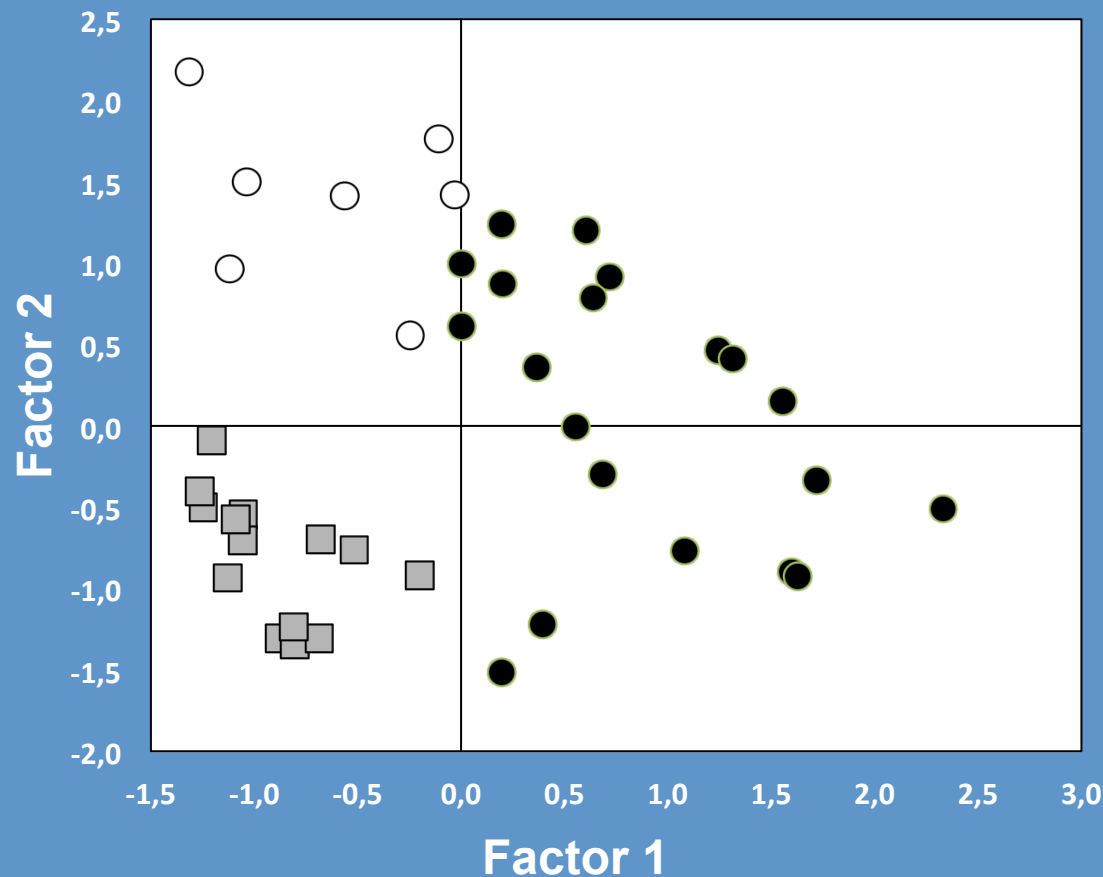
Backscatter strength and ground truth stations

B) Backscatter intensity and groundtruth stations



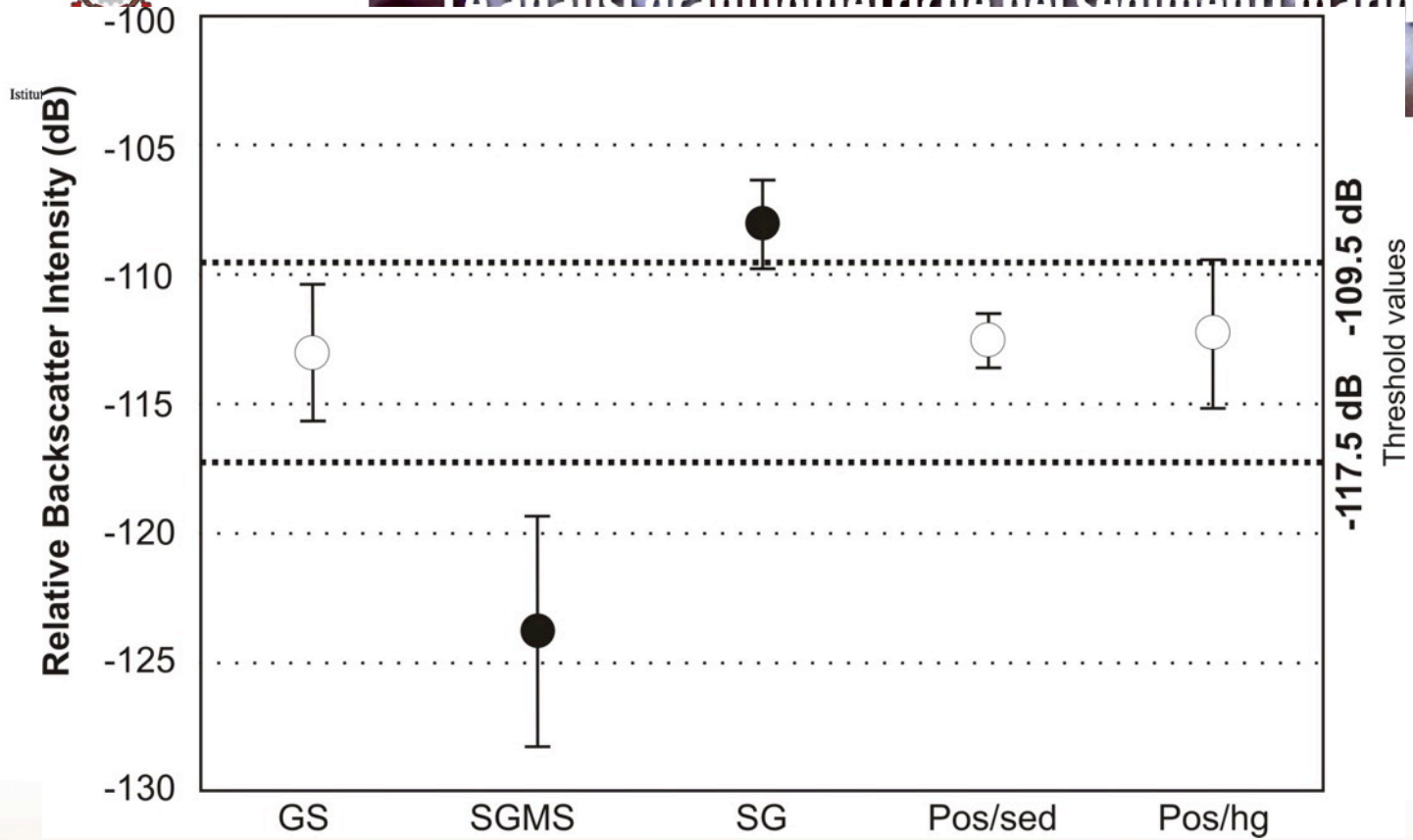
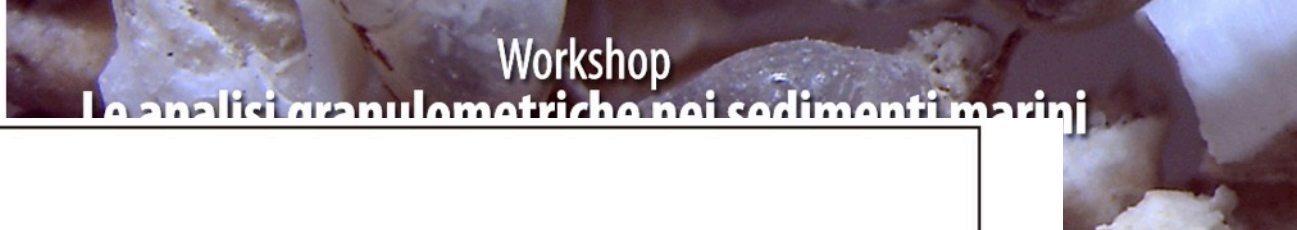
**Backscatter
strength vs.
sediment grain
size
Linear
correlation**





- **GS - Gravelly Sand**
- **SGMS - Slightly Gravelly Muddy Sand**
- **SG - Sandy Gravel**

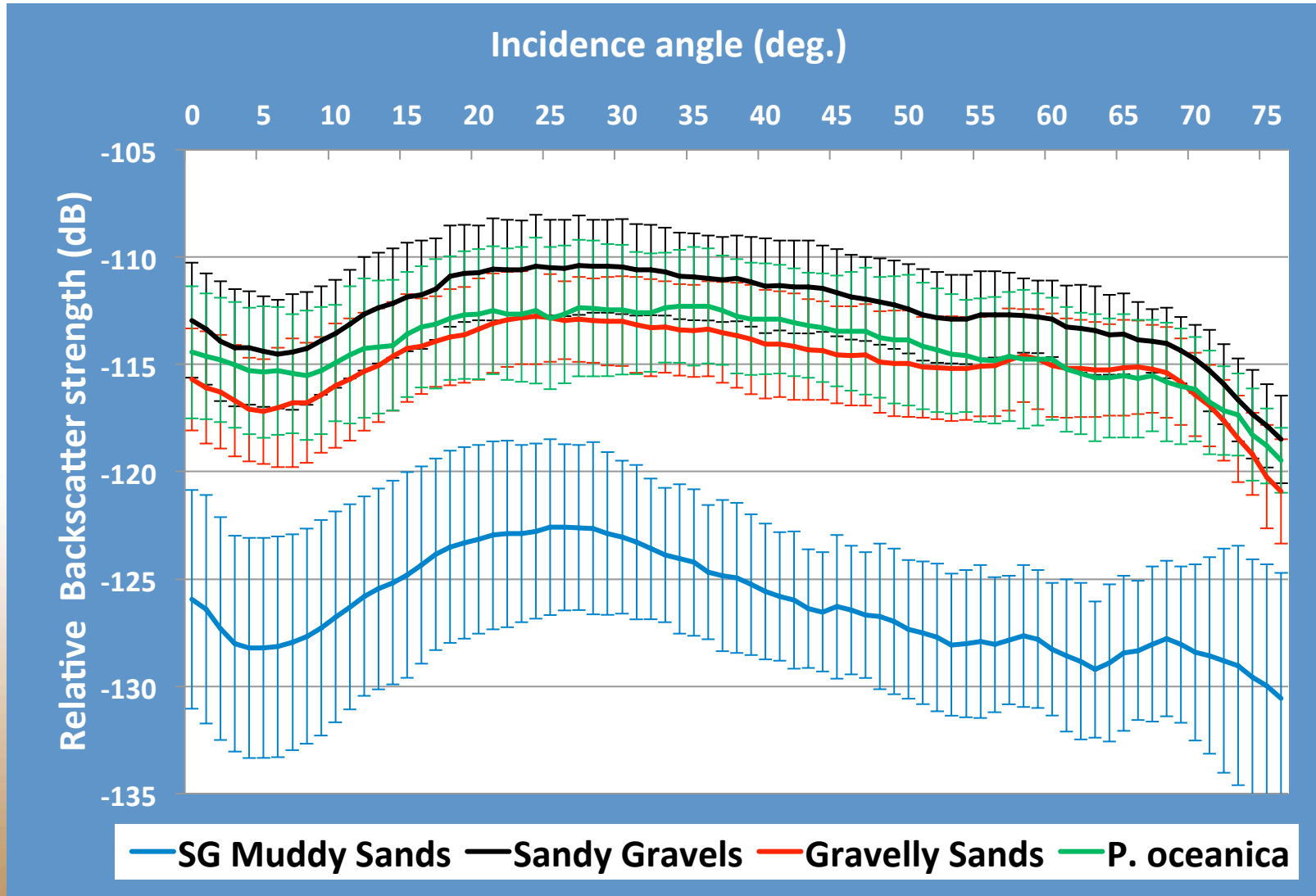
	F 1	F 2
Backscatter intensity (dB)	0.88	0.31
D1 Backscatter intensity (dB)	0.84	0.33
D2 Backscatter intensity (dB)	0.83	0.30
D2 slope	0.33	0.73
32-64 mm - very coarse gravel (%)	0.64	-0.14
16-32 mm - coarse gravel (%)	0.68	0.18
8-16 mm - medium gravel (%)	0.81	0.33
4-8 mm - fine gravel (%)	0.69	0.62
2-4 mm - very fine gravel (%)	0.58	0.75
1-2 mm -very coarse sand (%)	0.26	0.91
0.5-1 mm - coarse sand (%)	-0.11	0.78
0.25-0.5 mm - medium sand (%)	-0.74	-0.49
0.124-0.25 mm - fine sand (%)	-0.69	-0.54
0.062-0.124 mm - very fine sand (%)	-0.67	-0.66
<0.062 mm - Silt + Clay (%)	-0.64	-0.68
Explained Variance	44%	32%



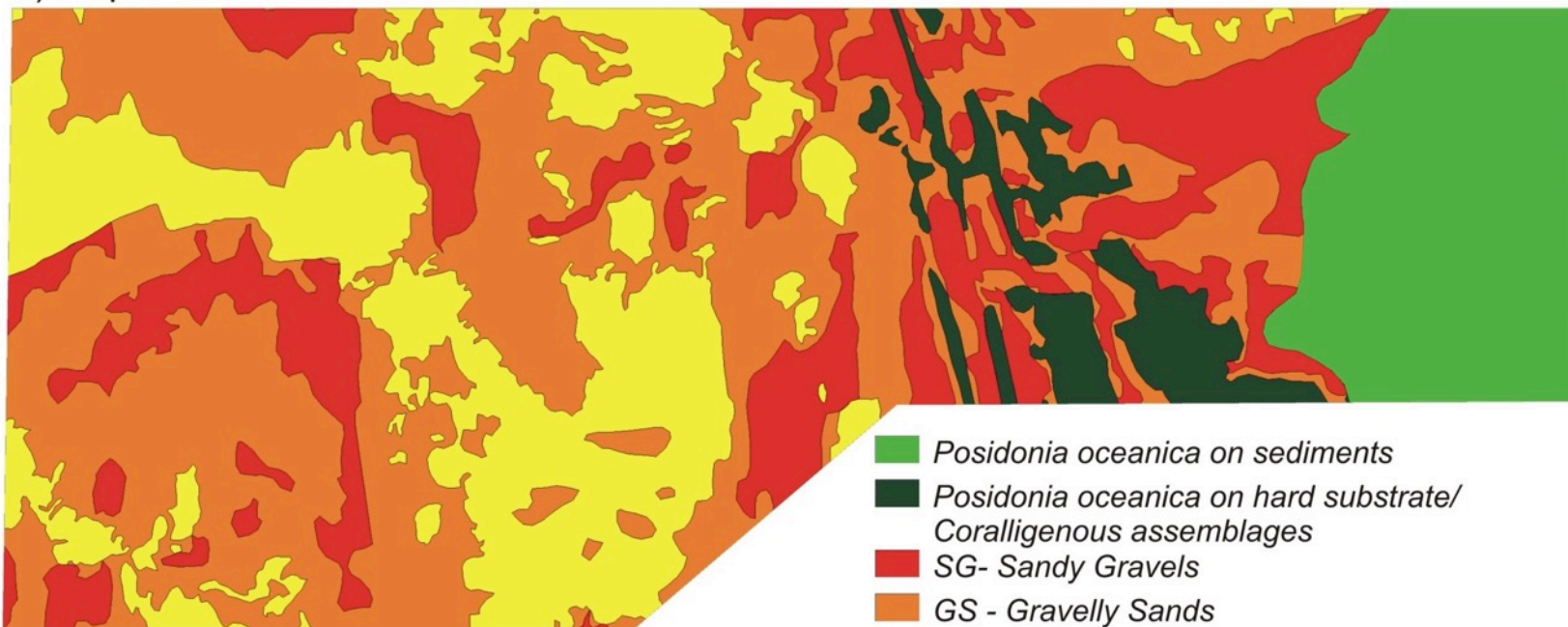
Source	DF	MS	F	p	SNK test
Backscatter intensity (dB)*					
Seabed	4	23.059	17.1	<0.00001	SG > GS=Pos/sed=Pos/hg> SGMS
Station (Seabed)	20	1.348	482.2	<0.00001	
Error	725	0.003			






* transformed $\ln(x+\text{constant})$; Cochran test NS after transformation

Mean Angular Response (\pm SD) including *Posidonia oceanica* on sediments



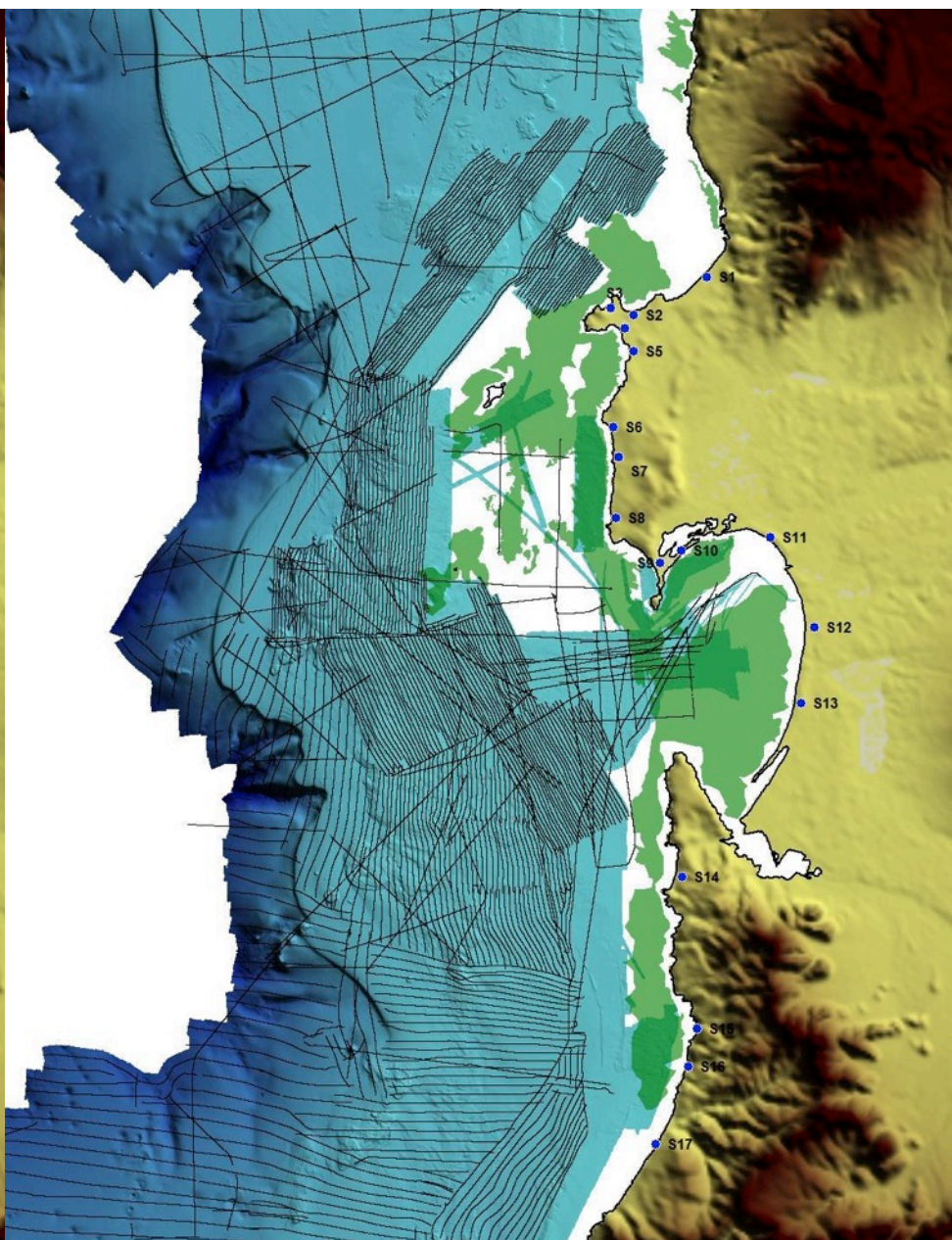
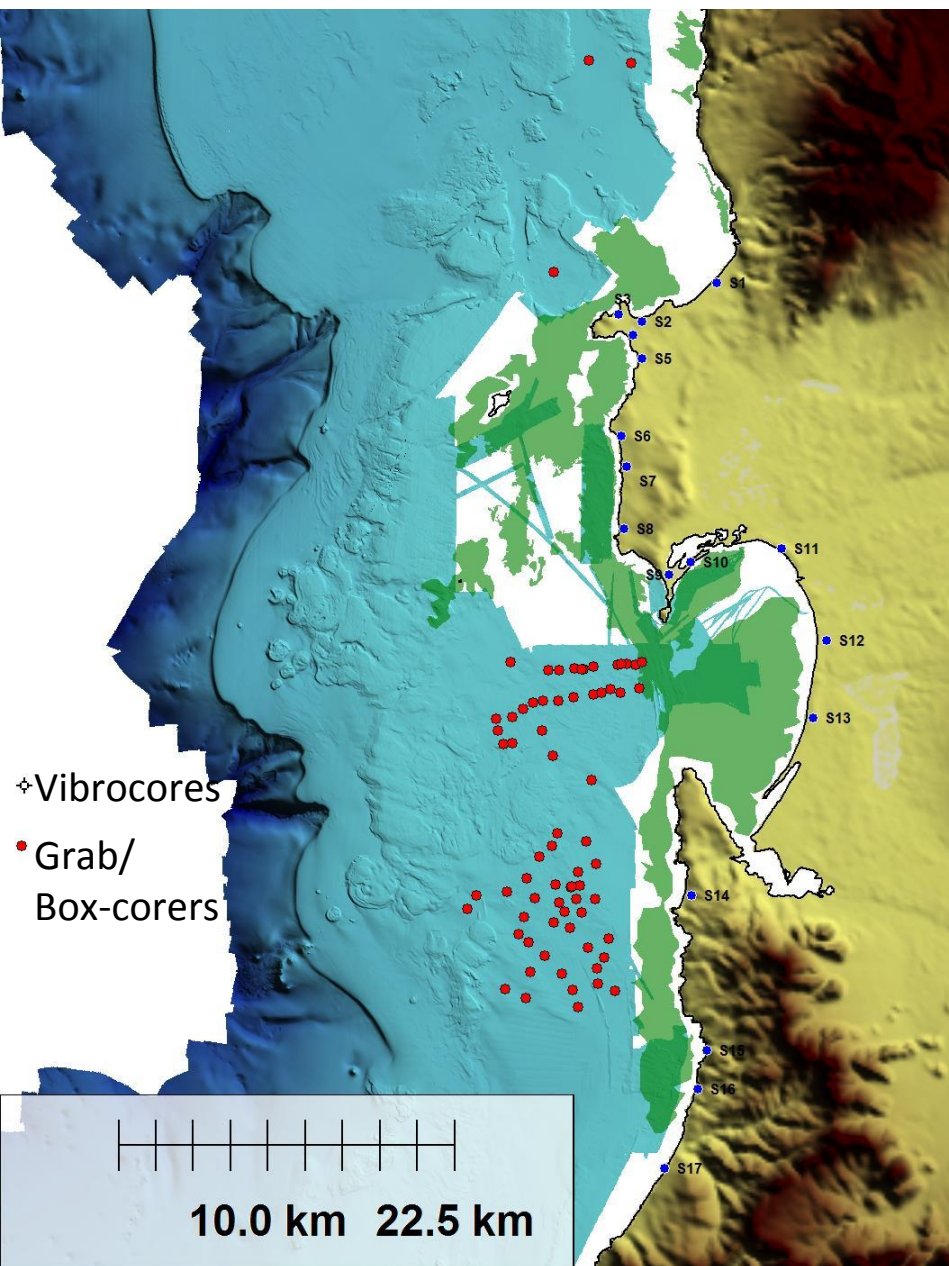
B) Map of seabed classification



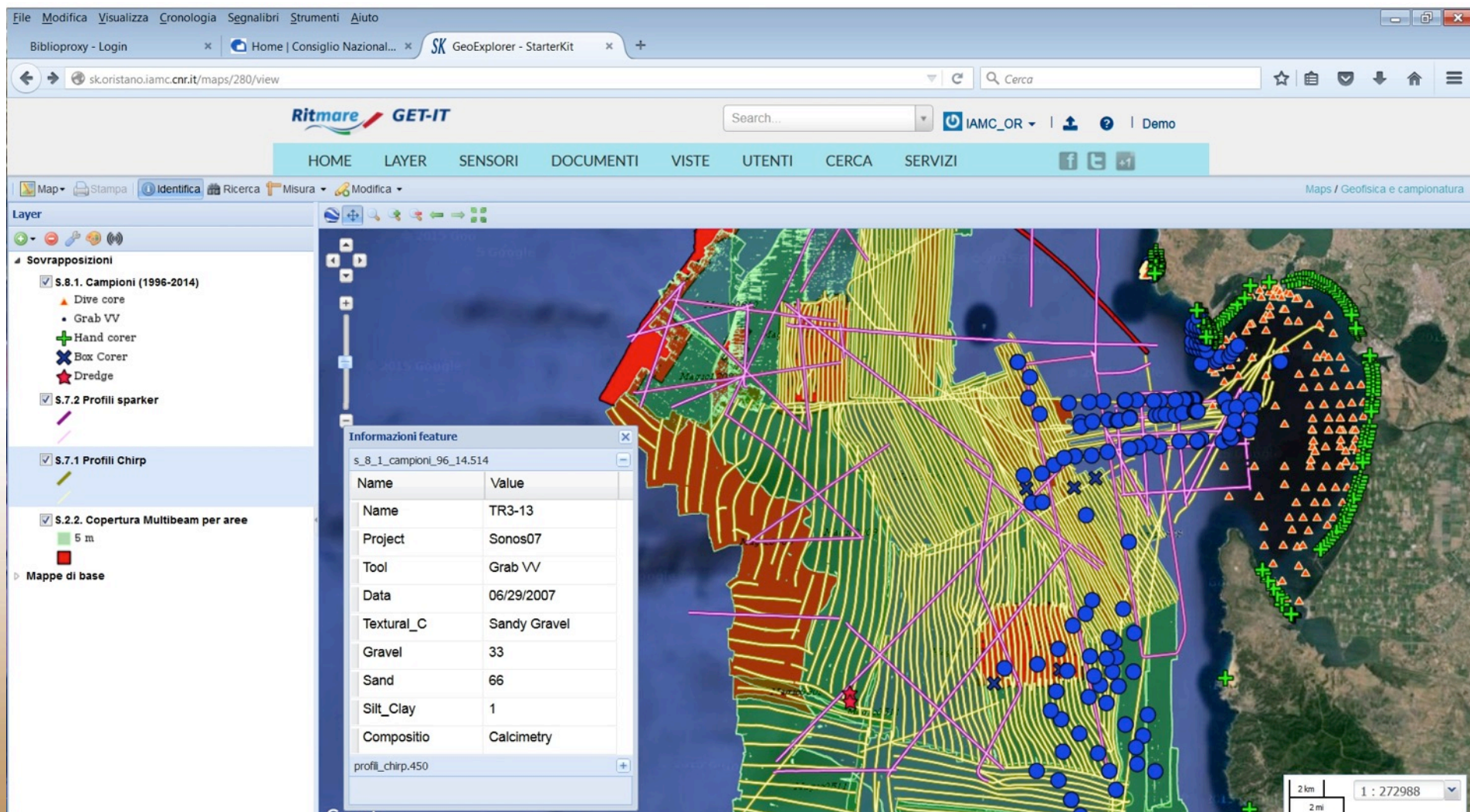
-  *Posidonia oceanica* on sediments
-  *Posidonia oceanica* on hard substrate/
Coralligenous assemblages
-  SG- Sandy Gravels
-  GS - Gravelly Sands
-  SGMS - Slightly Gravelly Muddy Sands



Sediments reservoirs



Geodatabase online (Get it- RITMARE)



The screenshot displays the RITMARE GET-IT web application interface. The browser address bar shows the URL `skoristano.iamc.cnr.it/maps/280/view`. The application header includes the RITMARE GET-IT logo, a search bar, and navigation tabs: HOME, LAYER, SENSORI, DOCUMENTI, VISTE, UTENTI, CERCA, and SERVIZI. A left sidebar contains a 'Layer' panel with several checked items: S.8.1. Campioni (1996-2014), S.7.2 Profili sparker, and S.7.1 Profili Chirp. The main map area shows a coastal region with various sampling points and profiles overlaid on a satellite background. A 'Mappe di base' section is visible at the bottom left of the sidebar. A 'Informazioni feature' window is open, displaying the following data:

Name	Value
Name	TR3-13
Project	Sonos07
Tool	Grab VV
Data	06/29/2007
Textural_C	Sandy Gravel
Gravel	33
Sand	66
Silt_Clay	1
Compositio	Calcimetry

The bottom right corner of the map shows a scale bar for 2 km and a scale of 1 : 272988.

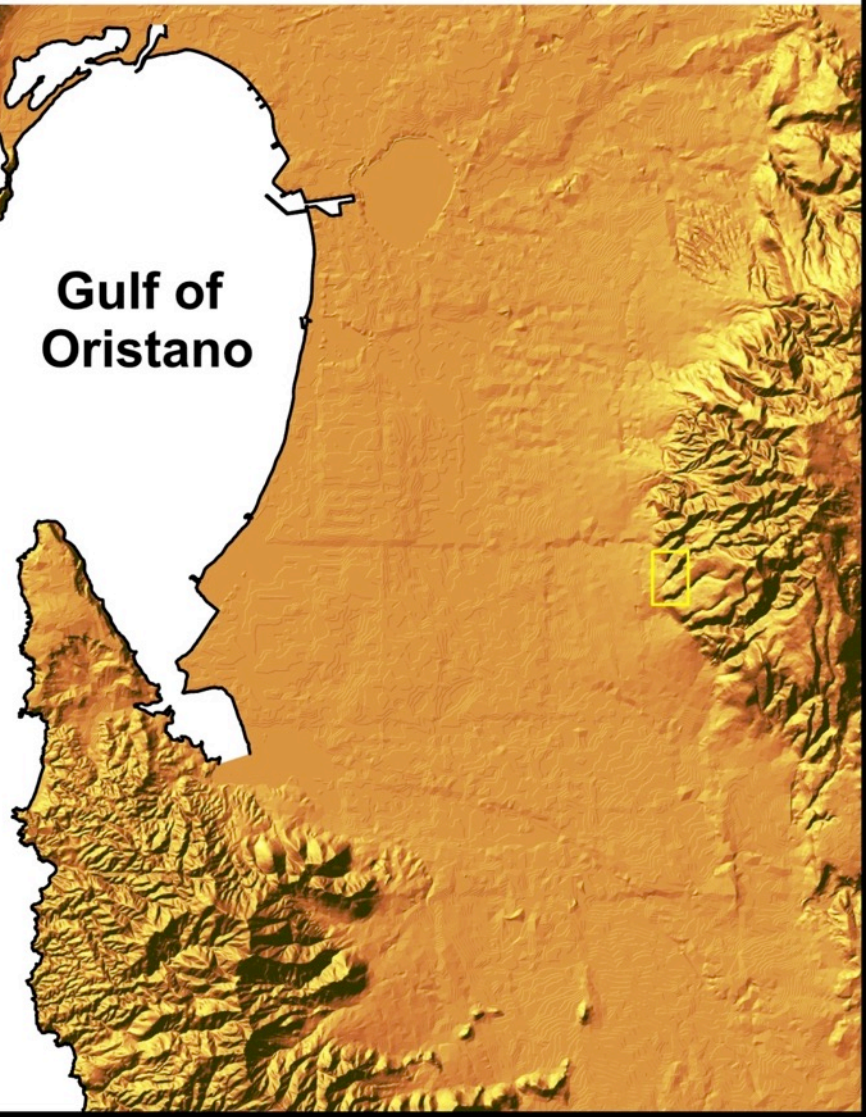
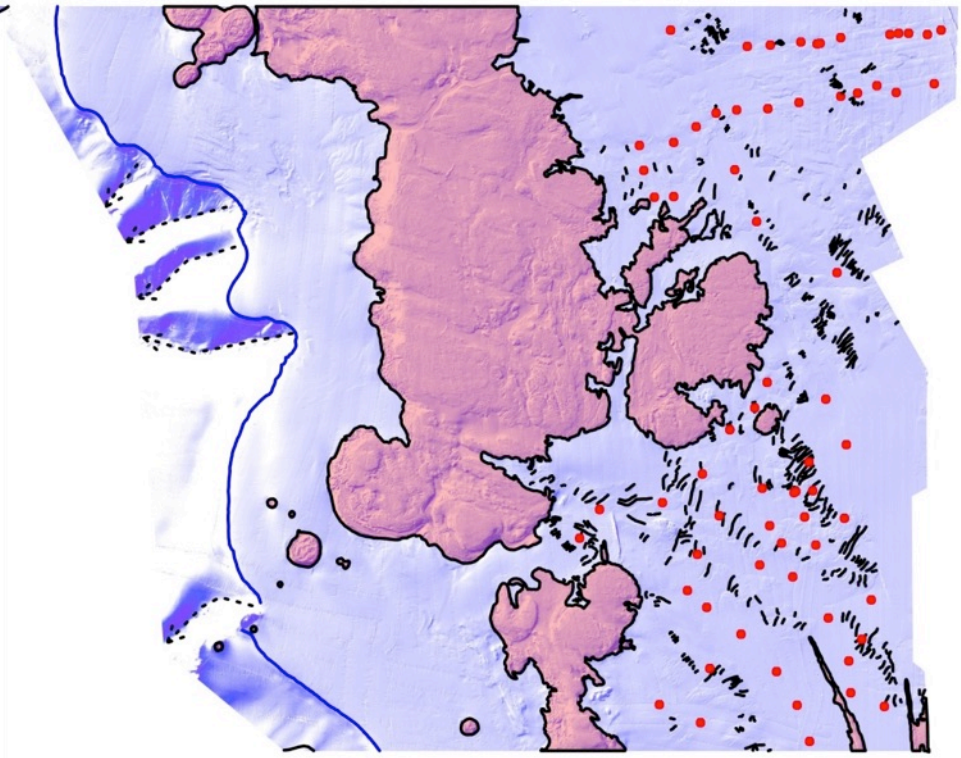
MAGIC project

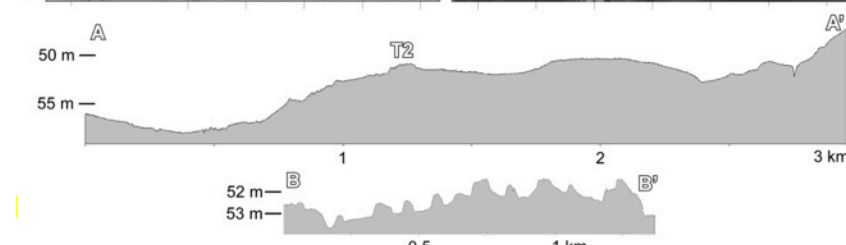
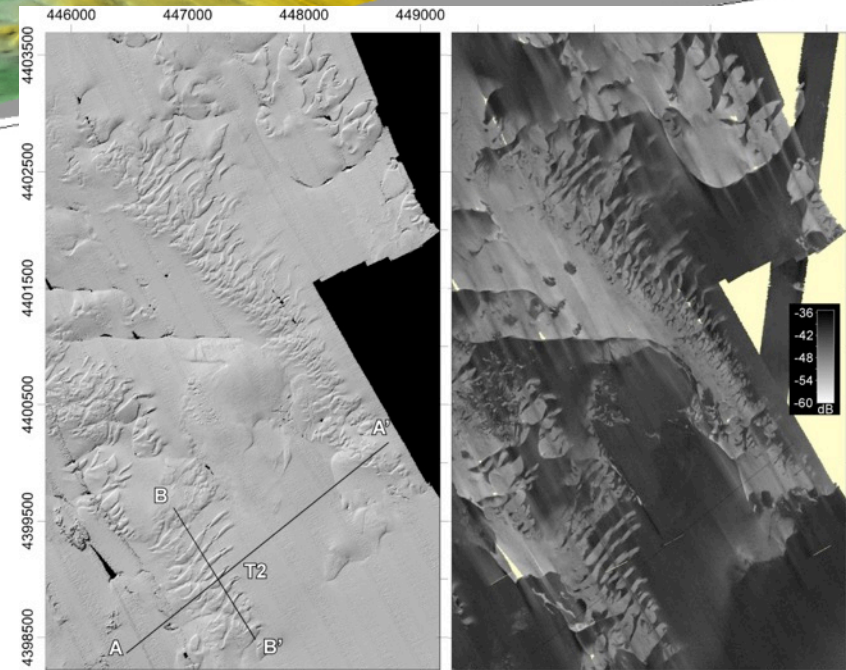
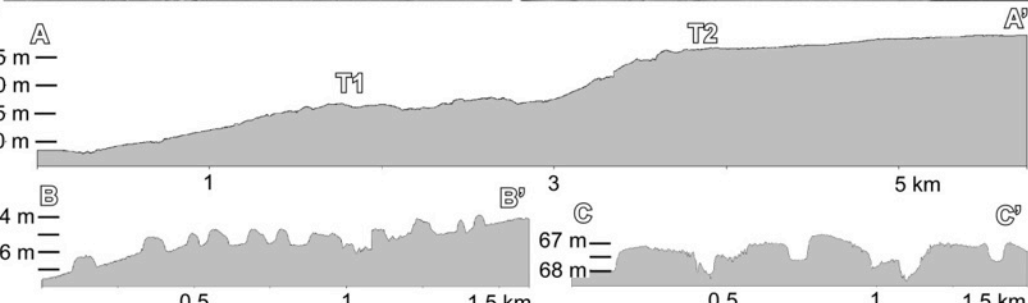
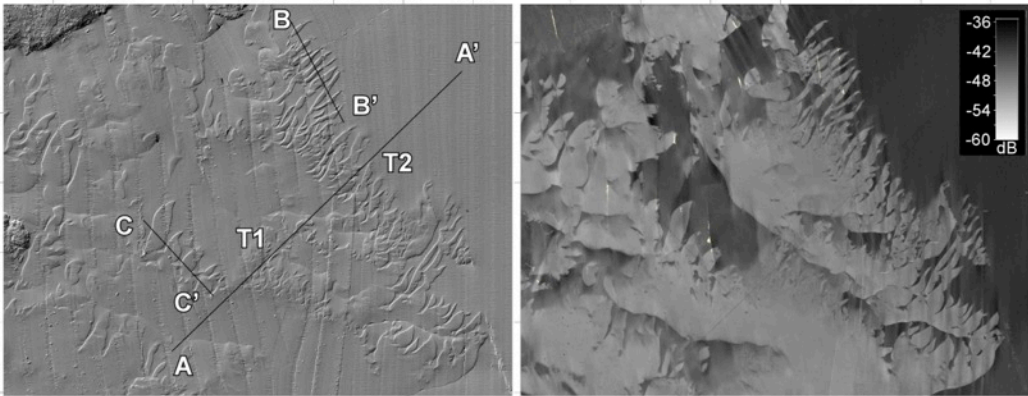
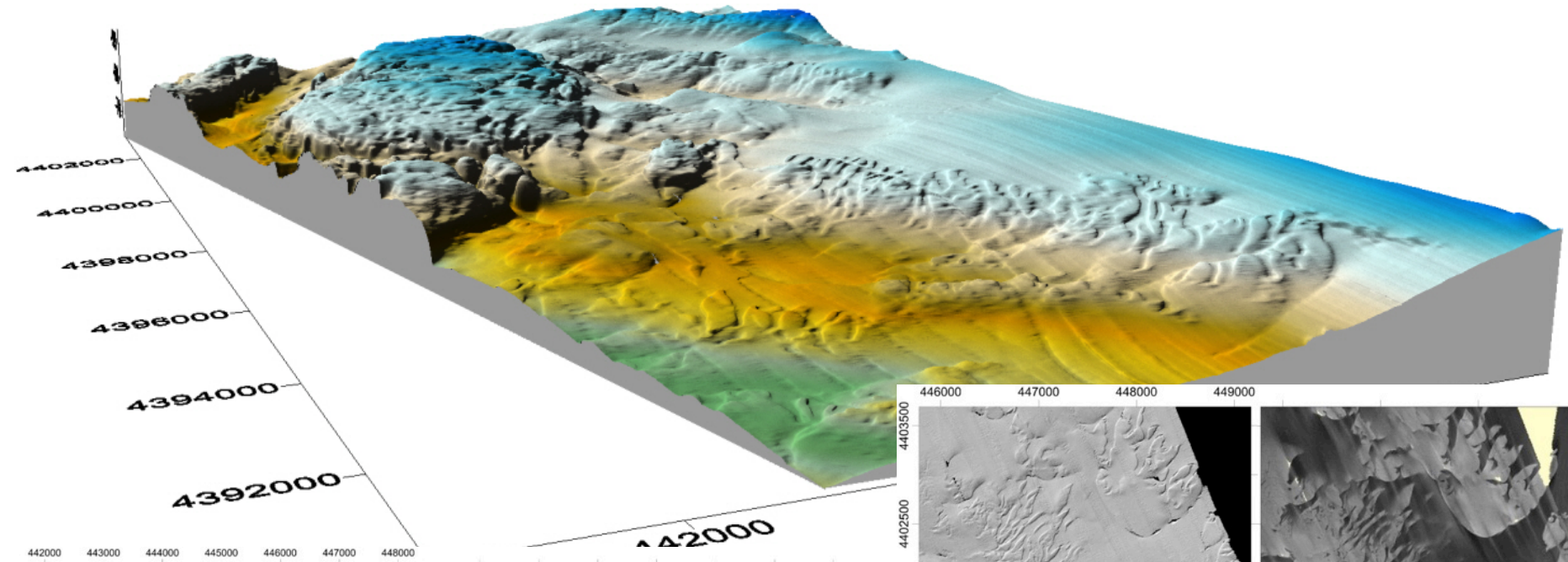


-  Bedrock outcrops
-  Dune crests
-  Shelf edge
-  Canyons
-  Sediment samples

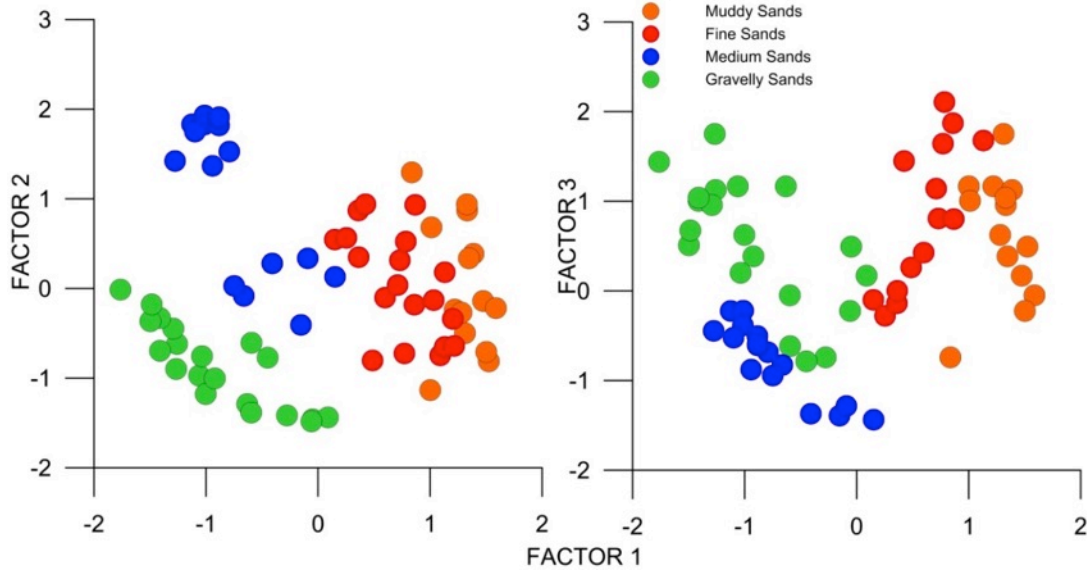


Gulf of Oristano

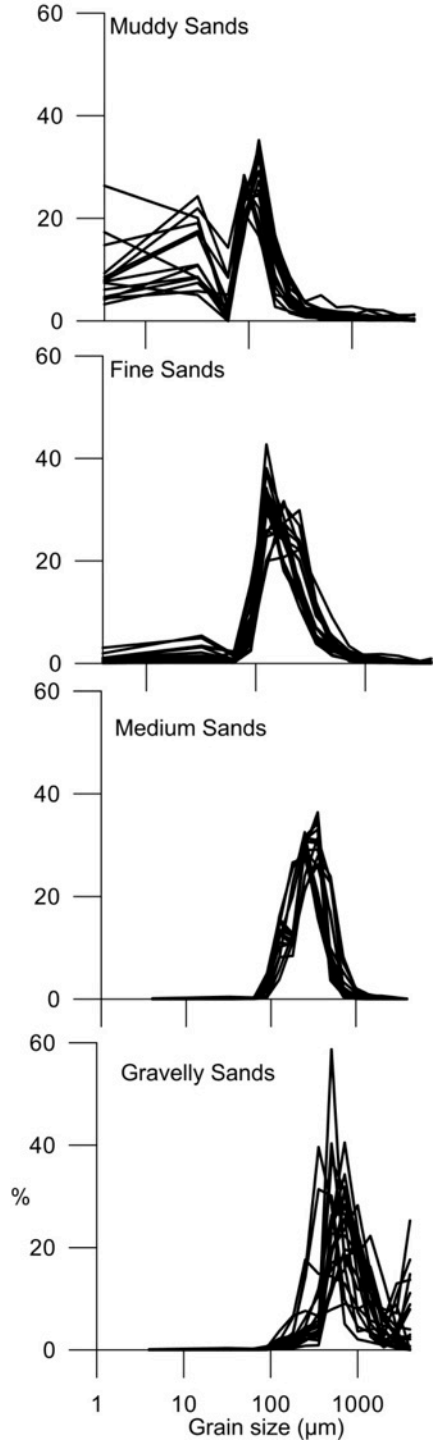




Marine sedimentary facies classification: factor analysis



µm	F1	F2	F3
>4000	0.17	-0.70	0.24
2800-4000	-0.19	-0.87	0.33
2000-2800	-0.18	-0.93	0.23
1400-2000	-0.25	-0.92	0.24
1000-1400	-0.39	-0.87	0.13
710-1000	-0.57	-0.76	-0.04
500-710	-0.87	-0.35	-0.15
355-500	-0.47	0.26	-0.77
250-355	-0.08	0.43	-0.87
180-250	0.56	0.30	-0.71
125-180	0.83	0.30	-0.29
90-125	0.86	0.41	0.07
63-90	0.74	0.20	-0.26
32-63	0.96	0.04	0.09
4-32	0.95	0.01	0.13
<4	0.93	0.06	0.13
% Exp. V.	41%	32%	15%



Sed. Facies		D ₅₀ µm	Gravel %	Coarse Sands %	Medium Sands %	Fine sands %	Mud %	CaCO ₃ %
Bioclastic Muddy Sands	Mean	123	1	4	7	64	24	66
	SD	27	1	3	3	8	11	8
BIOCLASTIC Fine Sands	Mean	203	1	7	27	63	3	63
	SD	29	1	3	9	8	2	17
MIXED Medium Sands	Mean	328	0	14	57	29	0	43
	SD	41	0	9	7	8	0	29
SILICICLASTIC Gravelly Sands	Mean	879	13	69	14	3	0	14
	SD	250	12	18	14	3	0	11



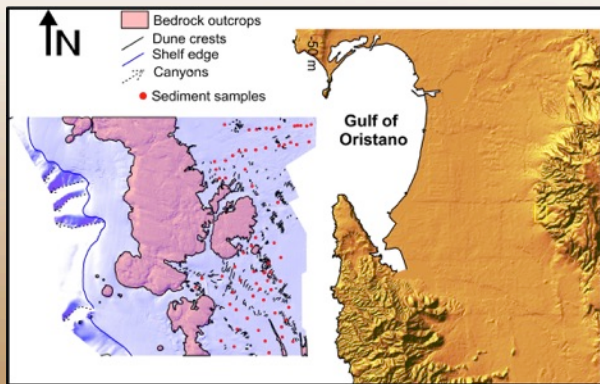
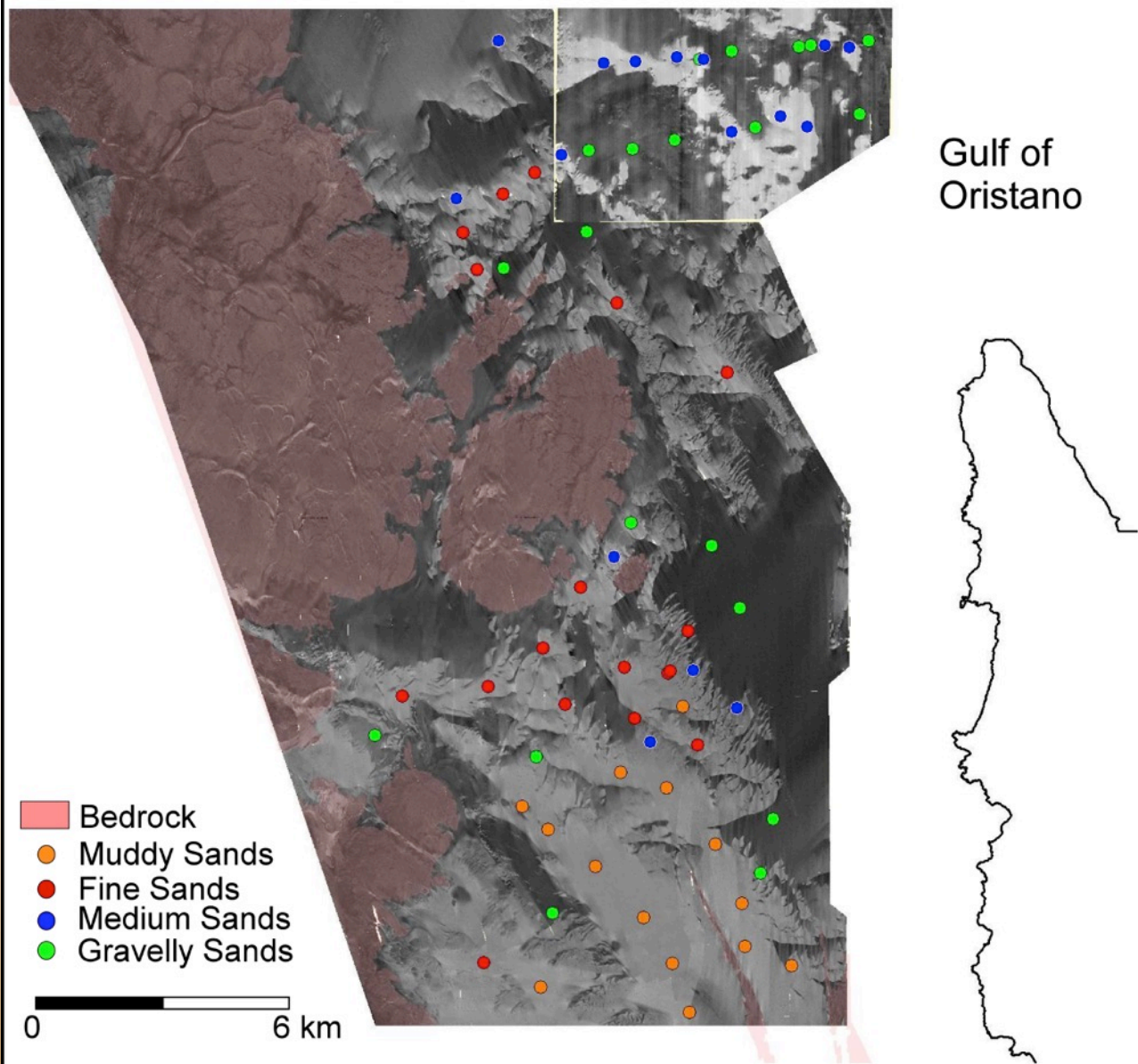
ISPRA

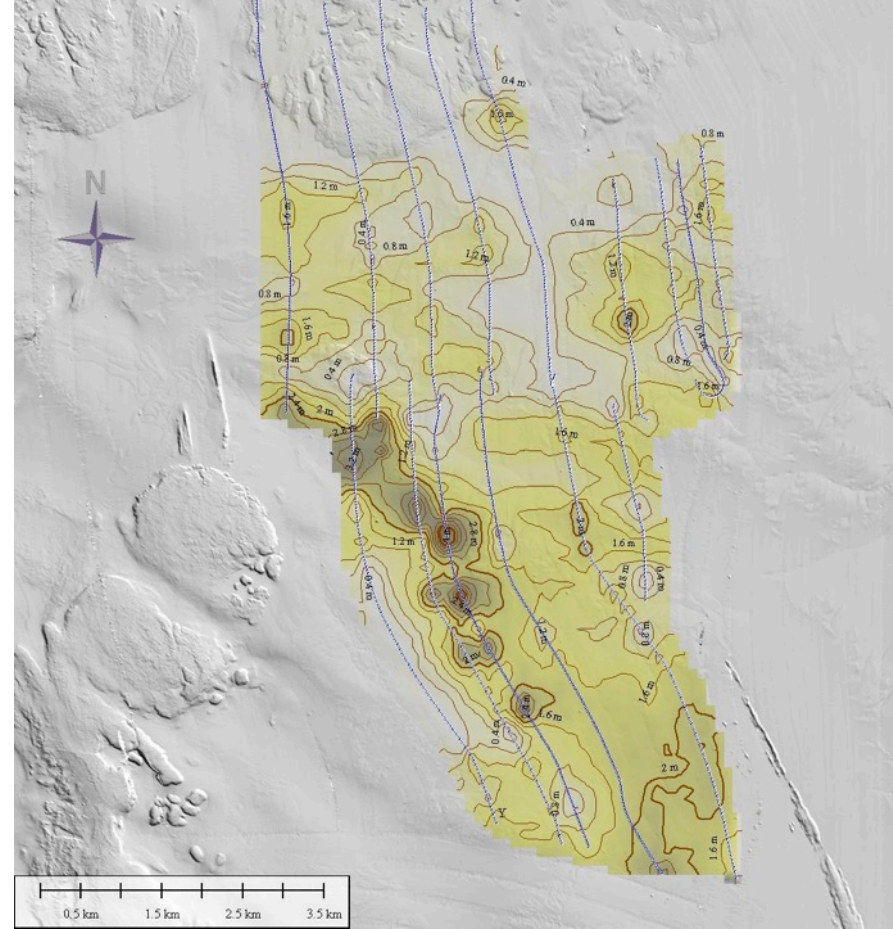
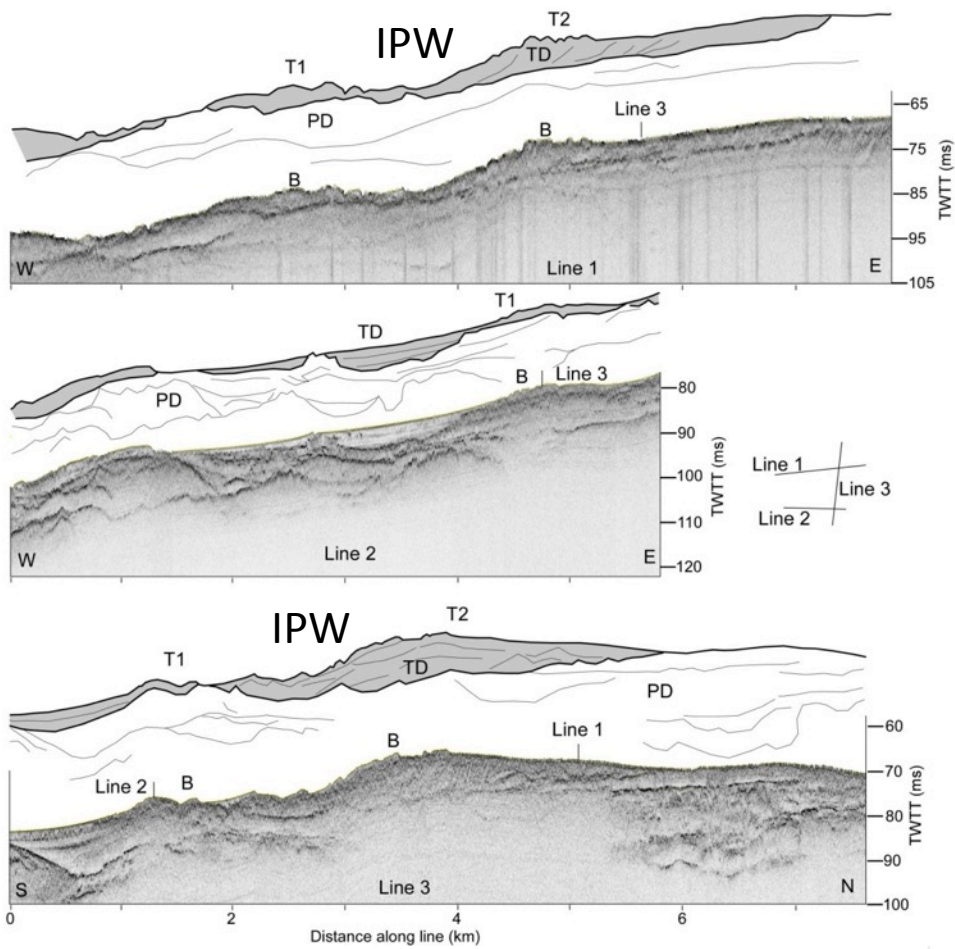
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Workshop

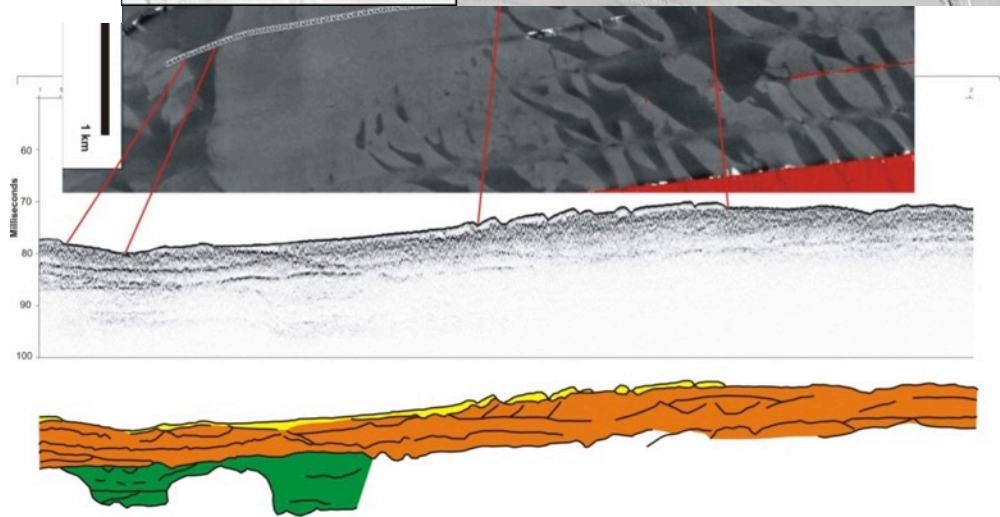
Le analisi granulometriche nei sedimenti marini

Risultati del I circuito di intercalibrazione per le analisi granulometriche
ROMA-17 novembre 2016





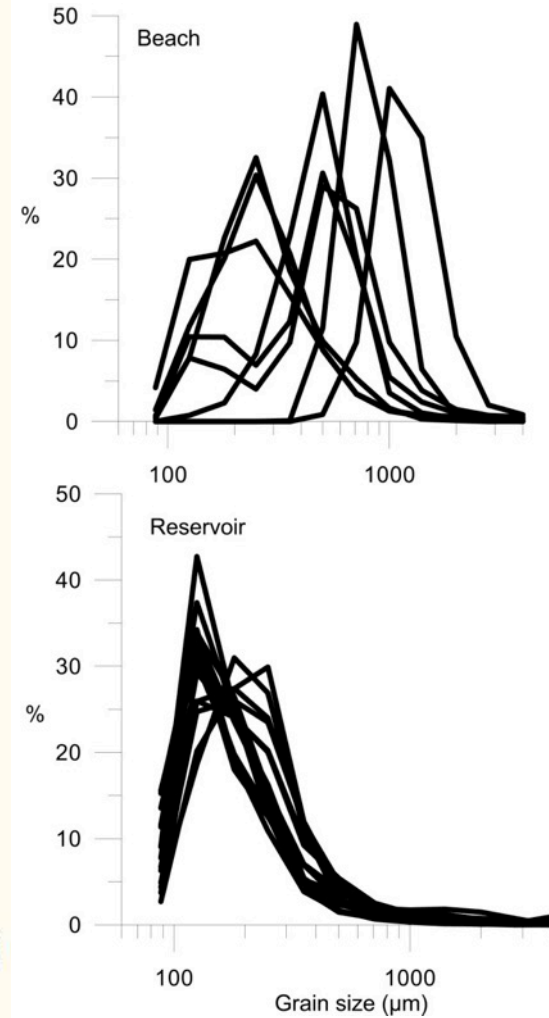
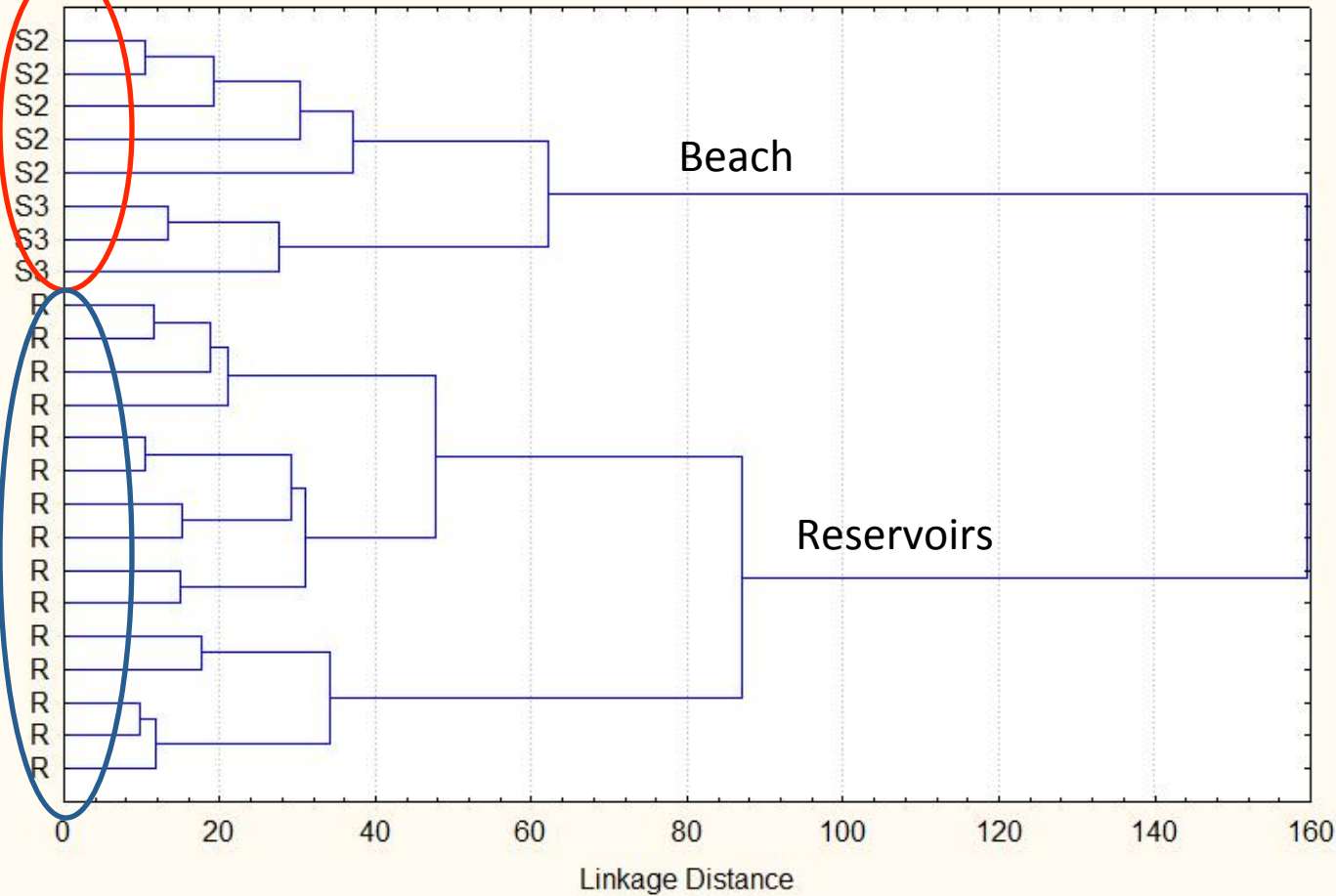
Backstepping Infralittoral prograding wedge (IPW) of siliciclastic coarse sands covered by mixed and carbonate medium and fine sands



Beach sediments vs. Reservoir sediment grain size

Carbonate sediments ($\text{CaCO}_3 > 60\%$)

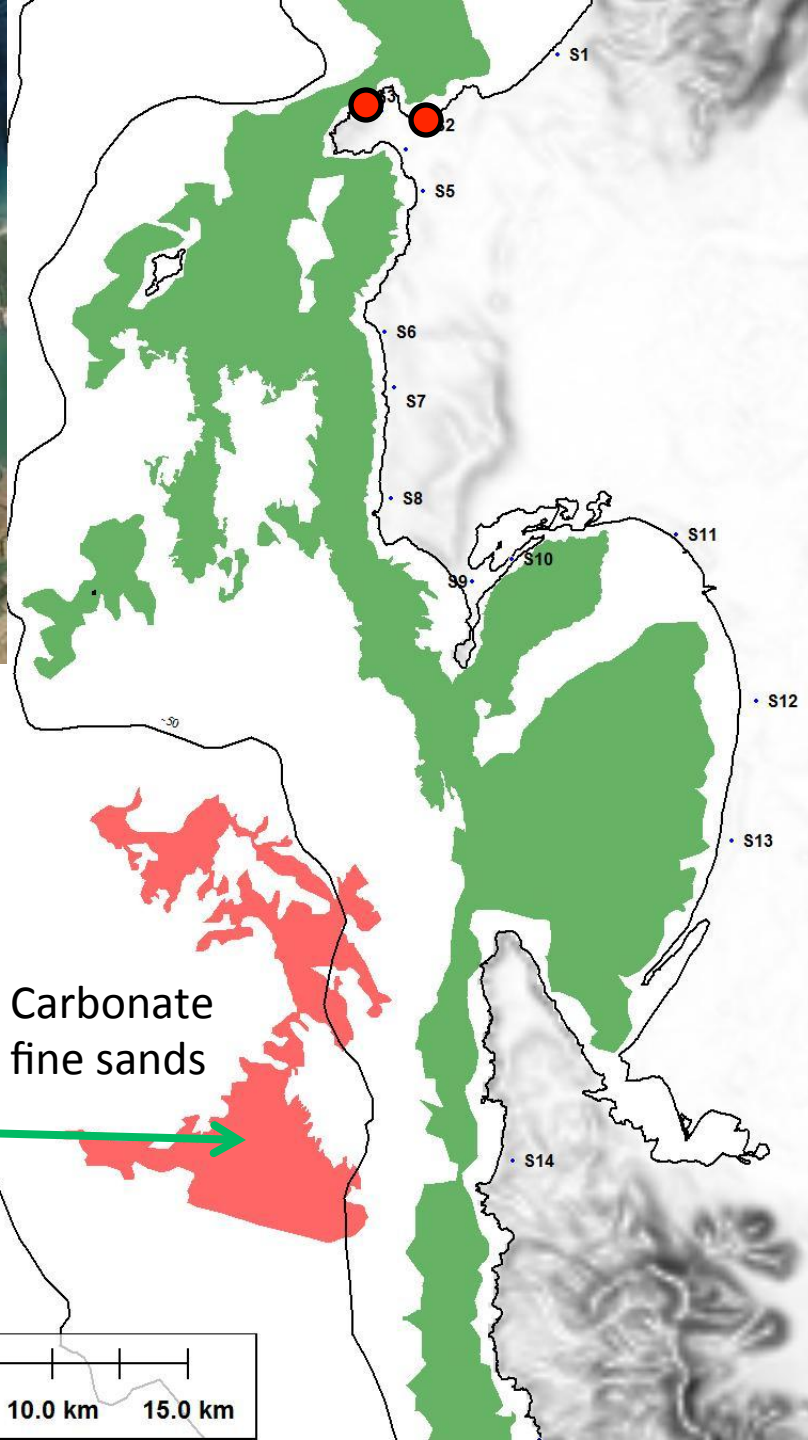
Tree Diagram for 23 Cases
Carbonate sediments



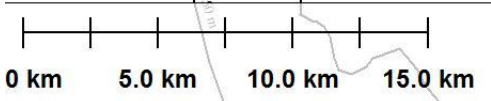
Beach sediments: low source to sink distance



Reservoirs: sediment sorting by hydrodynamics (sorted bedforms)



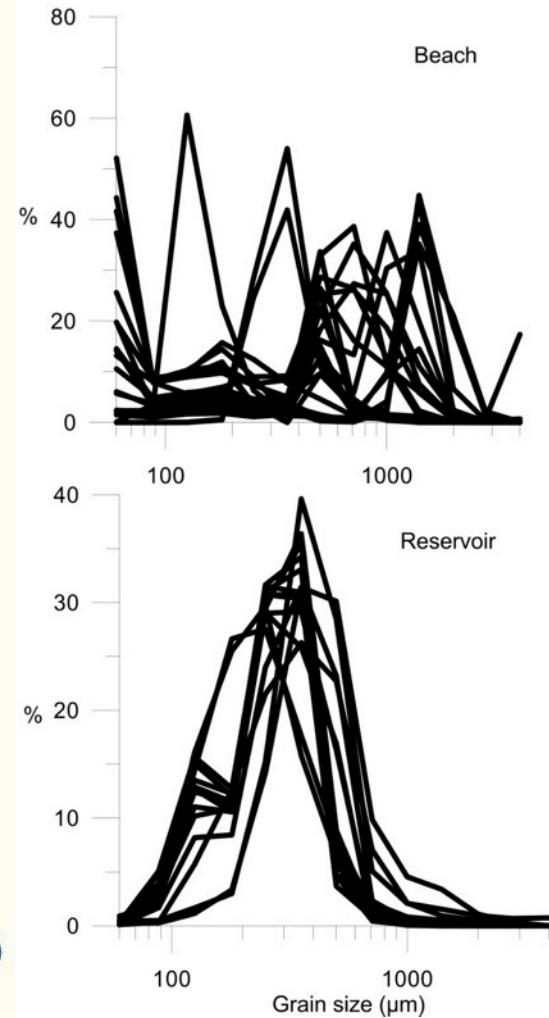
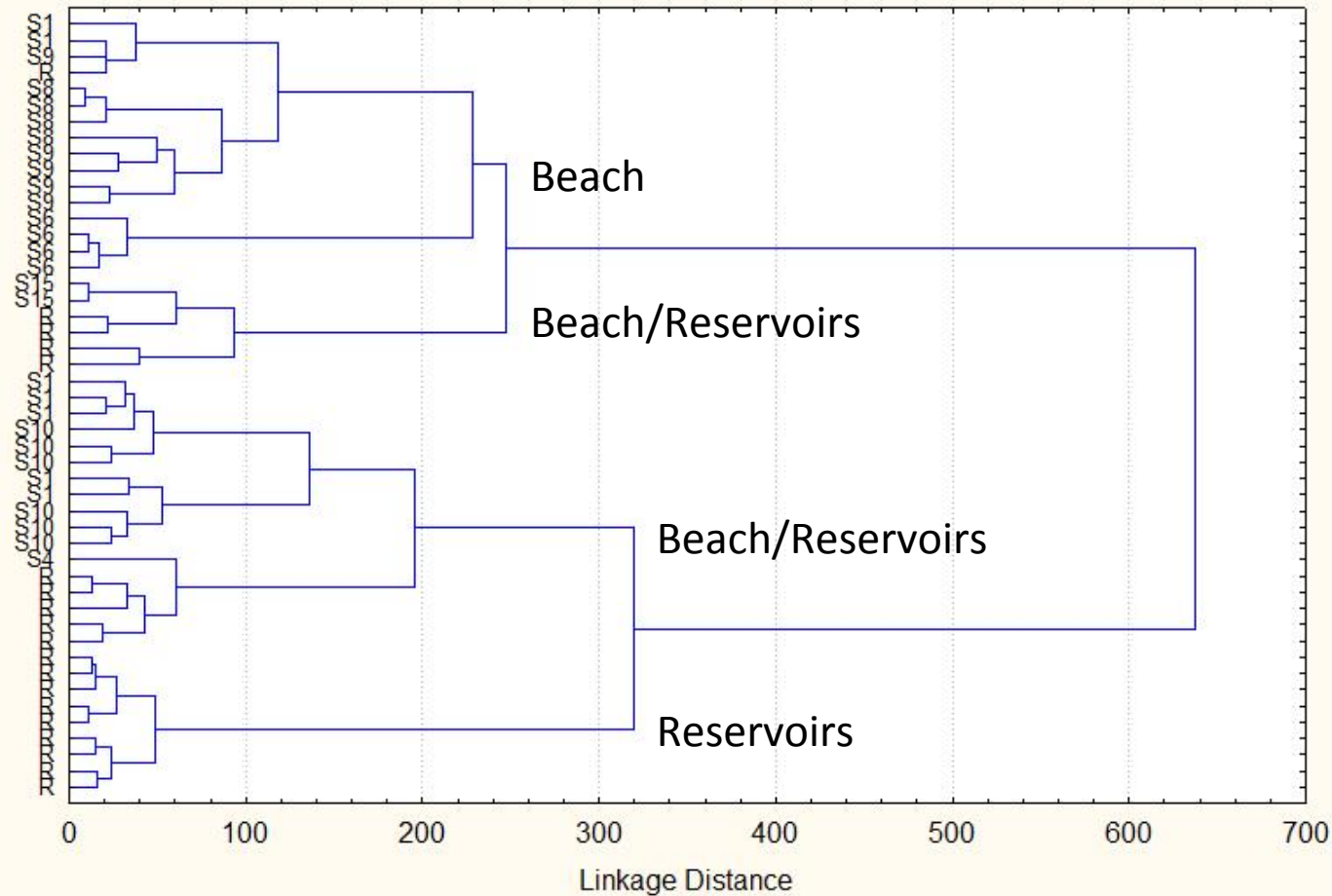
Carbonate fine sands

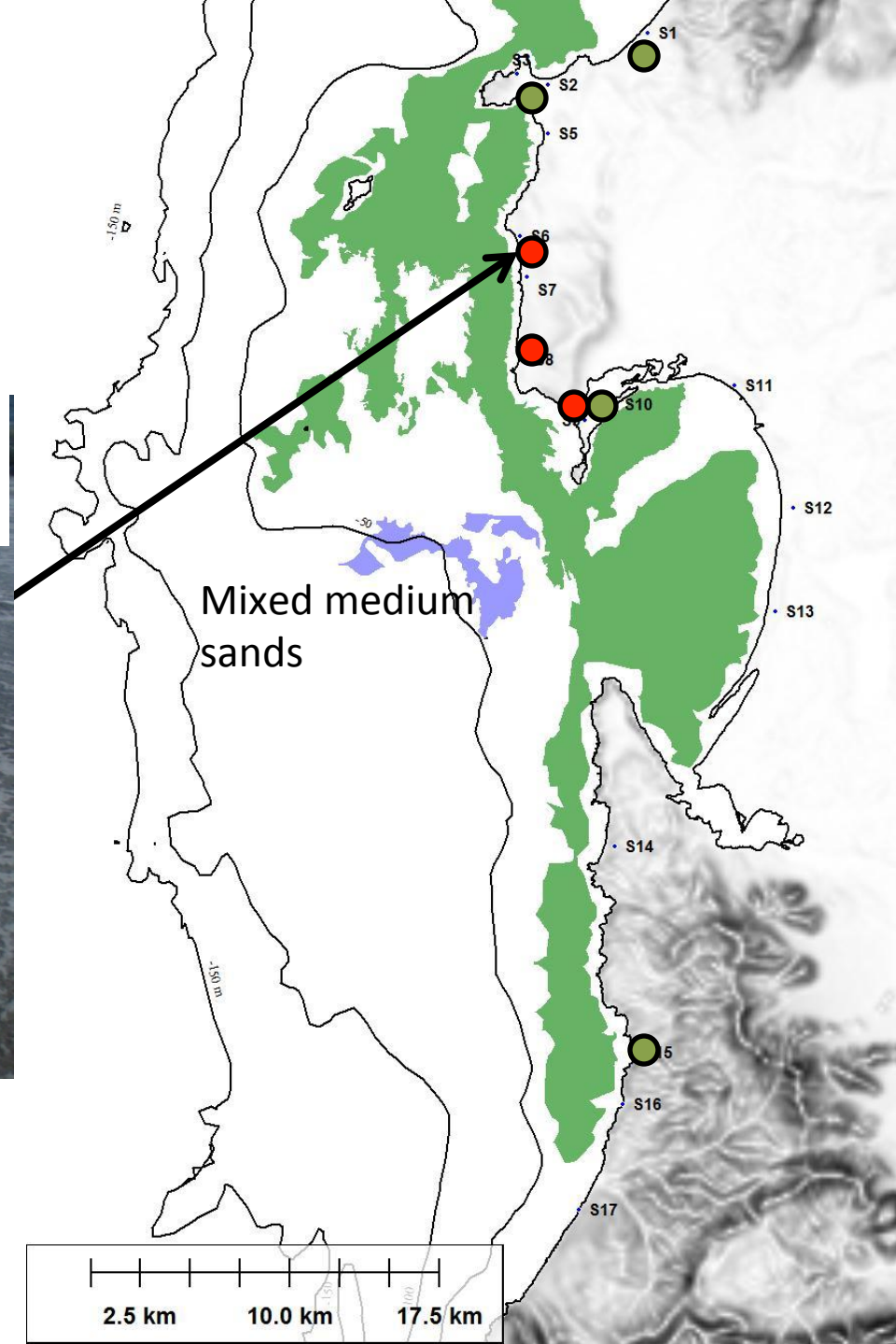
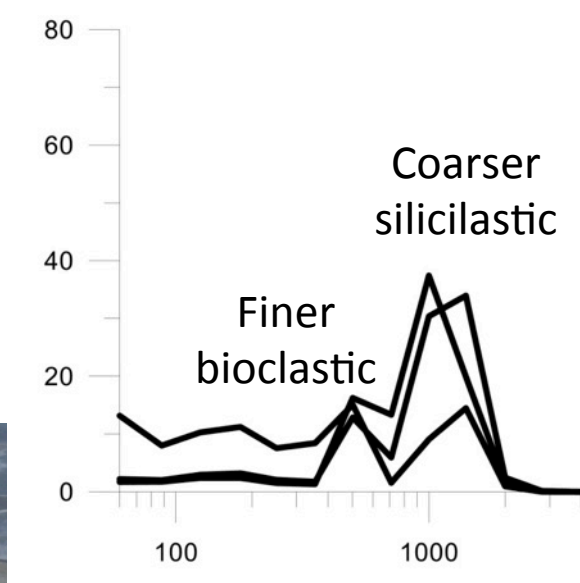
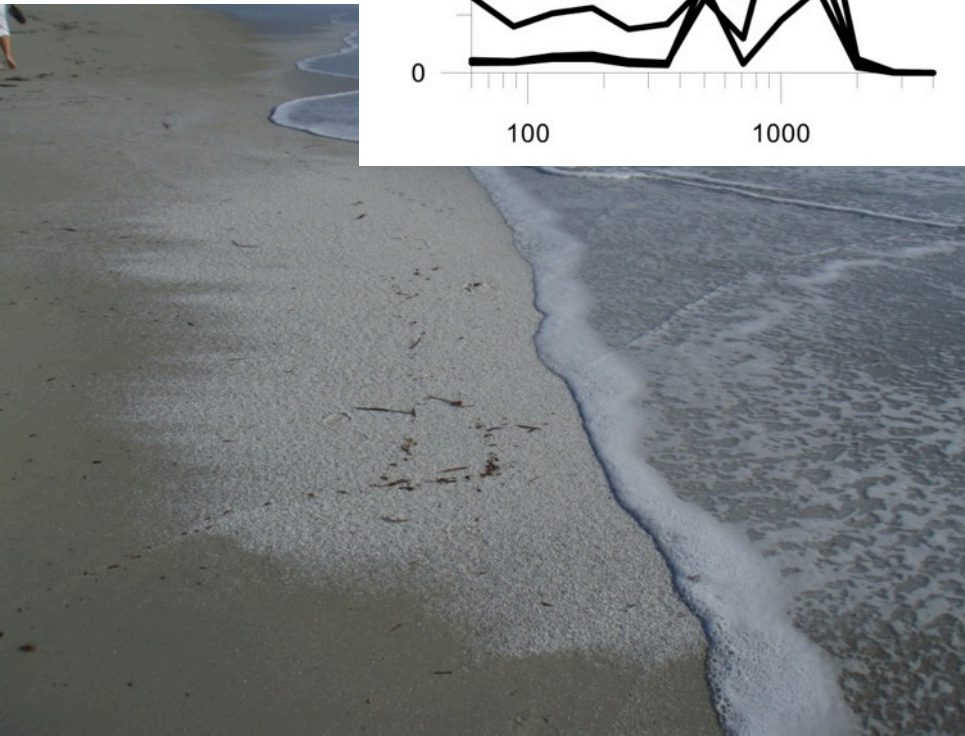


Beach sediments vs. Reservoir sediment grain size

Mixed sediments (CaCO₃ 20-60%)

Tree Diagram for 48 Cases
Mixed sediments



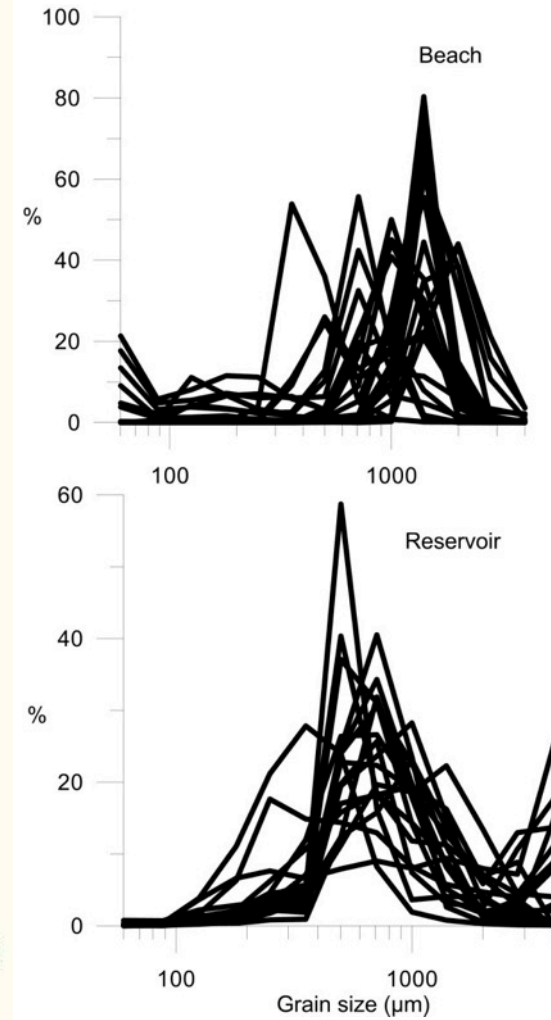
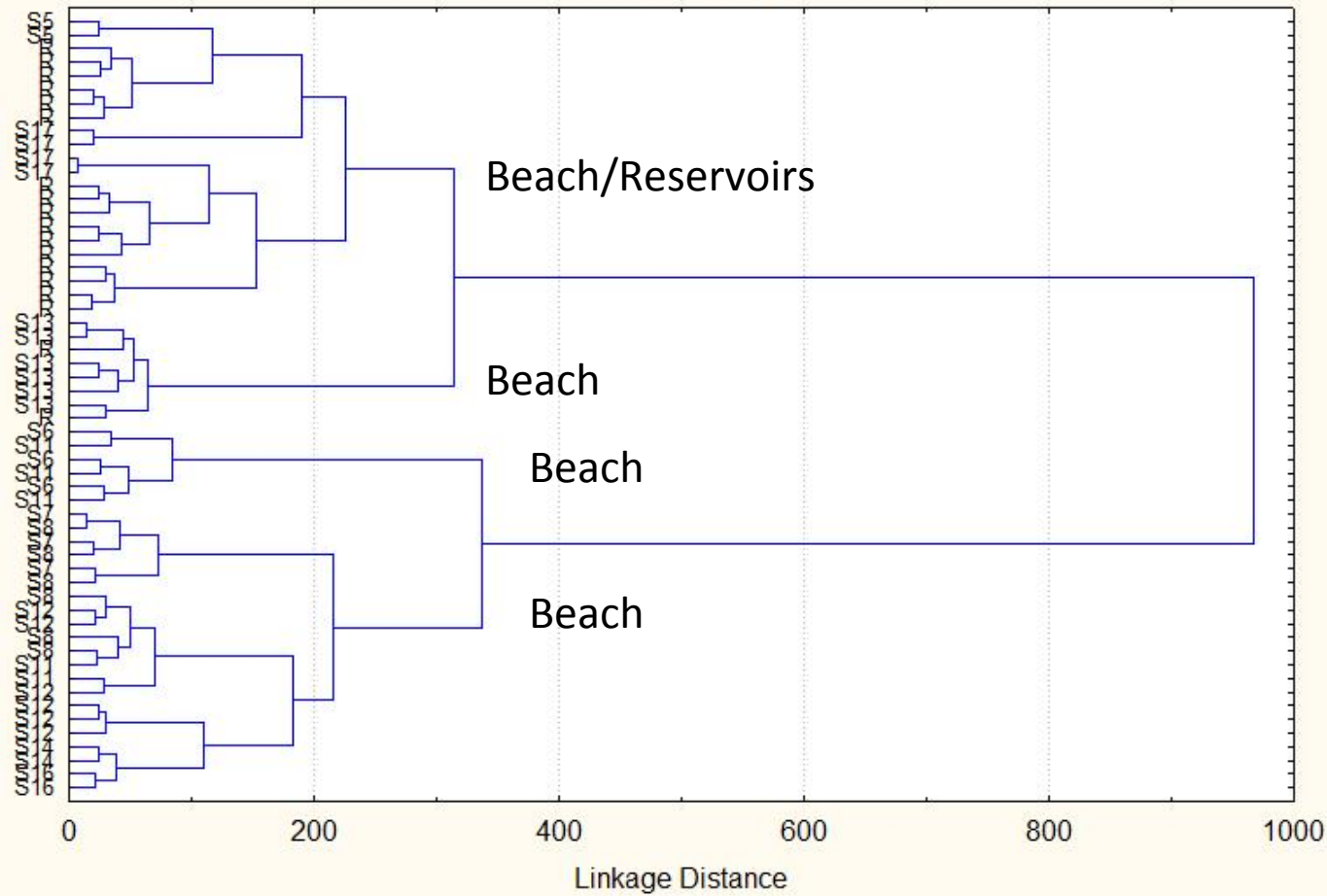


De Falco et al., Est Coast. Sh. Sc. 2003
De Falco et al., JCR, 2014
Simeone, Palombo, Guala Oc. & Coast. Man. 2012

Beach sediments vs. Reservoir sediment grain size

Siliciclastic sediments ($\text{CaCO}_3 < 20\%$)

Tree Diagram for 57 Cases
Siliciclastic Sediments





coarse sands



medium sands

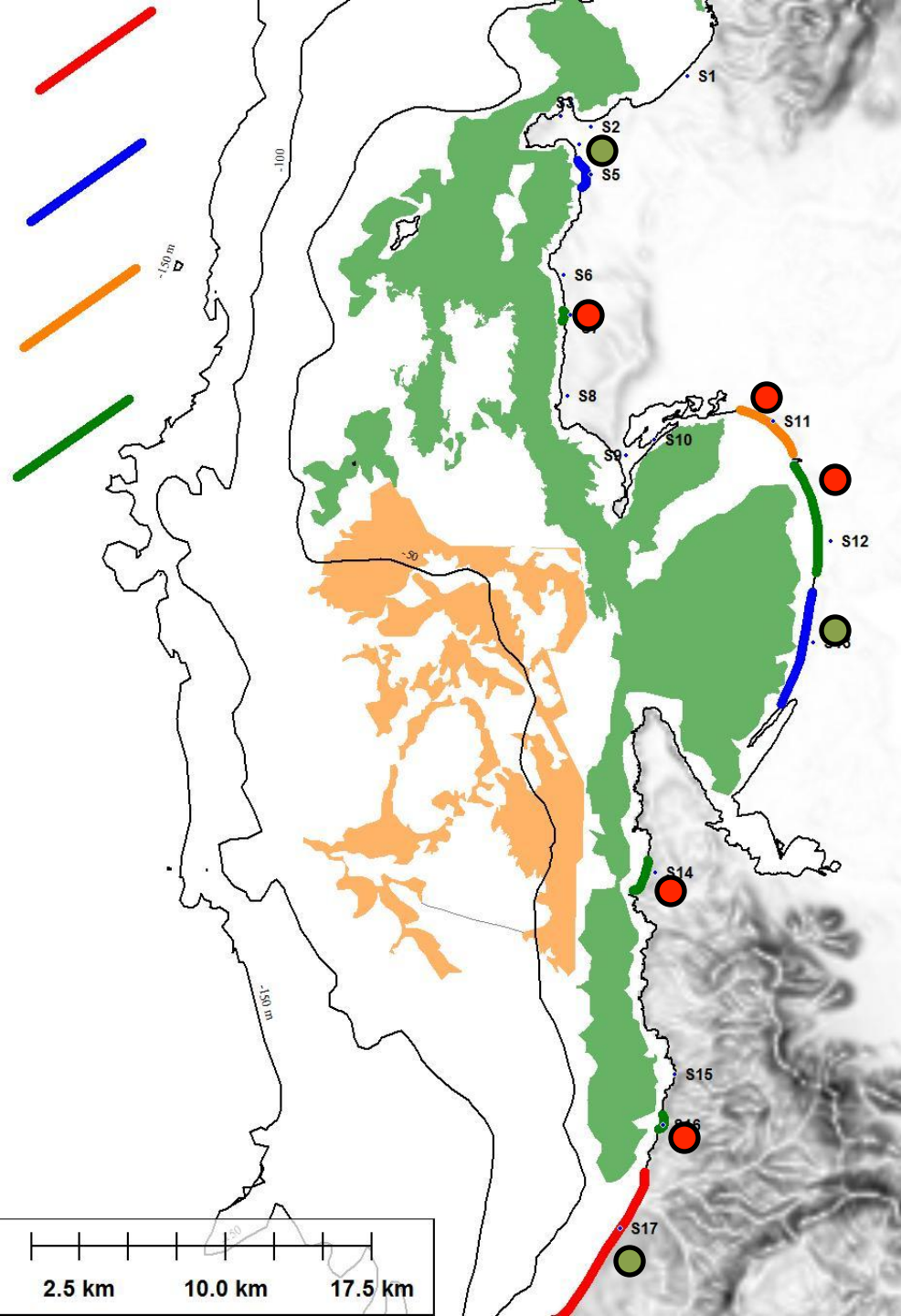


gravel/very Coarse
sands

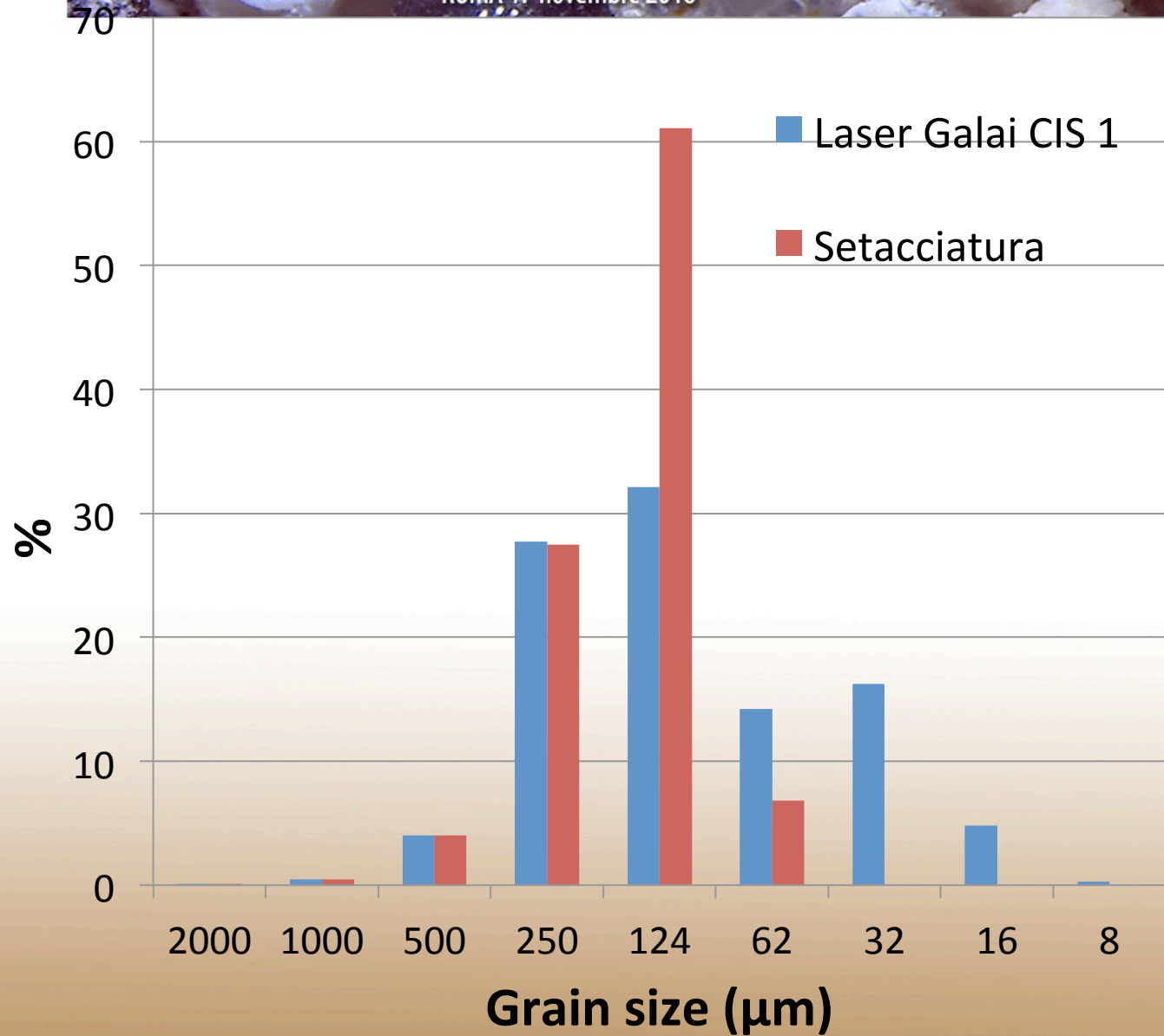


very coarse
sands

**Beach with Coarse-medium
sands of 3 beaches (out of 8)
are
compatible with reservoir
sediments of IPW**



***Si fa presto
a dire
sabbie***



A photograph of a beach scene. The foreground shows a wide, flat expanse of light-colored pebbles or coarse sand. The water is very clear and shallow, revealing the sandy bottom beneath. The water's surface is covered in gentle ripples, and the color transitions from a pale yellowish-green near the shore to a deeper blue further out. The overall atmosphere is calm and serene.

Grazie per l'attenzione