Geologic evolution of the Calabrian accretionary prism

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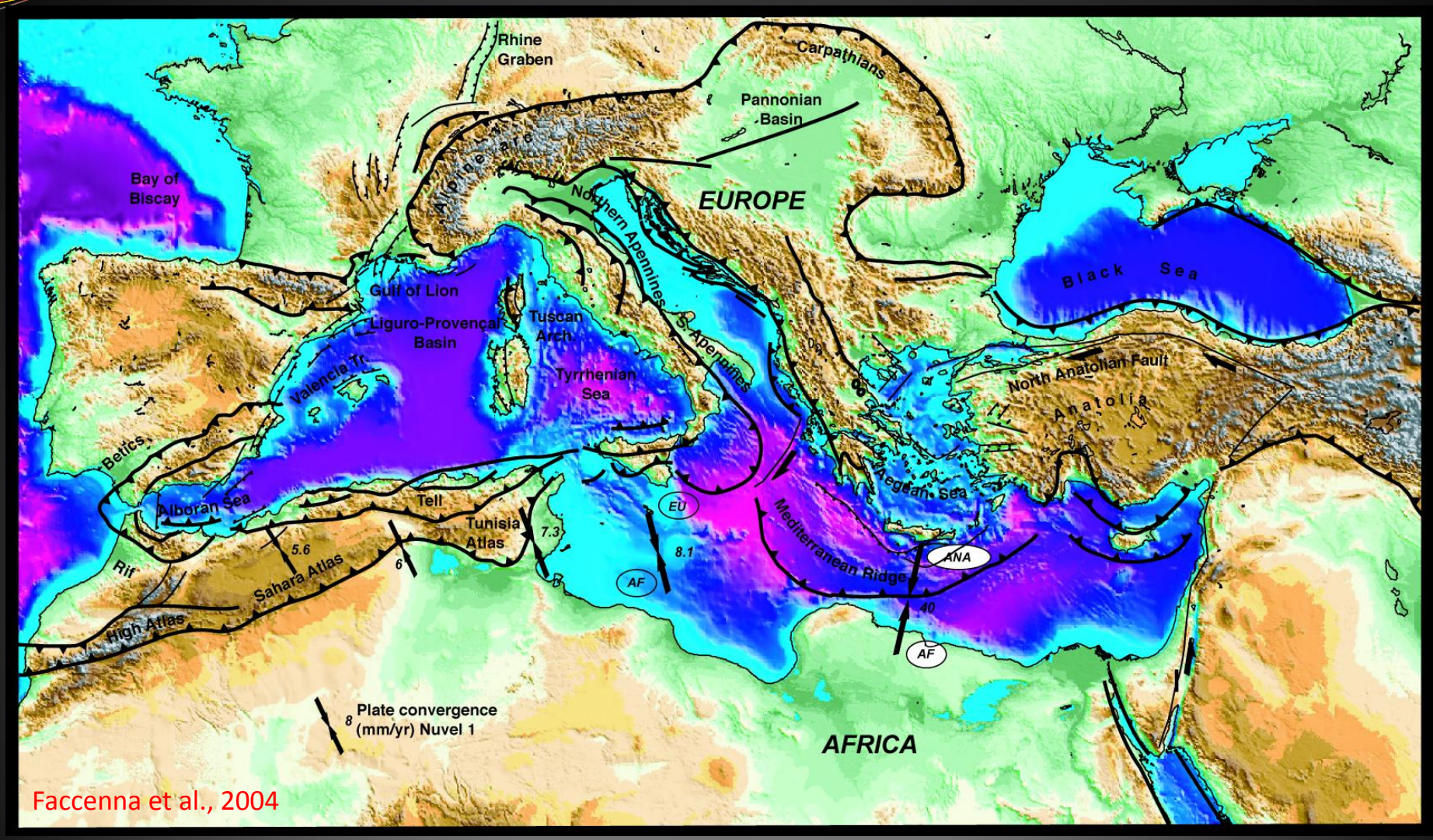
1. GEODYNAMIC BACKGROUND

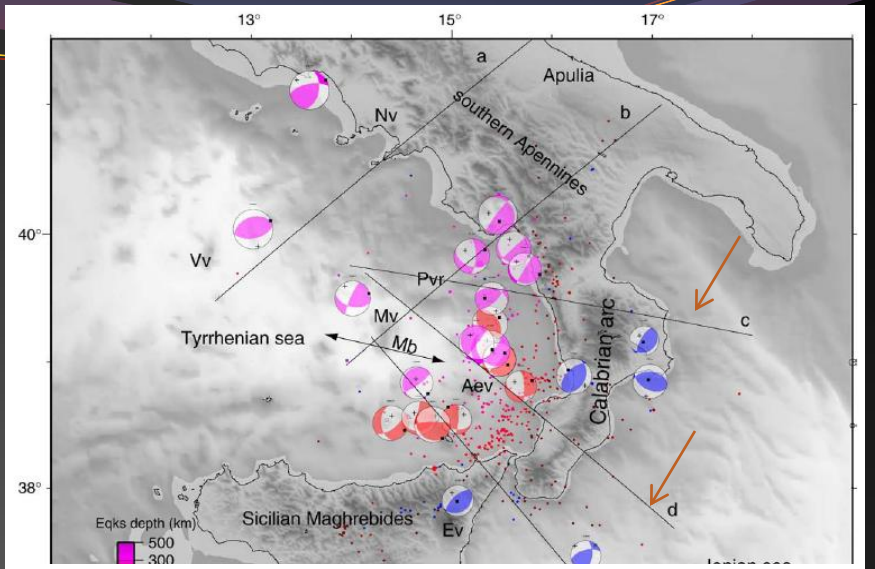


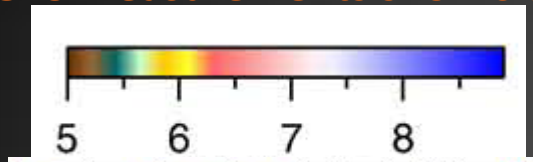
Faccenna et al., 2004

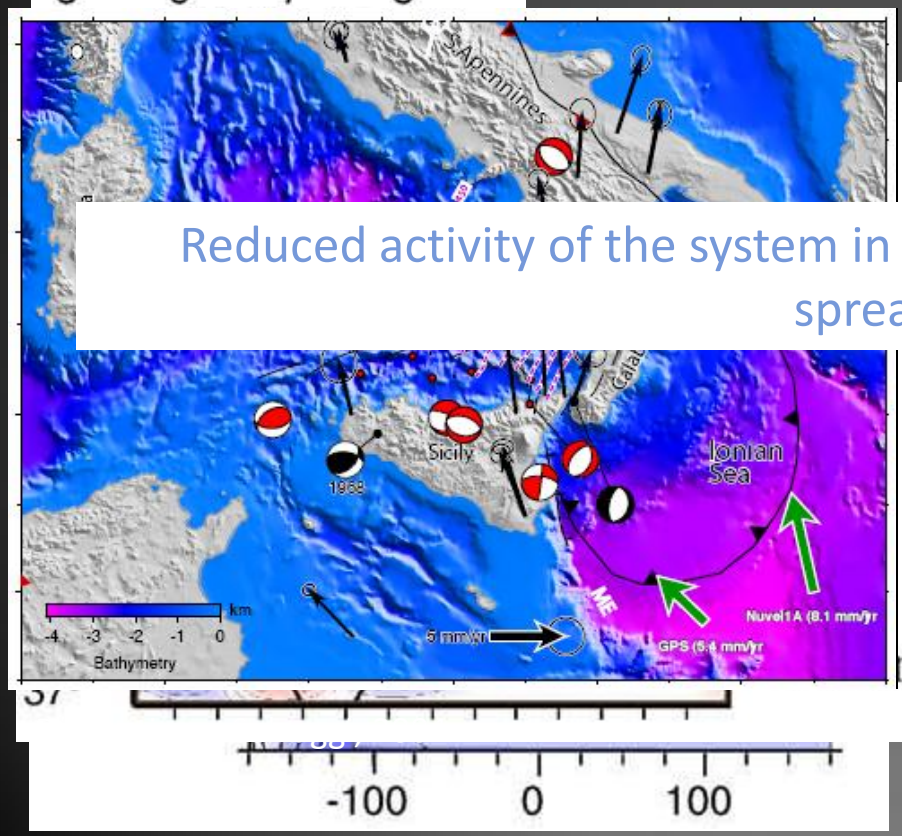
1. GEODYNAMIC BACKGROUND

- Earthquake distribution and tomographic images show NW dipping slab, affected by slab windows beneath the Southern Apennines

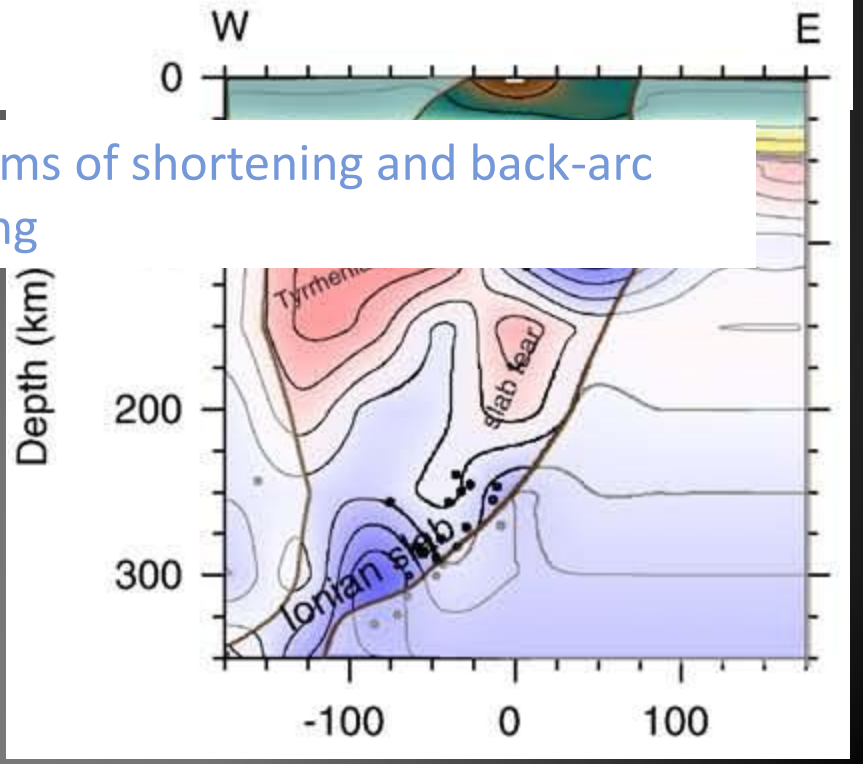
-GPS measurements show slow subduction rate





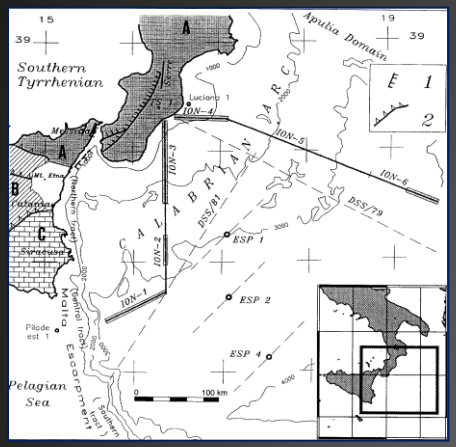


Reduced activity of the system in terms of shortening and back-arc spreading

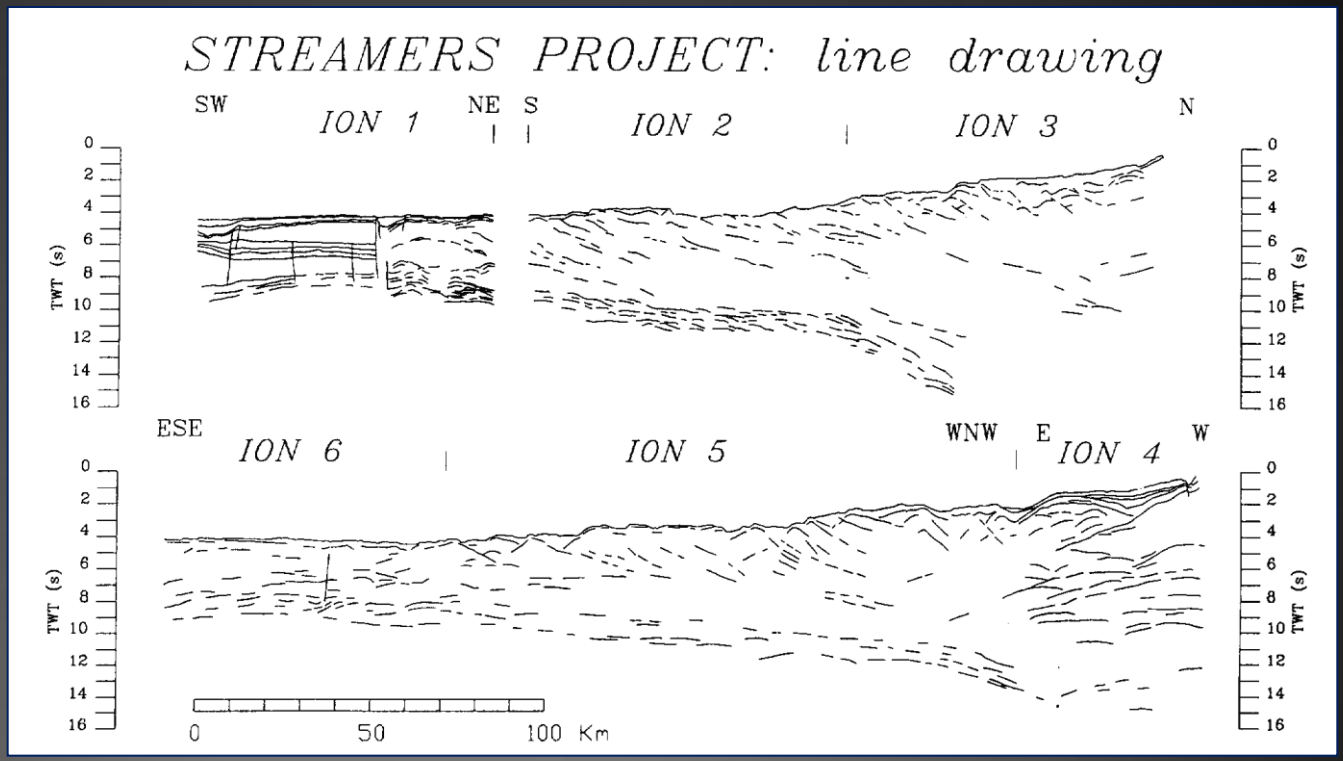


2. PREVIOUS WORKS

Previous authors described the structural setting of the Calabrian accretionary wedge by using seismic reflection profiles (Rossi and Sartori, 1981; Barone et al., 1982; Finetti, 1982; Cernobori et al., 1996; Sioni, 1996).



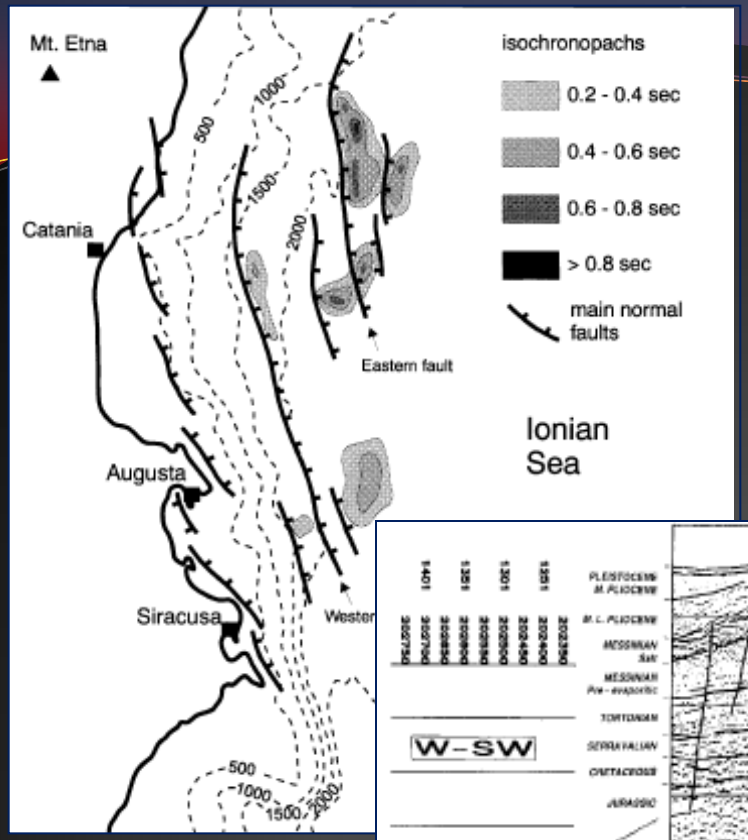
Cernobori et al., 1996

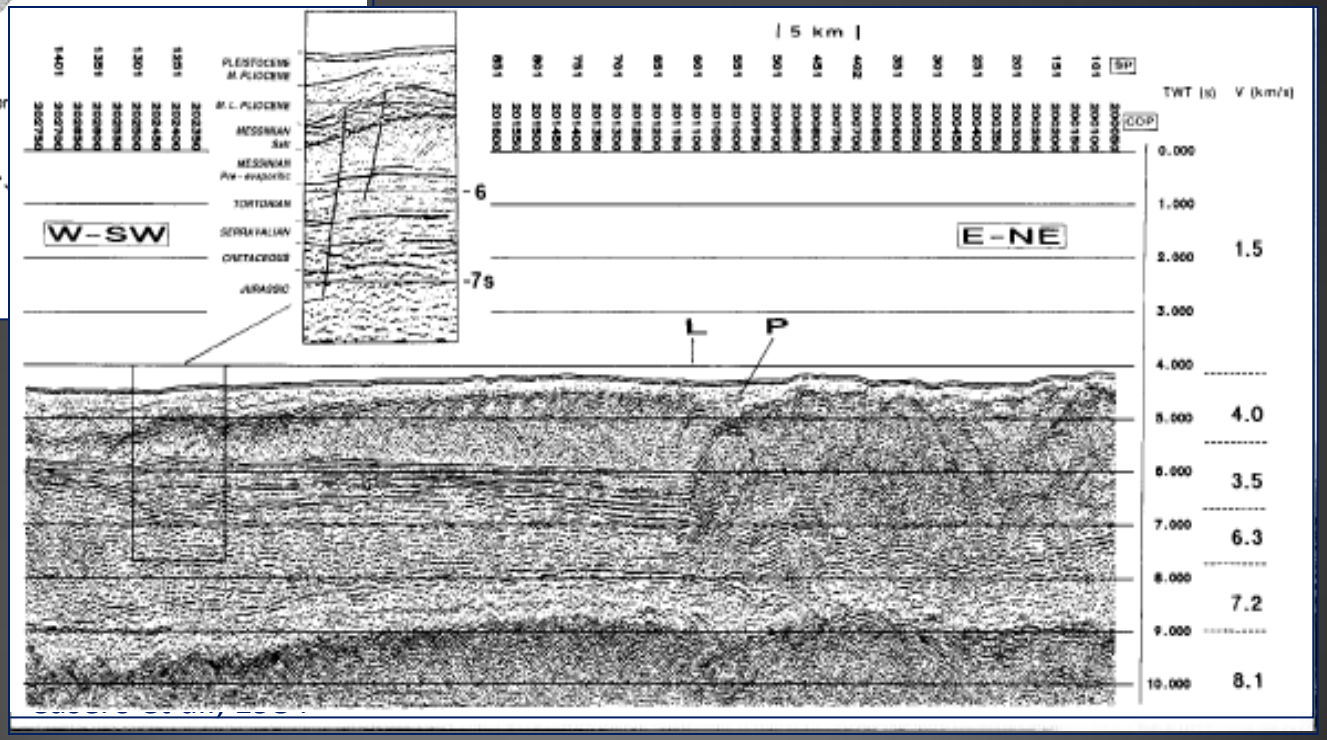


The Calabrian subduction zone represents an anomalous (analogously to the Mediterranean Ridge) low tapered accretionary complex characterized by the absence of trench-like feature and of clear outer deformation front.

2. PREVIOUS WORKS

Rossi and Borsetti, 1974; Cernobori et al., 1996; Hirn et al., 1997; Bianca et al., 1999; Adam et al., 2000; Nicolich et al., 2000; Argnani et al. 2002; Argnani e Bonazzi, 2005

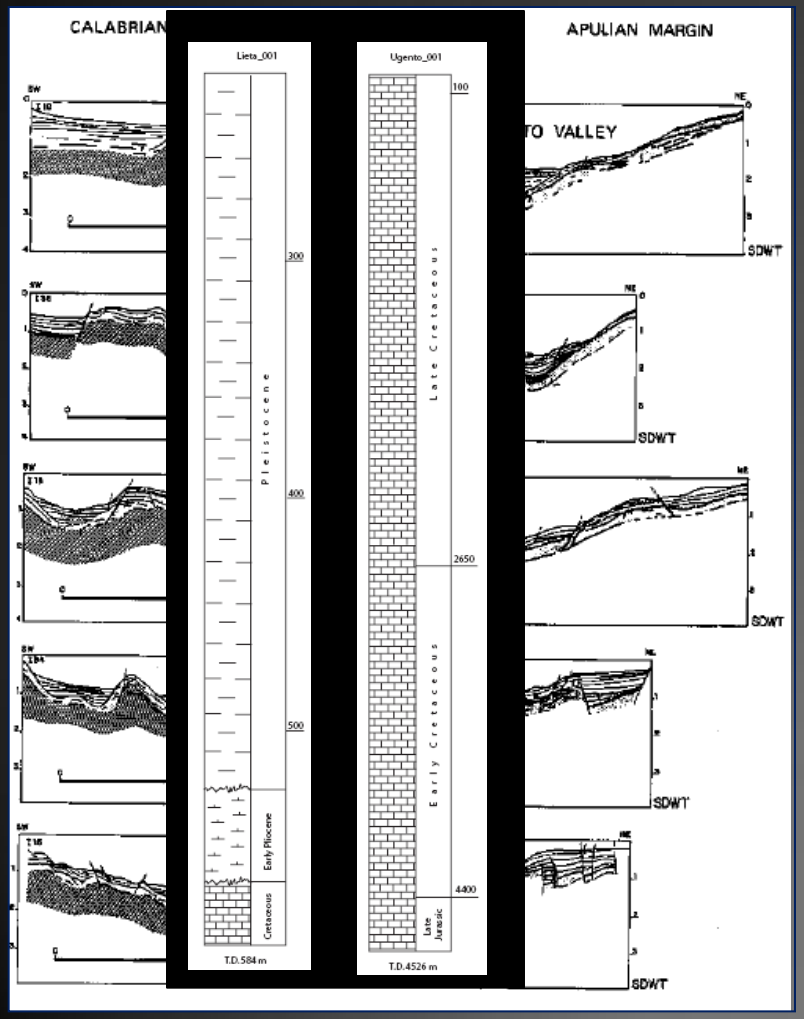




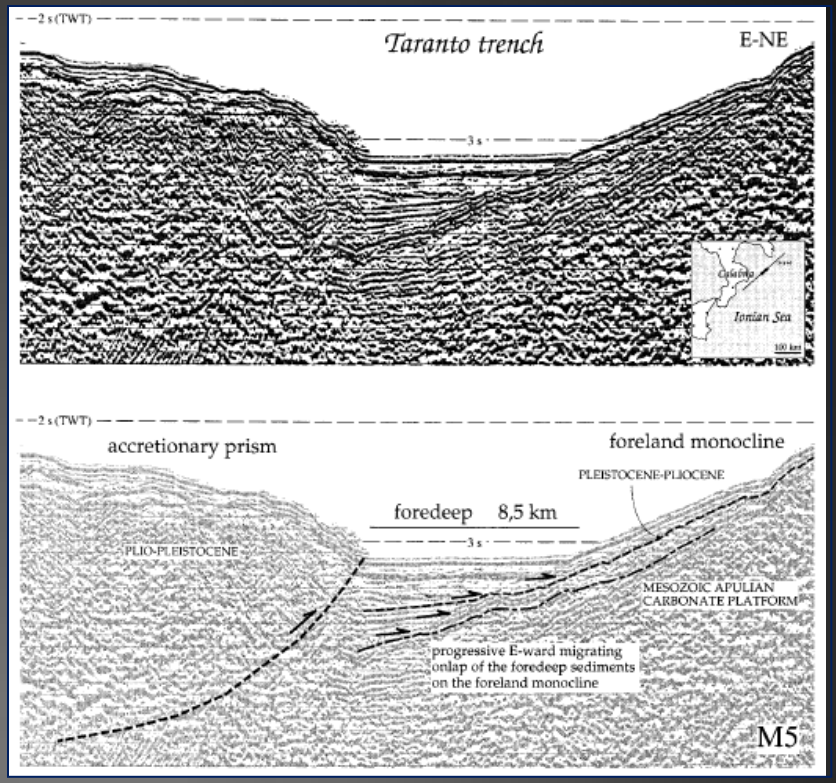
Cernobori et al., 1996

2. PREVIOUS WORKS

Several geophysical (seismic reflection survey) and geological data (industrial wells and sample and dredge) have been collected in this area (Finetti and Morelli, 1973; Rossi e Borsetti, 1974; Finetti, 1976; Rossi et al., 1983; Doglioni, 1999).



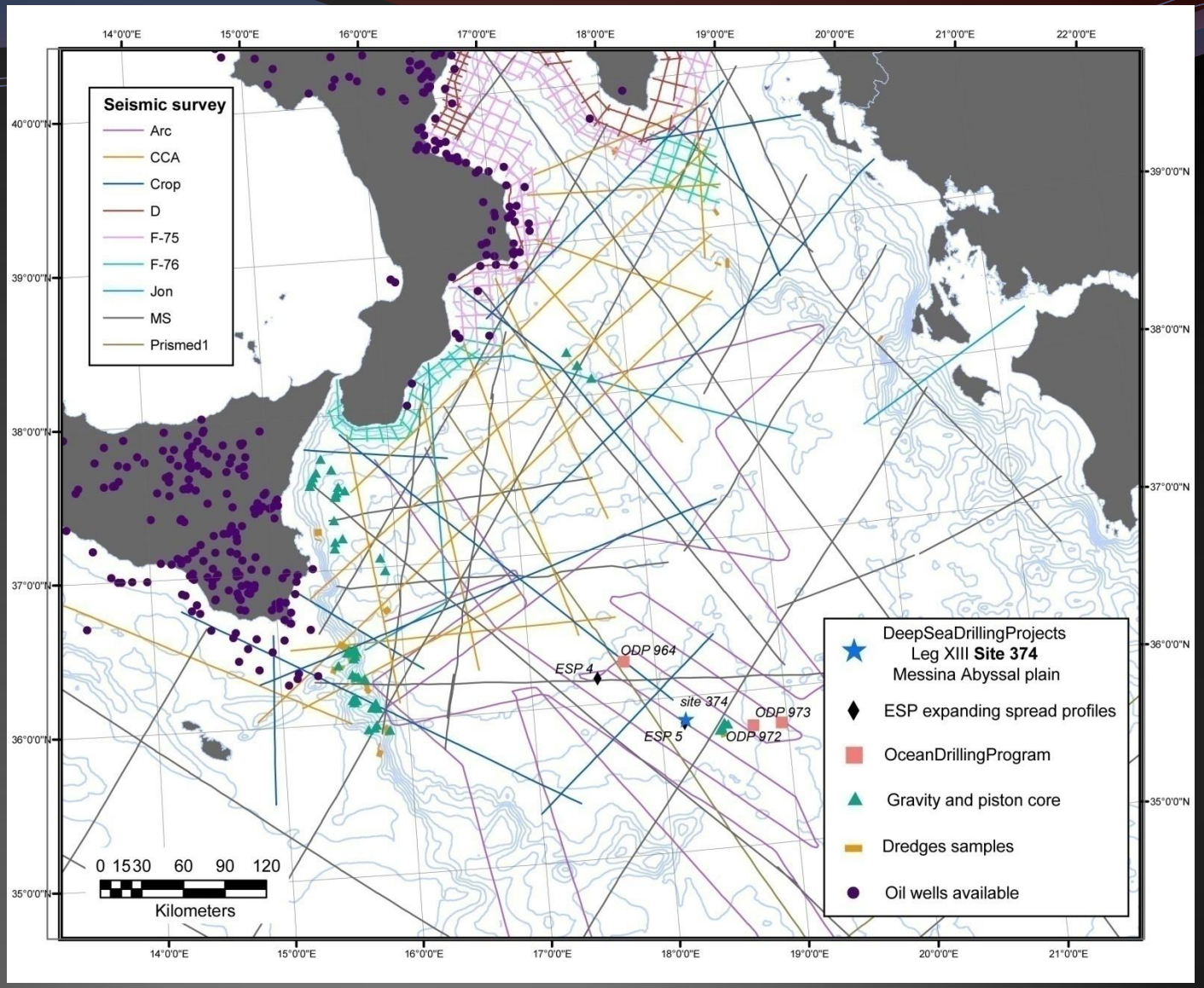
Rossi et al., 1983



Doglioni et al., 1999

3. METHODS

Available data for the Ionian offshore



Seismic reflection (Rossi e Borsetti, 1977; Finetti 1982, 1985; Cernobori et al., 1996; Catalano et al., 2000, 2001; Hirn et al., 1997) and refraction surveys (Makris et al., 1986; Ferrucci et al., 1991; de Voogd et al., 1992; Truffert et al., 1993), dredging and sampling (Rossi e Borsetti, 1974; Scandone et al., 1981; Fabbri et al., 1982; Barbieri et al., 1982; Casero et al., 1984), heat flow measurements (Della Vedova e Pellis, 1992), magnetic (Aris Rota e Fichera, 1985) and gravimetric (Morelli et al., 1975) surveys produced a wealth of data for the interpretation of this area.

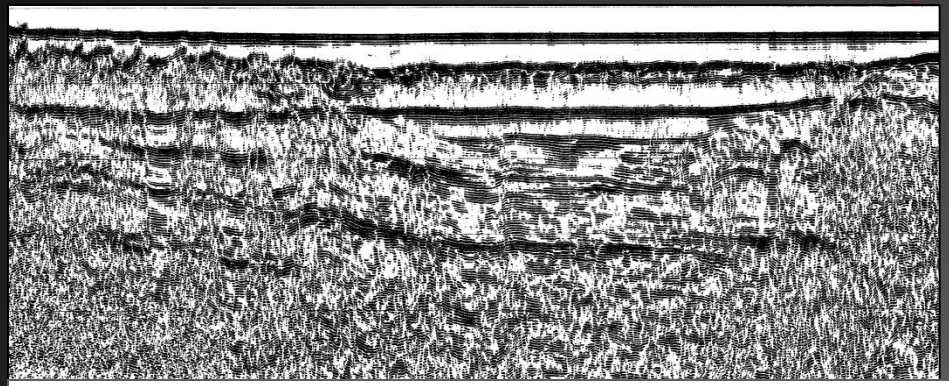
3. METHODS

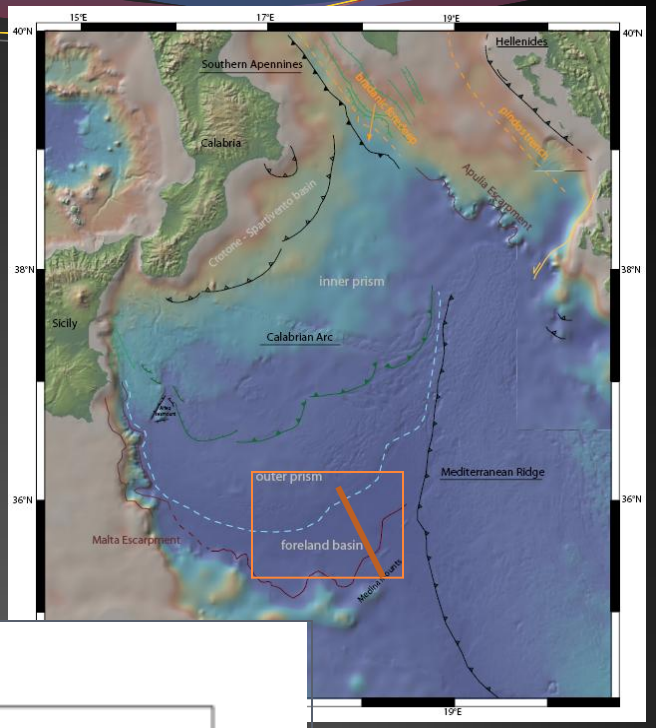
Seismic stratigraphy

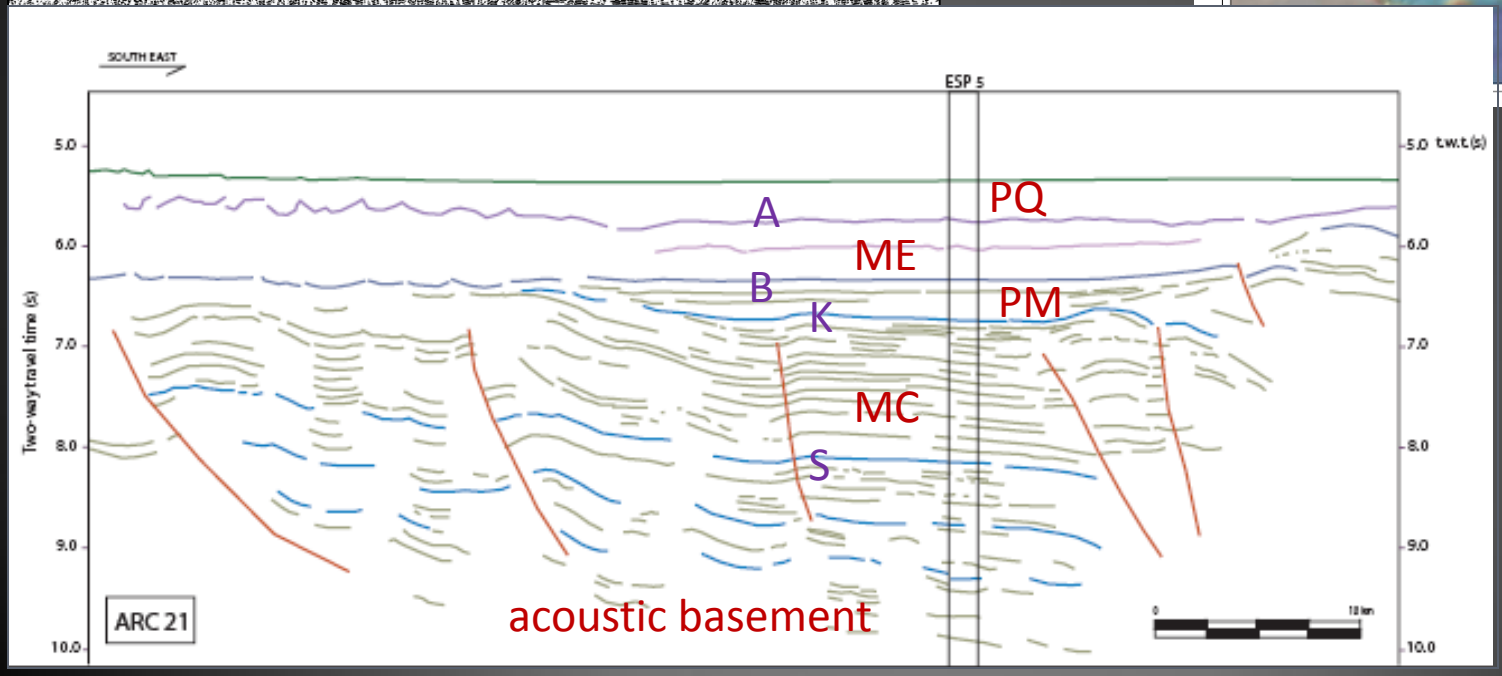
Regional reflectors

Seismostratigraphic unit

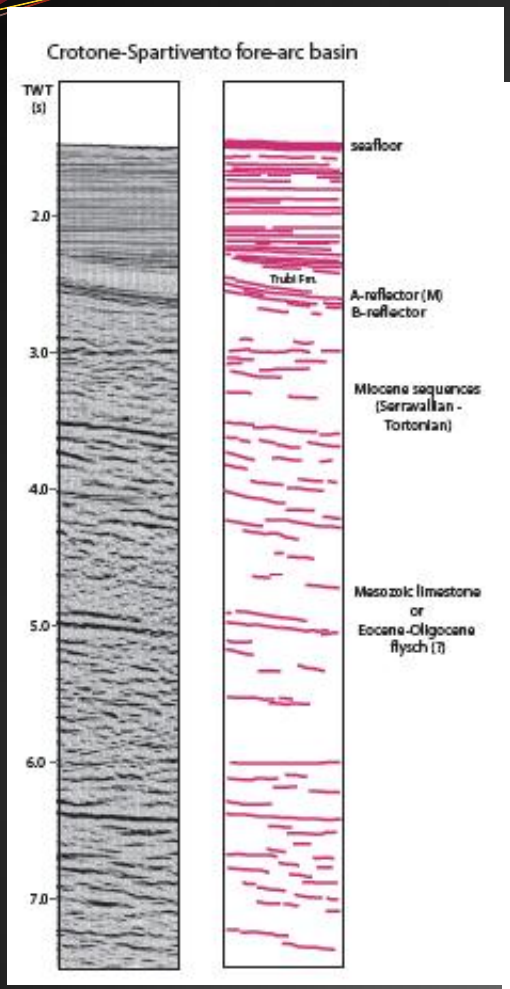
NW SE

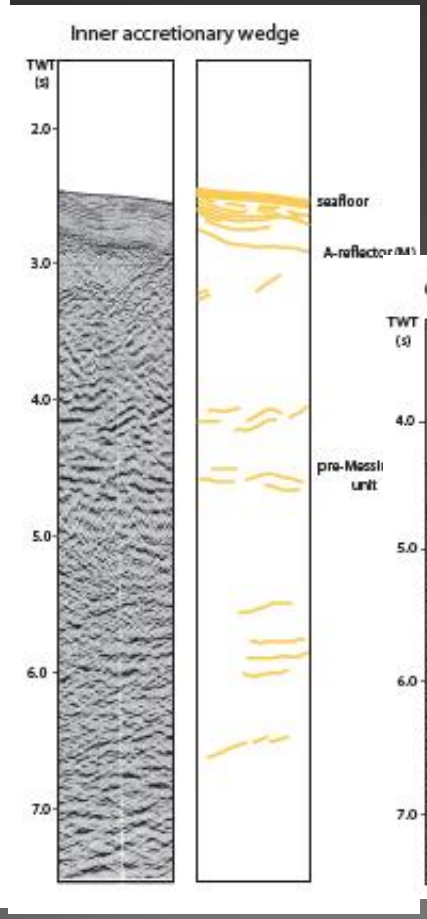


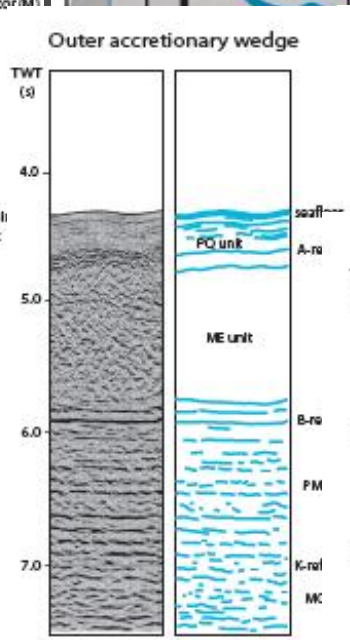


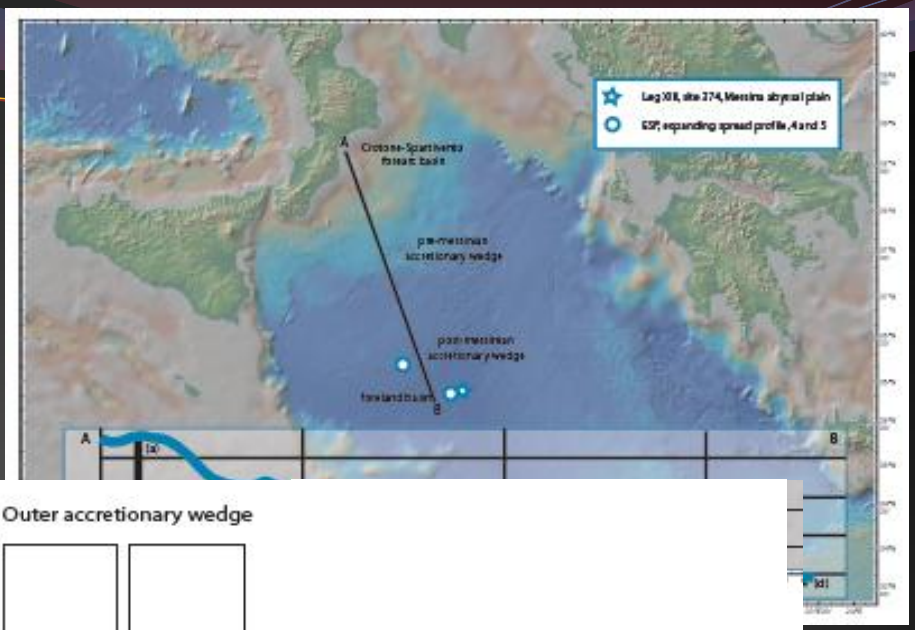


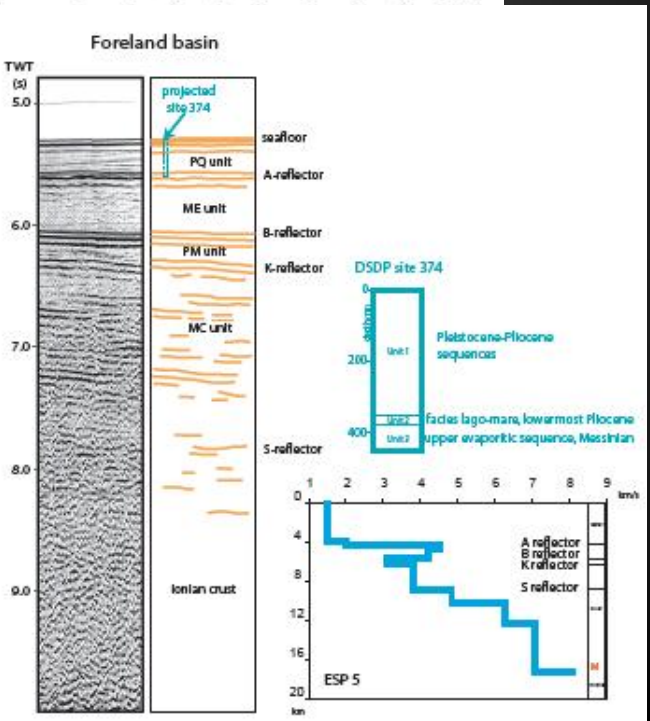
3. METHODS


Crotone-Spartivento fore-arc basin
TWT (s)
2.0
3.0
4.0
5.0
6.0
7.0
seafloor
Trubi Fm.
A-reflector (M)
B-reflector
Miocene sequences (Serravallian - Tortonian)
Mesozoic limestone or Eocene-Oligocene flysch (?)


Inner accretionary wedge
TWT (s)
2.0
3.0
4.0
5.0
6.0
7.0
seafloor
A-reflector (M)


Outer accretionary wedge
TWT (s)
4.0
5.0
6.0
7.0
PQ unit
ME unit
PM
MC

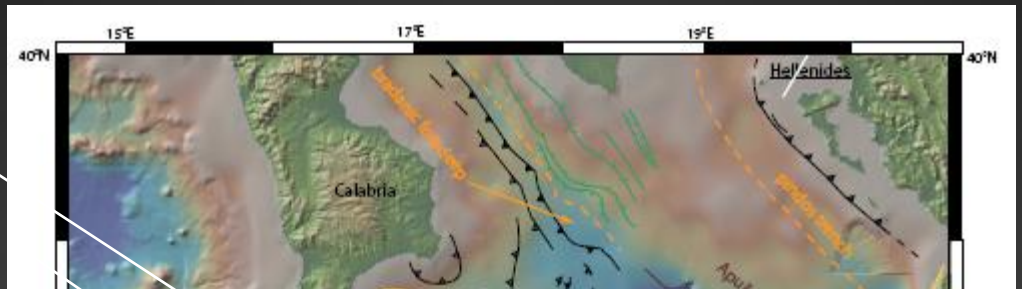

Leg 107, site 374, Messina abyssal plain
ESP, expanding spread profile, 4 and 5
A
B
pre-messinian accretionary wedge
post-messinian accretionary wedge
foreland basin

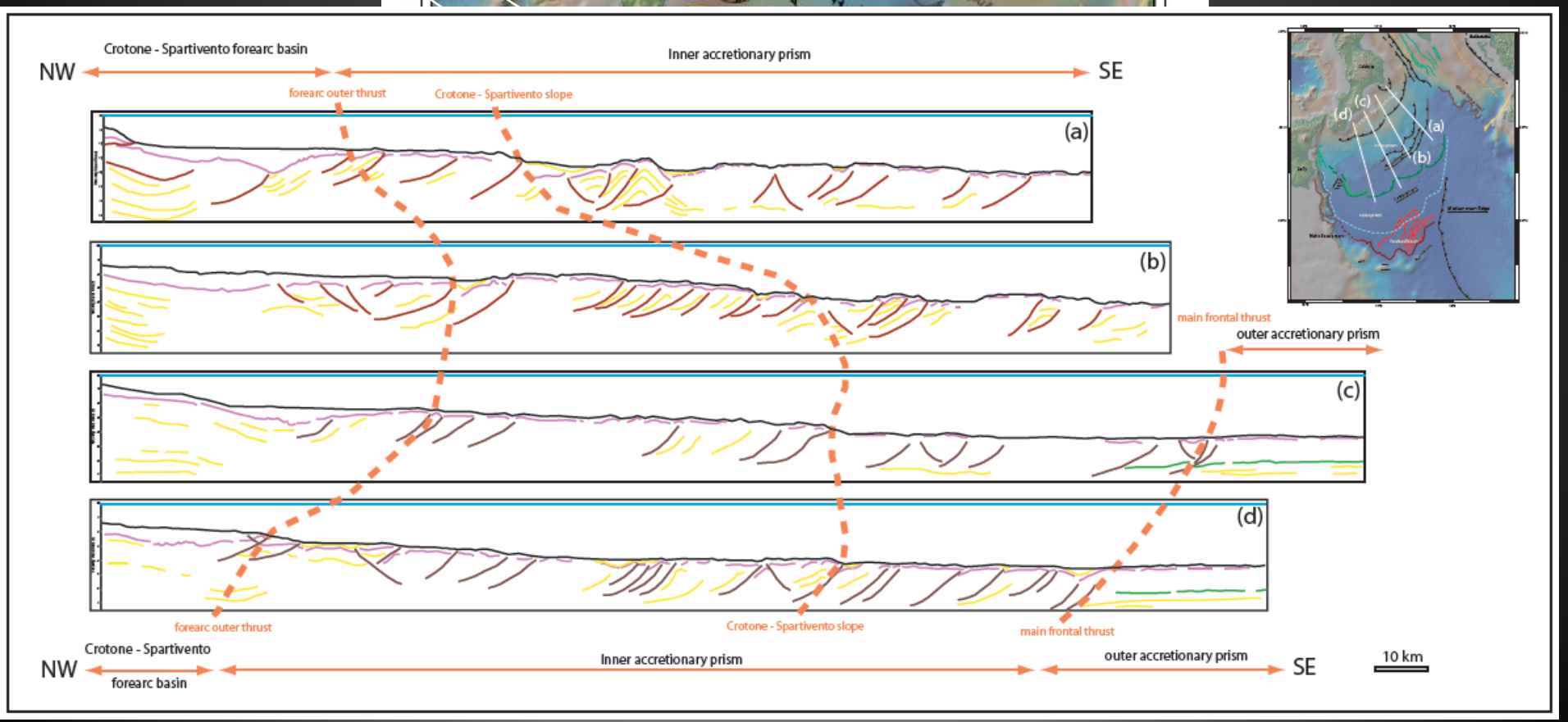

Foreland basin
TWT (s)
5.0
6.0
7.0
8.0
9.0
projected site 374
seafloor
PQ unit
A-reflector
ME unit
B-reflector
PM unit
K-reflector
MC unit
S-reflector
Ionian crust
DSDP site 374
Pleistocene-Pliocene sequences
facies lago-mare, lowermost Pliocene
upper evaporitic sequence, Messinian
A reflector
B reflector
K reflector
S reflector
ESP 5

Structural map of Ionian offshore

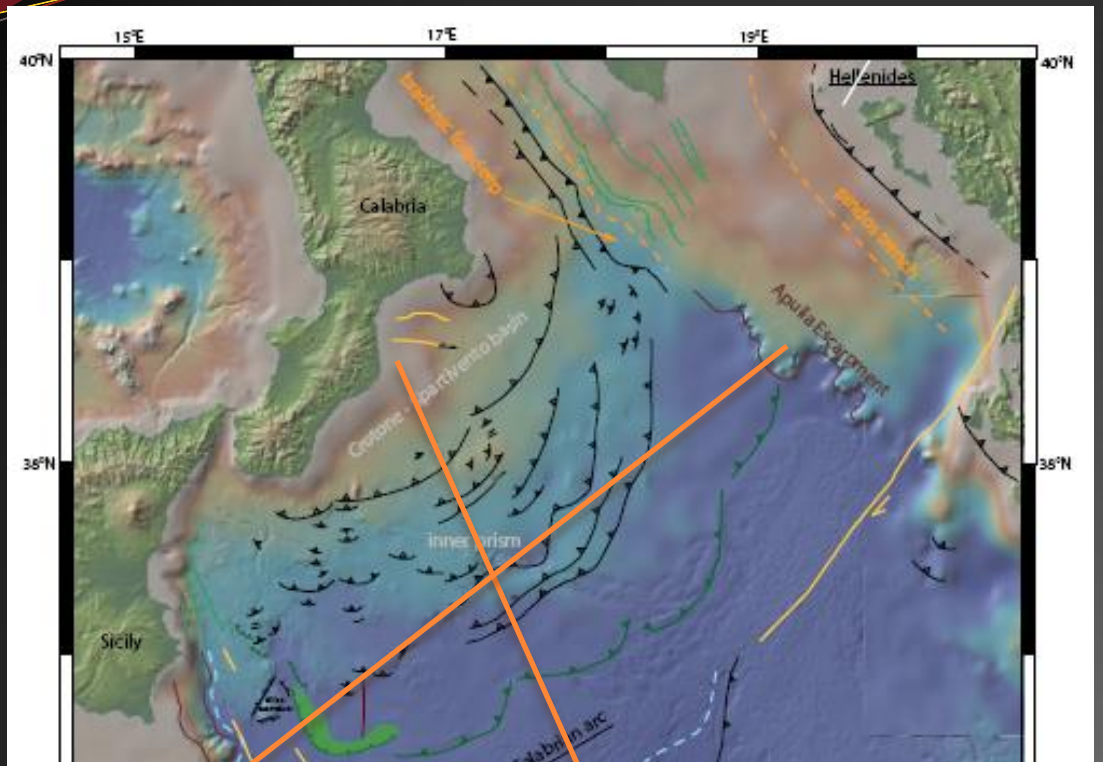
forearc outer thrust

Crotone-Spartivento slope

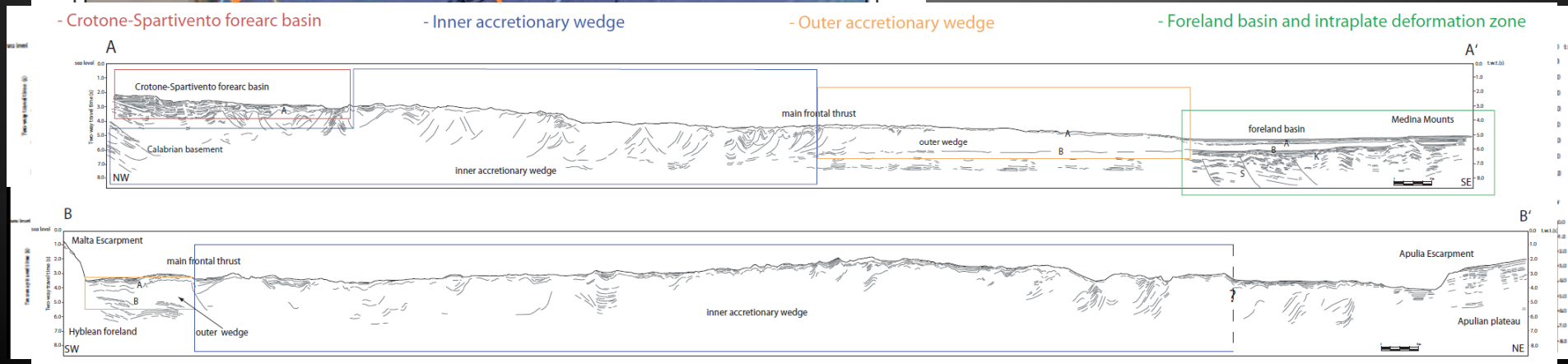




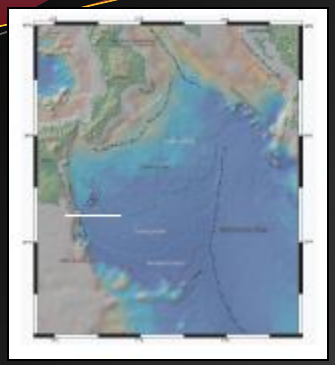
4. RESULTS



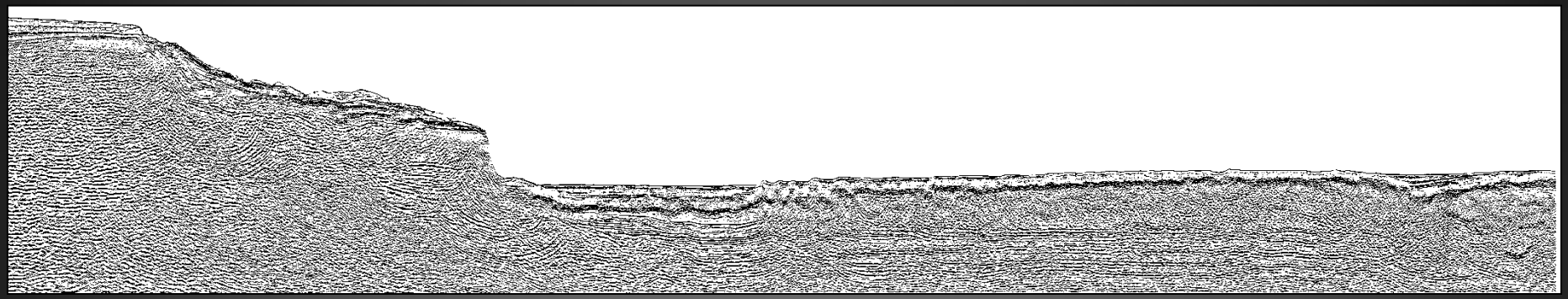
- Crotone-Spartivento basin
- Inner accretionary prism
- Outer wedge
- Foreland basin

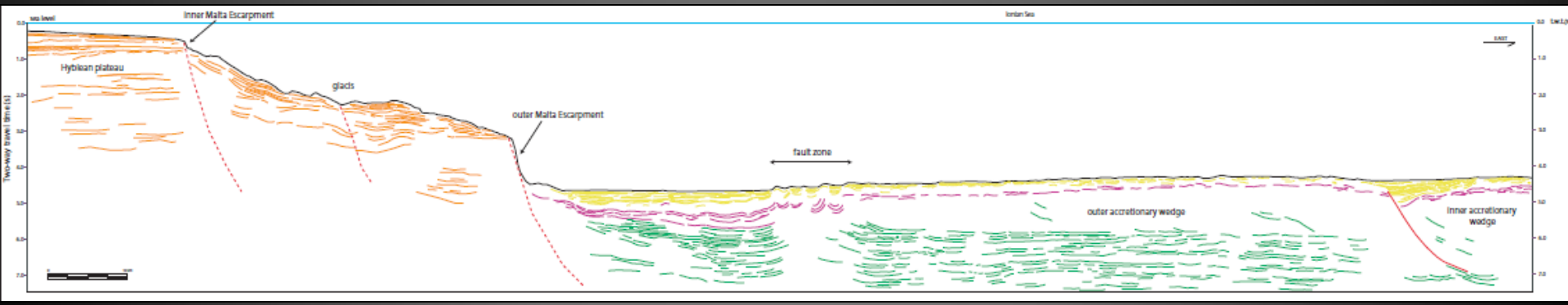


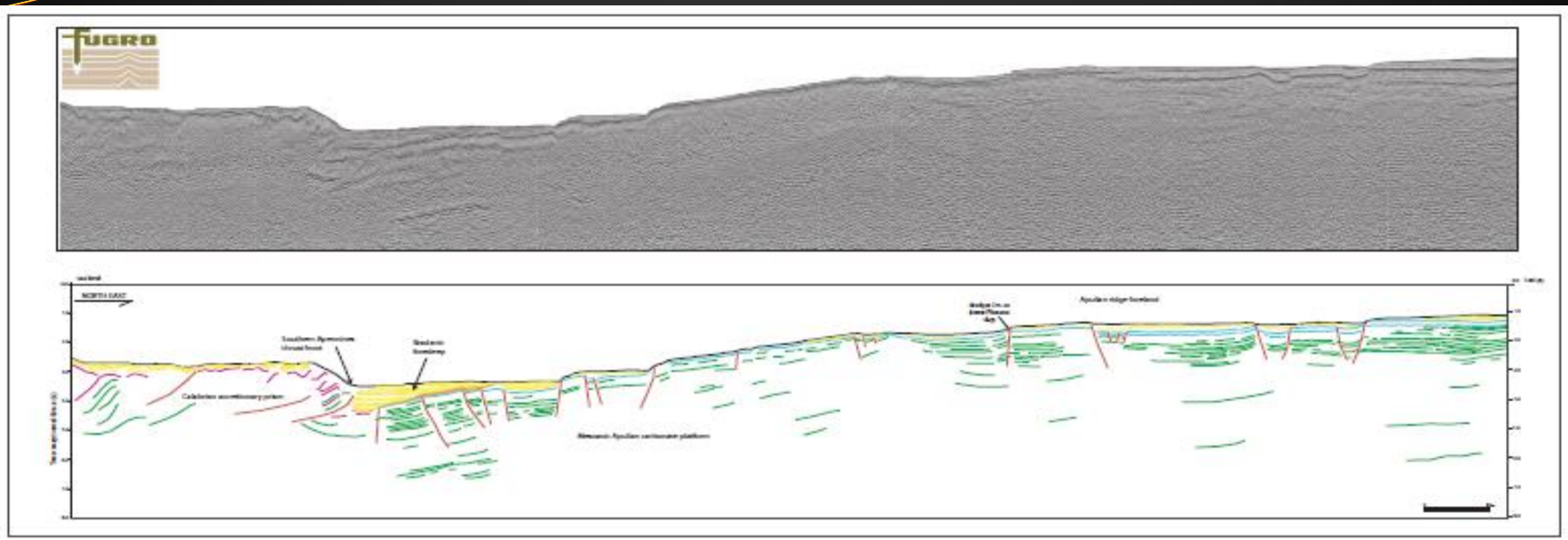
Lateral margins

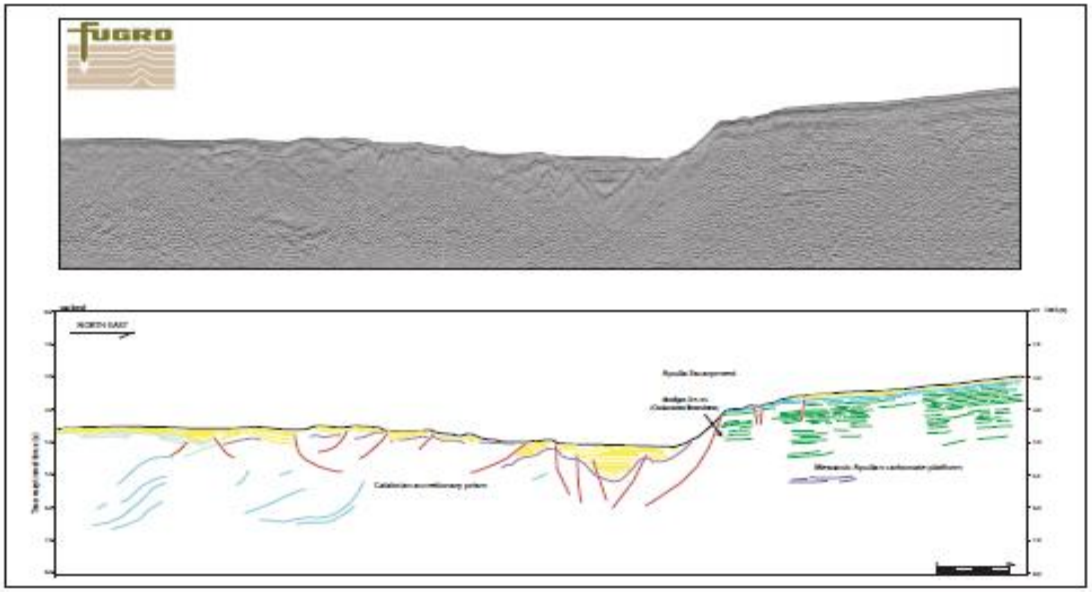


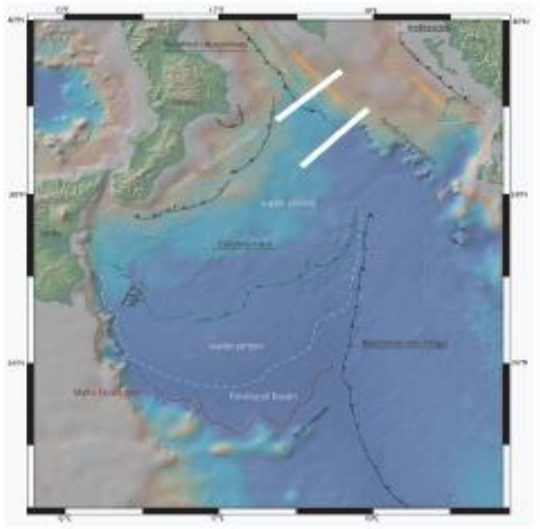
Malta Escarpment and lateral ramp of the wedge





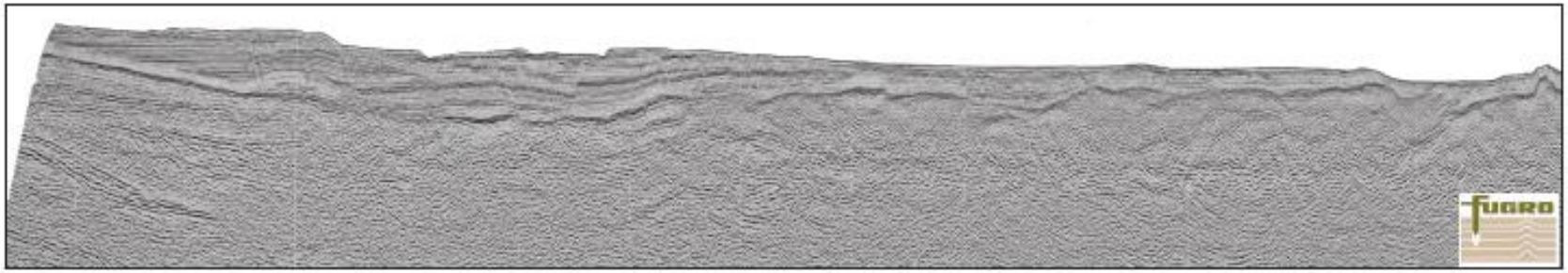


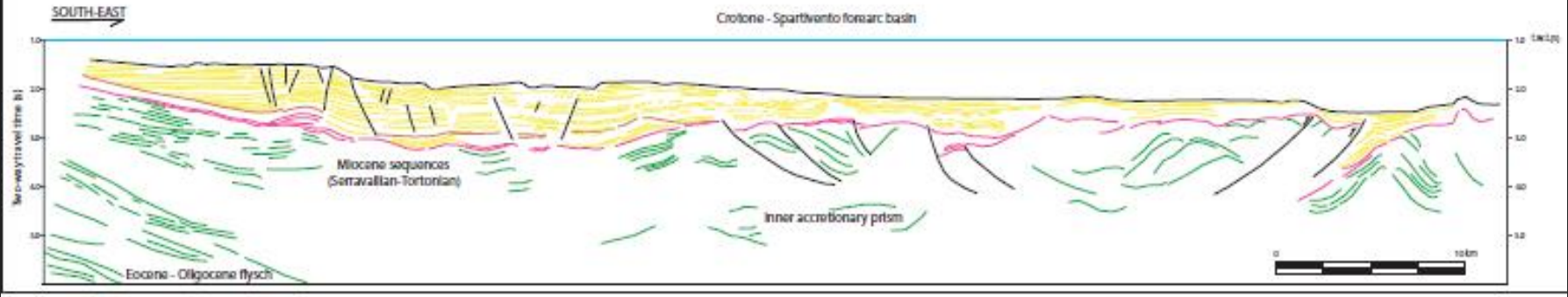


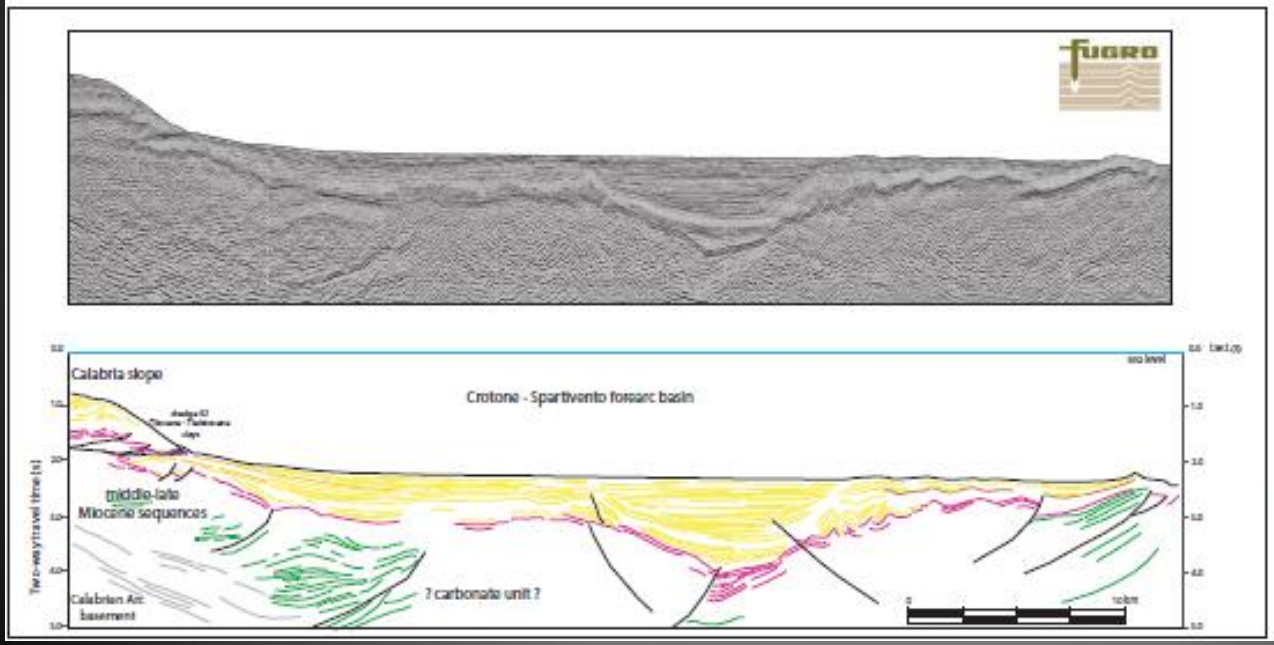


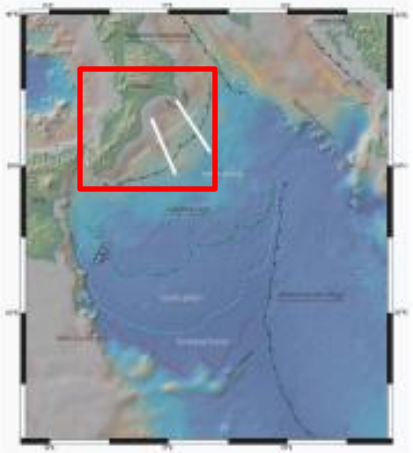
Crotone – Spartivento forearc basin

4. RESULTS

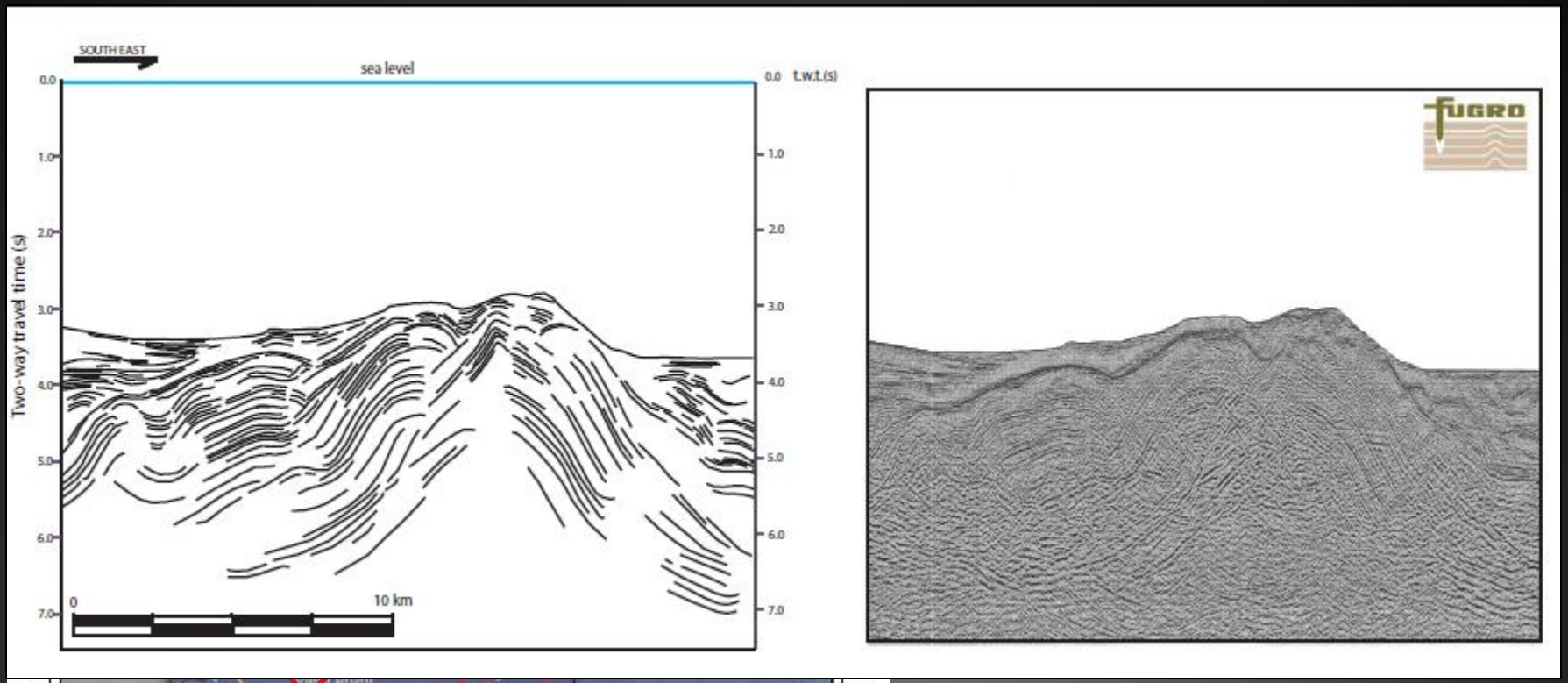


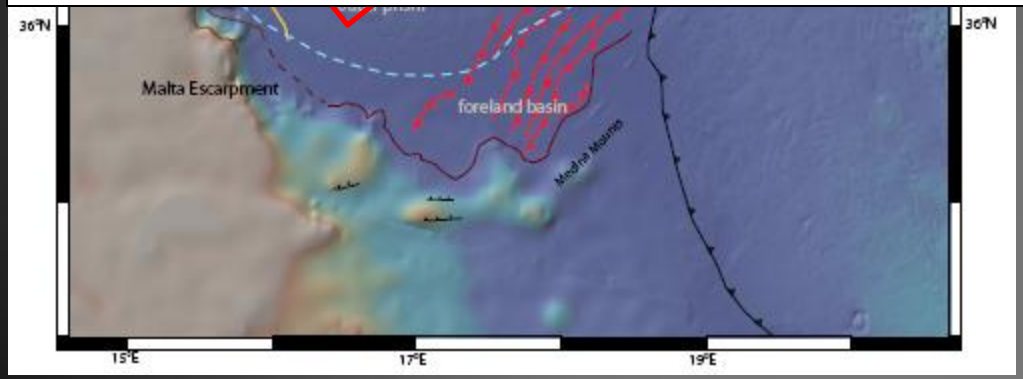






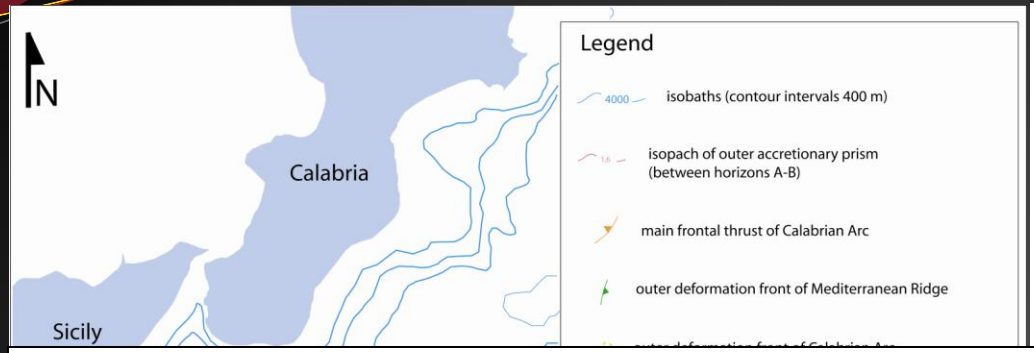
Inner accretionary prism

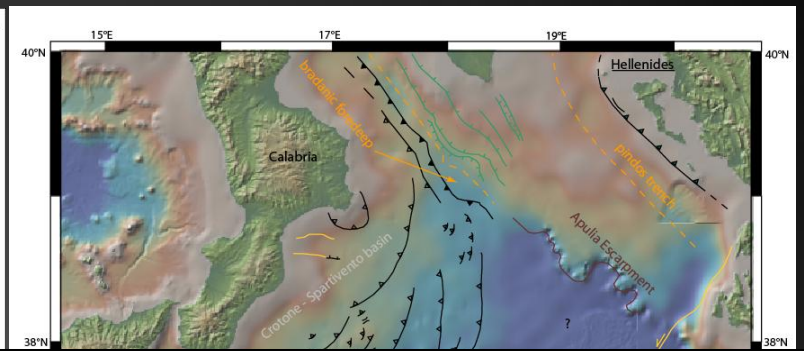


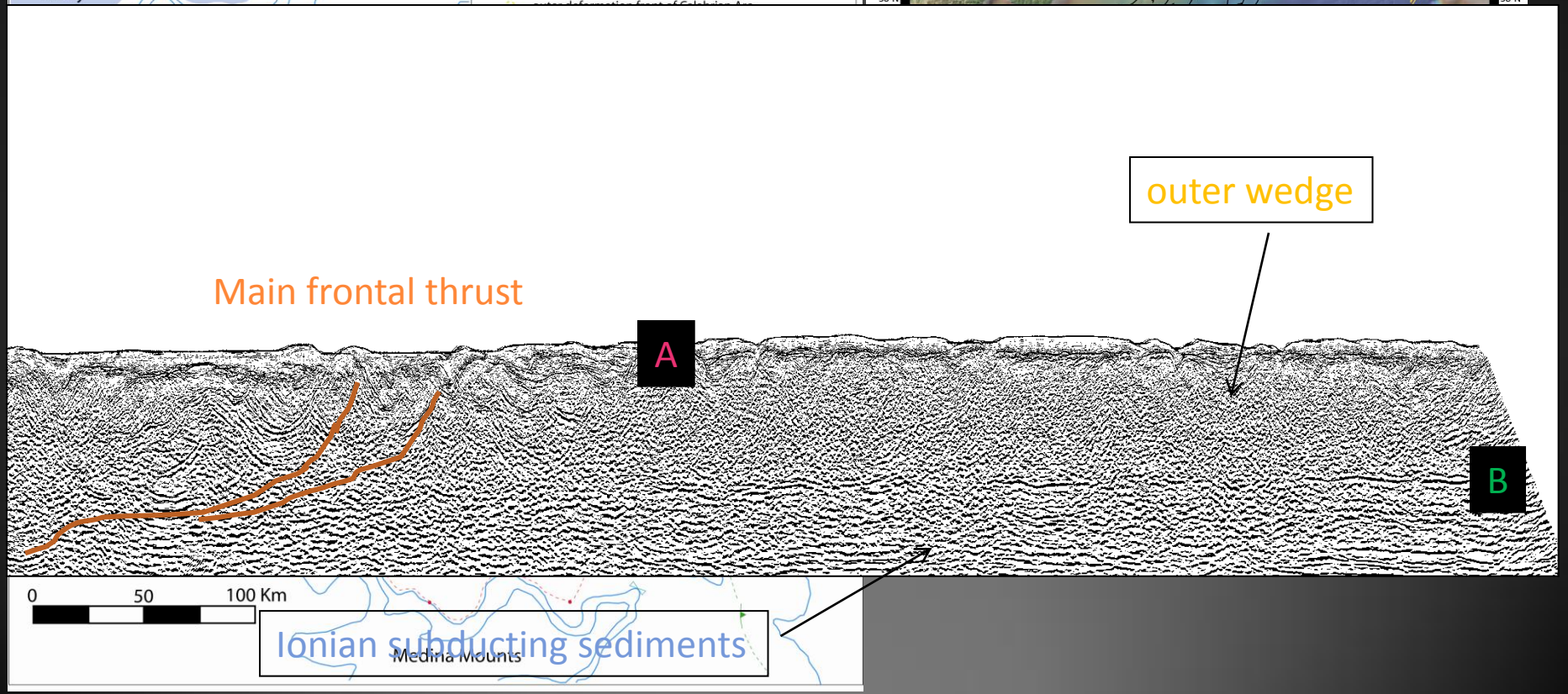


- Post-Messinian out-of-sequence thrusting

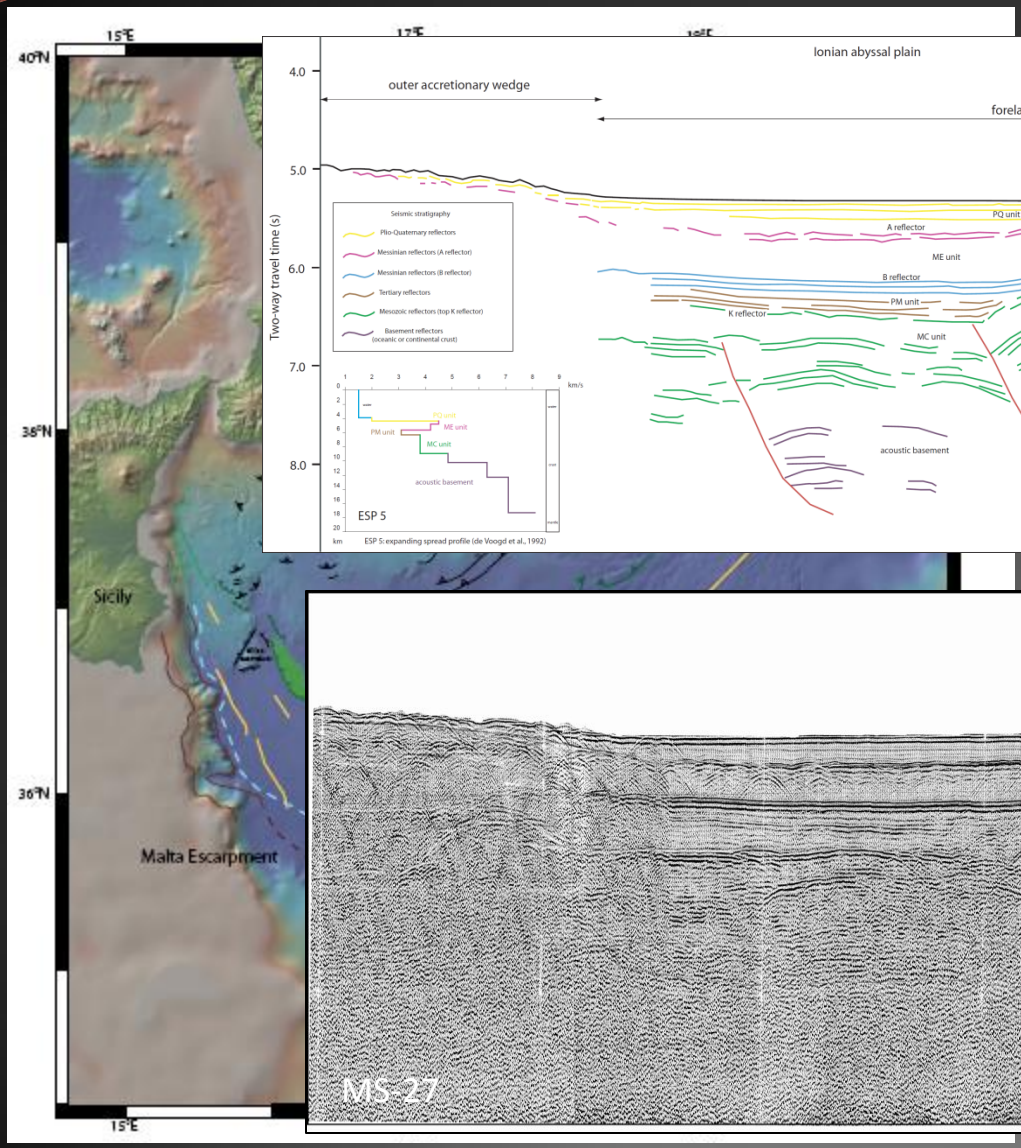
Outer wedge


N
Calabria
Sicily
Legend
4000
isobaths (contour intervals 400 m)
isopach of outer accretionary prism (between horizons A-B)
main frontal thrust of Calabrian Arc
outer deformation front of Mediterranean Ridge


15°E
17°E
19°E
40°N
38°N
Hellenides
Calabria
Apulia Escarpment
Crotone - Spartivento basin


outer wedge
Main frontal thrust
A
B
0
50
100 Km
Ionian subducting sediments
Medina Mounts

Foreland basin and intraplate deformation zones



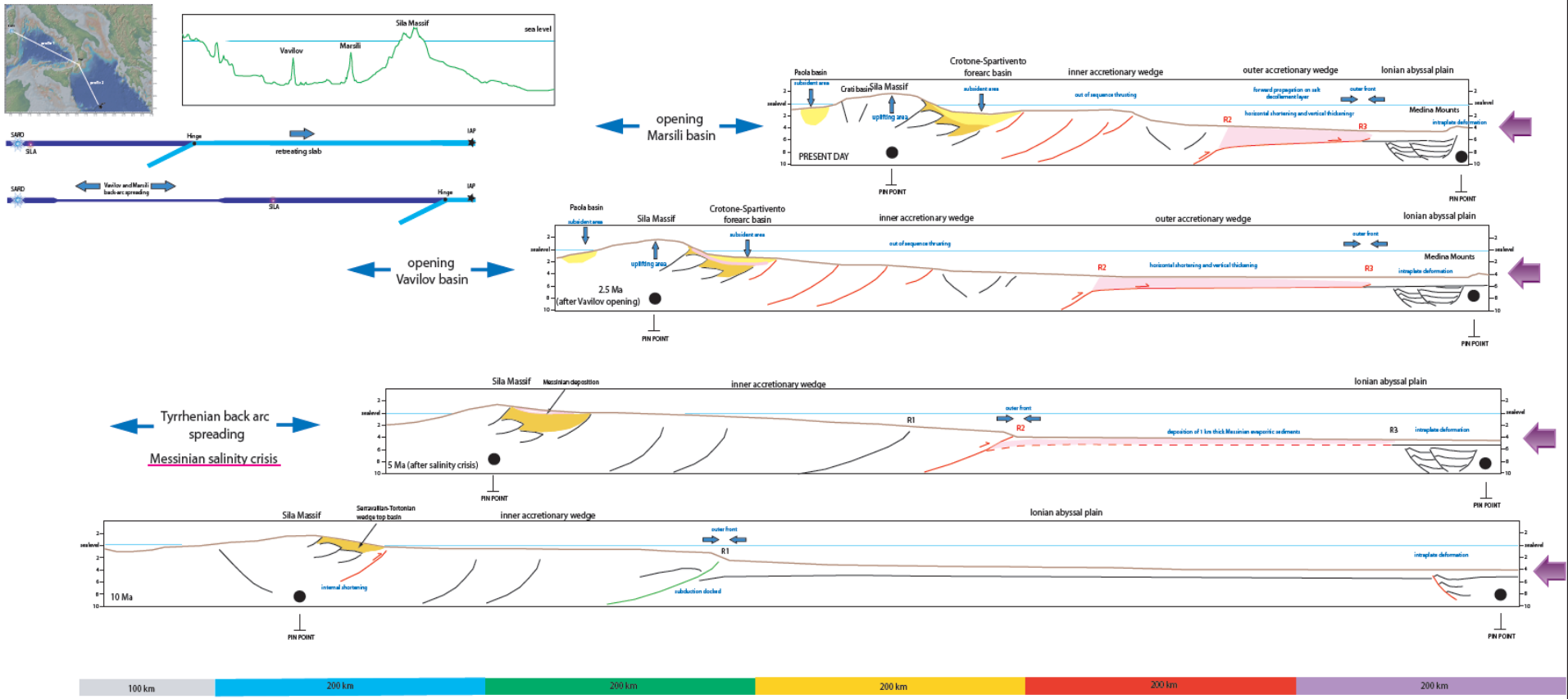
Remarks

-We distinguish two main sectors of the wedge: inner and outer
-Post-Messinian shortening diffuse over the entire wedge
-No clear outer deformation front
-Extremely low tapered outer wedge
-Sharp change in slope in the inner wedge (Crotone-Spartivento slope)

Open questions

- Present day activity of the subduction process
- Linkage Calabrian arc – Southern Apennines

Time-space evolution of the Calabrian accretionary prism



6. CONCLUSION

- Definition of the geometry and kinematics of the Calabrian accretionary prism. In particular four major structural domains are recognized and depicted by considering their stratigraphy, style and time of deformations, internal seismic characters

- Definitio Thanks for your attention etionary prism during the last 15 Ma. The growth of the prism included both forward propagation stages (frontal accretion) and out-of-sequence internal thrusting and basal accretion, underplating (duplex)

- The Messinian salinity crisis influences the evolution and the structures of the Calabrian accretionary prism