



GEBCO Science Day
8 October 2013 ISMAR-Venice



<http://www.magicproject.it>

MaGIC project: the Italian experience of a common effort of the scientific community to acquire, process, interpret a very large amount HR bathymetric data at a national scale

Francesco L. Chiocci and many, many coauthors

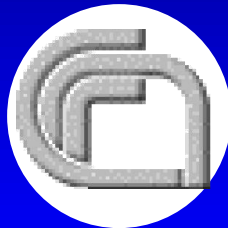
MAGIC project: *MA*rine *Geohazard* along the *It*alian *Co*asts



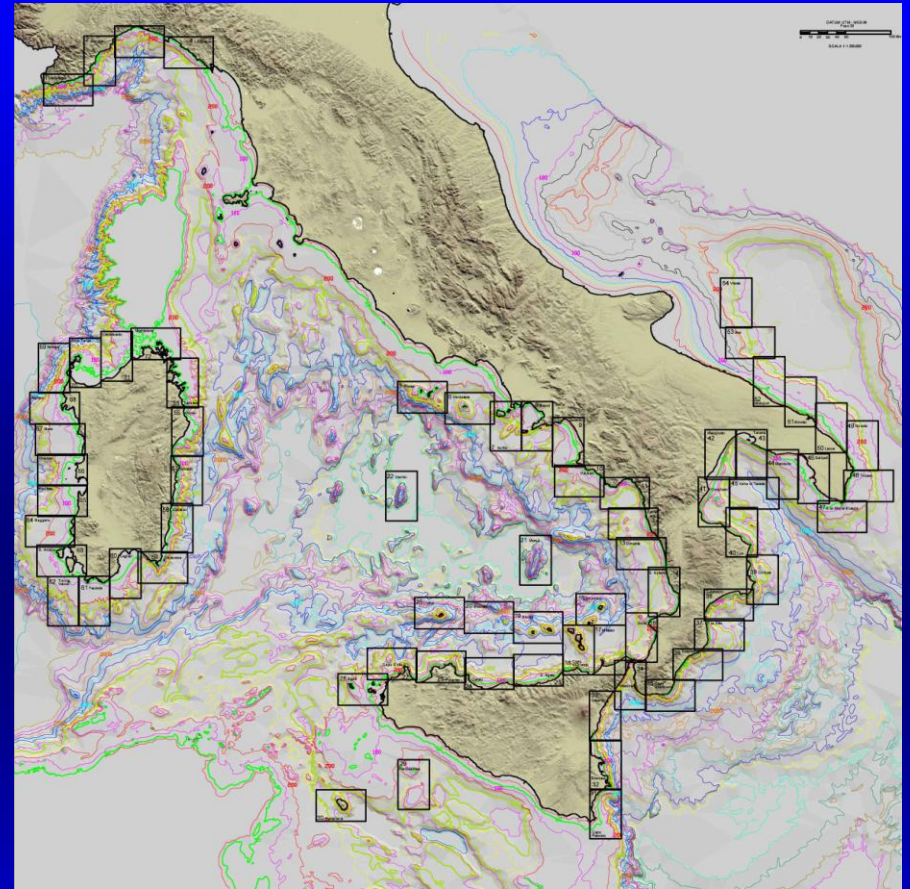
Multibeam mapping
(1:50.000)
of most of the Italian
margins

5-year period:
In the depth range 50-500m
December 2007-December 2012

Funded by the Italian Civil
Protection Department (DPC)



5.25 M€ direct funding +
2 M€ ship-time CNR co-financing



Aims of the Project:

provide DPC a basic tool for monitoring
and managing marine geohazards and risk

The whole Italian Marine Geology scientific
community is involved in the project

CNR Roma - Istituto di
Geologia Ambientale e
Geoingegneria



CNR Bologna - Istituto per le
Scienze del Mare

CNR Napoli - Istituto per
l'Ambiente Marino e Costiero

Università di Genova

Università di Trieste

Università di Roma

“La Sapienza”

Università di Palermo

Università di Cagliari

Università di Milano Bicocca

Università di Sassari

Università del Sannio



Ist. Naz. Oceanografia
e Geofisica Sperimentale,
Trieste



MAGIC project: *MA*rine *Ge*ohazard along the *It*alian *Co*asts

Tyrrhenian basin and Sicily Channel:

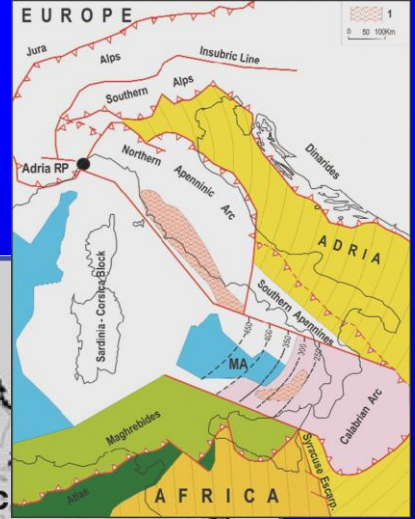
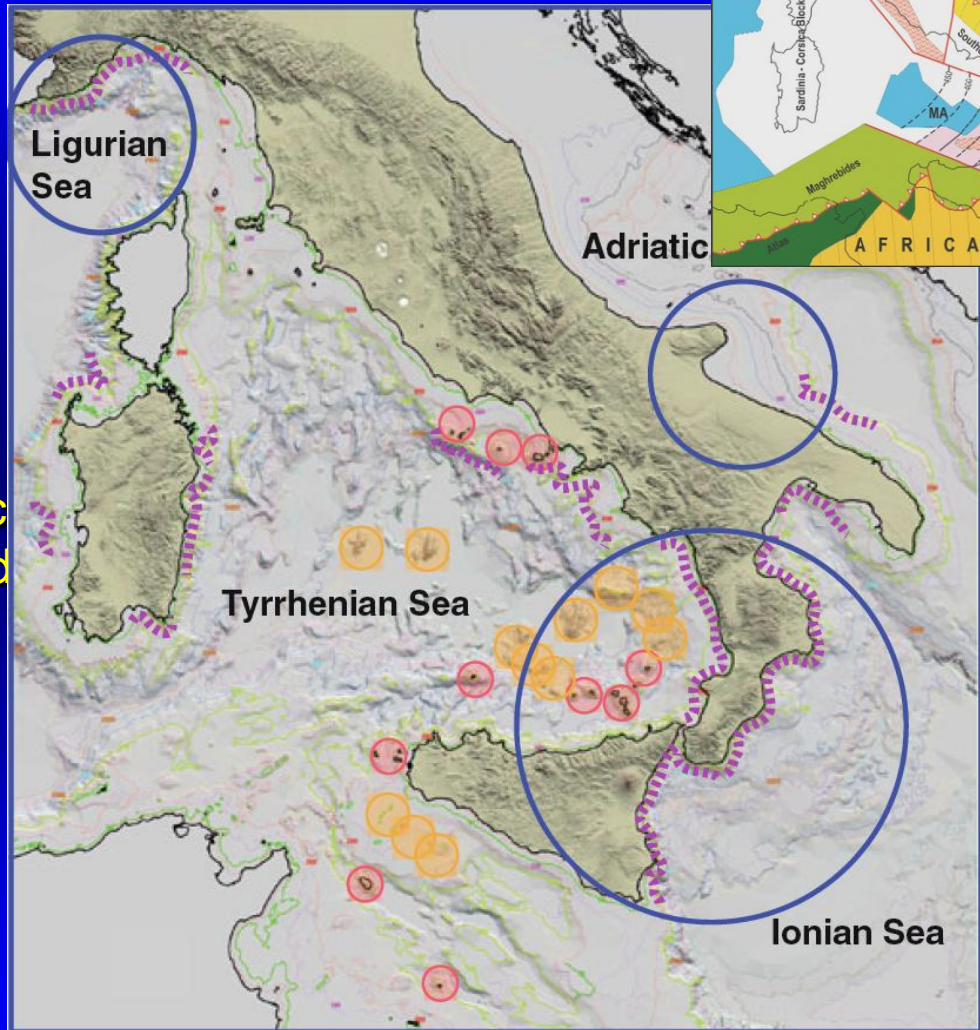
Volcanic activity
Strong seismicity

Ionian and South Adriatic:

Fault systems related with tectonic deformation and seismicity on land

All margins:

Canyon incision and sediment instability



MAGIC project: *MA*rine *Geohazard* along the *Ita*lian *Co*asts

Project Partners



CNR (Consiglio Nazionale delle Ricerche)

- **IGAG** Istituto per la Geologia Ambientale e Geoingegneria - Roma
- **ISMAR** Istituto per le Scienze Marine - Bologna
- **IAMC** Istituto per l'Ambiente Marino e Costiero – Napoli



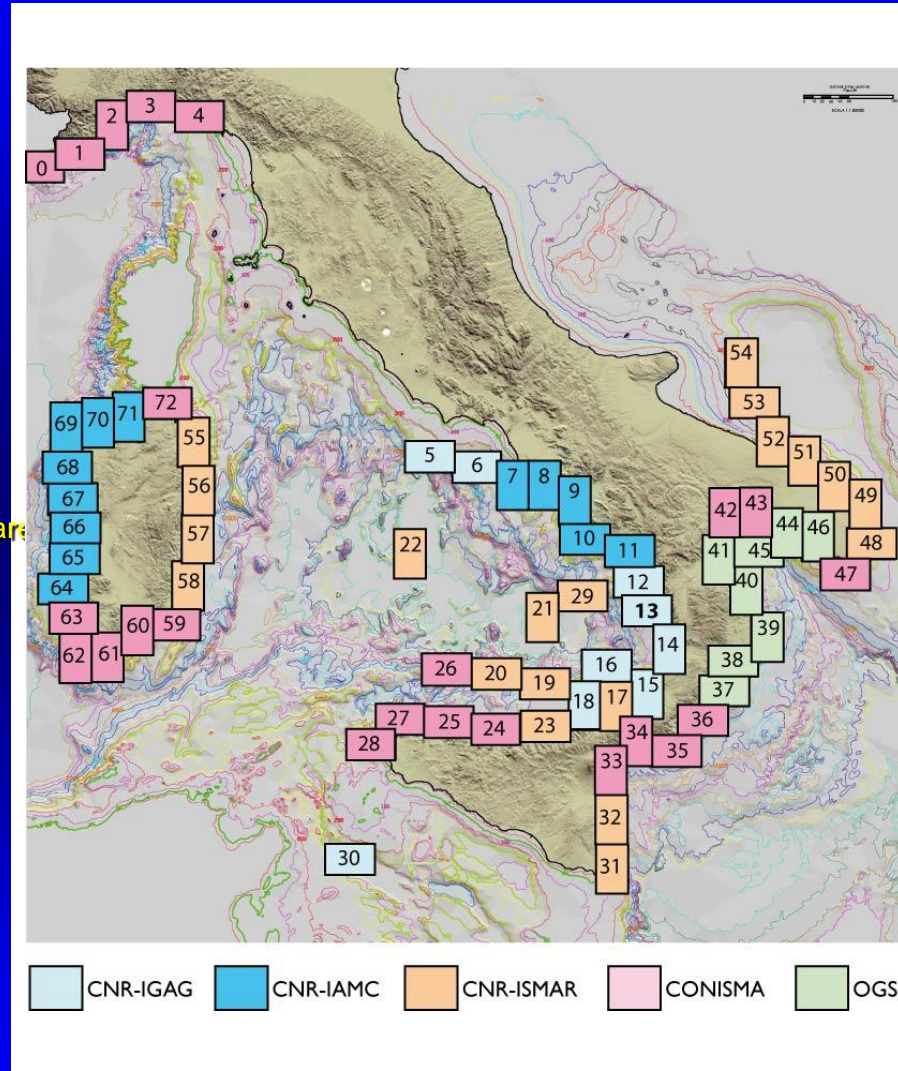
CoNISMa (Consorzio Nazionale Interuniversitario per le Scienze del Mare)

- University of Genova
- University of Trieste
- University of Rome Sapienza
- University of Palermo
- University of Cagliari
- University of Sassari
- University of Milano - Bicocca
- University of Sannio (Benevento)



OGS Istituto Nazionale di Oceanografia e Geofisica Sperimentale – Trieste
IGAG, Rome

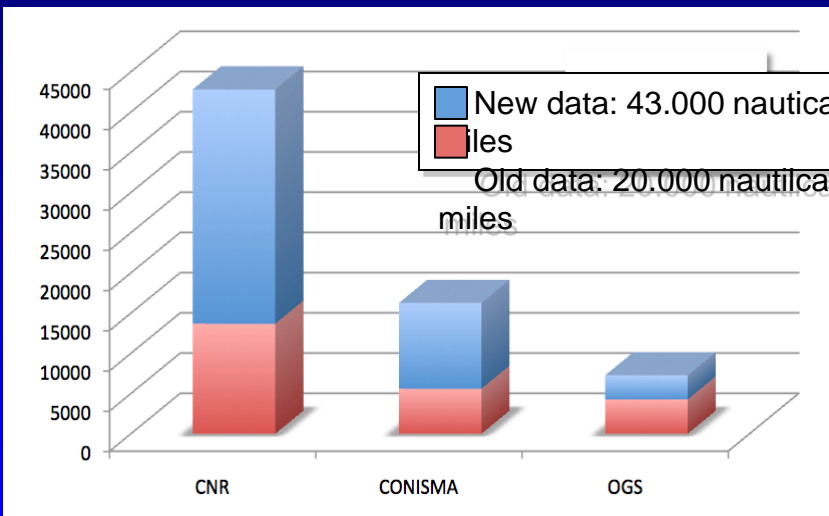
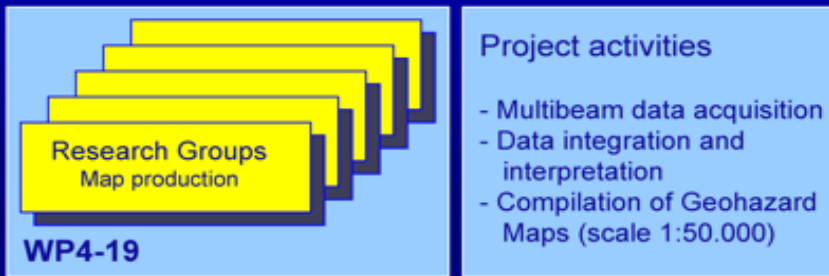
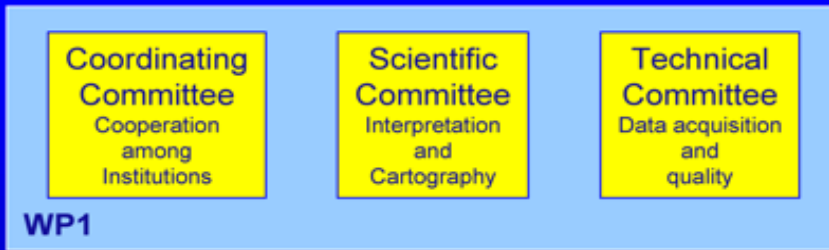
Chiocci



Main Contractor CNR-

Project Leader: Prof. Francesco L.

Structure of the project

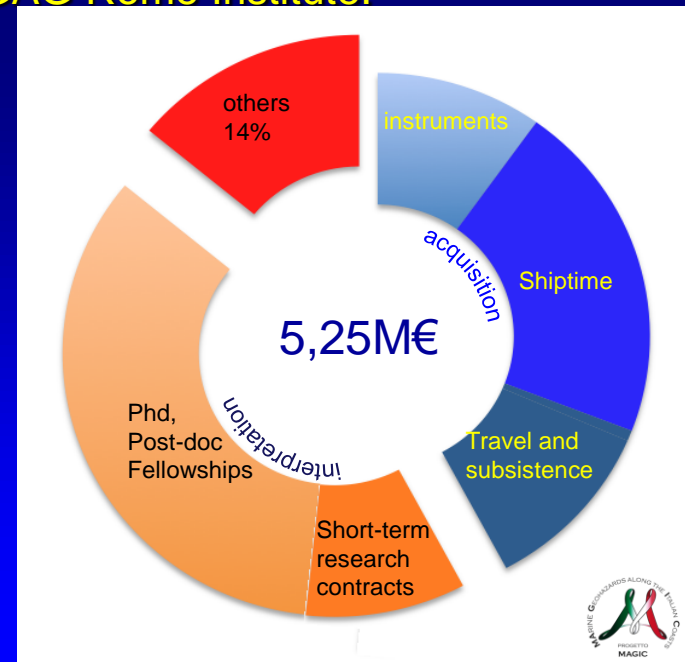


Each sheet is under responsibility of one of the 15 research groups, whose leaders form the Scientific Committee.

Funding is mainly devoted to shiptime and to fellowships and contract for young researchers .

Interpretation criteria and processing procedures are defined by collaborative approach in the committees

Respect of timetable, processing procedures, interpretation criteria is centralised at the CNR-IGAG Rome Institute.





Aggiornamento del 27/01/2011

Legenda:

- Acquisizione non terminata
- Acquisizione completata
- Fogli consegnati entro il 2° anno
- Icona foglio "Follow Up Foglio" (se le acquisizioni sono terminate dopo la consegna del foglio)
- LAVORO CONSEGNA TO FINO ALL'ANNO (con scritta agenda i fogli non richiesti in più)
- Mancanti

OS	UNI	Moduli	# Foglio	Nome	1° ANNO		2° ANNO		3° ANNO		4° ANNO		5° ANNO	
					1° semestre	2° semestre	1° semestre	2° semestre	1° semestre	2° semestre	1° semestre	2° semestre		
Contina	UNTS	4	1	Ventimiglia	Pre									
	UNTS	4	2	Savona	Pre									
	UNTS	4	3	Genova	Pre									
	UNTS	9	4	La Spezia			naive							
	UNTS	12	35	Capo Sparteneto			Foglio		FU			Schede	Note	
	UNPA	9	24	Cefalù										
	UNPA	9	25	Palermo			naive		FU	Schede				
	UNPA	9	26	Ustica	Pre	Foglio								
	UNPA	9	27	Capo S. Vito										
	UNPA	9	28	Egadi										
	UNPA	9	29	Ferdinandea										
	UNRM	11	33	Catania	Pre	Foglio	naive							
	UNRM	11	34	Messina	Pre	Foglio	naive							
	UNMB	13	36	Siderno	Pre	Foglio	naive							
	UNMB	13	47	S. Maria di Leuca	Pre									
UNSAI	15	42	Metaponto	Pre										
UNSAI	15	43	Taranto											
UNCA	18	59	Carbonara			naive								
UNCA	18	60	Cagliari			naive								
UNCA	18	61	Teulada			naive								
UNCA	18	62	Toro e Vacca			naive								
UNCA	18	63	S. Antico			naive								
UNSD	18	72	Madalena											
ISMAR	8	17	Milazzo	Pre	Foglio									
	8	19	Alcidi-Filicudi	Pre	Foglio									
	8	20	Stato Eolo Enarete	Pre	Foglio									
	8	21	Marsili	Pre	Foglio									
	8	21b	Vulcano-Palmaro	Pre										
	8	22	Vavilov	Pre	Foglio									
	8	23	S. Agata											
	10	31	Capo Passero	Pre										
	10	32	Siracusa	Pre										
	16	48	Trapani											
	16	49	Oltanto											
	16	50	Lecca											
	16	51	Biridiu	Pre										
	16	52	Monopoli	Pre										
	16	53	Bari	Pre	Foglio									
16	54	Vieste	Pre	Foglio										
17	55	Tavelara												
17	56	Orosei												
17	57	Arbatax												
17	58	Costa Rei												
IAMC	6	7	Ischia	Pre	Foglio									
	6	8	Napoli	Pre	Foglio									
	6	9	Salerno	Pre	Foglio									
	6	10	Palinuro	Pre	Foglio									
	6	11	Maratea	Pre	Foglio									
	19	64	Buggeru											
	19	65	Piscinas											
	19	66	Oristano											
	19	67	Boae											
	19	68	Alghero											

All the project milestones have been timely accomplished

Nota: Qualora l'acquisizione del Foglio IAMC, ita3 (sottopila) venga anticipata al semestre precedente (per motivi di disponibilità navale), stesso avviene conseguentemente anticipare allo stesso semestre la consegna dei fogli, delle Schede e delle Note a compendio.

Nota: Foglio Ferdinandea consegna anticipata di un semestre con pagamento al 1° anno.

Non sono previste consegne di Schede e Note.

Non sono previste consegne di Schede e Note.



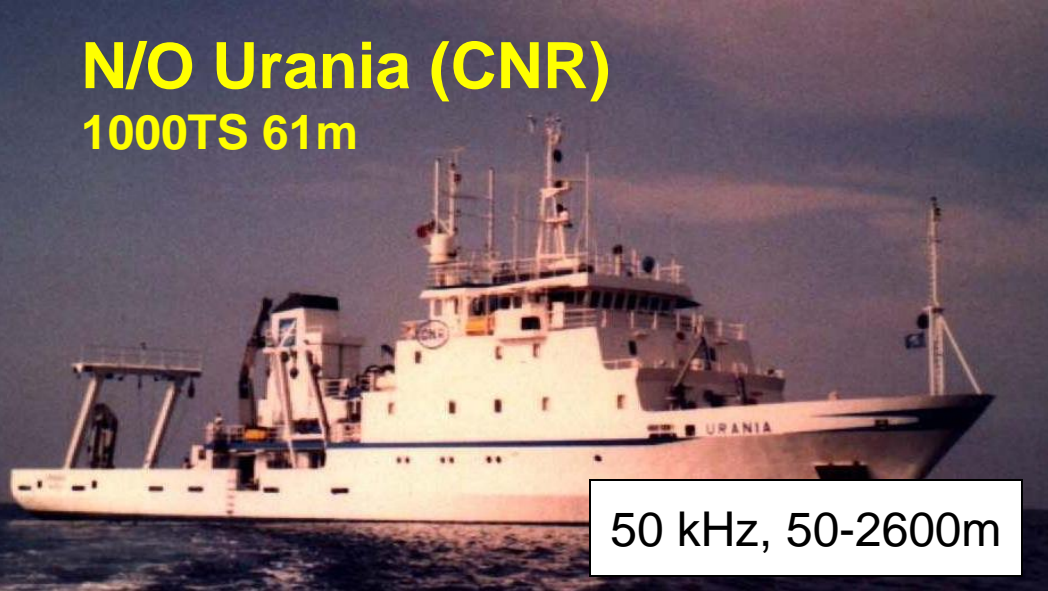
100 kHz, 25-1000 m
12-24 kHz, 100-8000 m

N/O Explora (OGS)
1400TS 72m



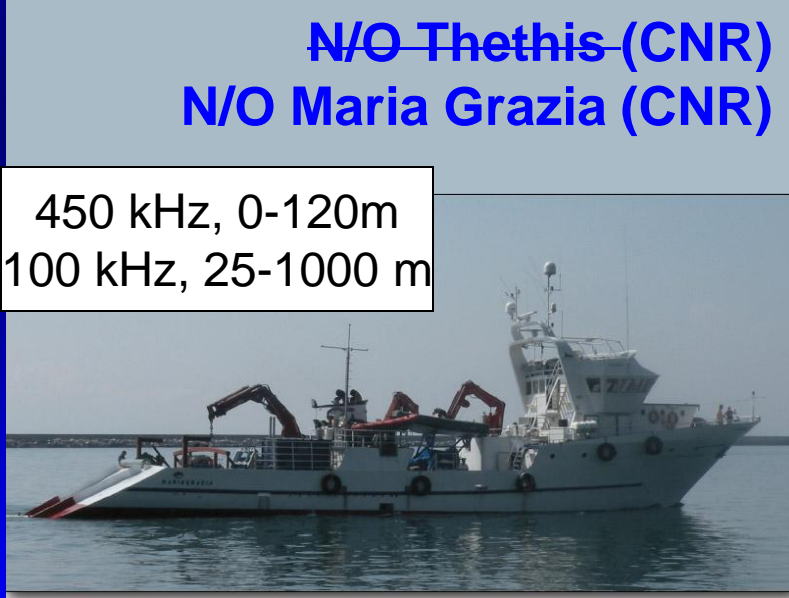
N/O Universitatis (CoNISMa)
700TS 45m

450 kHz, 0-120m
50 kHz, 50-2600m



N/O Urania (CNR)
1000TS 61m

50 kHz, 50-2600m



N/O Thethis (CNR)
N/O Maria Grazia (CNR)

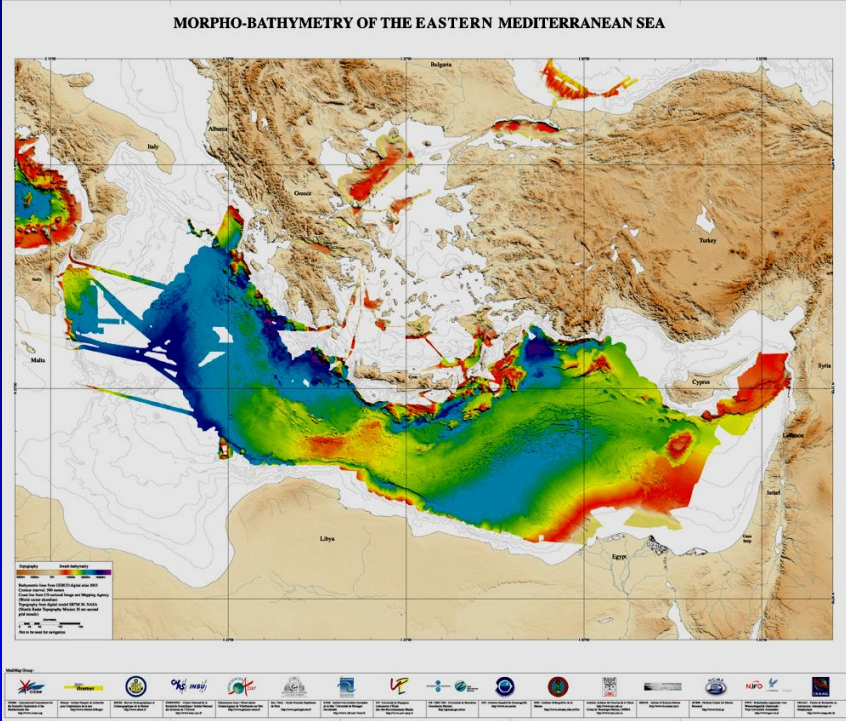
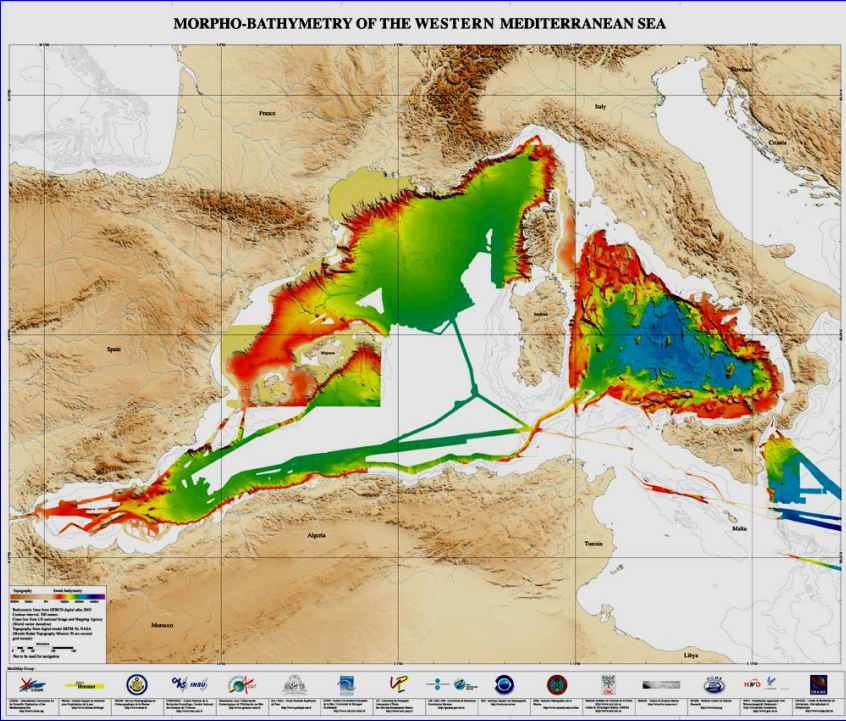
450 kHz, 0-120m
100 kHz, 25-1000 m

500 ship-days

THE COST (per km²) IS WATER DEPTH DEPENDENT

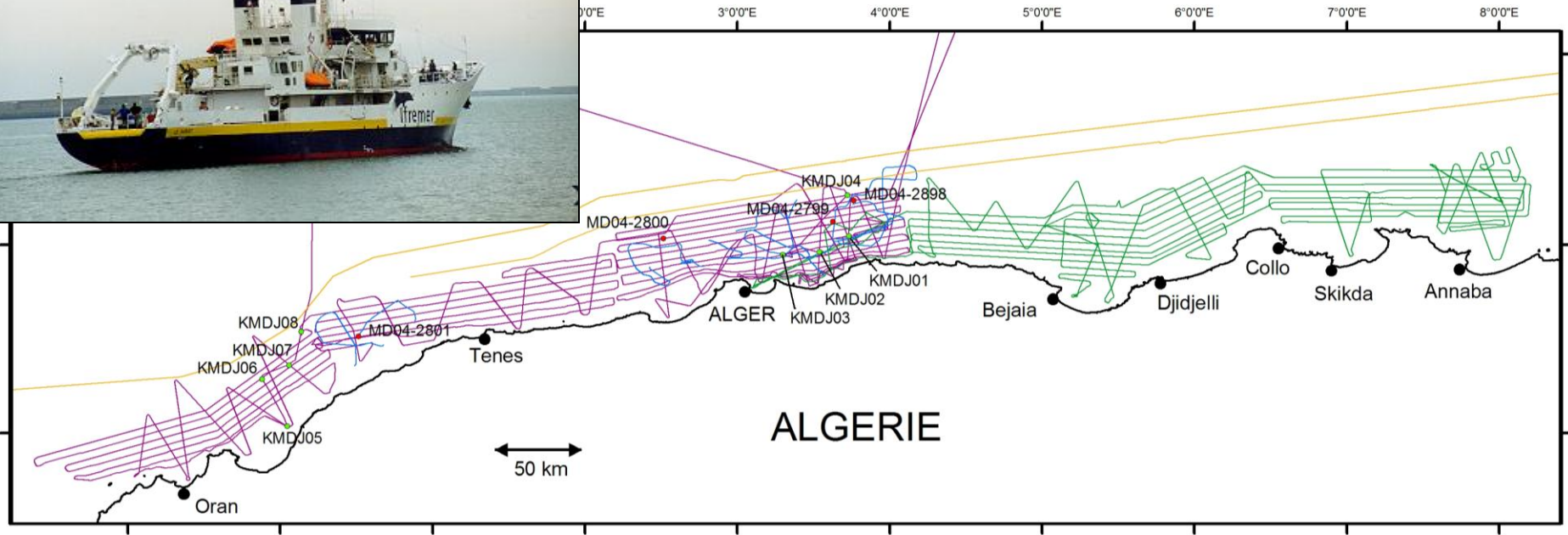
MEDIMAP/CIESM

Ifremer-Brest
ISMAR-CNR Bologna
CNRS-Insu
Universitat de Barcelona
Universitat de Madrid
Universidad de Granada
Universiteit Amsterdam3
Unitat de Tecnologia Marina, CMIMA/CSIC,
Barcelona.

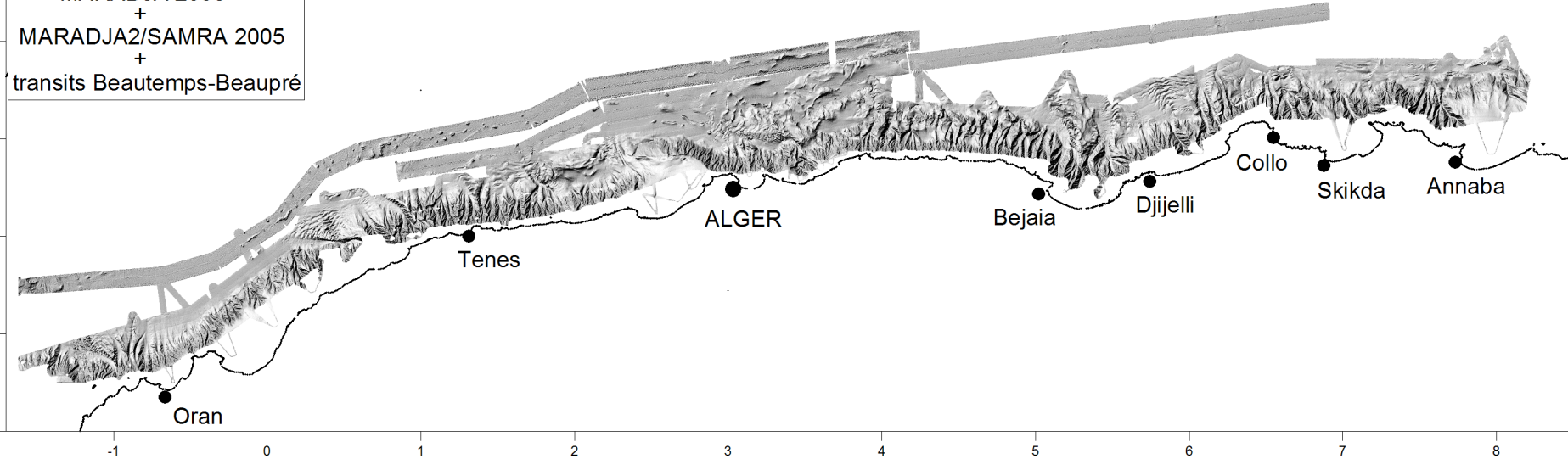


Eurostrataform, Eurodelta and Eurodom
ESF Eurocores projects
West-Med and Spacoma
Spanish RTD projects
Grandes and Prodelta

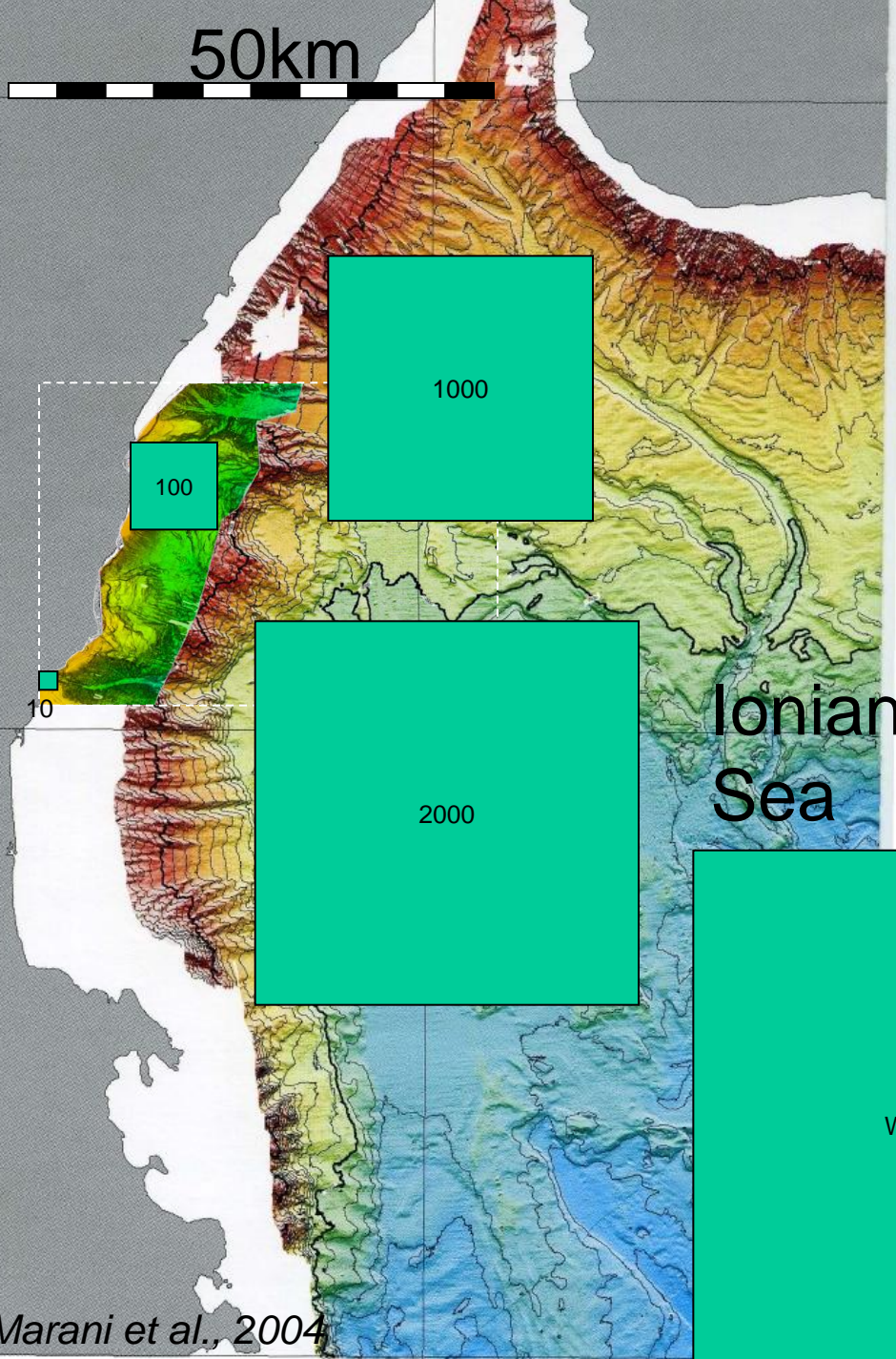
Algeria: Cruises MARADJA 2003 - 2005



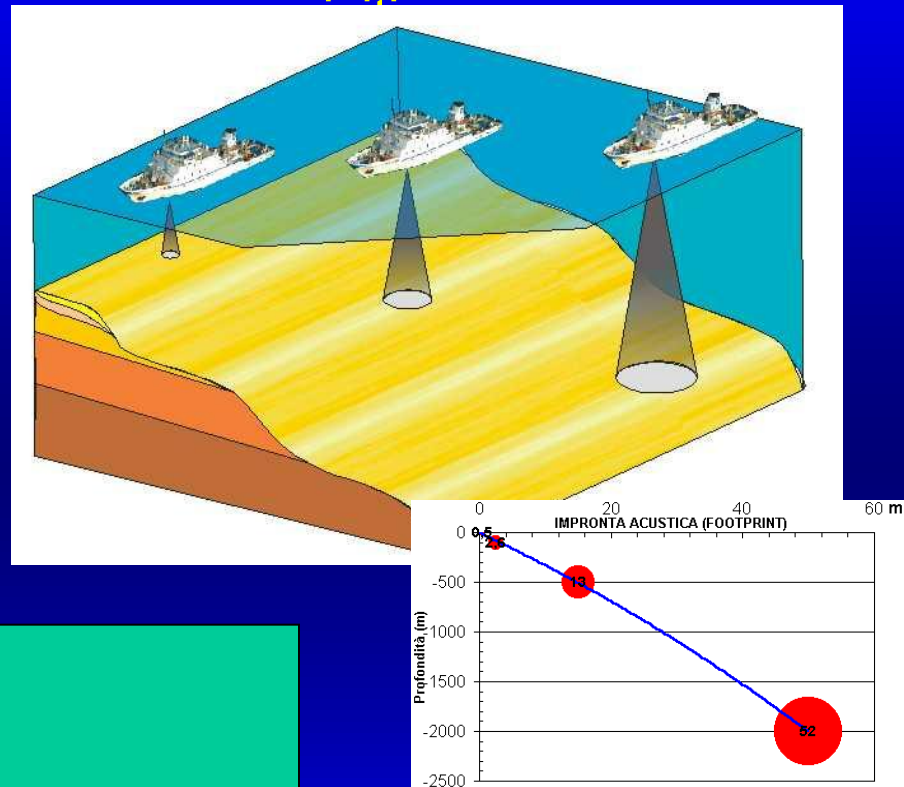
MARADJA 2003
+
MARADJA2/SAMRA 2005
+
transits Beautemps-Beaupré

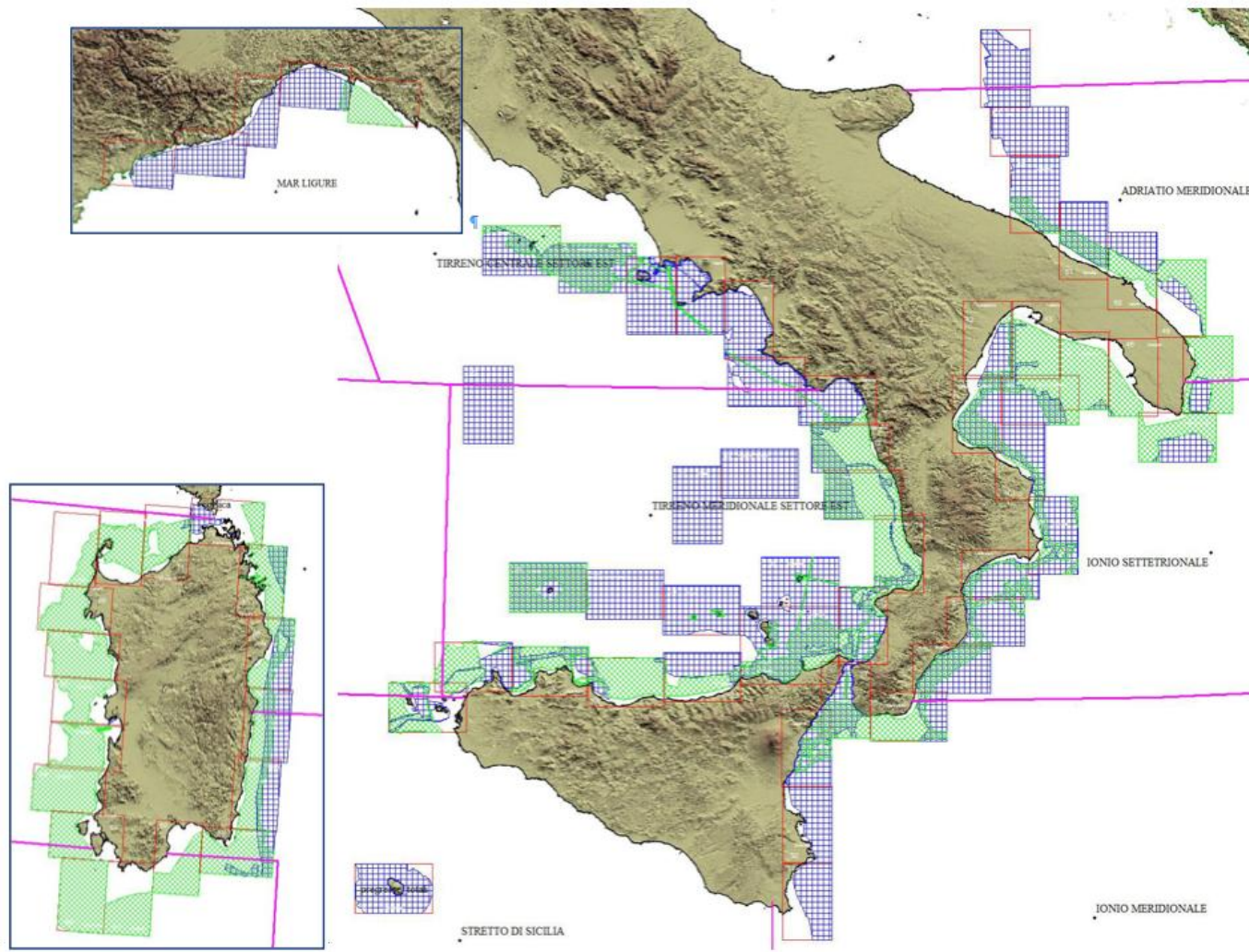


50km



Seafloor coverage
for one shiptime day
(24h) of data

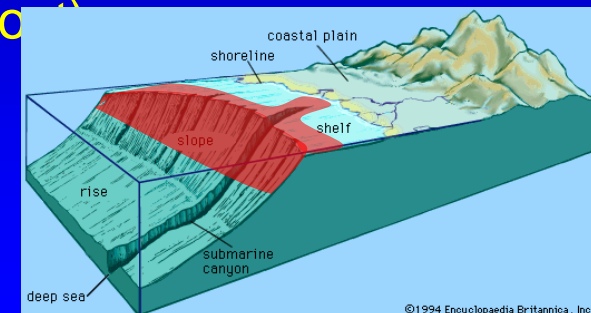




Therefore MaGIC project acquired data along the continental margins, with a reference depth range 50-500.

It can be extended to deeper water if time allows (low-cost) and to shallow water if needed (e.g. canyon head)

It can be narrowed to outer shelf if not relevant features are present



Goals of MaGIC project:

INTEREST FOR CIVIL PROTECTION

FALL OUT FOR SCIENTIFIC RESEARCH

1) To realise the Map of Geohazard features of the Italian Seas (72 sheets, 1:50.000)

To identify areas with high risk, hypothesise causes and manage operations during emergencies, land planning (?)

Understand, by comparing features and interpretations, mass wasting processes in our tectonically active country



2) To create a high-resolution bathymetric database

Managing emergencies understanding of what happened

Triplication of the amount of multibeam data acquired until now, needed base for any scientific study



3) To create a database of maps from scientific literature (infor.mare sub-project)

Quick identification of state of knowledge and competencies in a given area

Previous knowledge synthesis tool



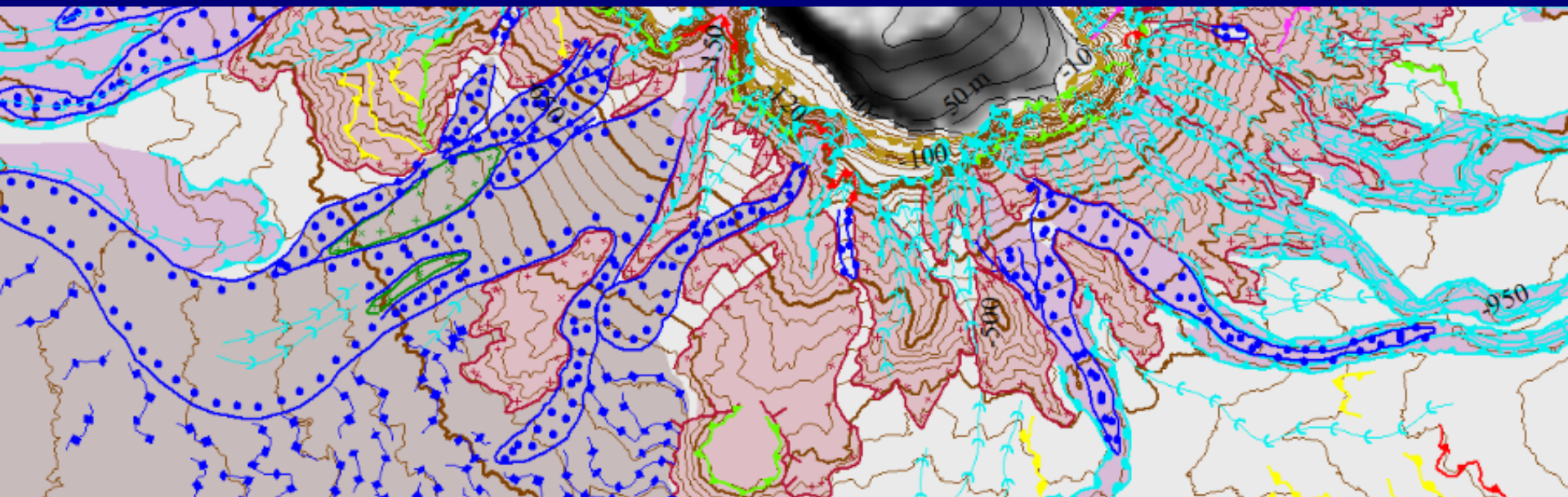


“Map of Geohazard Features of the Italian Seas”

How do we define criteria of objective interpretation and homogenous representation independent from context an interpreter experience?

How do we identify geohazards from only multibeam morphology (i.e. possibly ignoring the real genesis of some/most of the features)?

Solution: to map ALL and ONLY features having morphobathymetric expression



Criteria of representation of geohazard features of the Italian Seas

1 - show all the available information, maintaining a good readability of the map in terms of geohazards

2 - set up criteria to define, identify and map geohazard features homogeneously

3 - establish a hierarchy among the information, trough different mapping levels

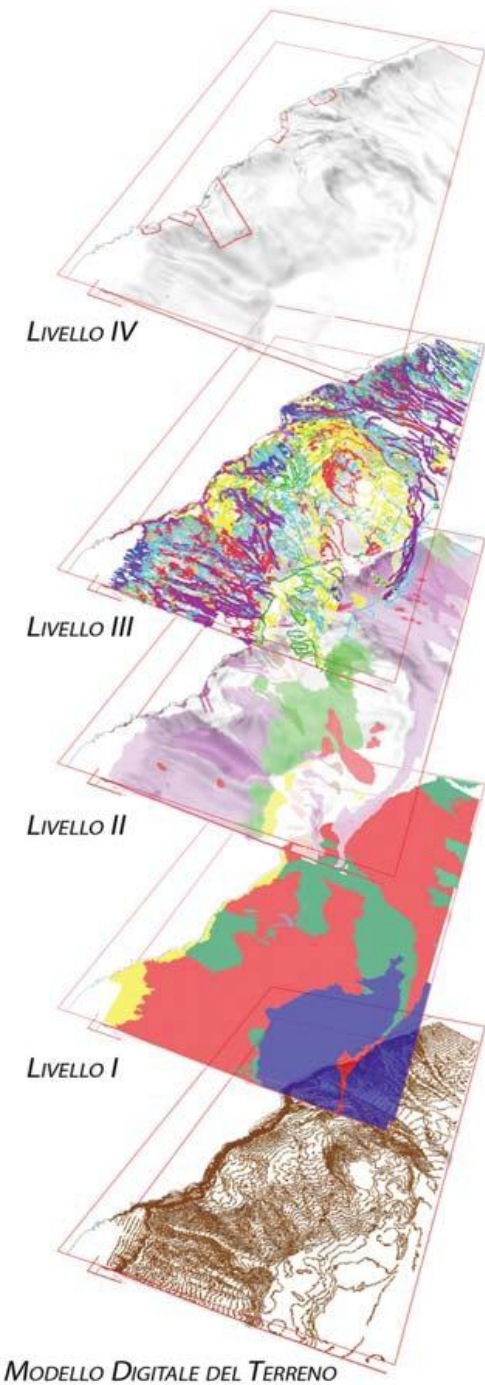
FOUR LEVEL REPRESENTATION

1st Physiographic domains (1:250.000 areas)

2nd Morphostructural units (1:50.000 areas + database)

3rd Morphologic features (1:50.000 vectors)

4th Critical points (detailed scale - variable highlights)



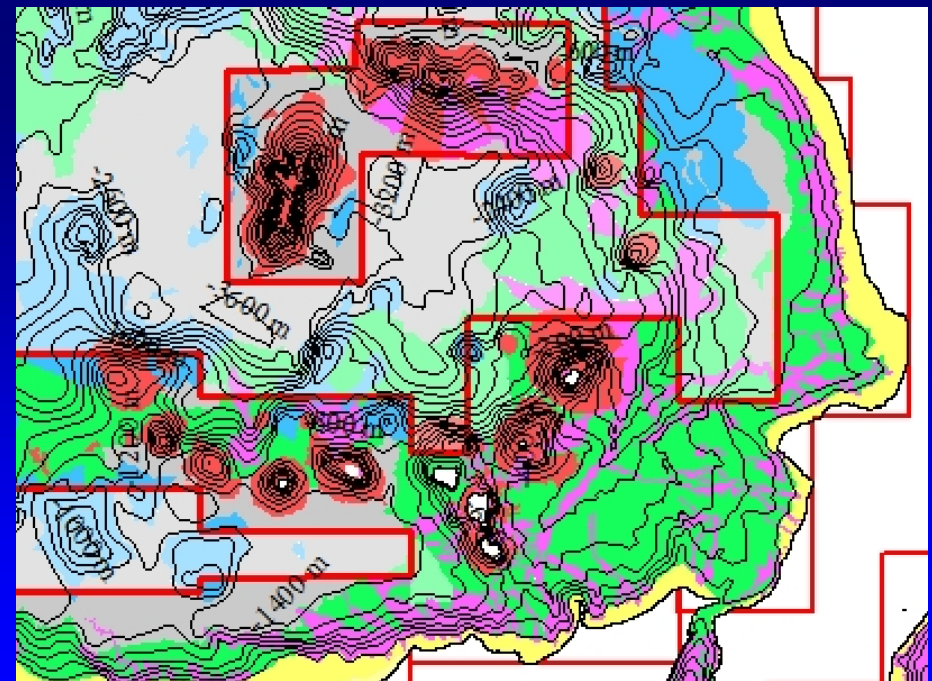
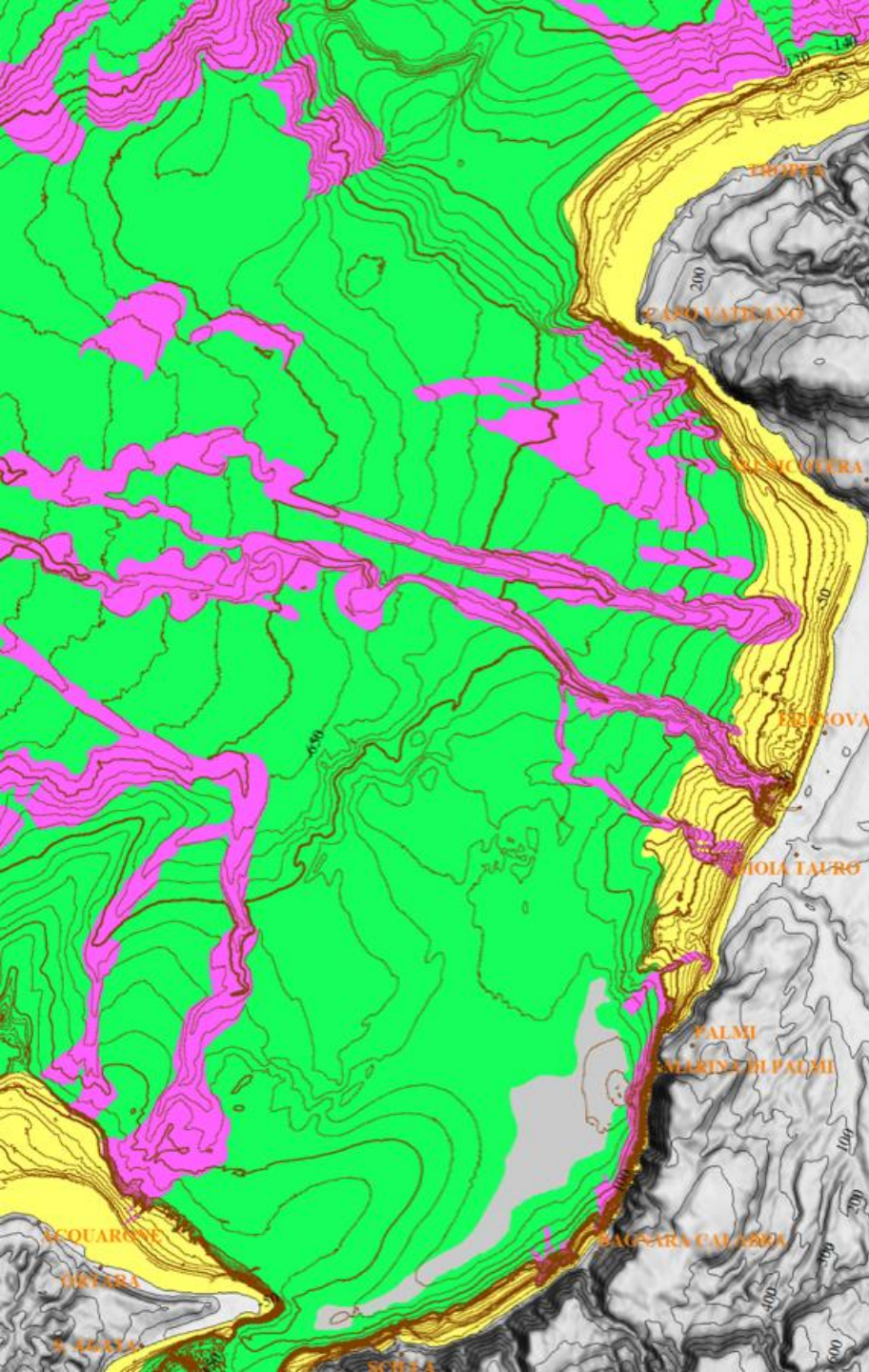
FOUR LEVEL REPRESENTATION

1st Physiographic domains
(1:250.000 areas)

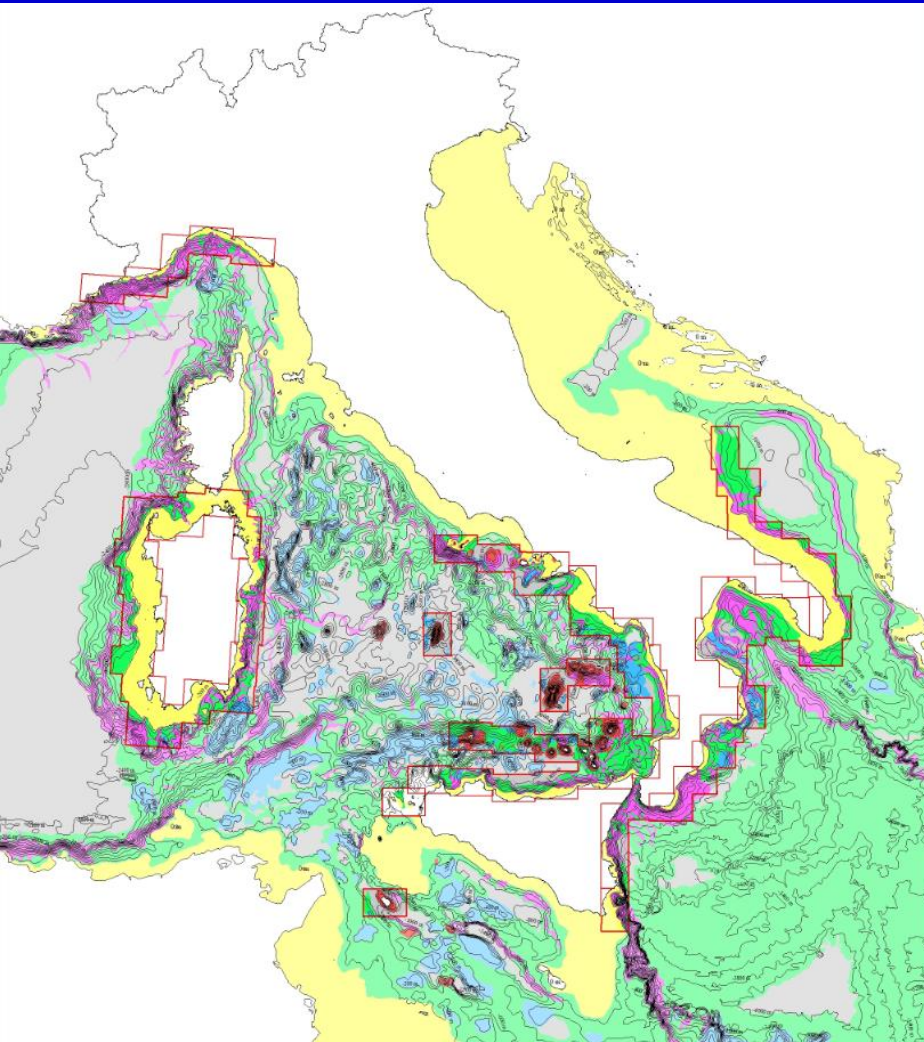
2nd Morphostructural units
(1:50.000 areas + database)

3rd Morphologic features
(1:50.000 vectors)

4th Critical points
(detailed scale - variable
highlights)



Map of the physiographic domains of the seas surrounding Italy 1:250.000 scale



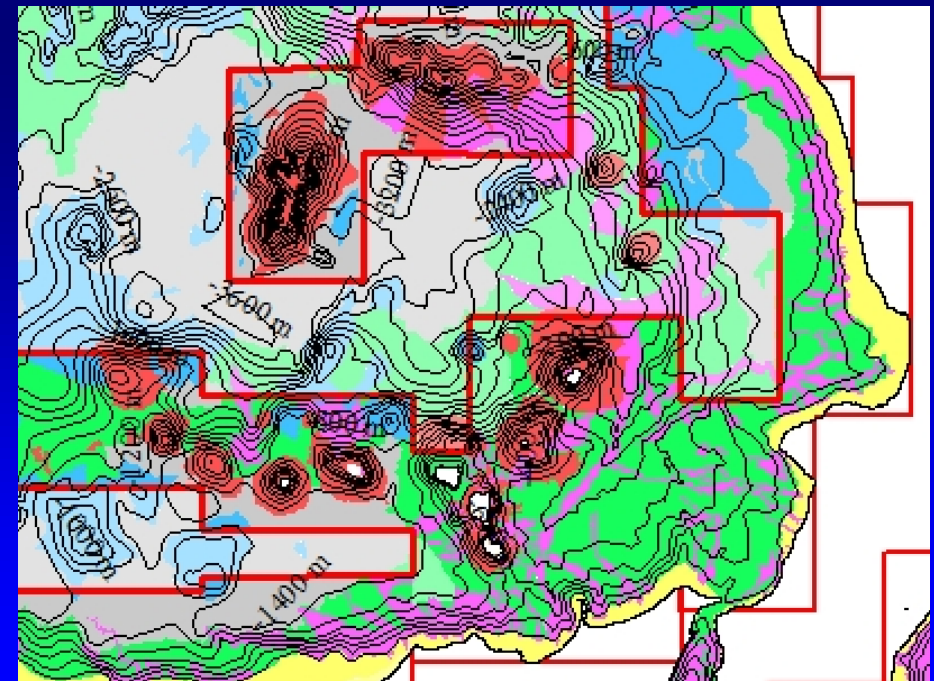
FOUR LEVEL REPRESENTATION

*1st Physiographic domains
(1:250.000 areas)*

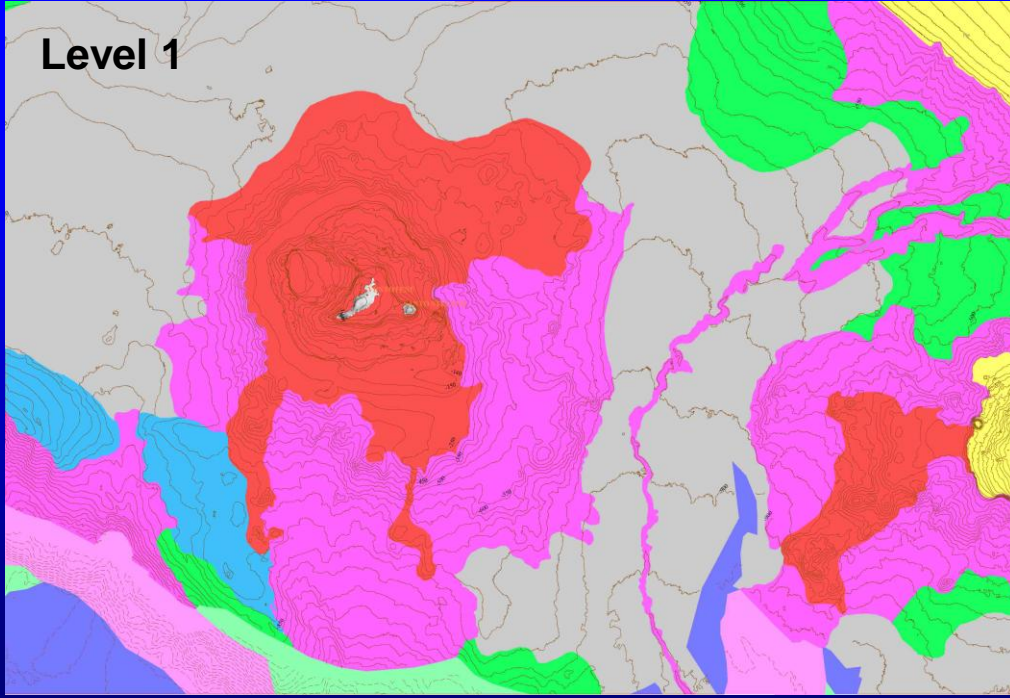
*2nd Morphostructural units
(1:50.000 areas + database)*

*3rd Morphologic features
(1:50.000 vectors)*

*4th Critical points
(detailed scale - variable
highlights)*



Level 1



FOUR LEVEL REPRESENTATION

1st Physiographic domains
(1:250.000 areas)

2nd Morphostructural units
(1:50.000 areas + database)

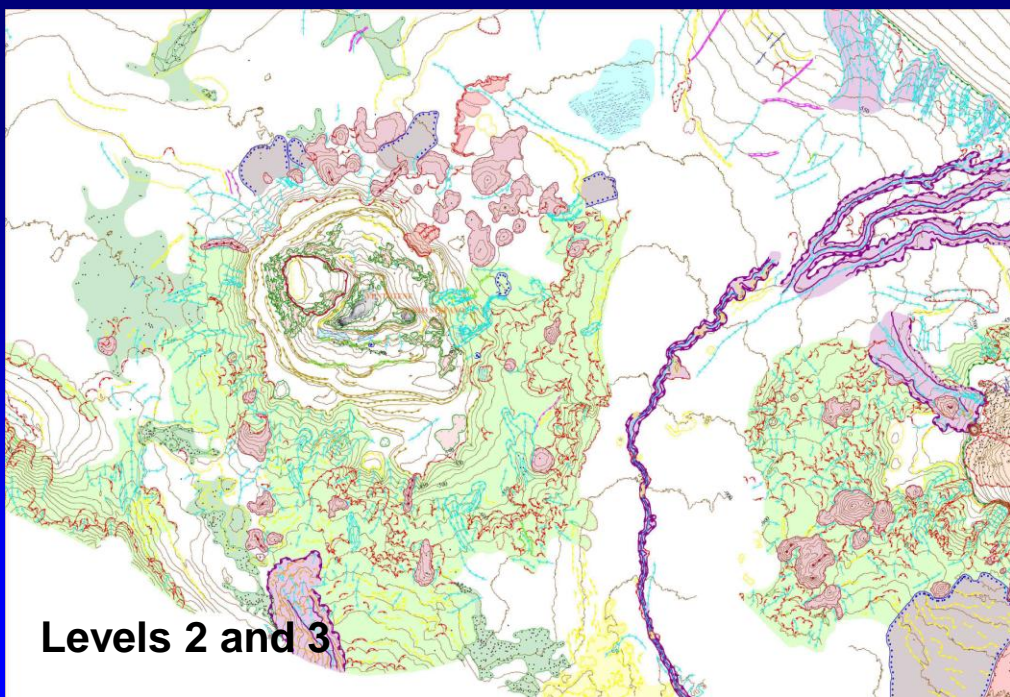
3rd Morphologic features
(1:50.000 vectors)

4th Critical points
(detailed scale - variable
highlights)

Represented as color areas in
1:50.000 maps

+ accompanying morphometric sheet
for each unit

Levels 2 and 3



Erosional Channels and Canyons (CCE)

Single Slide (FRS)

Widespread Erosion Area (ERD)

Erosional Amphitheatre Thalweg (TAE)

Bedform Area (FOF)

Fluid Escape Area (FUF)

Unchannelised Flux Area (FNC)

Rocky bedrock Area (ASL)

Volcanic bedrock Area (AFV)

Tectonic Line (LIT)

3rd Level - Morphobathymetric elements (EM)

LEGENDA

1.1 Ciglio di Erosione Generica		1.17 Bordo di Thalweg di Canale Secondario o Semplice		4.1 Rilievo di Origine Incerta	
1.2 Ciglio di Nicchia di Frana Semplice		1.18 Bordo di Thalweg di Canyon		4.2 Depressione di Origine Incerta	
1.3 Area di Traslazione		1.19 Letto di Canale a Profilo Arrotondato		4.3 Pockmark/Area a	
1.4 Ciglio di Nicchia di Frana Complessa		1.20 Letto di Canale Con Profilo a V		4.4 Area ad Espulsione di fluidi	
1.5 Ciglio di Nicchia di Frana Intracanalale		2.1 Solco Erosivo		4.5 Vulcano di fango/Area a	
1.6 Bordo di Canyon		2.2 Area a Depressioni Erosive		4.6 Diapiro di fango/Area a	
1.7 Bordo di Area a Erosione Diffusa		2.3 Duna (Cresta/Area a)		4.7 Area con Fessure di Trazione	
1.8 Ciglio di Canale Secondario o Semplice		2.4 Area a Megaripple		4.8 Cresta di Pieghe di Compressione/Area a	
1.9 Ciglio di Canale con Argine		2.5 Onda di Sedimento (Cresta/Area a)		4.9 Area con Deformazioni da Creep	
1.10 Ciglio di Terrazzamento Intracanalale		2.6 Impronte da Ostacolo		4.10 Cresta (lama, arrotondata)	
1.11 Ciglio di Gradino Intracanalale		3.1 Deposito Intracanalale		4.11 Substrato Litoide Affiorante	
1.12 Ciglio di Terrazzo deposizionale		3.2 Deposito da Flusso Gravitativo non Canalizzato		4.12 Substrato Vulcanico Affiorante	
1.13 Ciglio di Scarpata di Faglia		3.3 Corpo di Frana a superficie regolare		4.13 Blocostruzione	
1.14 Ciglio Indefinito		3.4 Corpo di Frana a Hummocky/Area a		4.14 Centro Ertuttivo (certo/incerto)	
1.15 Ciglio di Piattaforma Continentale		3.5 Corpo di Frana a Blocchi/Area a			
1.16 Base di Scarpata		3.6 Colata Lavica			

FOUR LEVEL REPRESENTATION

1st Physiographic domains

(1:250.000 areas)

2nd Morphostructural units

(1:50.000 areas + database)

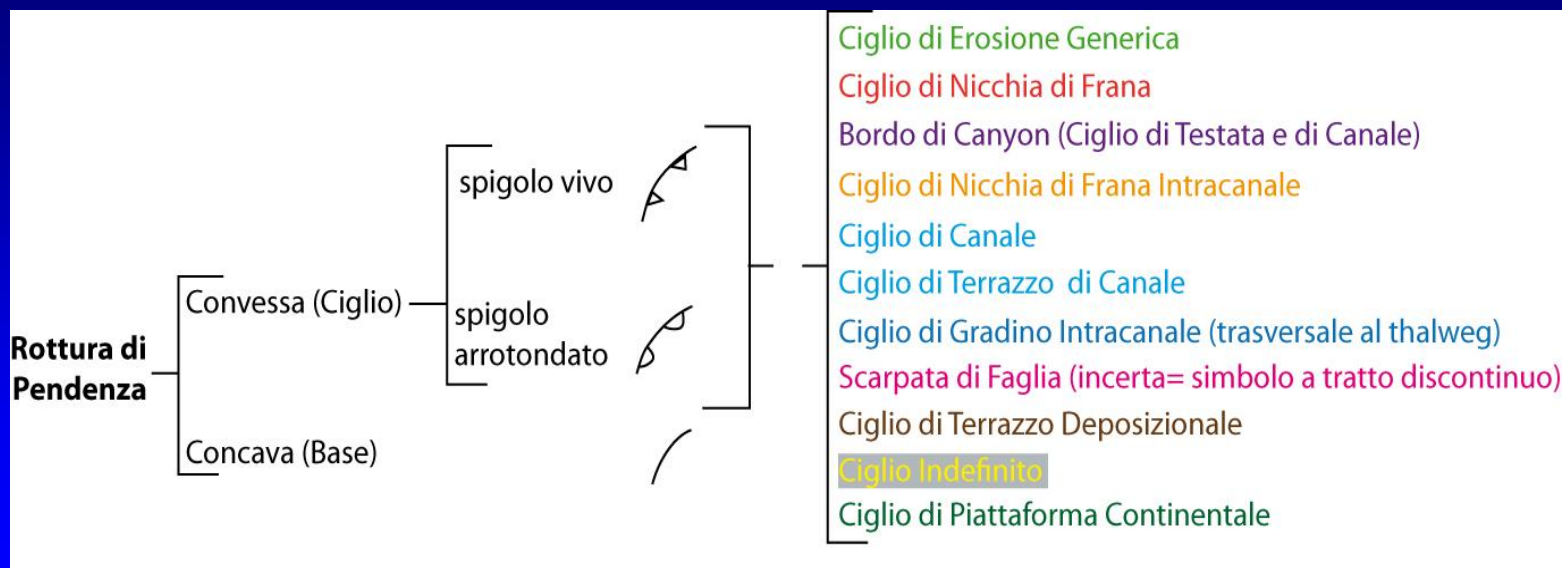
3rd Morphologic features

(1:50.000 vectors)

4th Critical points

(detailed scale - variable

highlights)



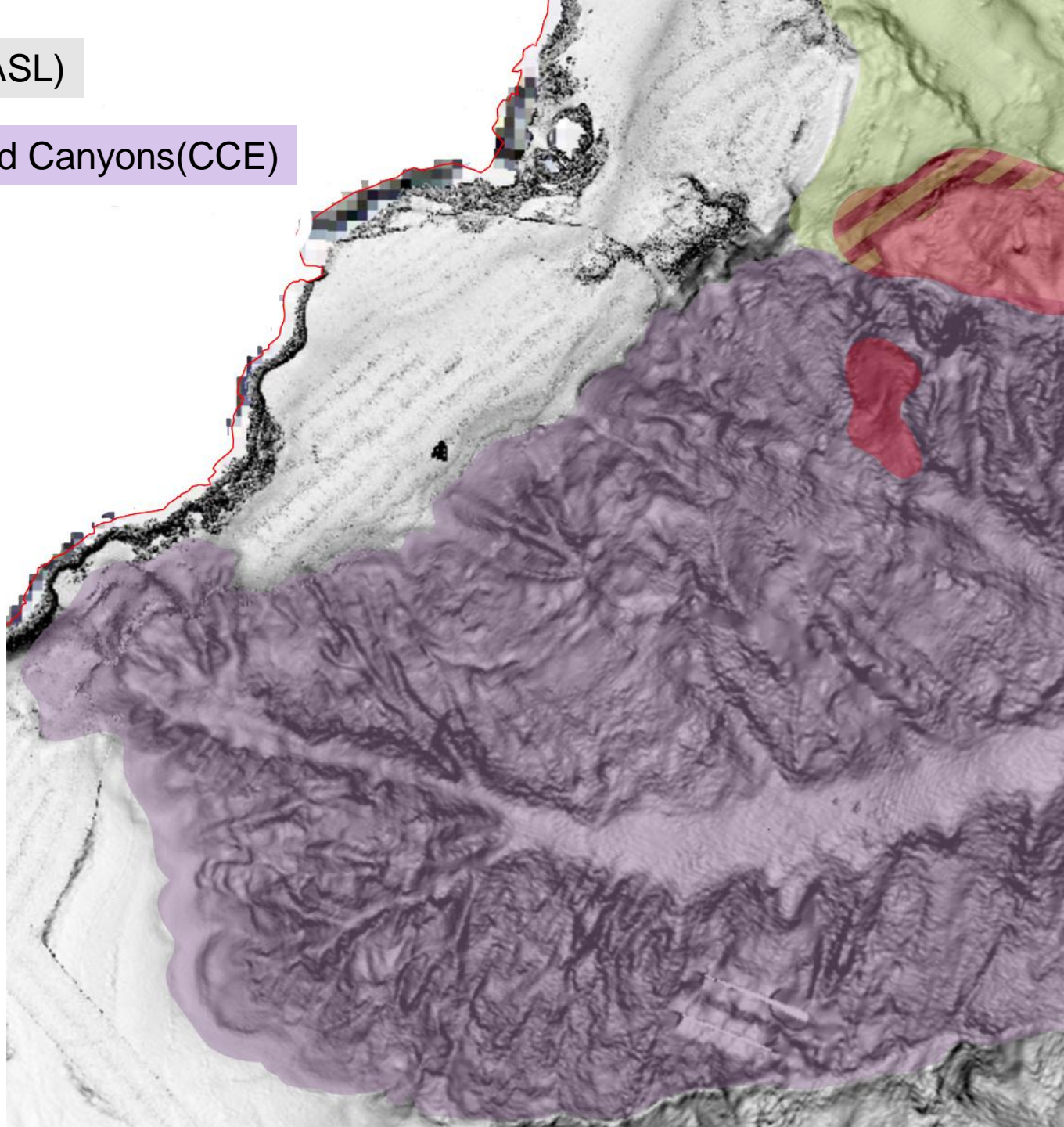
Rocky Bedrock Area (ASL)

Erosional Channels and Canyons(CCE)

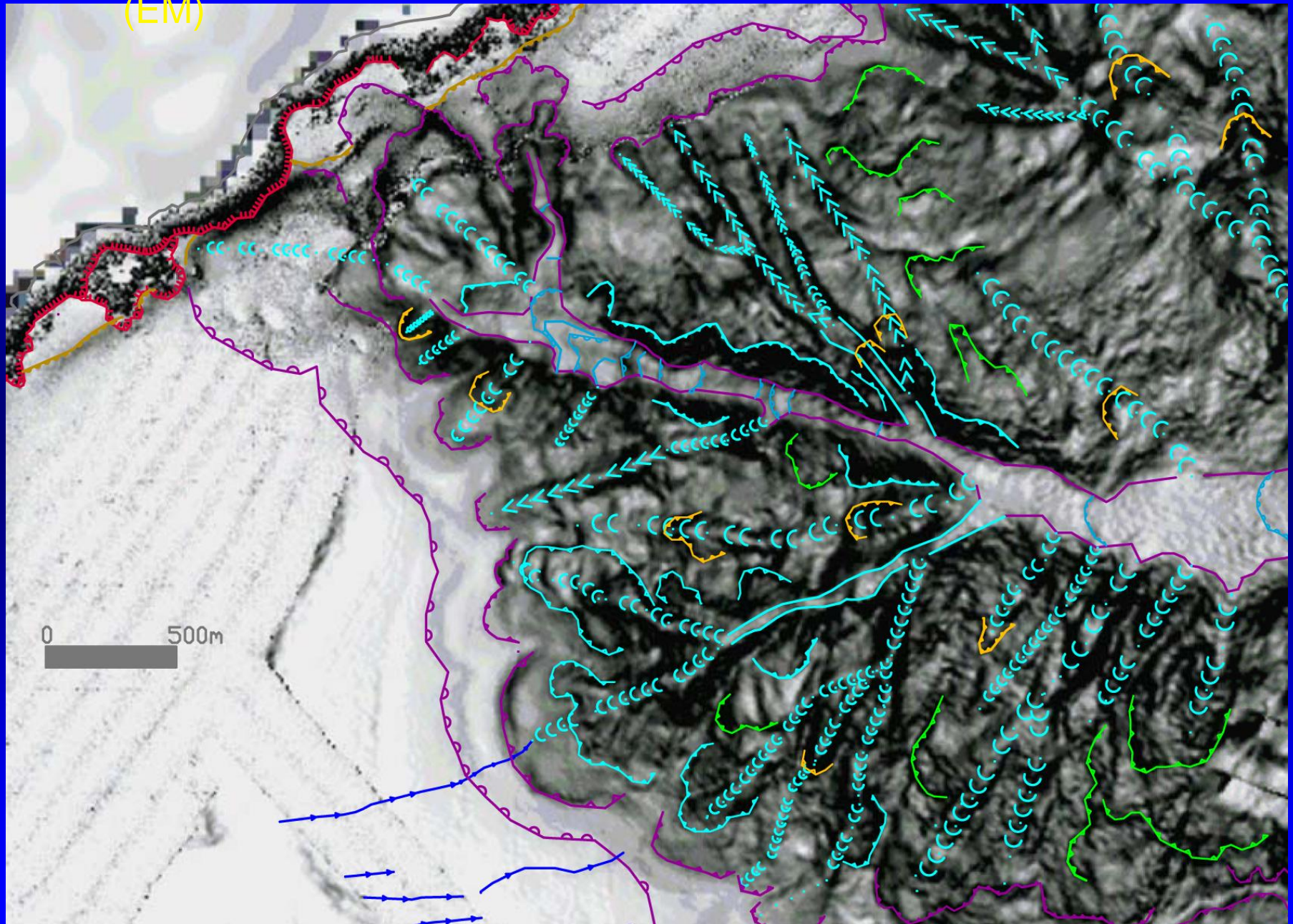
Single Slide (FRS)

Sheet 33
(Catania)

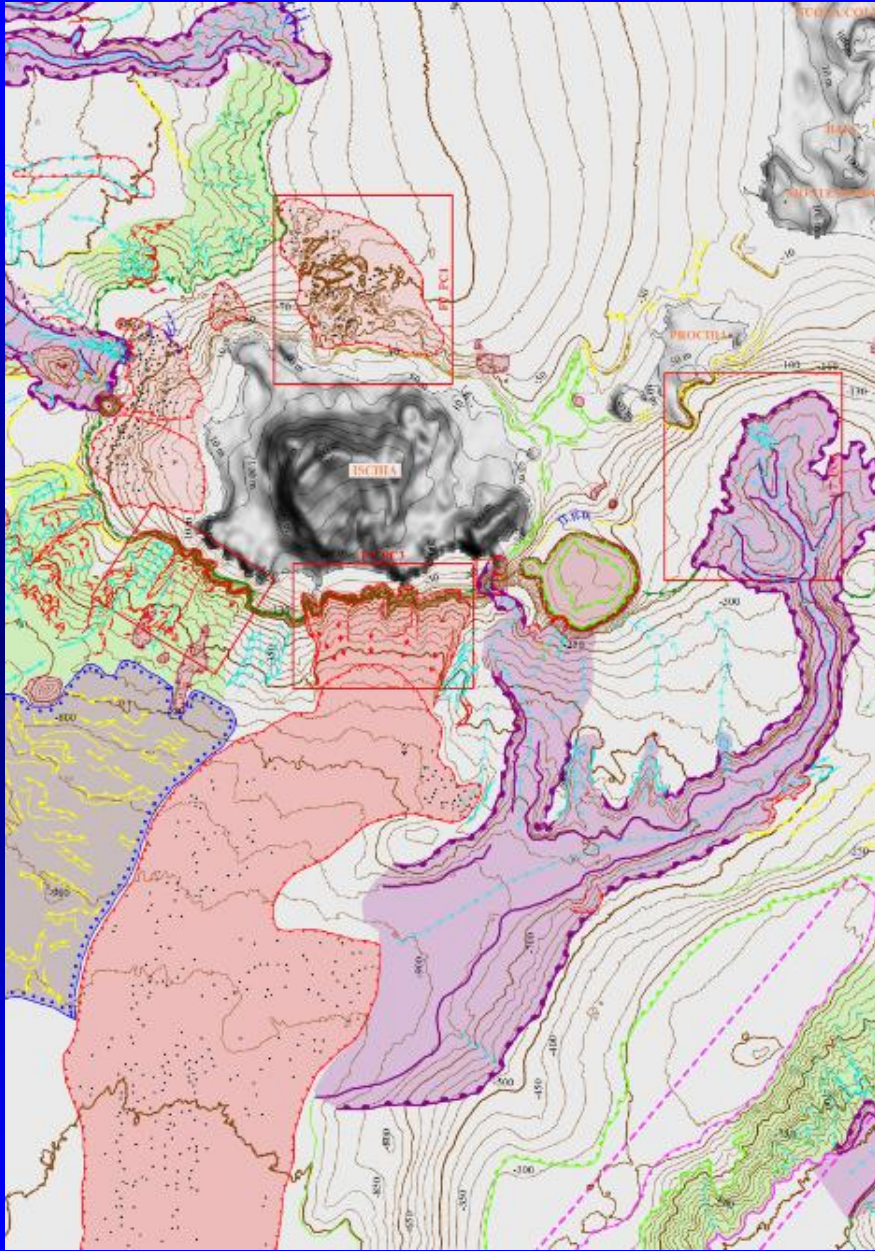
1 km



Sheet 33 (Catania): 3rd Level - Morphobathymetric elements (EM)



4th Level : Critical Point (PC)



FOUR LEVEL REPRESENTATION

1st Physiographic domains
(1:250.000 areas)

2nd Morphostructural units
(1:50.000 areas + database)

3rd Morphologic features
(1:50.000 vectors)

4th Critical points
(detailed scale - variable
highlights)

Represented as
boxes in 1:50.000
maps and described
in monographs

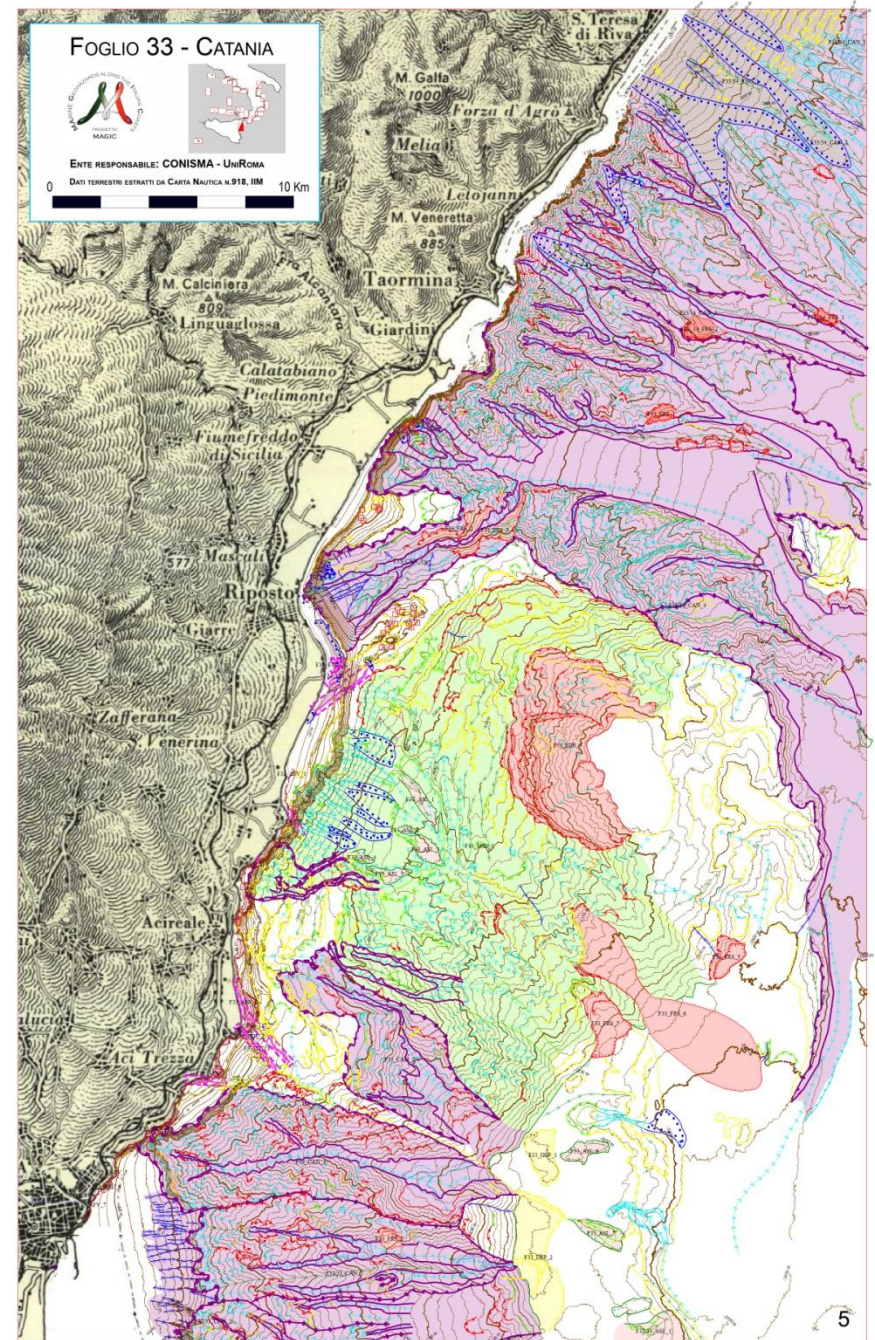
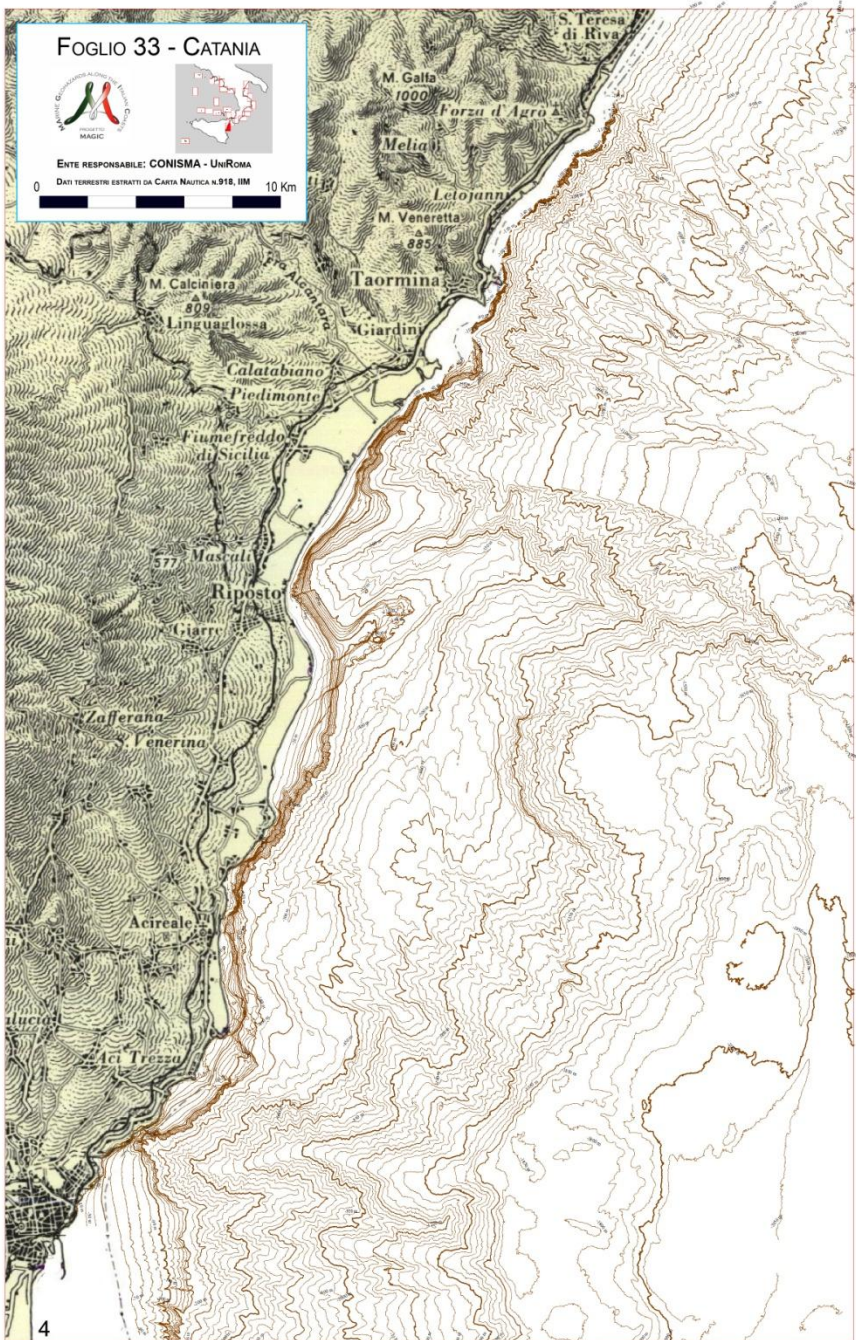


DATA OUTREACH

The final report has been delivered to Civil Protection Department and will be publicised to governmental authorities in mid-October

An Atlas is expected to be published by 2014, to spread the result obtained by MaGIC project over the scientists, end users and general public. Probably it will be presented on a devoted session at the Congress of the Italian Geological Society on Sept. 2014

This is the draft of the Atlas



Descrizione del foglio

plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto,,

plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto, plutoPippoo, pippol, pluto,,

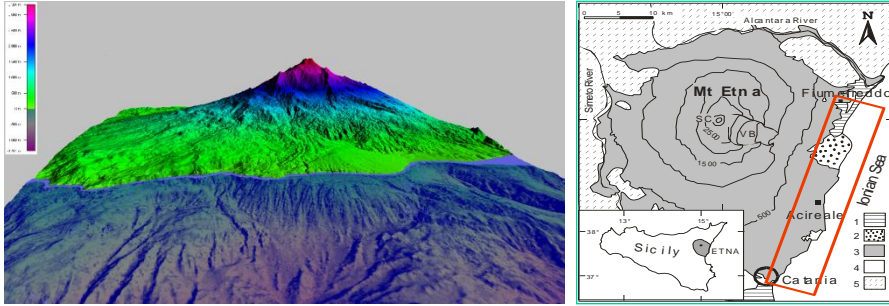


Fig. 1 a) Etna on-shore ed off-shore. b) Schema Geologico della regione dell'Etna che mostra faglie e sismicità della regione. (Brumetti et al., 2007).

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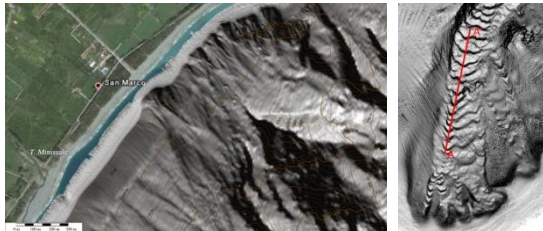


Fig. 2 PC1_F33 - a) Erosione del terrazzo deposizionale sommerso da parte di nicchie di distacco alla testata del canale di Fiumefreddo di Sicilia. Equidistanza contour 10 m; b) Dettaglio delle frane antistanti S. Marco. Es. Vert. 3X. B) Sezione lungo l'asse del canale di Praialonga

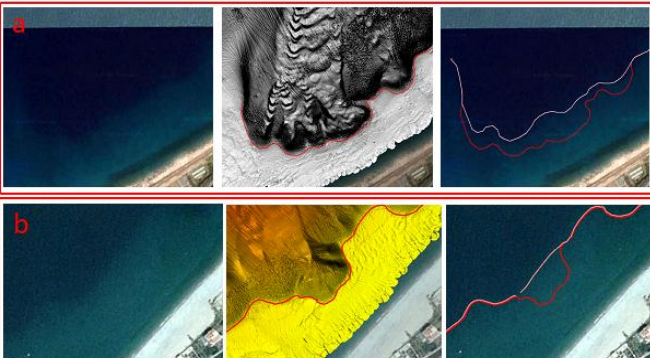


Fig. 3 PC3_F15 - Arretramento del ciglio della testata dei canali erosivi. Il confronto multitemporale tra le foto aeree e rilievi batimorfologici ha rivelato la presenza di fenomeni erosivi diffusi, costituiti da nicchie di distacco di piccole dimensioni del tutto simili per forme e dimensioni a quelle individuate nel canale di Marinella di Bagnara. a) Arretramento del margine meridionale della testata del canale di Praialonga, ubicazione rettangolo blu in Fig. 1 PC3_F15.

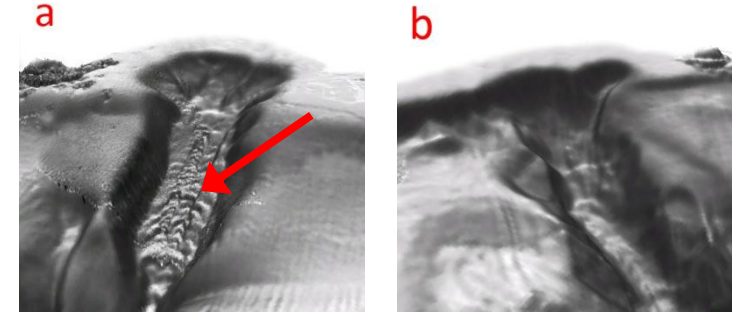


Fig. 4 PC1_F15 - Superfici 3D della testata meridionale (a, per la localizzazione rettangolo rosso in Fig.1 PC1_F15) e settentrionale (b, per la localizzazione rettangolo verde in Fig.1 PC1_F15) del canyon di Gioia (EV 3X).

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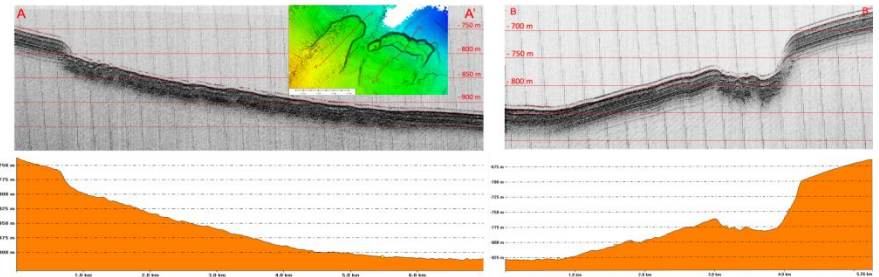


Fig. 5 PC4_F15 - Profili sismici longitudinali alla frana F1 (sinistra) e F2 (destra).

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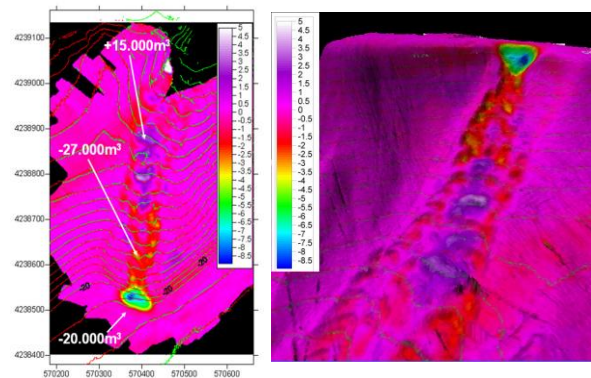


Fig. 6 PC2_F15 - Mappa dei residui batimetrici, in pianta e in visione prospettica relativa alla testata del canale di Marinella di Bagnara. Risulta evidente la nicchia di distacco (dal verde al blu) avvenuta a poche decine di metri dalla linea di costa. Per la localizzazione rettangolo rosso in Fig. 1 PC2_F15

MAGIC project: *M*arine *G*eohazard along the *I*talian *C*oasts

Results (direct)

Some 20.000 nautical miles of existing multibeam data recovered and reprocessed (if possible)

More than 40.000 nautical miles of MB data acquired during >500 ship working days

72 Sheets (1:50.000, A0 format) of the “*Map of Geohazard Features of the Italian Seas*” have been produced (4 interpretative levels)

Nearly 8.000 maps present in scientific/technical literature have been classified, georefernced and made available in the web-GIS “infor.mare” sub-project

Results (indirect)

Creation of a large base of bathymetric data that will be used for any civil protection operation and will highlight future variation at the seafloor

Increase in our knowledge of events/processes occurring at the seafloor, by extensive data comparison and repetition of survey trough time on key areas

Spread over among the Italian Marine Geology research community competencies on multibeam data acquisition, processing and interpretation

Promote marine geology studies on the Italian Seas especially among young fellows

Create a collaborative approach among the marine geology research community, to answer needs and opportunities at national and international level

Thank you for your
attention

