

Bologna - dal 19 al 21 novembre 2018



37° convegno

# VINCOLI GEOLOGICI PER LA CORRELAZIONE TRA LINEAMENTI TETTONICI OFF-SHORE E ON-SHORE TARDO-QUATERNARI IN SICILIA ORIENTALE: IL CONTRIBUTO DI ANALISI GEOLOGICO-STRUTTURALI E GEOMORFOLOGICHE DI DETTAGLIO

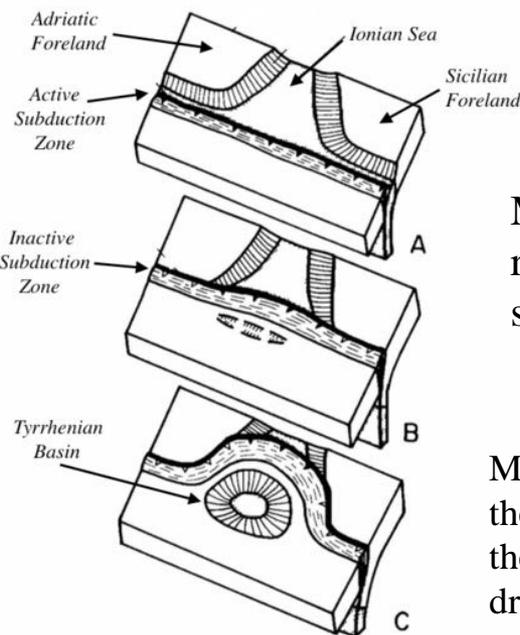
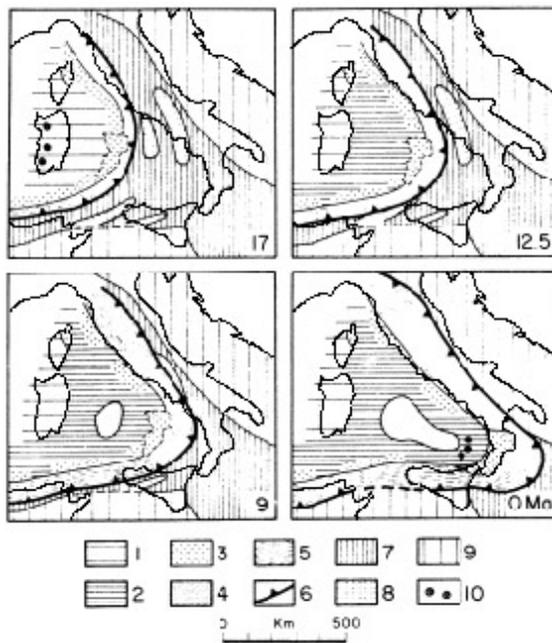
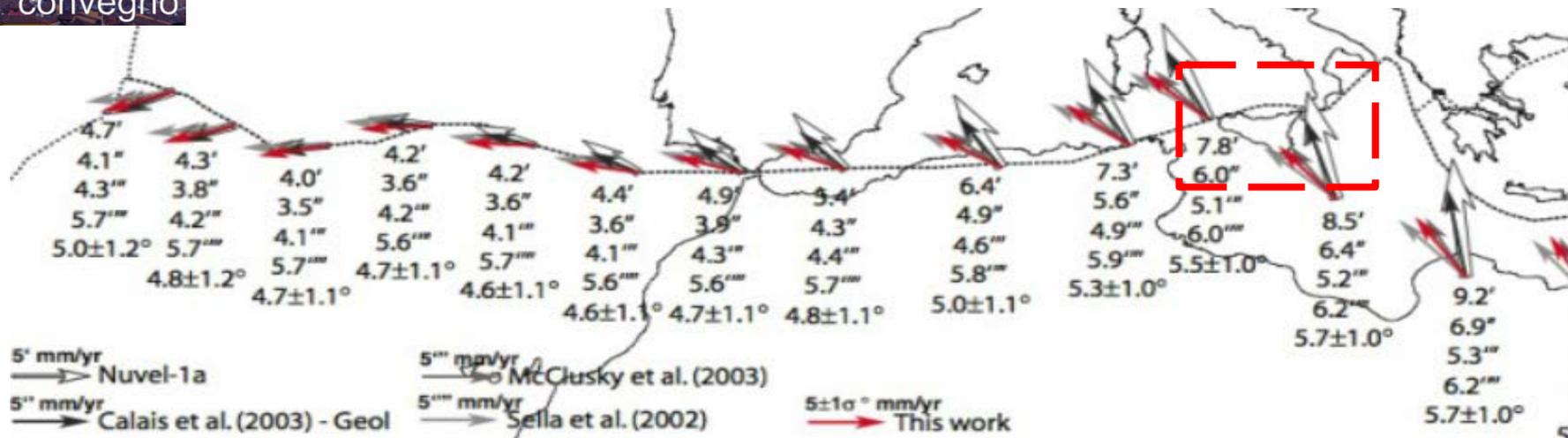
Catalano S.<sup>1</sup>, Pavano F.<sup>1</sup>, **Romagnoli G.**<sup>2</sup> e Tortorici G.<sup>1</sup>

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# Contesto geodinamico

Nubia-Eurasia kinematic boundary condition along a simplified plate boundary (dashed line).  
From Serpelloni et al., 2007



Migrazione dell'Arco Calabro e rollback della litosfera ionica in subduzione

Malinverno & Ryan 1986: Extension in the Tyrrhenian Sea and shortening in the Apennines as result of arc migration driven by sinking of the lithosphere

# Sismicità dell'area

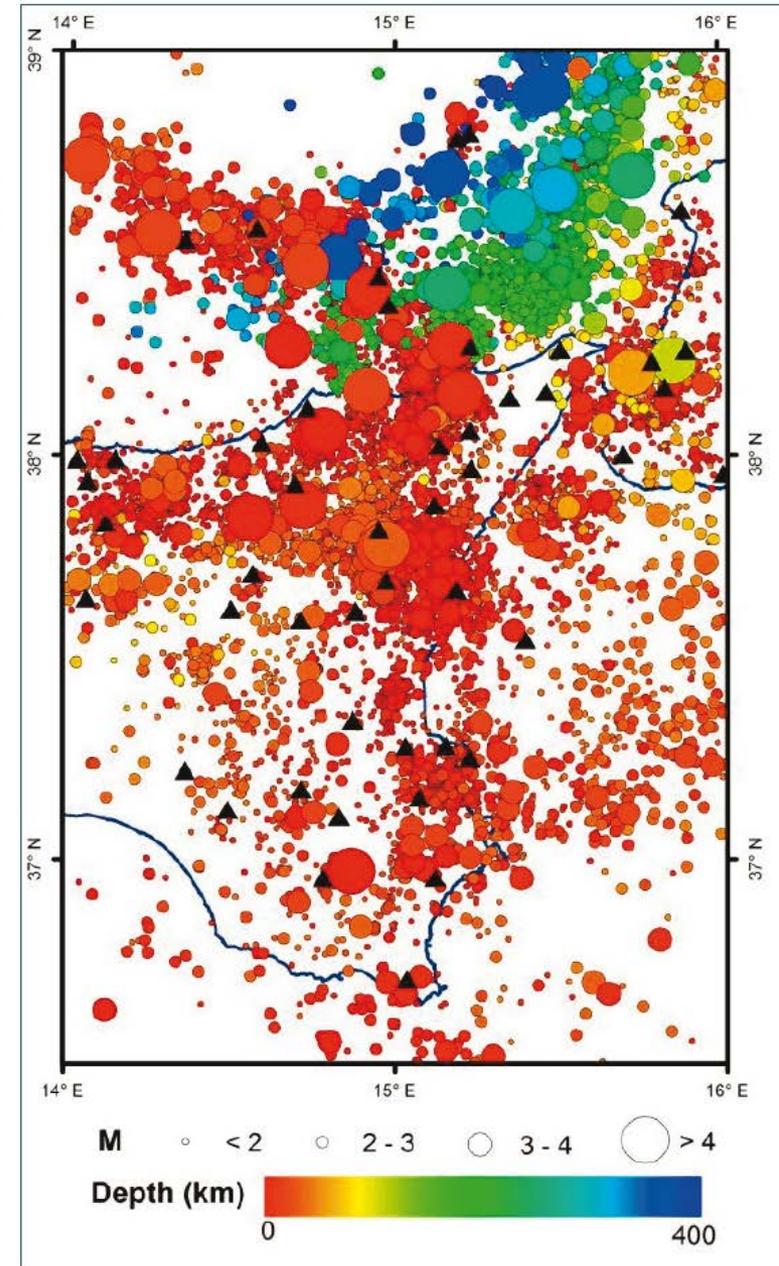
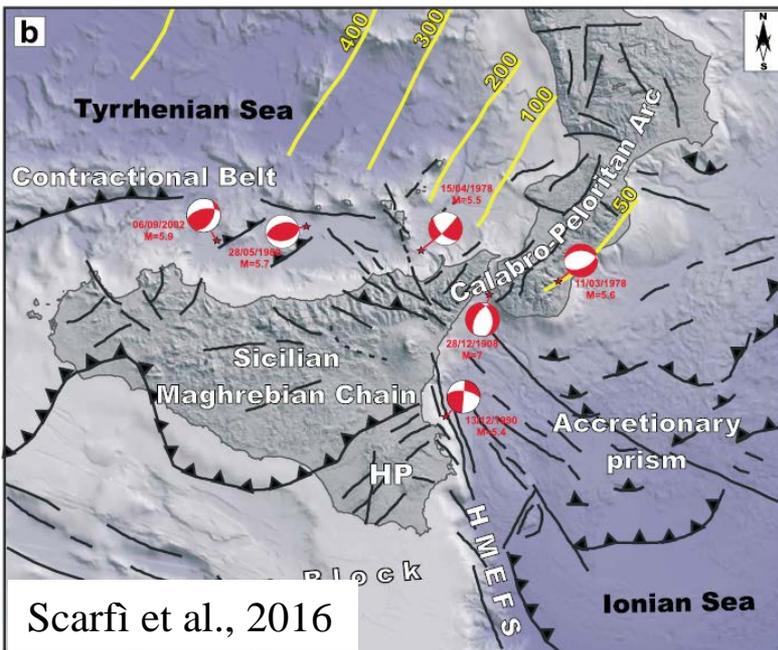
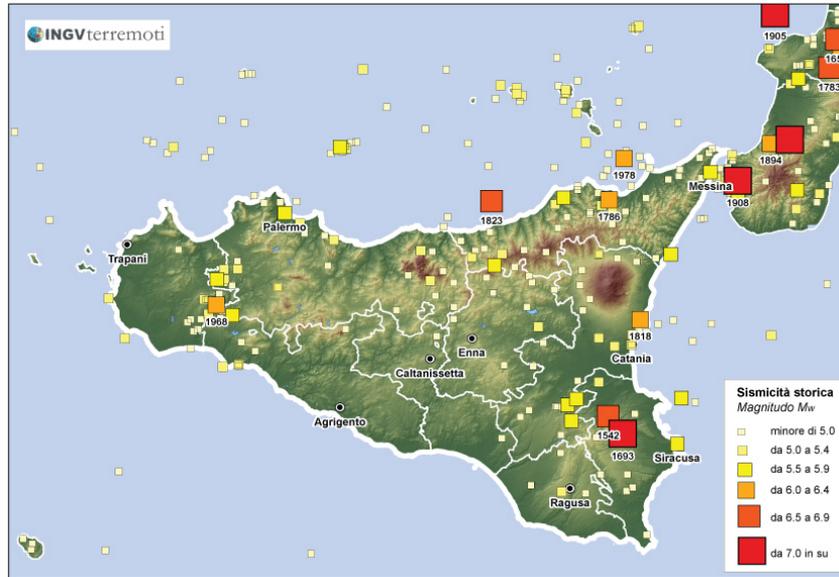


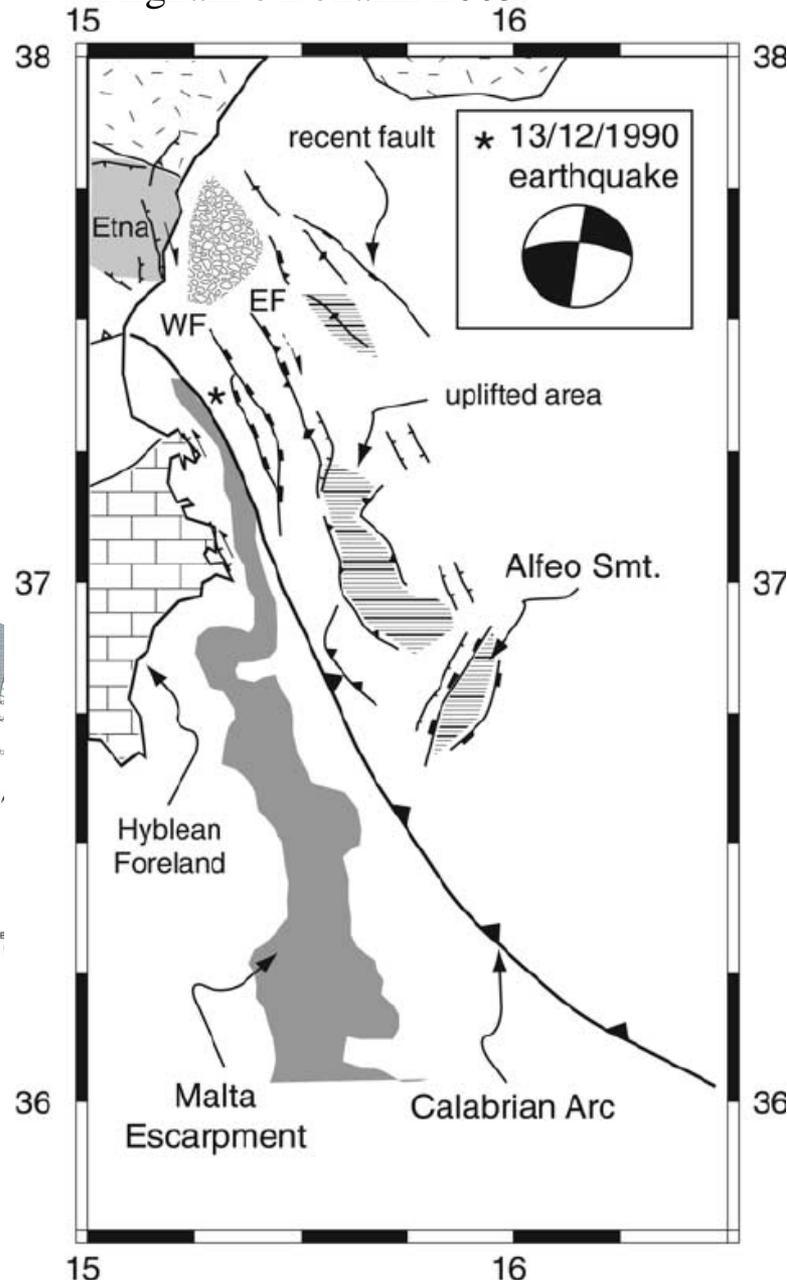
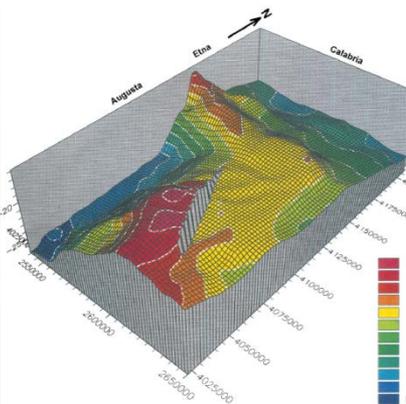
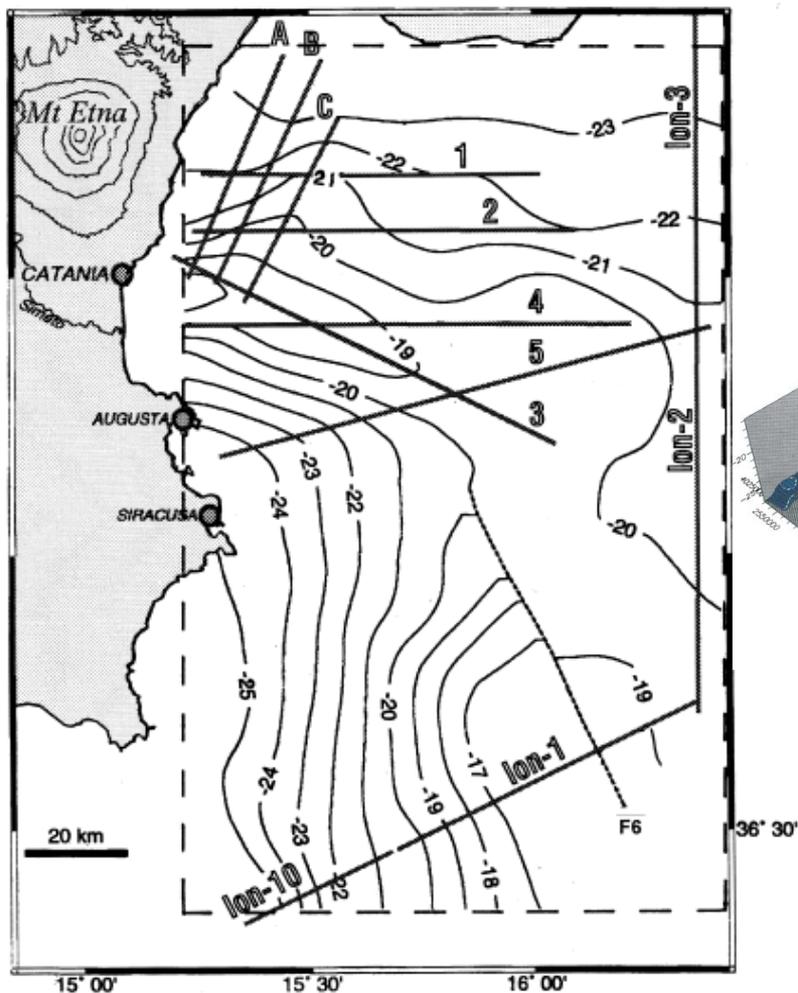
FIGURE 2. The seismicity map of the study area during the 2006 - 2016 period, black triangles indicate the seismic stations. Siino et al., 2018

# Lineamenti tettonici off-shore

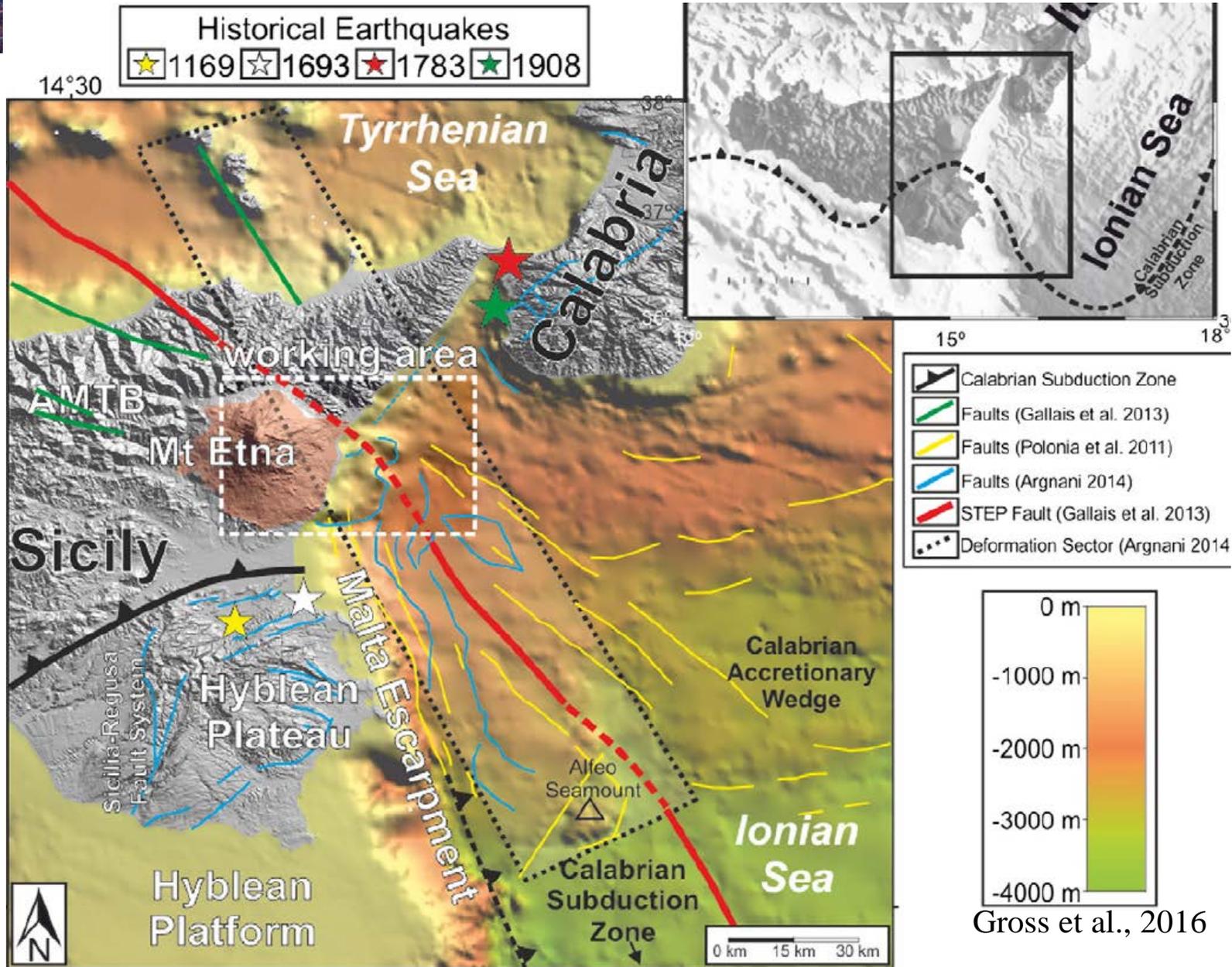
Avanzamento delle conoscenze sui lineamenti sommersi nell'off-shore tirrenico e ionico della Sicilia orientale

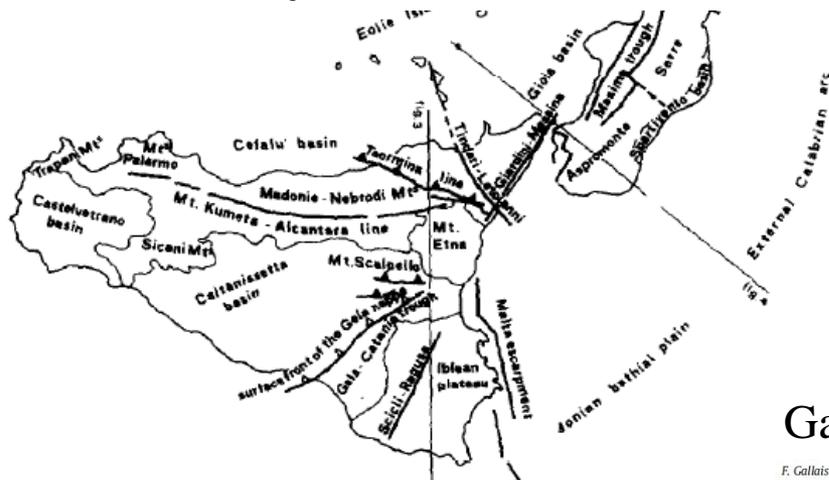
Limite tettonico che separa lo slab ionico subducente dalla più spessa crosta continentale iblea Nicolich et al., 2000

Argnani e Bonazzi 2005

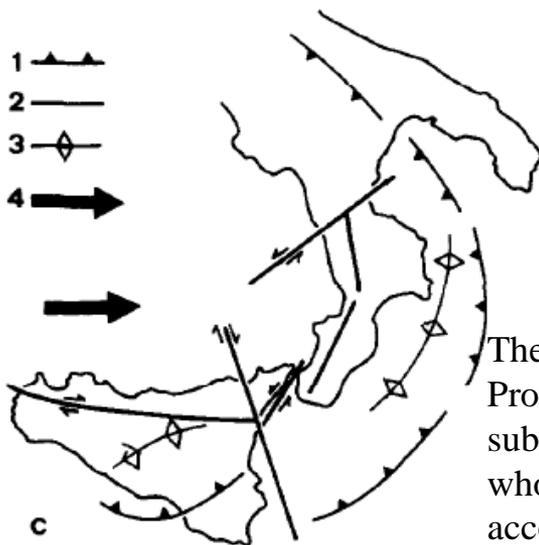


Tendenza a estendere a terra i principali sistemi riconosciuti seguendo schemi geologici datati agli anni '80 sia in termini di interpretazione che di nomenclatura di strutture on-shore ad orientazione NW-SE  
 Slab Transfer Edge Propagator





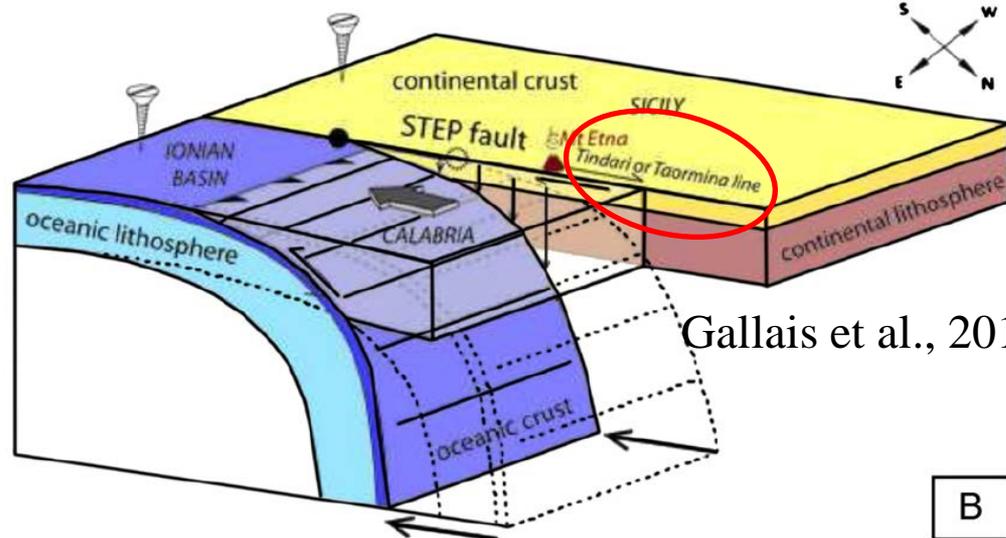
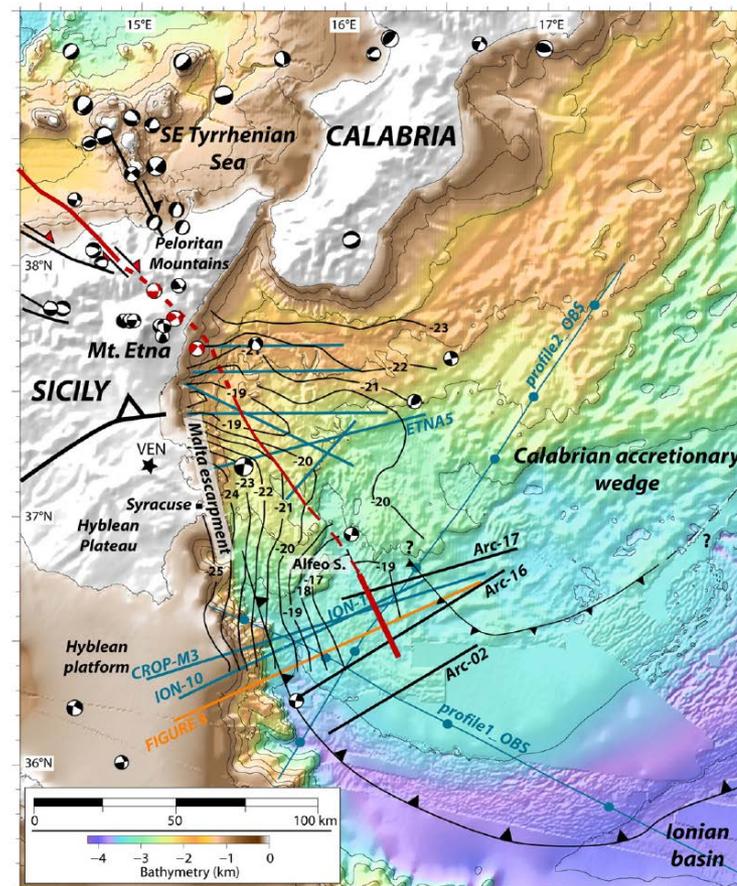
Ghisetti & Vezzani 1982



The faults called Slab Transfer Edge Propagator (STEP) faults, are depicted as subvertical tears that cut across the whole thickness of the lithosphere and accommodate differential rates of slab rollback (Argnani et al., 2014)

Gallais et al., 2013

F. Gallais et al. / Tectonophysics 602 (2013) 141–152

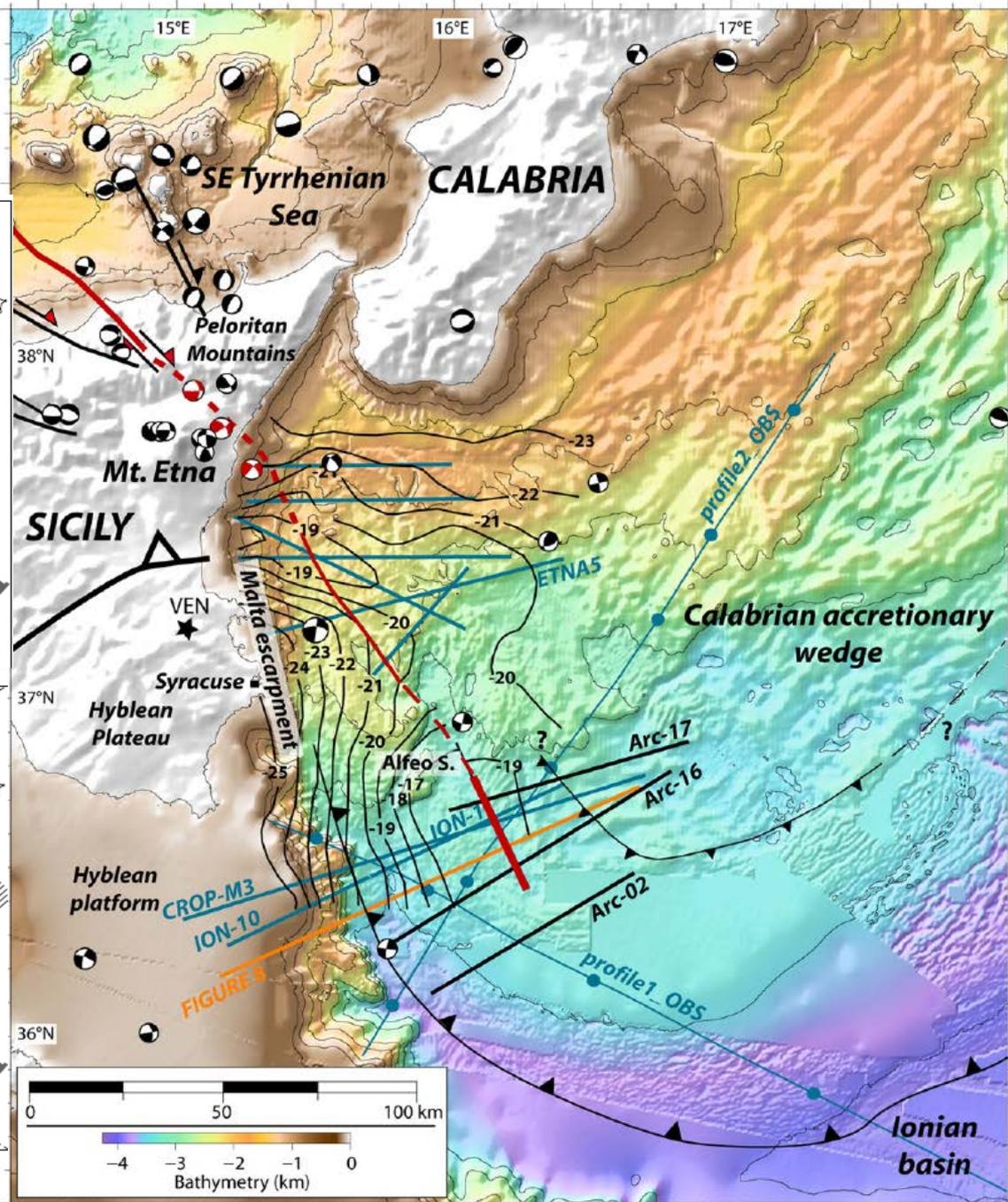
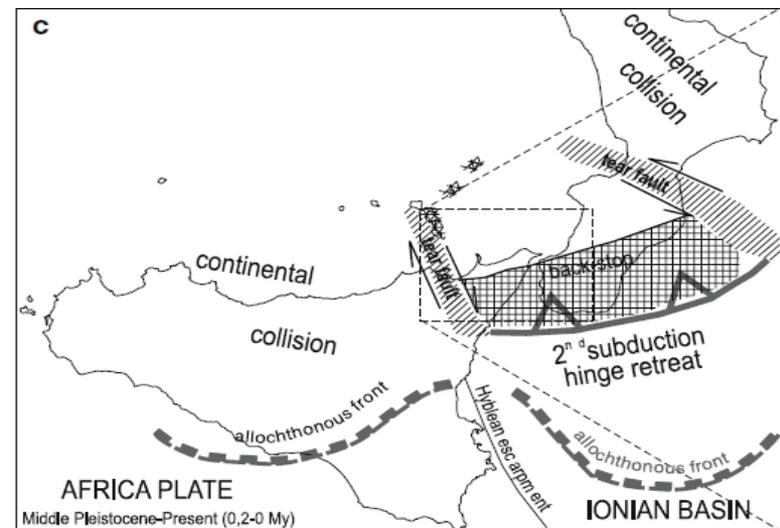
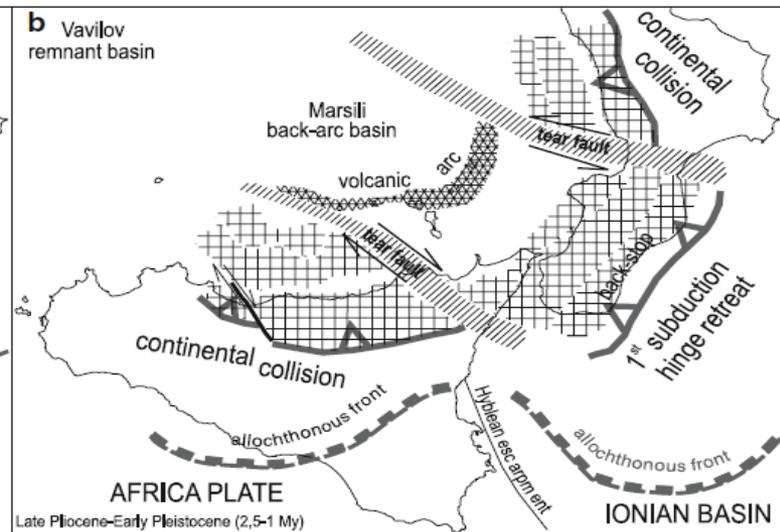


Gallais et al., 2013

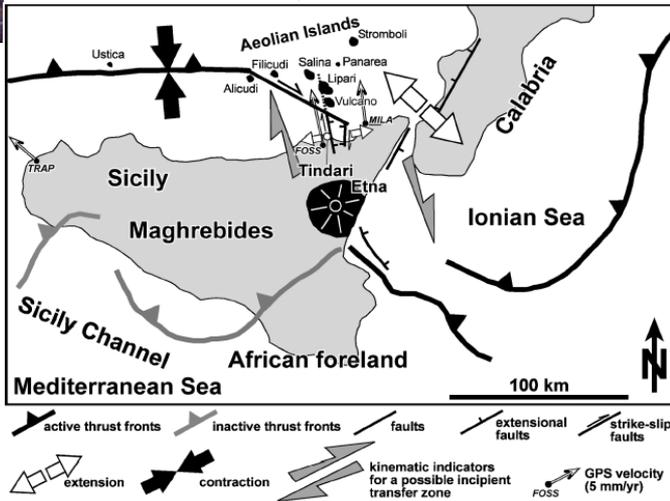
B



Structural interpretations onshore Sicily are taken from **Guarnieri, 2006**.



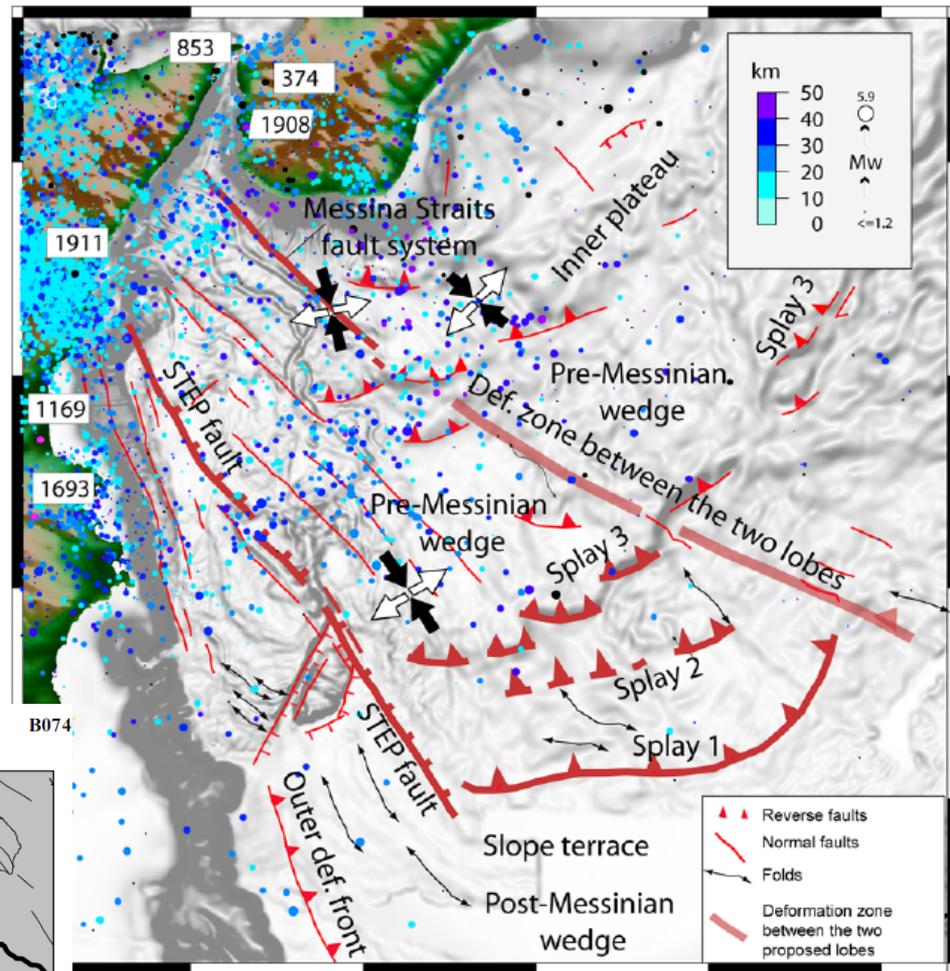
Billi et al., 2006



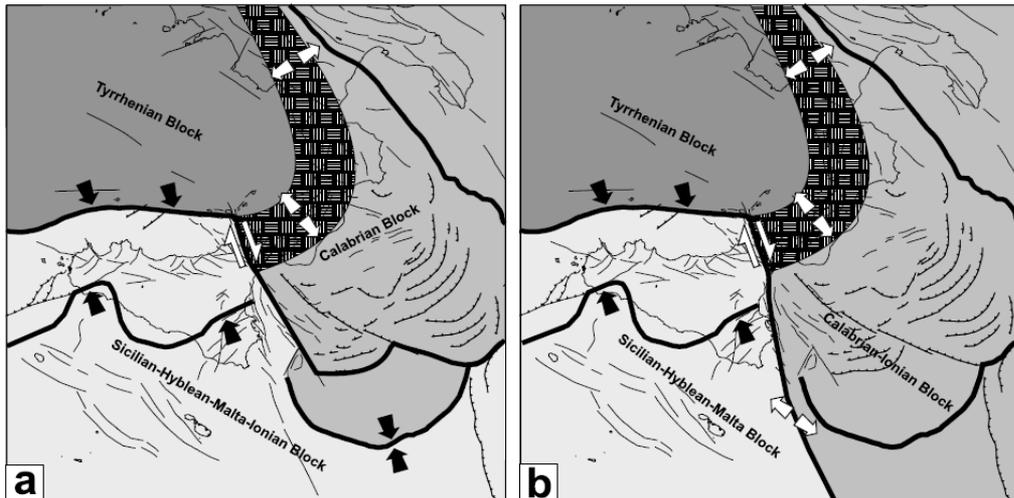
Aeolian–Tindari–Letojanni fault system characterized by GPS relative velocities of  $\sim 3.6$  mm/yr along the N126E direction

PALANO ET AL.: GPS VELOCITY/STRAIN IN SOUTH ITALY

STEP (Slab Transfer Edge Propagator) fault system

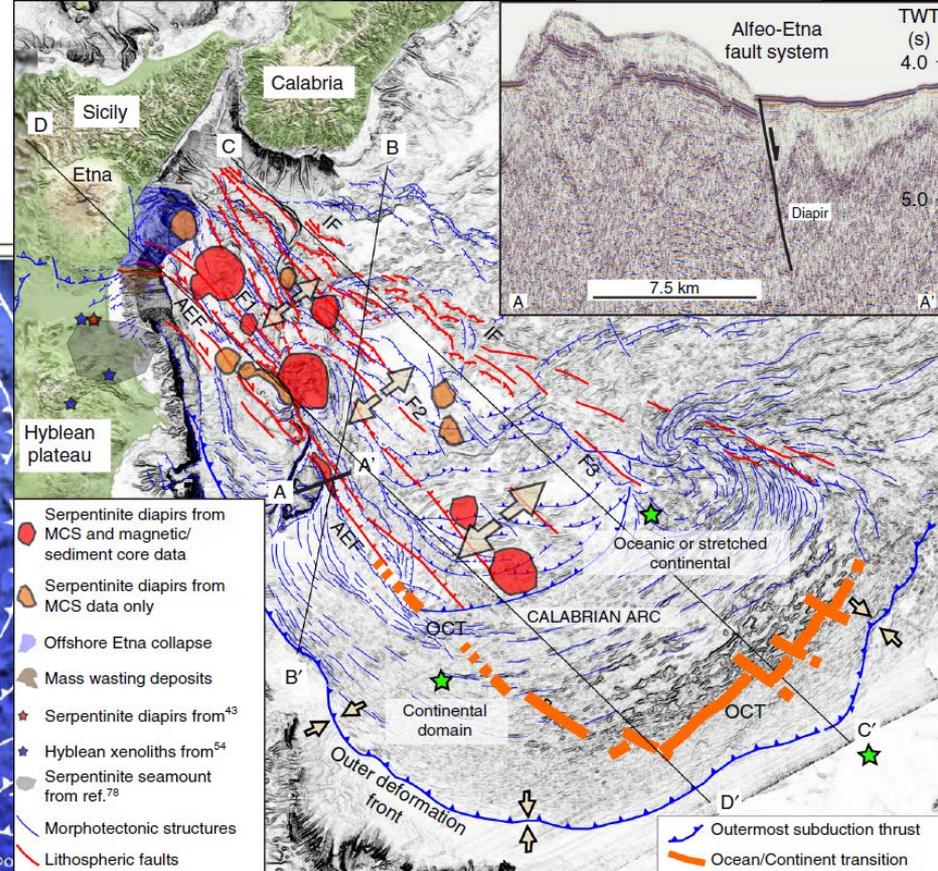
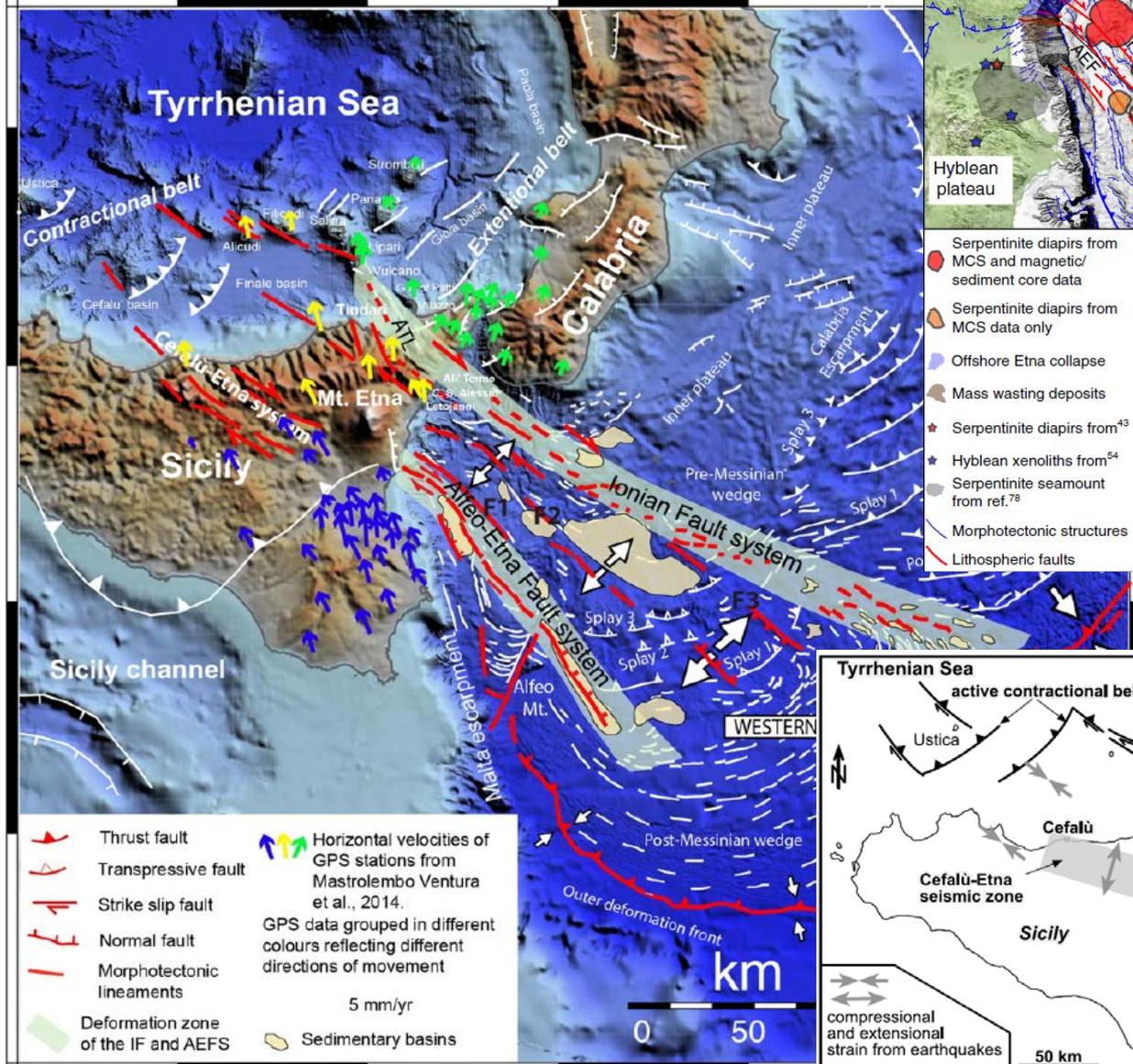


Polonia et al., 2012

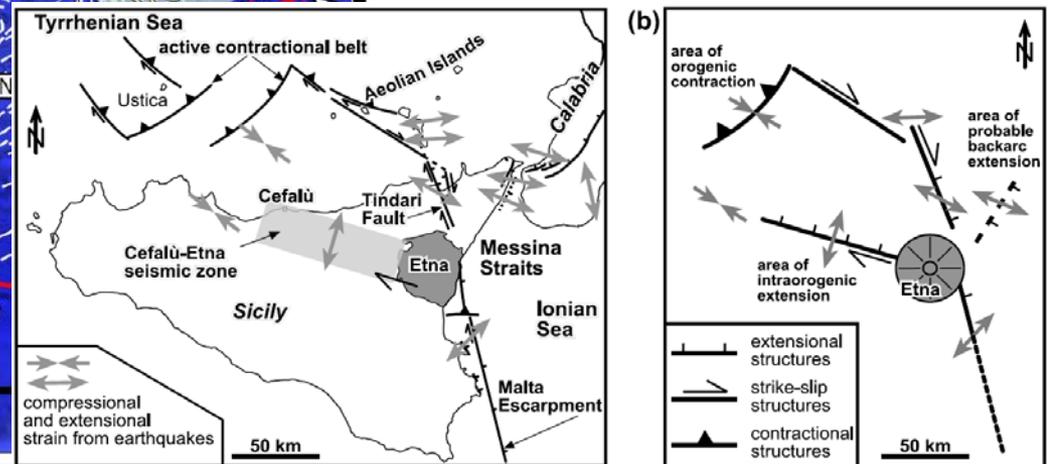


Polonia et al 2016

A. Polonia et al. / *Tectonophysics* 675 (2016) 69–90



Billi et al., 2010

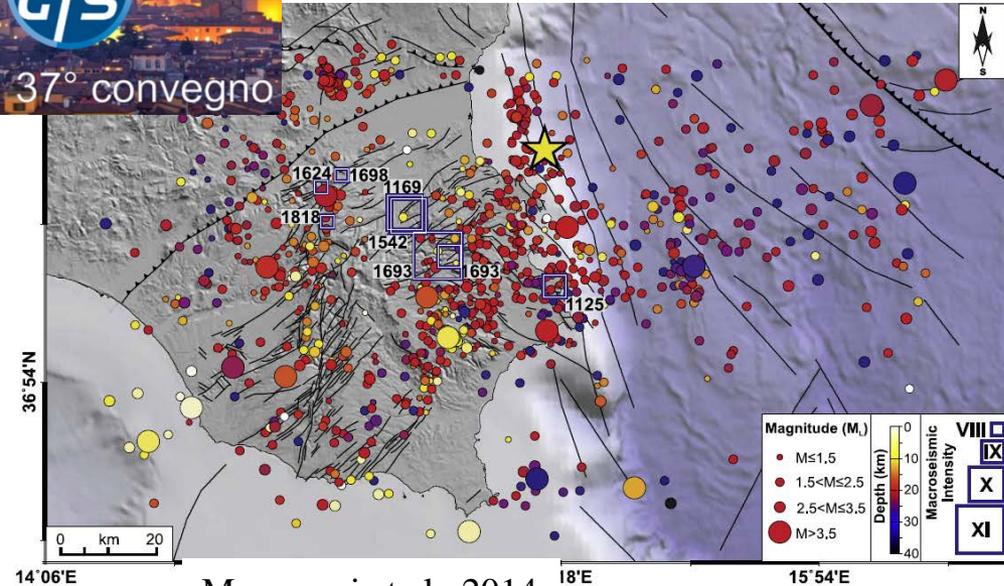




Correlazioni tra lineamenti tettonici individuati in off-shore e quelli on-shore risultano essere poco vincolate: a strutture ben note in Letteratura vengono attribuite cinematiche ed entità dei rigetti di lungo periodo, differenti da quelli che le hanno effettivamente contraddistinte durante il Quaternario.

### *Obiettivi*

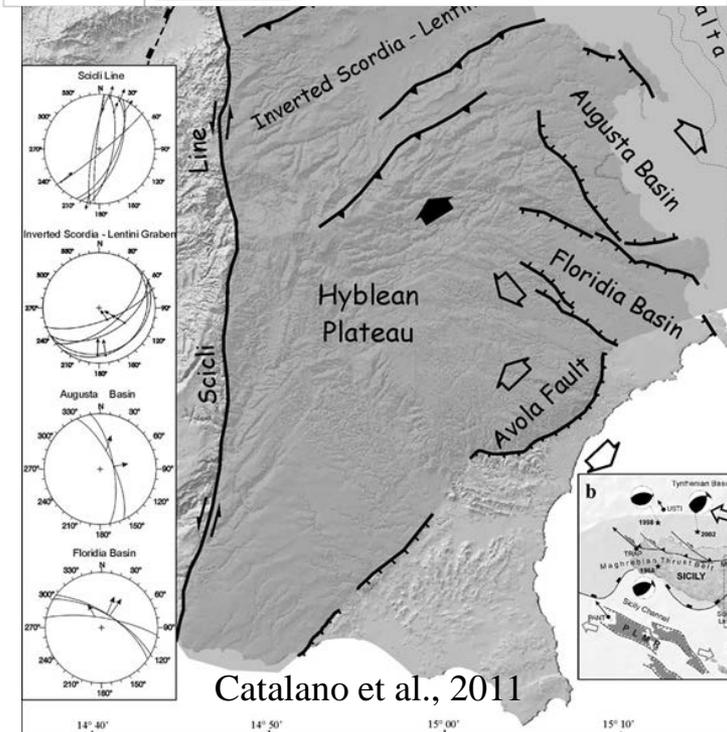
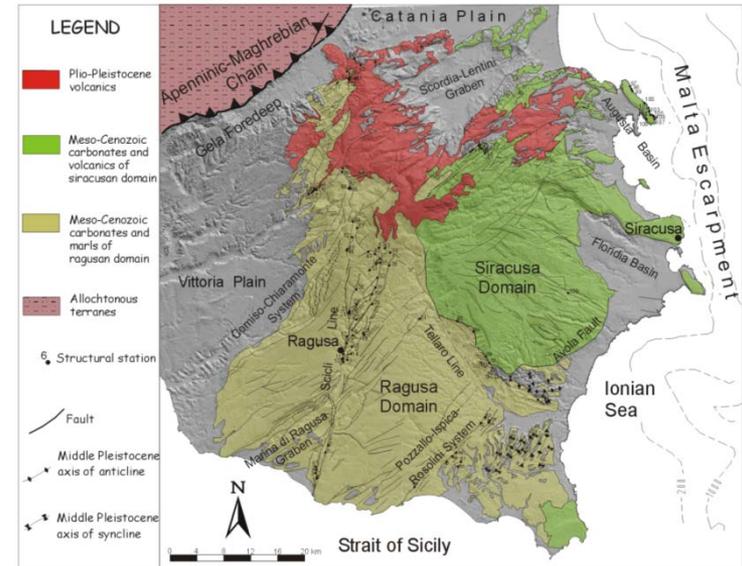
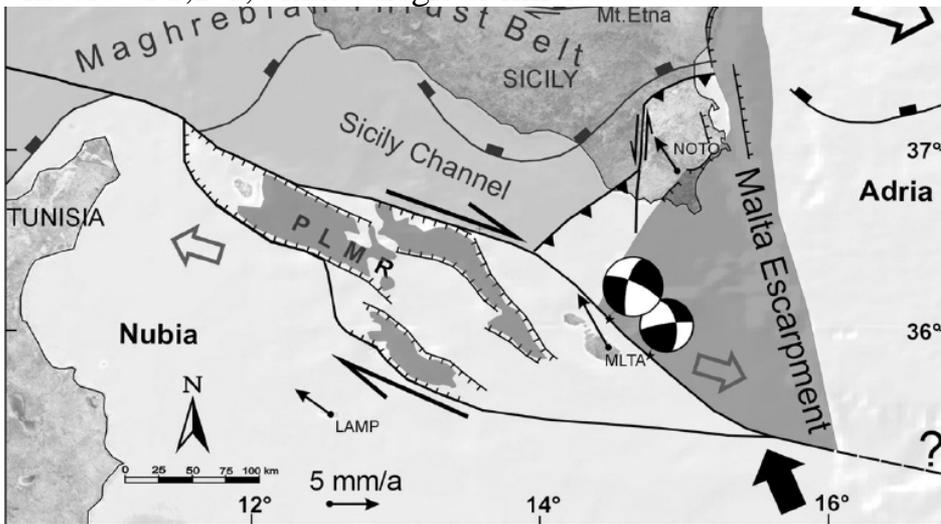
- Ricostruire un quadro aggiornato dei lineamenti tettonici principali tardo-quaternari.
- Fornire dei vincoli utili per una migliore correlazione tra lineamenti *onshore* e *offshore*.



Musumeci et al., 2014

earthquake locations from 1954 to 2013 and historical earthquakes are shown by circles and squares, respectively. Star shows the location of the  $M_s$  6.5 (al., 1995). Historical earthquakes are from Guidoboni et al. (2007). See inset for symbols and colours.

Catalano et al., 2008: linea di Scicli con tasso di movimento medio di 1,2-1,4 mm/a negli ultimi 850

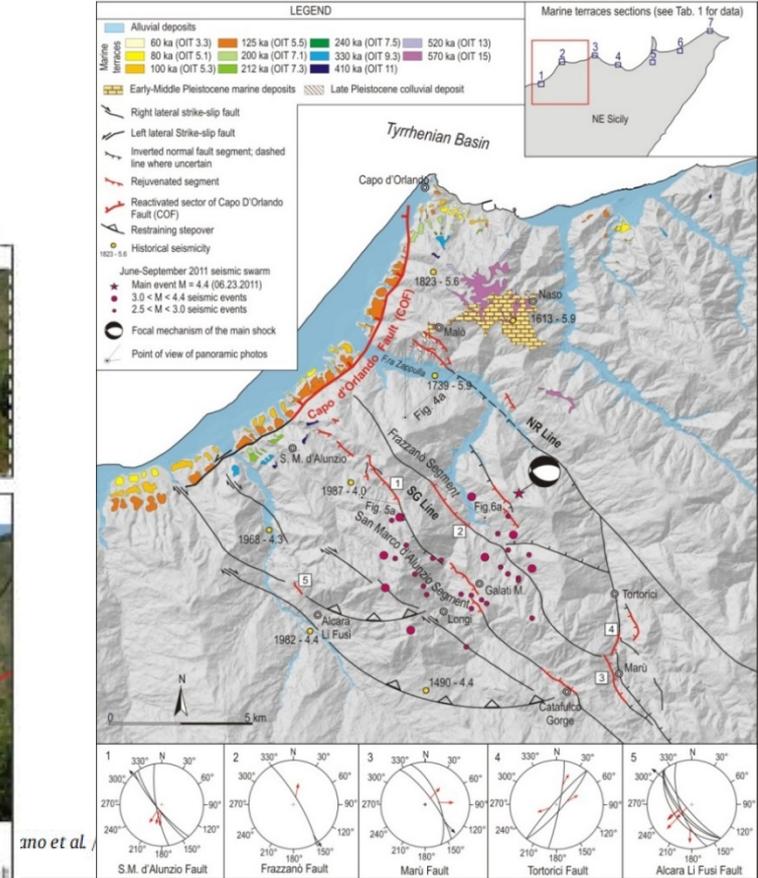
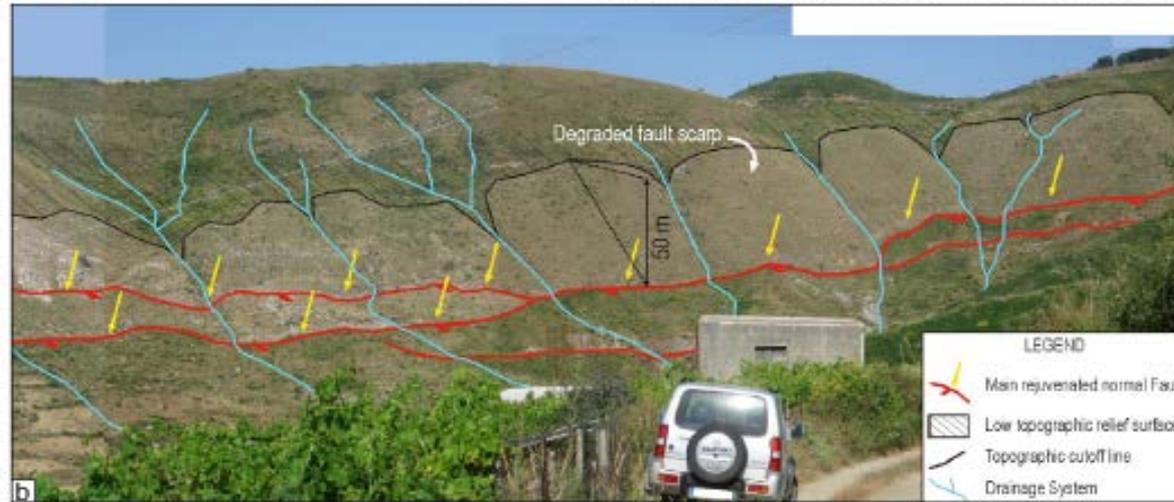
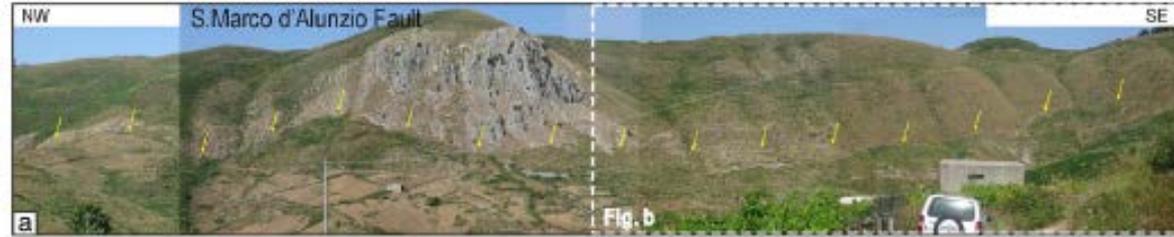


Catalano et al., 2011



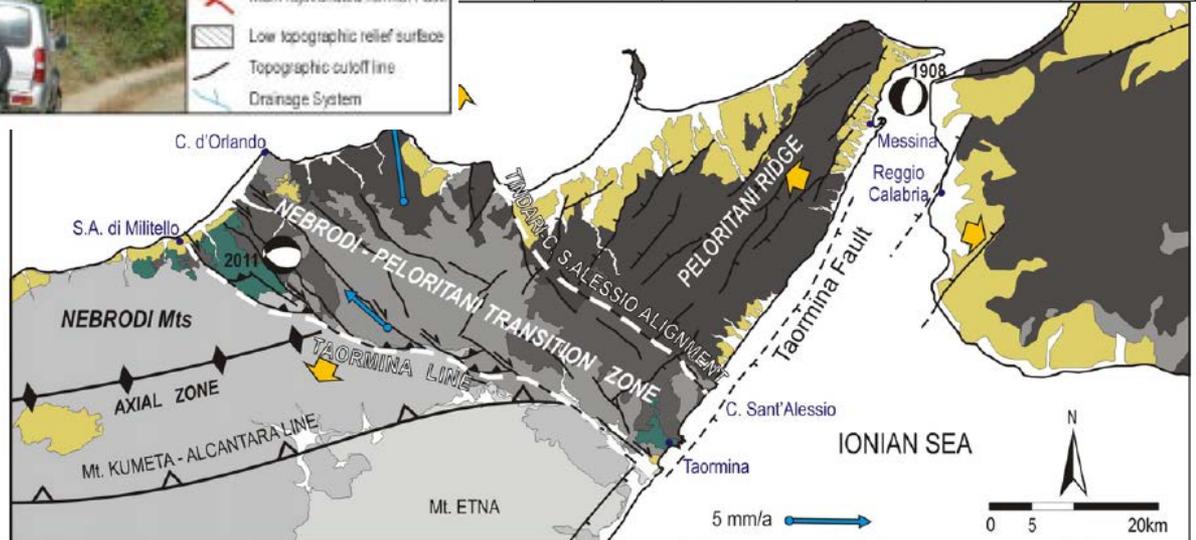
# Processi di inversione tettonica di lineamenti preesistenti: Sicilia nord-orientale

F. Pavano et al. / *Tectonophysics* 659 (2015) 1–11



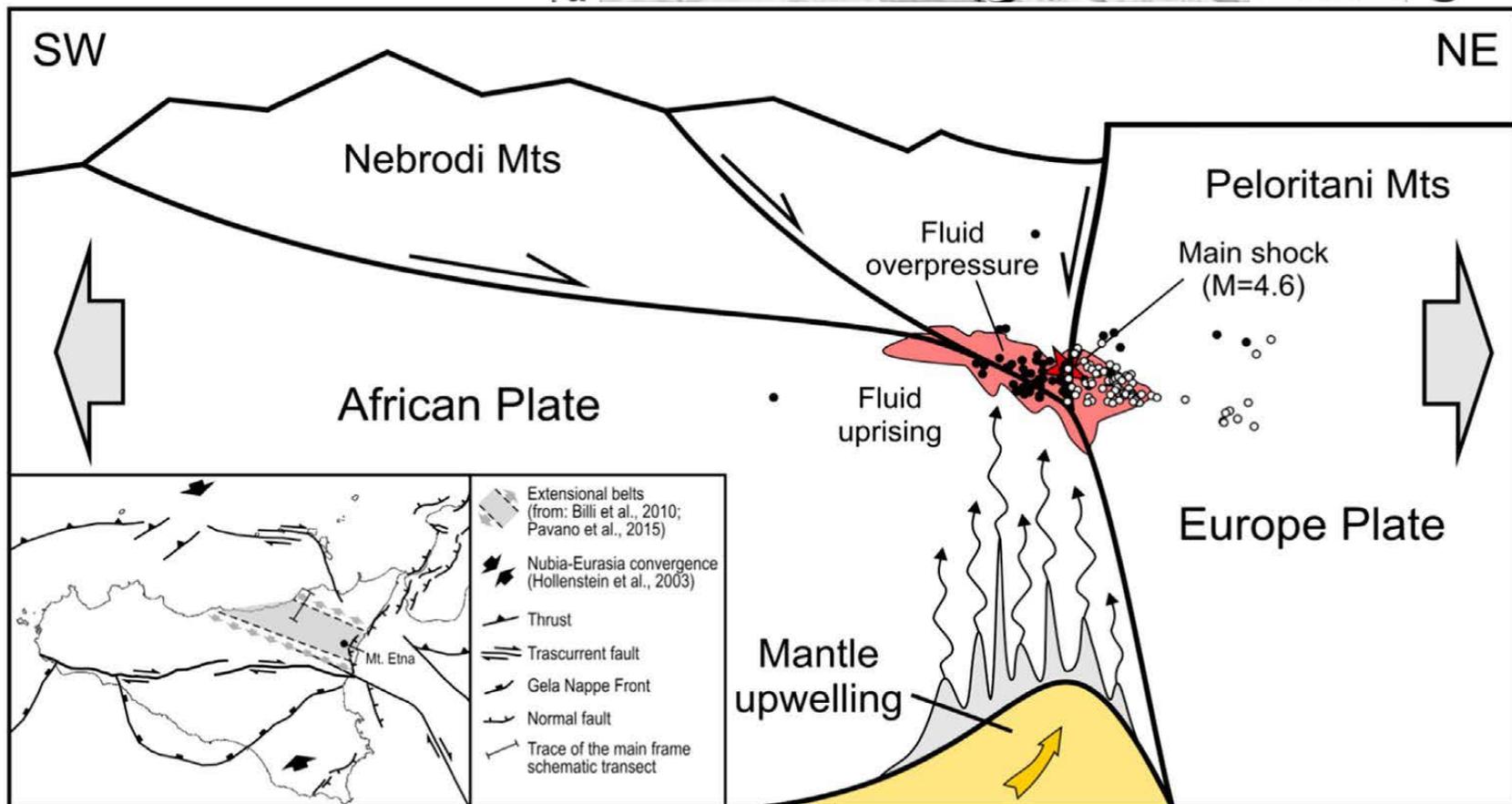
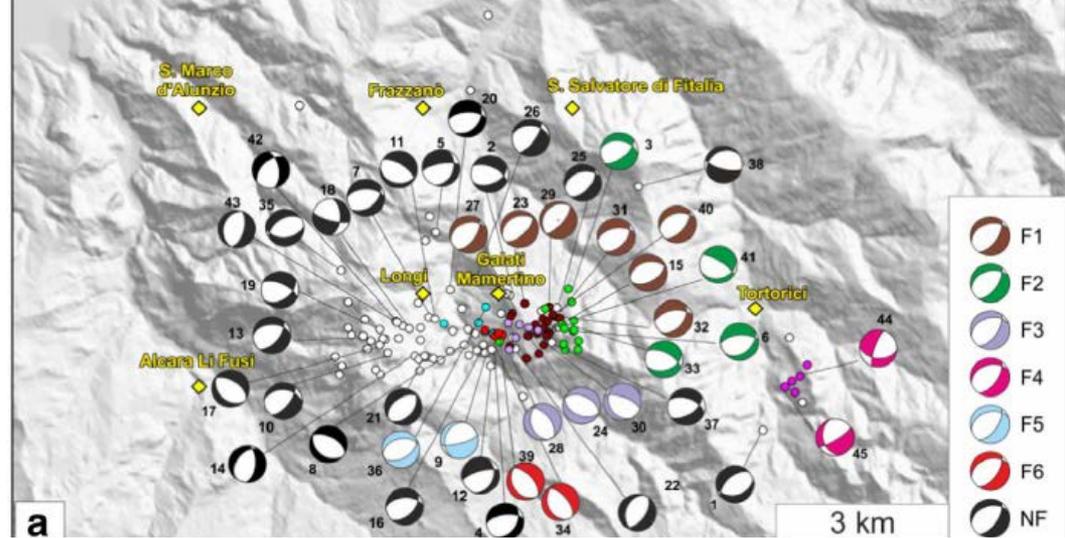
Pavano et al., 2015.

*Active tectonics along the Nebrodi–Peloritani boundary in northeastern Sicily (Southern Italy)*



*Seismological and structural constraints on the 2011–2013,  $M_{max}$  4.6 seismic sequence at the south-eastern edge of the Calabrian arc.*

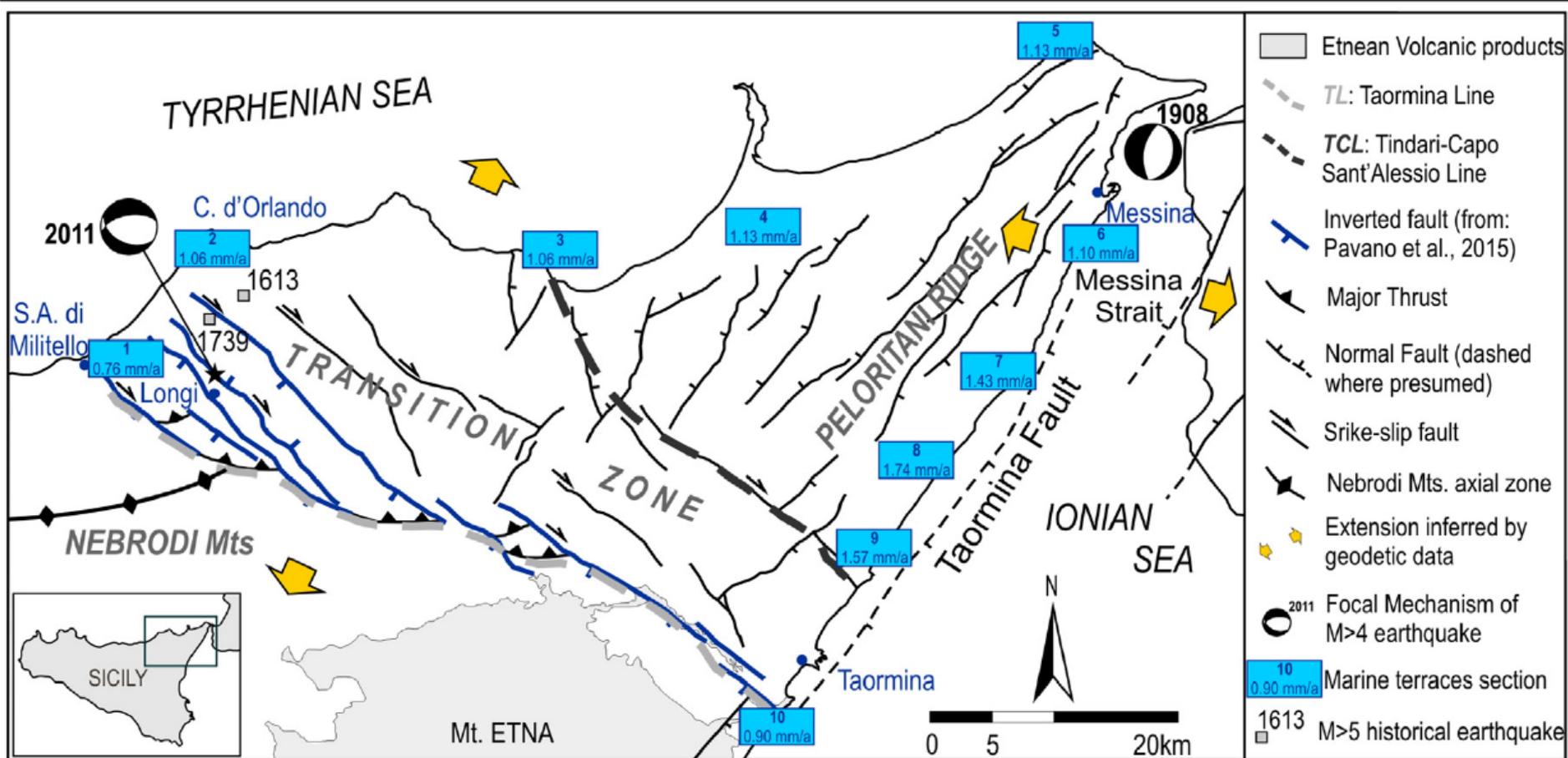
Cammarata et al., 2018



*Hypsometry and relief analysis of the southern termination of the Calabrian arc, NE-Sicily (southern Italy)*

Pavano et al., 2018.

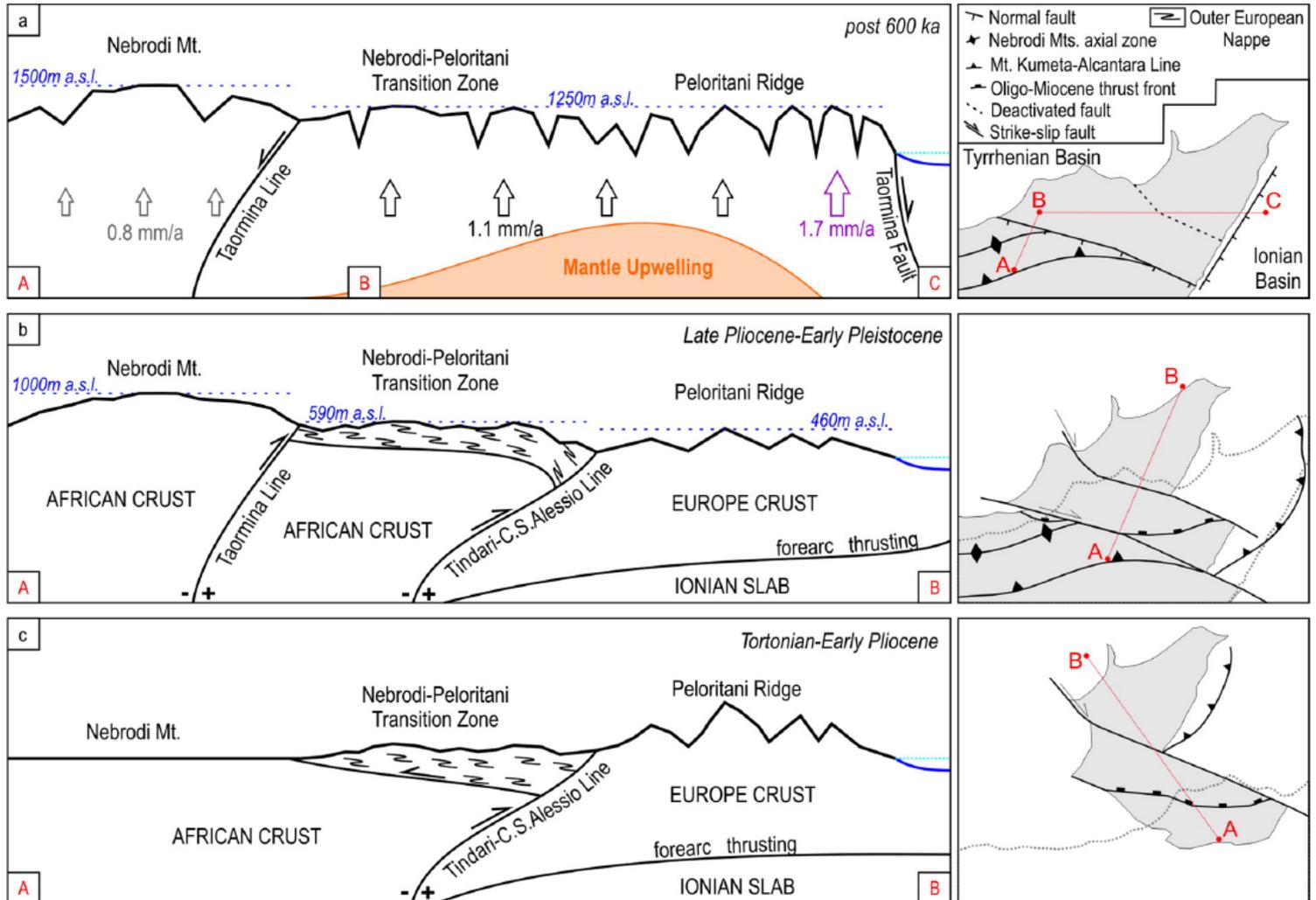
F. Pavano et al. / *Geomorphology* 304 (2018) 74–88



# Late Quaternary morphotectonic evolution of the region, defining the role played by the main tectonic alignments on the present geomorphic setting

Pavano et al., 2018.

F. Pavano et al. / *Geomorphology* 304 (2018) 74–88

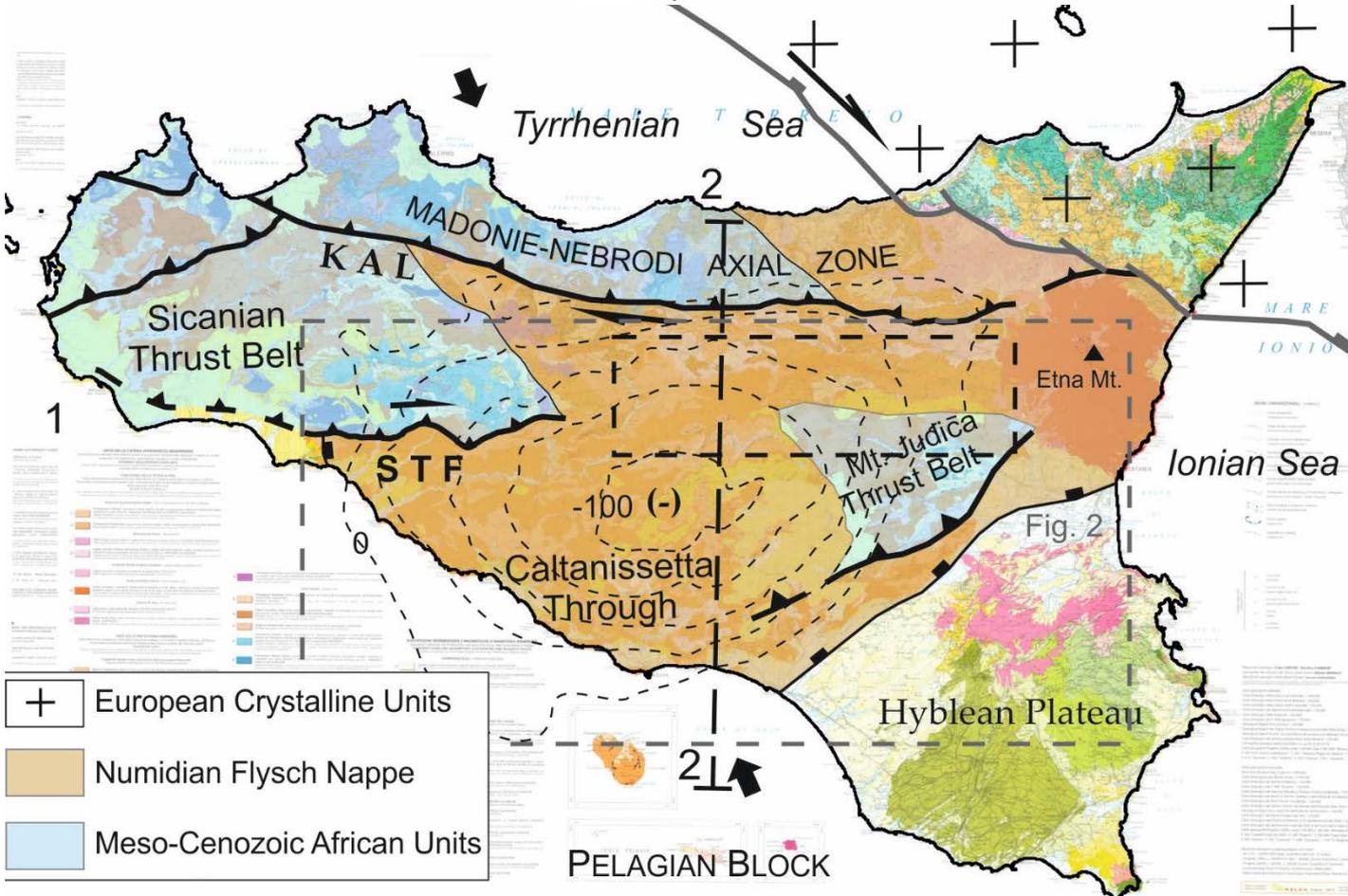
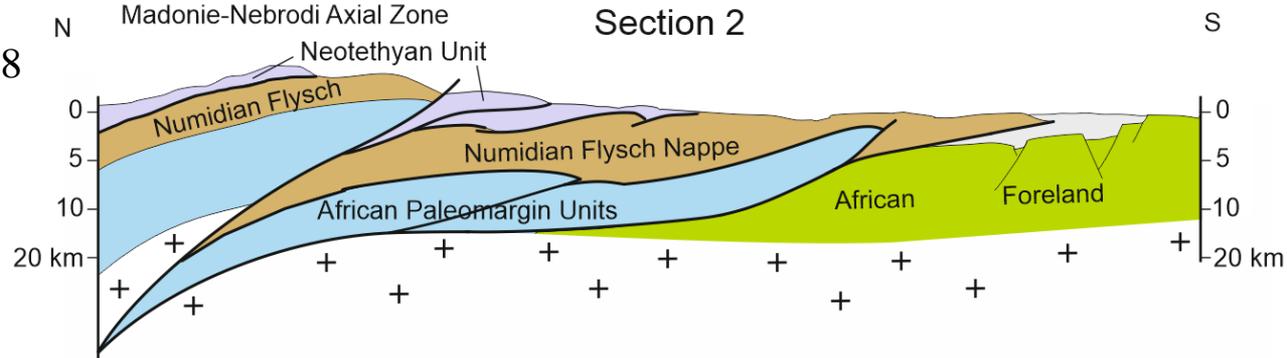




*The Late Tortonian-Quaternary kinematic model of central Sicily: new insights on the mode of deformation of the inverted African margin*

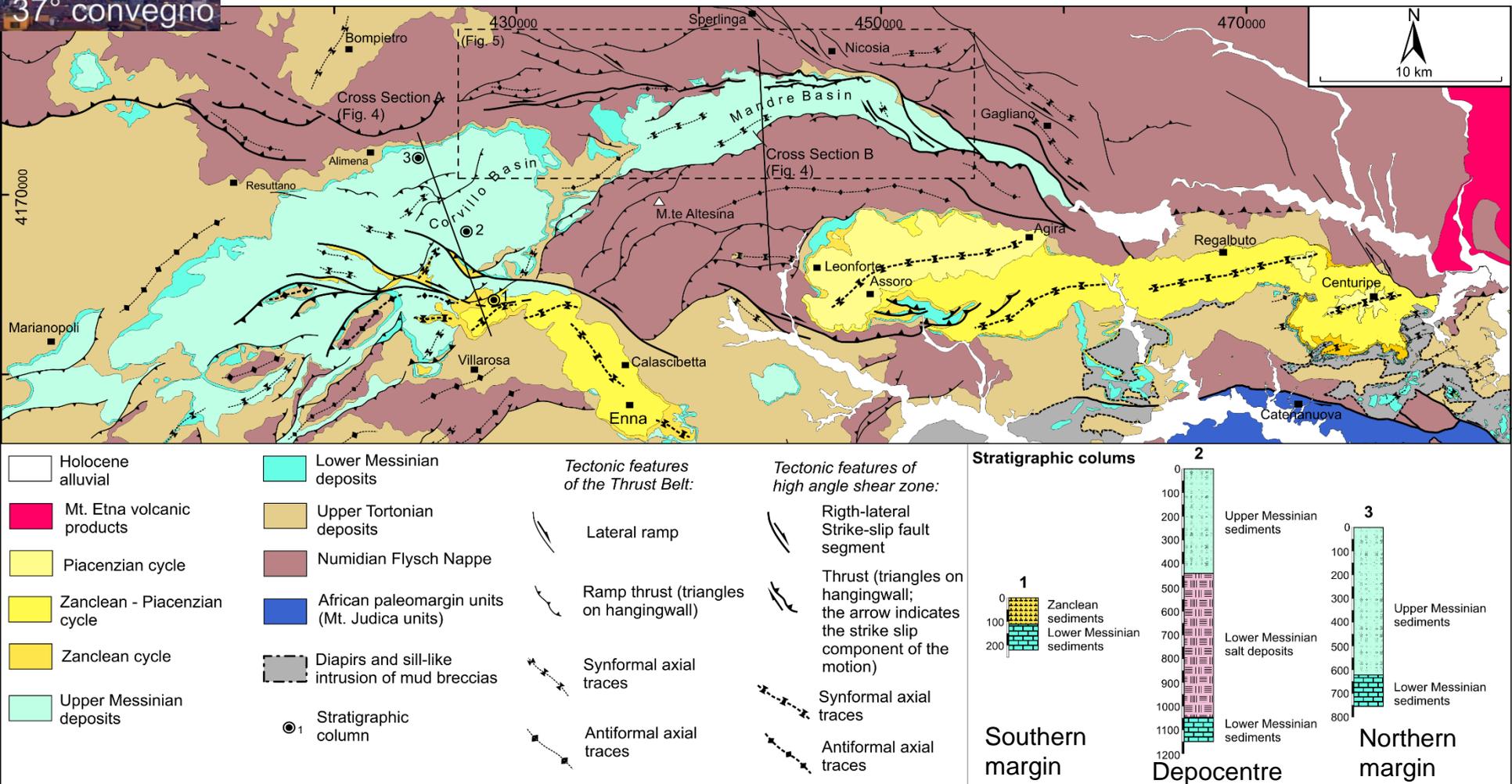
Catalano et al., 2018

Schematic geological section modified from Lentini et al., 1996



Tectonic sketch map of Sicily showing the main tectonic lineament of the Sicily Collision Belt and the main tectonic domain. Geological map of Sicily from Lentini and Carbone 2014, in the background.

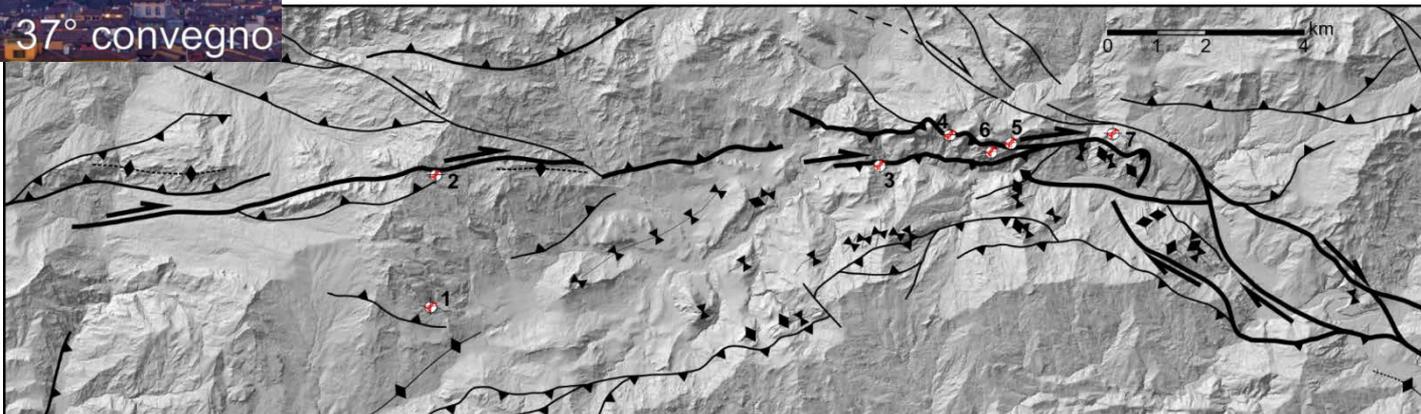
Catalano et al., 2018



Geological and structural map of the northern margin of the Caltanissetta Trough (Corvillo, mandre and Centuripe basins). The tectonic features of a high-angle shear zone and the tectonic features of the Thrust Belt are indicated.

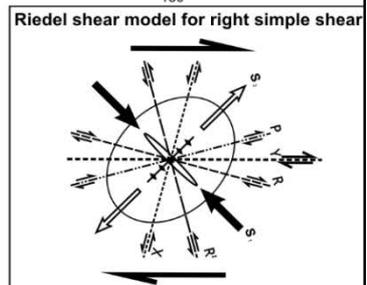
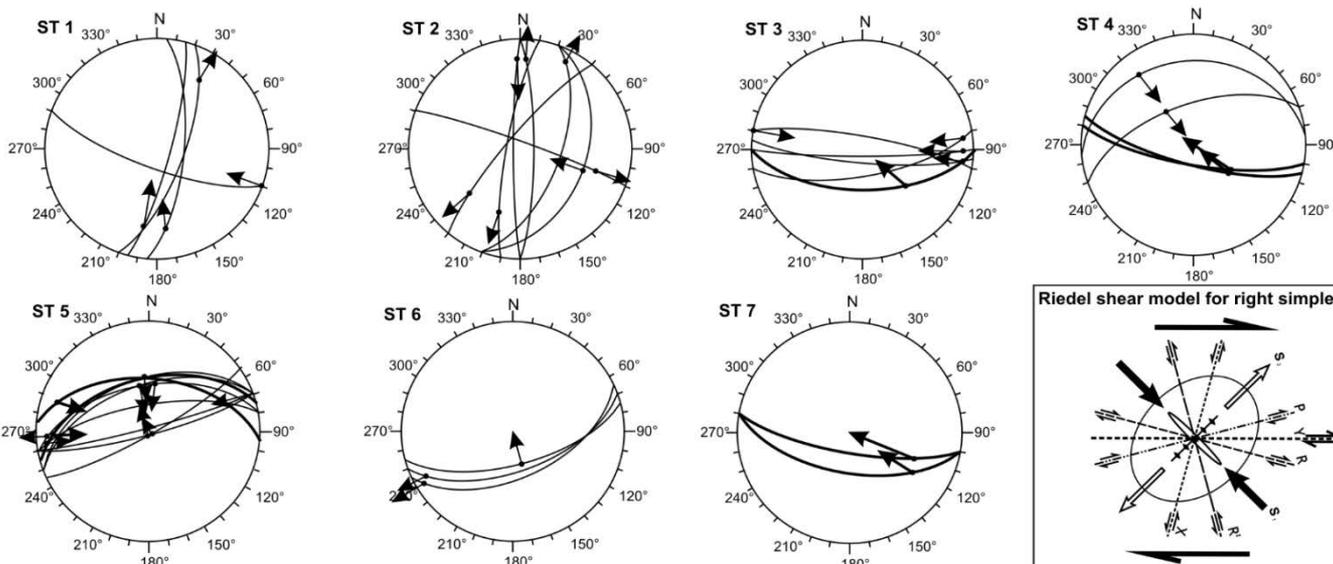
Picture of the northern margin of the Mandre Basin, characterized by upper Messinian clastic deposits





Geometry of the tectonic features of a high-angle shear zone along the northern margin of the Mandre Basin. The structural data collected in the area, plotted in the stereonets (ST1-7) and the related deformation model, referring to the dextral shearing along the shear zone, are shown.

**Stereoplots (Schmidt net, lower hemisphere projection)**

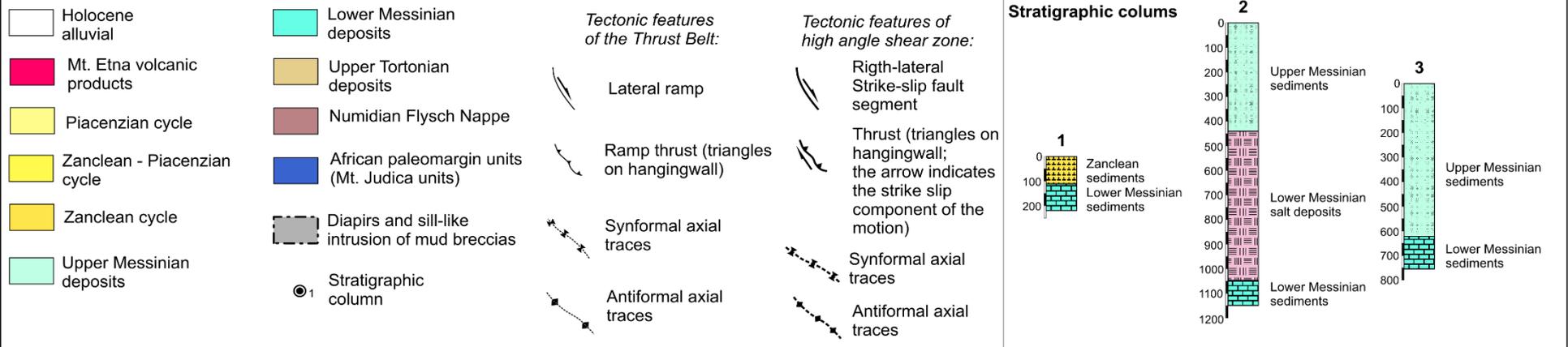
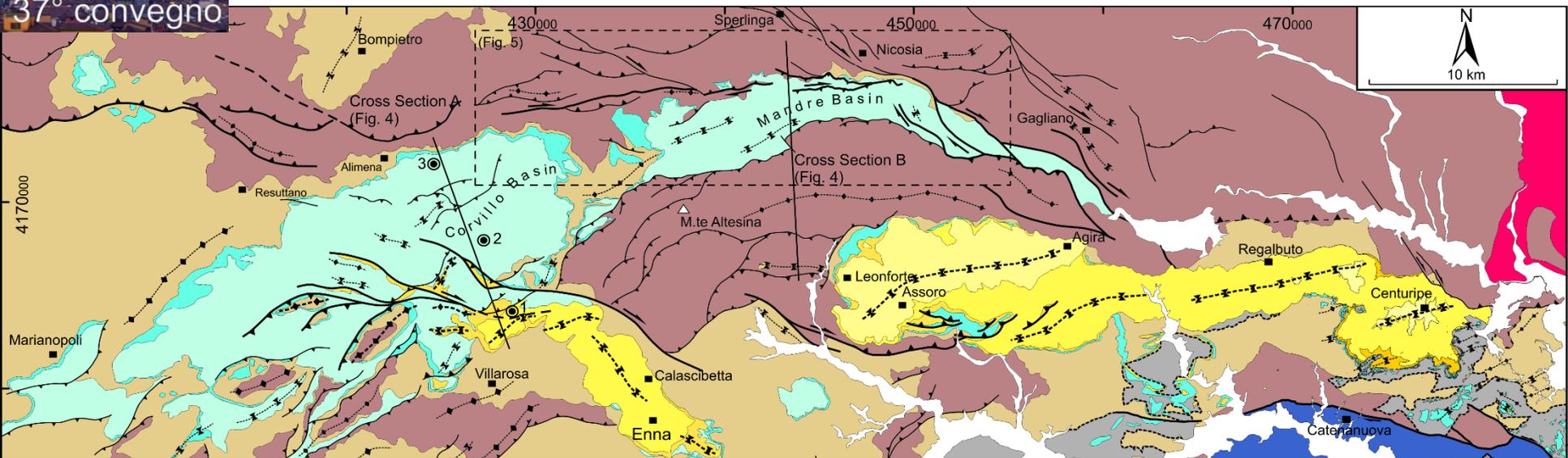


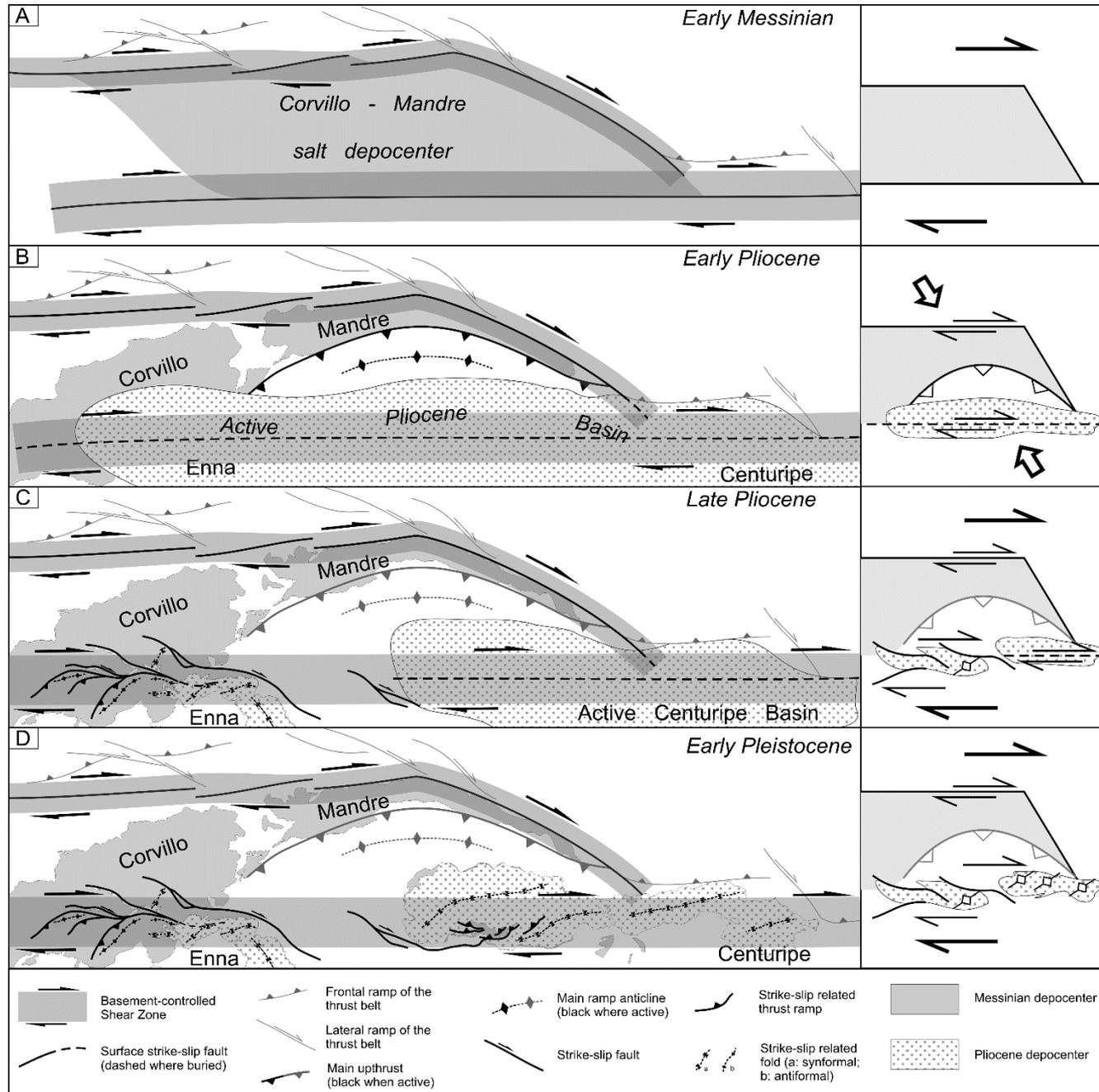
**Tectonic features of the Thrust Belt:**

- Lateral ramp
- Ramp thrust (triangles on hangingwall)
- Synformal axial traces
- Antiformal axial traces

**Tectonic features of high angle shear zone:**

- Right-lateral Strike-slip fault segment
- Thrust (triangles on hangingwall; the arrow indicates the strike slip component of the motion)
- Site of structural measurement

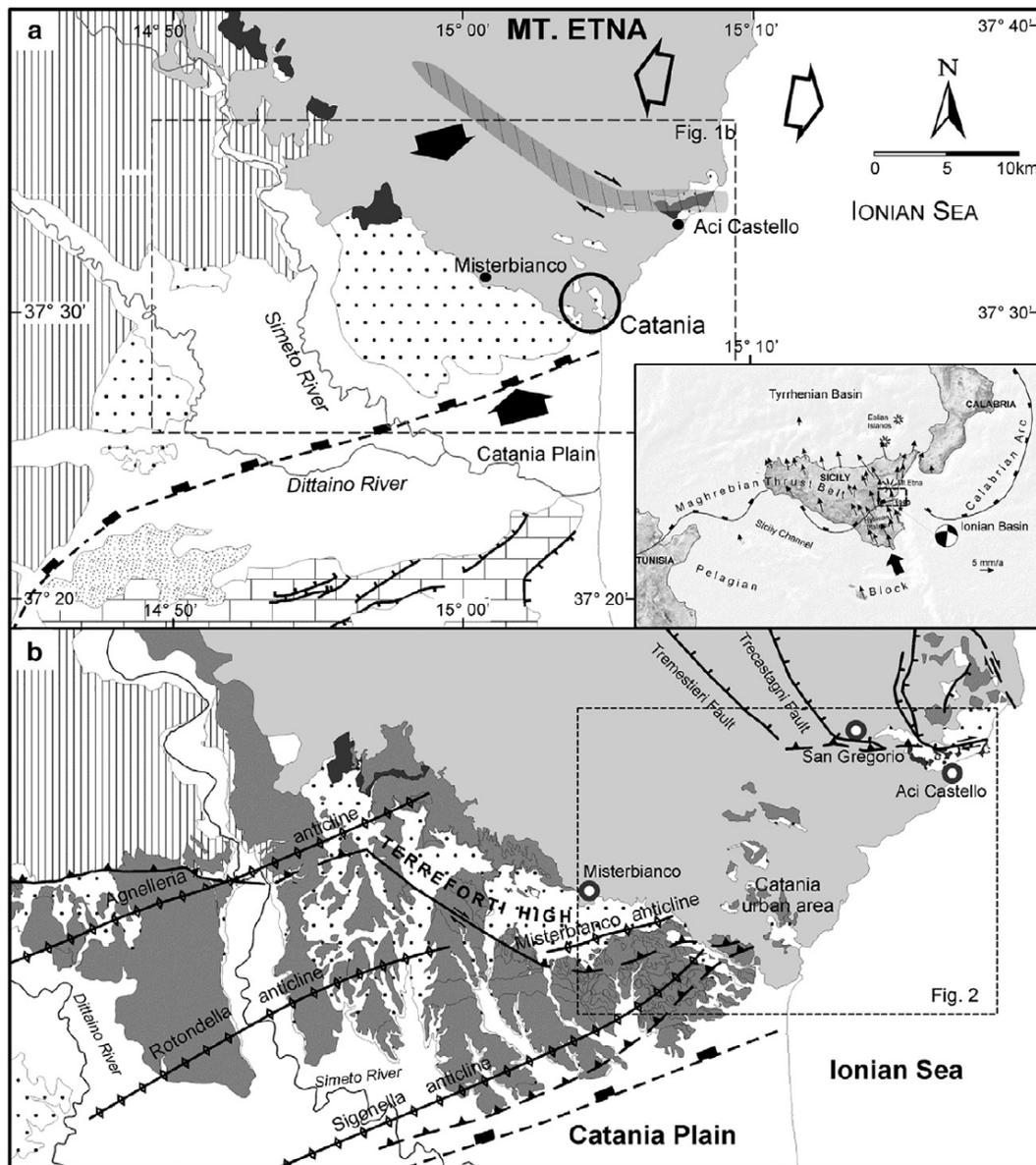




Schematic tectonic evolution of the Corvillo, Mandre and Centuripe basin area (northern margin of the Caltanissetta Trough) from Early Messinian to Early Pleistocene times. Catalano et al., 2018.

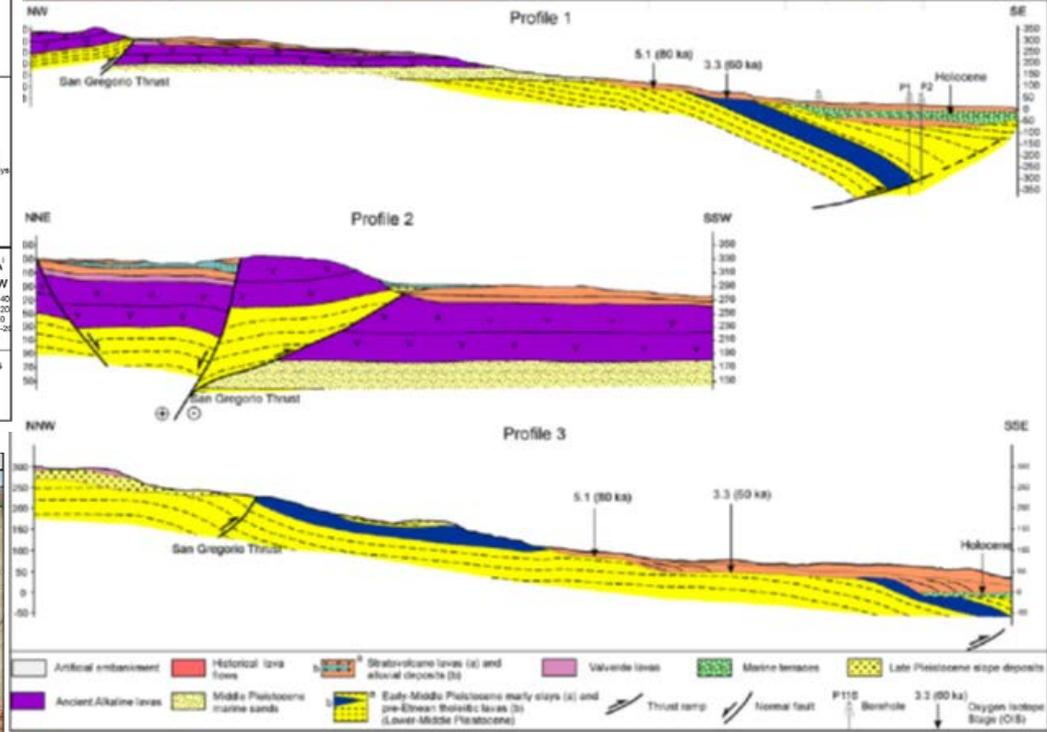
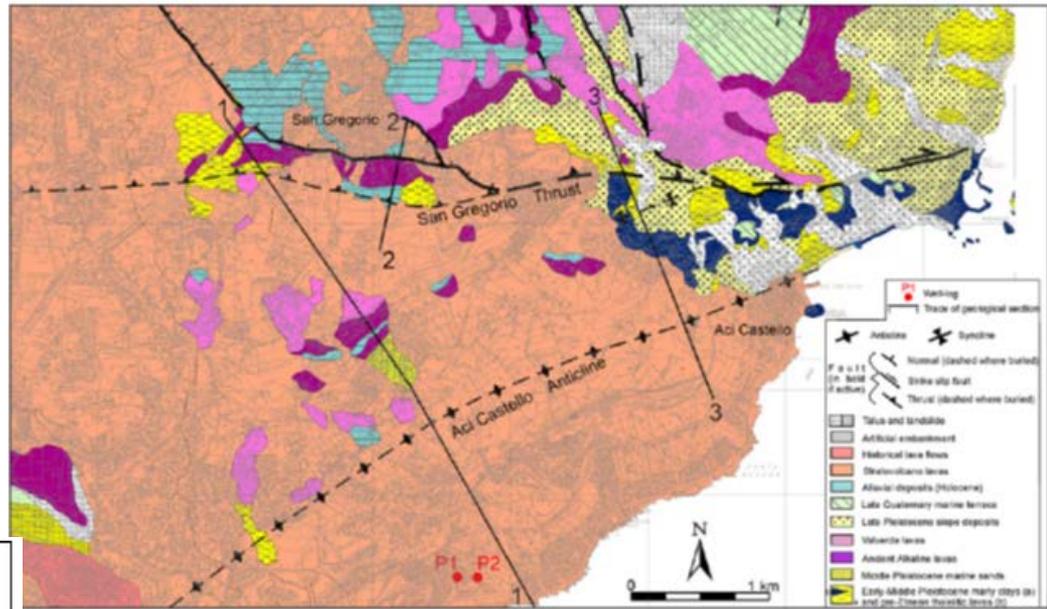
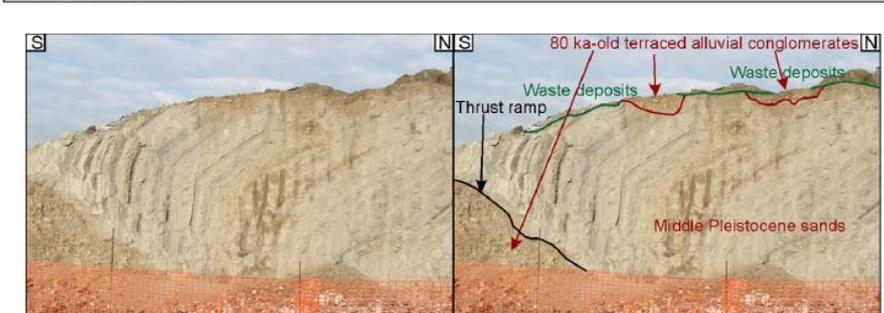
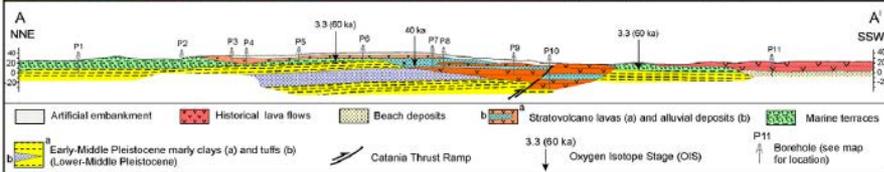
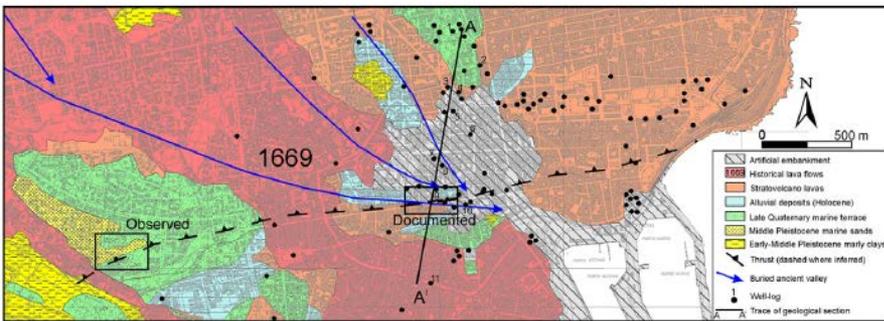
*Late Quaternary tectonics and active ground deformation in the Catania urban area (eastern Sicily): New constraints from a geological investigation*

Catalano et al., 2017

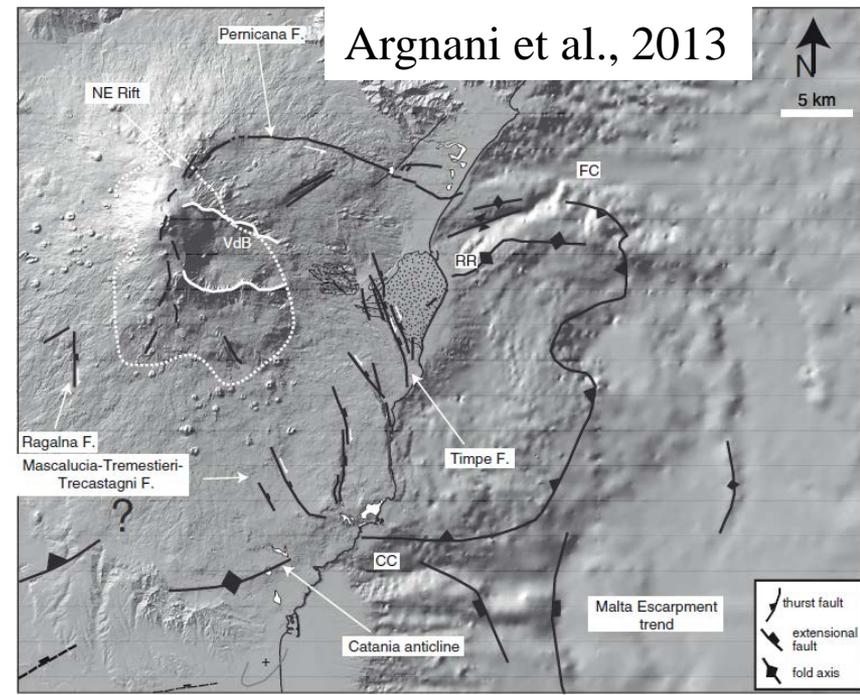
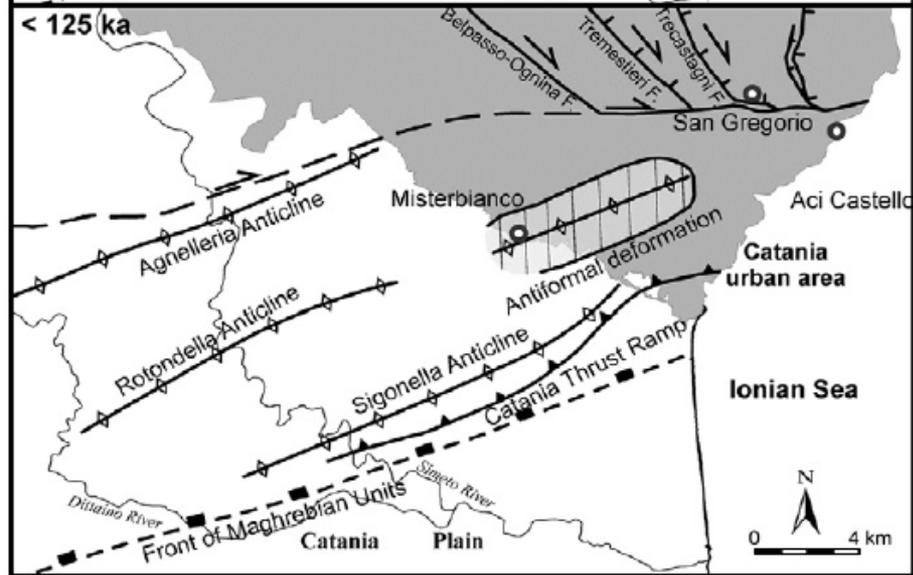
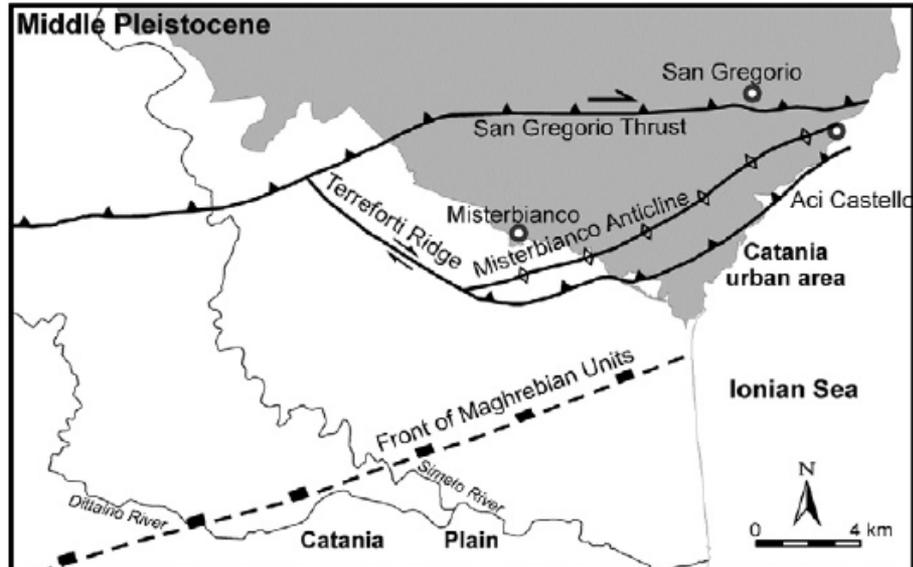




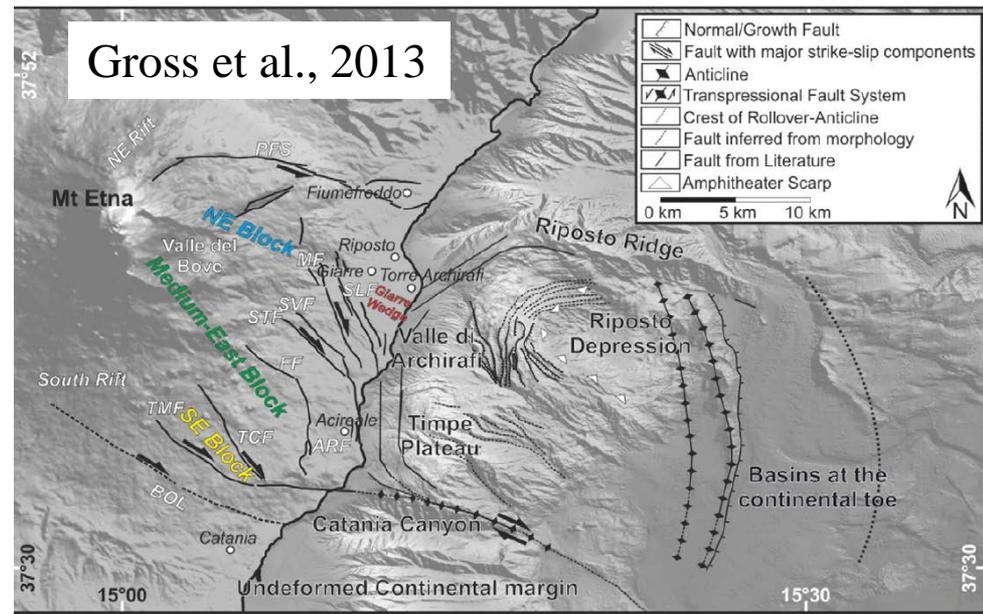
Catalano et al., 2017



Catalano et al., 2017



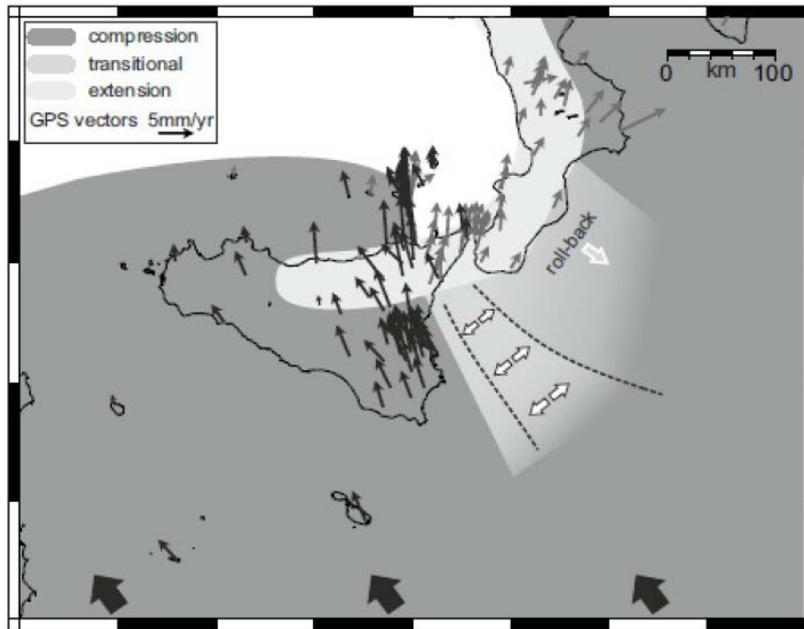
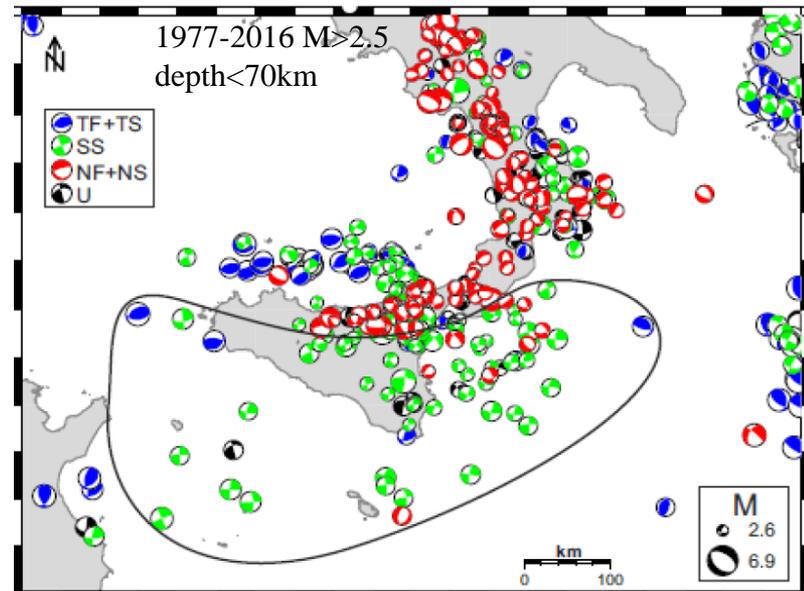
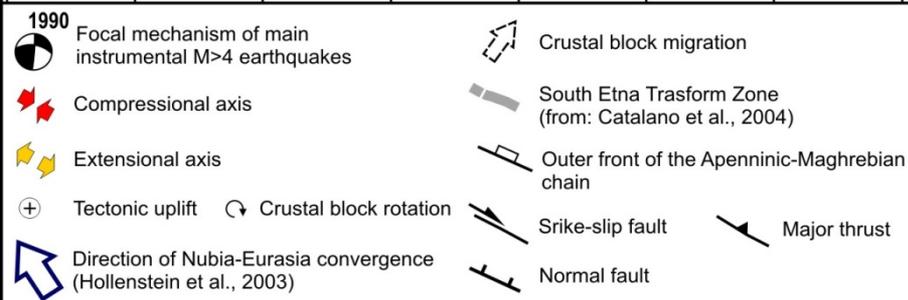
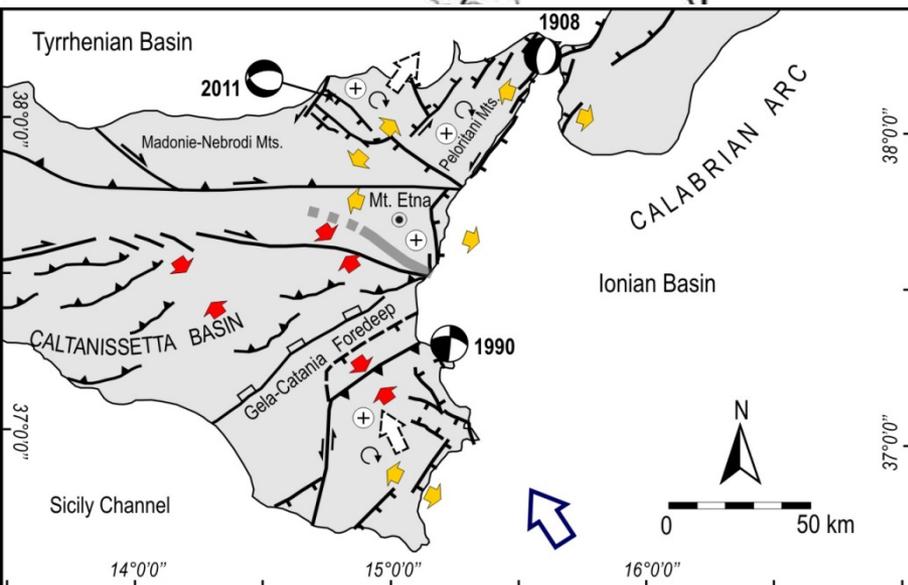
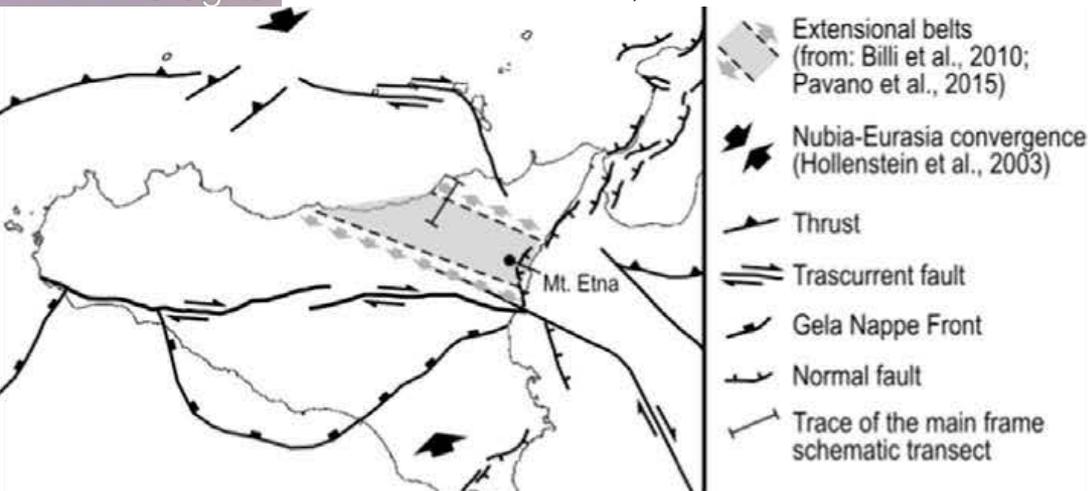
F. Cross et al. / Tectonophysics 667 (2016) 63–76



Northern Fault System: PFS=Permiana Fault System

Timpe Fault System: MF=Moscarello; SVF=S. Venerina STF=S. Tecla; SLF=S. Leonardello; FF=Fiandaca; ARF=Acireale

Southern Fault System: TMF=Tremestieri; TCF=Trecastagni; BOL=Belpasso-Ognina Lineament





## ***Conclusioni***

- La ricostruzione del quadro tettonico tardo-quadernario permette di poter verificare la validità dei modelli sismotettonici di una delle regioni a maggiore pericolosità sismica del Mediterraneo.
- Il contributo dei dati a terra risulta pertanto fondamentale sia per la caratterizzazione geometrica che per quella cinematica di eventuali prosecuzioni a terra di strutture riconosciute a mare.
- L'integrazione e la correlazione tra dati geofisici *offshore* e dati geologici *onshore* è necessaria per definire l'esatto ruolo e rilevanza dei lineamenti tettonici riconosciuti.