Multiphase tectonic interaction of Tyrrhenian - Tunisia Margin - Ionian systems: Implications for regional seismogenesis.

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Seismicity West Mediterranean

Much of the current seismicity does not occur on structures operating during the geodynamic processes that formed the Western Mediterranean Basins

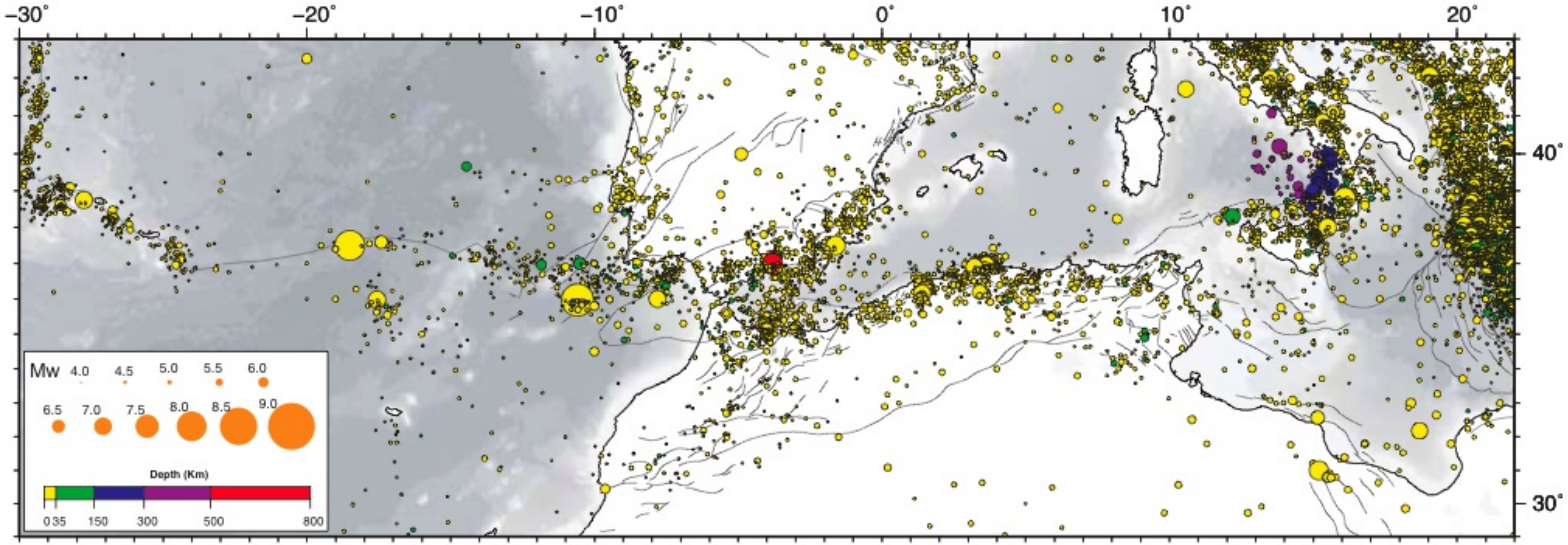


Figure 2. Earthquakes with *M* , 4 in the Atlantic and Western Mediterranean region taken from the Karnik (1996) catalogue (data from 1901 to 1964) and International Seismological Centre (ISC) *Bulletin* (data from 1965 to 2004), colour-coded with respect to epicentre depths. Faults, as in the other following figures, are taken from the Geodynamic Map of the Mediterranean compiled in the frame of the Commission for the Geological Map of the World (http://ccgm.free.fr).

Serpelloni et al., 2007

Kinematic and tectonic systems: Complex setting !

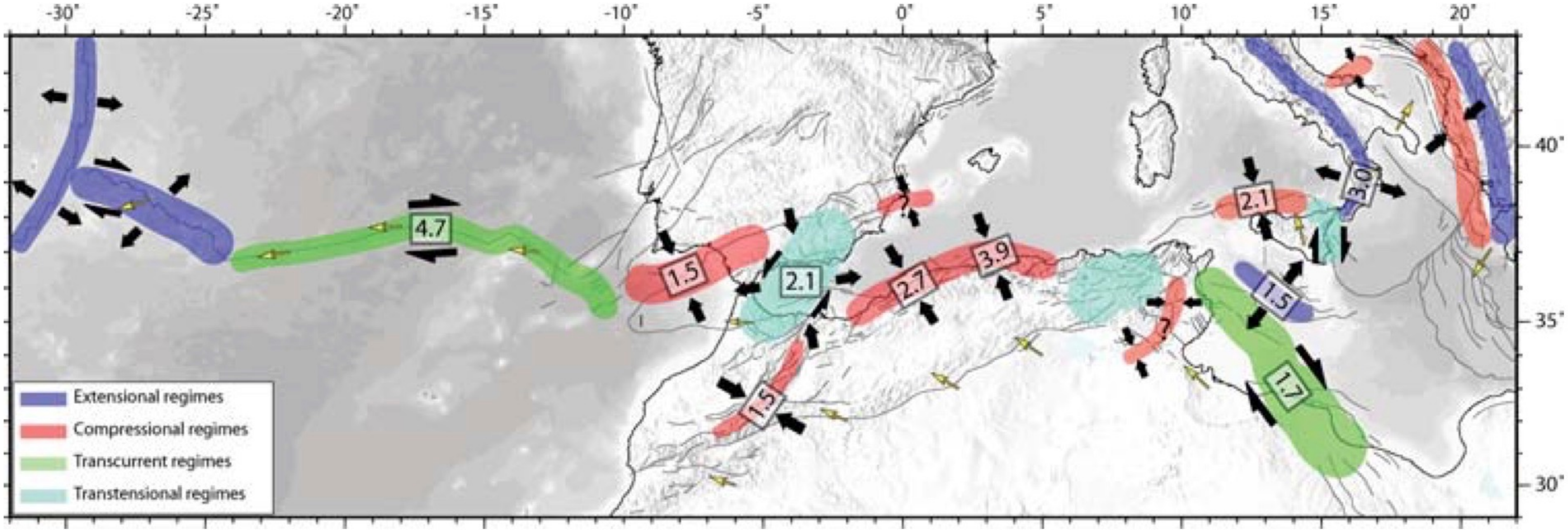
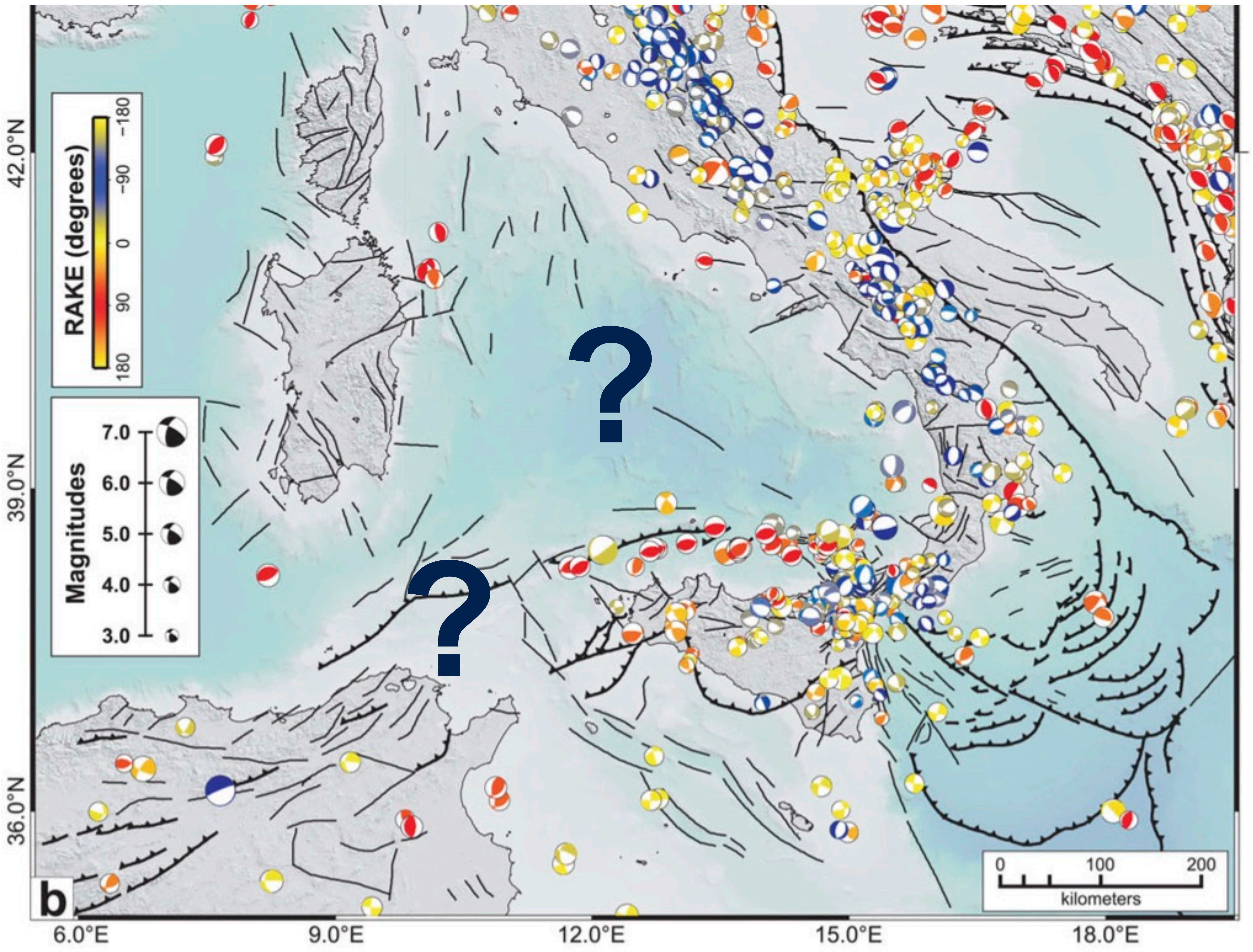


Figure 10. Sketch of the major kinematics and tectonics features of the Nubia-Eurasia plate boundary derived in this work. Deformation rates are in mm yr¡ 1.

Serpelloni et al., GJI 2007

Palano, GJI 2015

No available data across much of Tunisia and Tyrrhenian



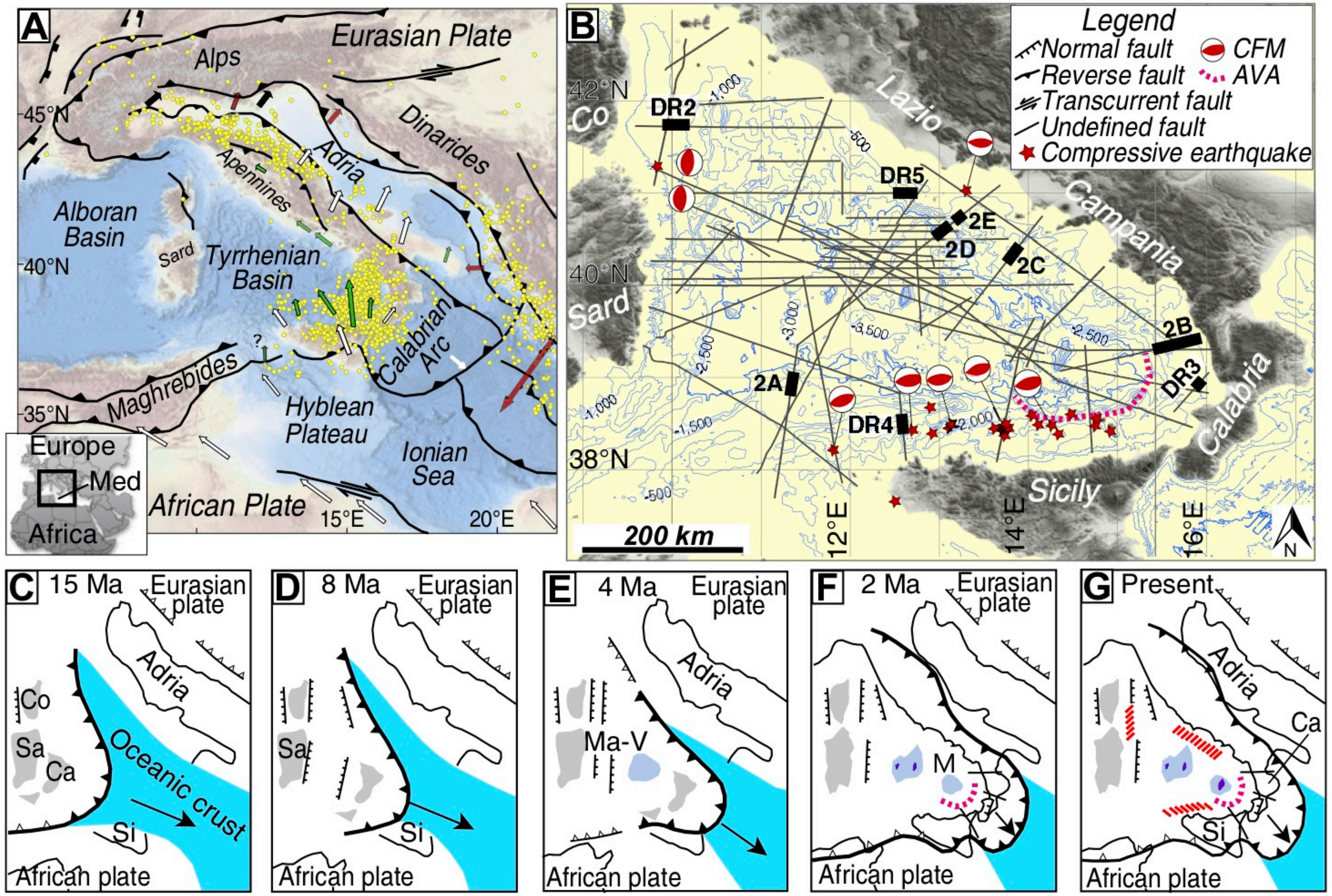


Figure 1. Structural setting and location map of study area. (A) Geodynamic sketch map of the central Mediterranean. Base map is from the EMODnet bathymetry portal (http://doi.org/10.12770/c7b53704-999d-4721-b1a3-04ec60c87238); main structures are as synthetized by Bigi et al. (1991). Instrumental seismicity (yellow dots) <30 km depth is from the European Mediterranean Seismological Centre (EMSC; http://www.seismicportal.eu/). Thick arrows are displacement vectors of Africa with respect to Eurasia: green arrows are derived from GPS measurements (Serpelloni et al., 2007); white and black arrows are derived from GPS residual velocities (Serpelloni et al., 2005); red arrows are from GPS measurements from https://www.unavco.org/software/visualization/GPS-Velocity-Viewer/GPS-Velocity-Viewer.html. Med—Mediterranean. (B) Location map of multichannel seismic reflection data sets (black lines). Blue isobaths every 500 m are derived from EMODnet bathymetry. Compressive focal mechanisms (CFM) and compressive earthquakes (red stars) are modified from Vannucci et al. (2004) and Presti et al. (2013). Black thick segments mark seismic profiles shown in Figure 2 and in the Data Repository (Figs. DR2–DR5 [see footnote 1]). (C–G) Cartoons of southeastward Apennines system migration, modified from Gvirtzman and Nur (2001) and Reitz and Seeber (2012). Light violet marks the Tyrrhenian abyssal plains; dark violet marks the main volcanic edificies; blue marks the Ionian Oceanic Crust; black arrow marks the direction of the Apennine thrust-front migration; Sa, Sard—Sardinia; Co—Corsica; Ca—Calabria; Si—Sicily; Ma—Magnaghi Basin; V—Vavilov Basin; M—Marsili Basin; AVA—Aeolian Volcanic Arc; parallel red lines mark the areas in compression.

Zitellini et al., (Geology 2020)

Recent inversion of the Tyrrhenian Basin

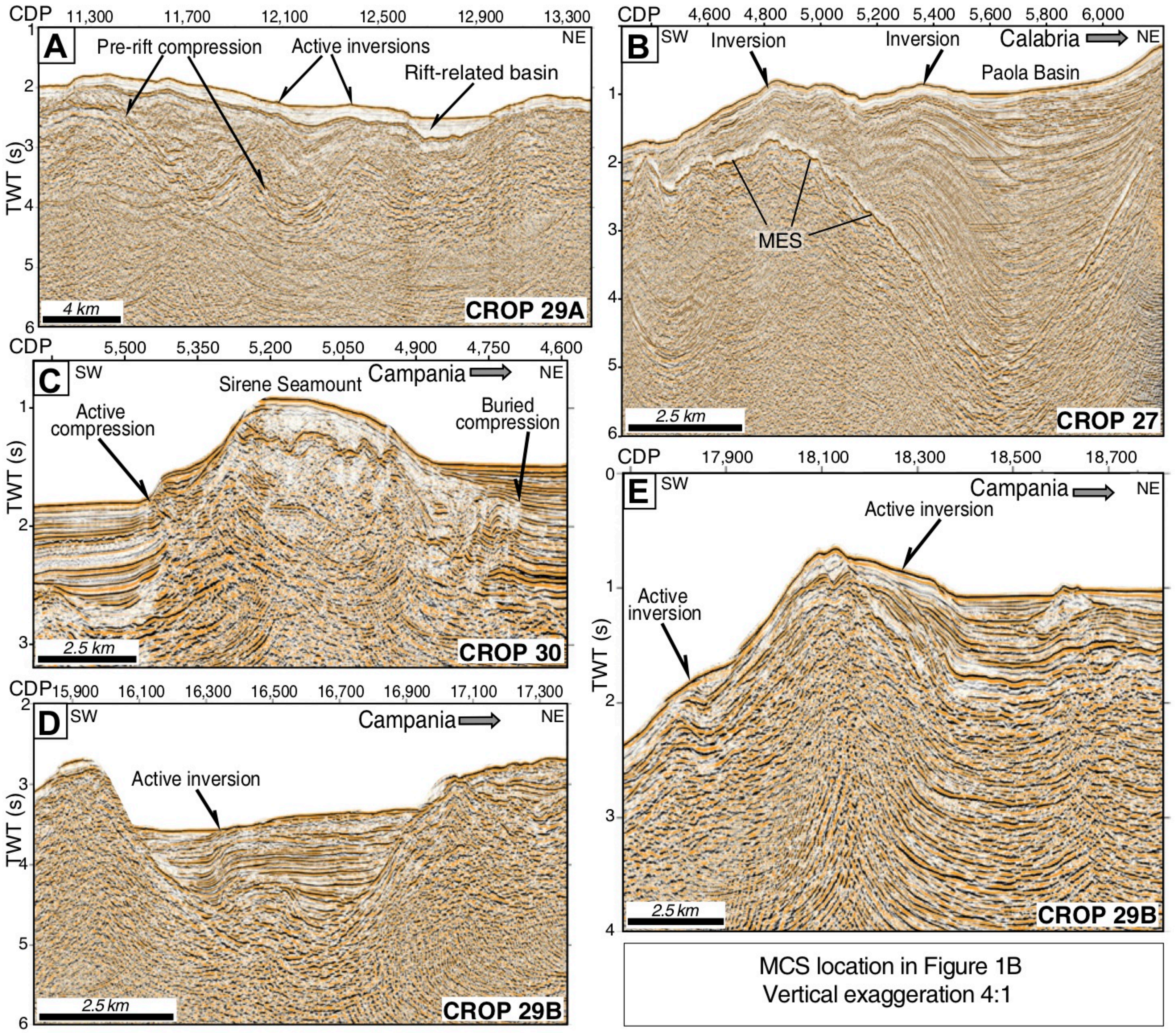
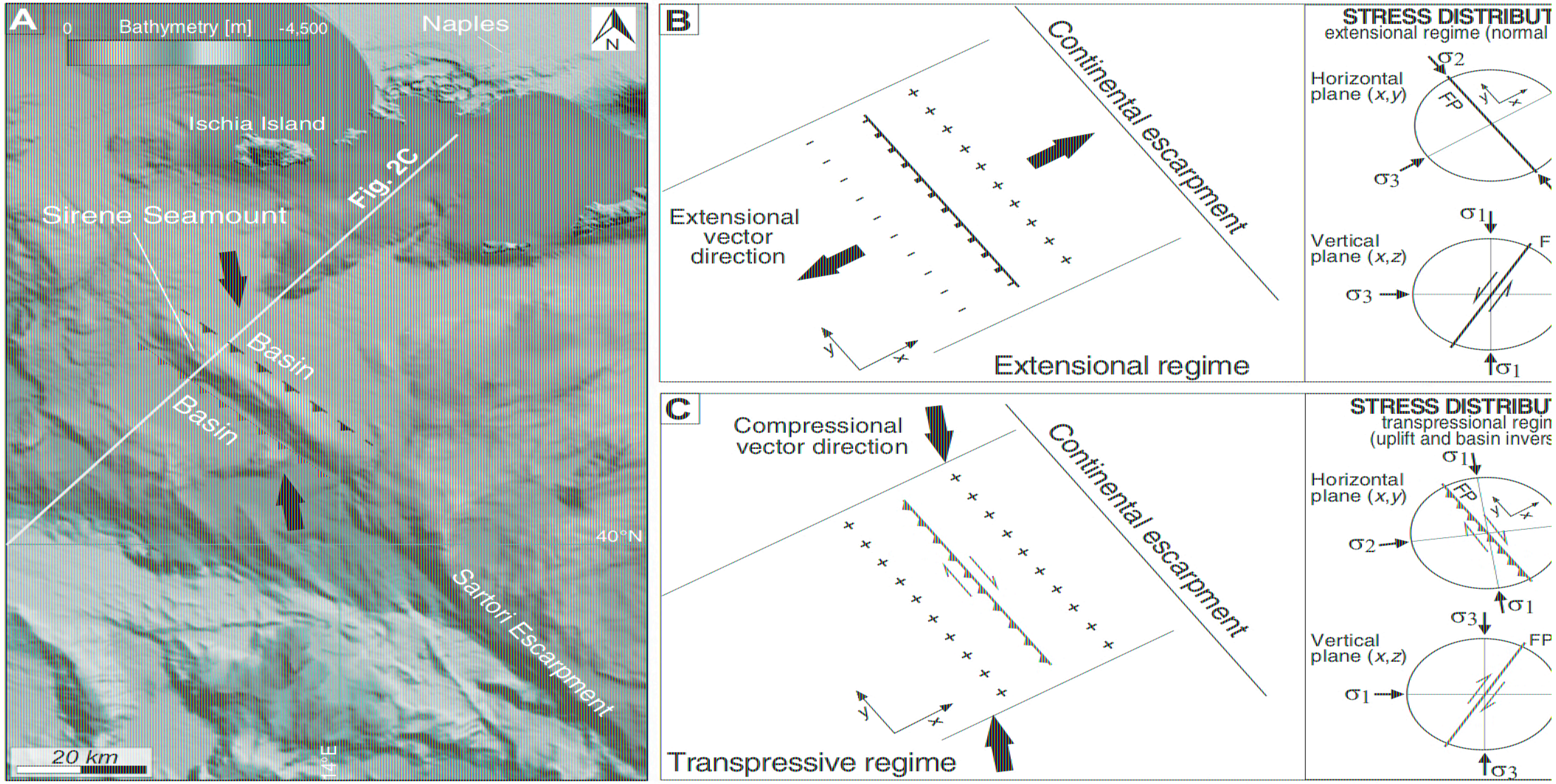


Figure 2. Multichannel seismic (MCS) profiles in the Tyrrhenian Basin showing compressional structures; see Figure 1B for location. Horizontal scale is represented by common-depth-point (CDP). Vertical scale is two-way traveltime (TWT). (A) Anticline-syncline structures buried below well-stratified sediments detected to the northwest of Sicily, presently reactivated in compression. (B) Inverted sediments of the Paola Basin, located offshore of the western Calabria region. MES—Messinian erosional surface. (C) Sirene Seamount located offshore of the Campanian margin, showing compressive and/or transpressive structure growing in the middle of the former extensional sedimentary basin. (D) Inverted sedimentary basin located offshore of the Lazium-Campanian margin. (E) Progressive displacement of pre-compression sedimentary sequences onlapping the western flank of the basin.

Zitellini et al., (Geology 2020)

Recent inversion of the Tyrrhenian Basin



fault system striking NW-SE generated a set of subparallel, steeply dipping normal faults perpendicul
hatched thick solid line indicates normal fault; "+" is footwall and "–" is hanging wall. Stress-field compone
are shown on horizontal (*x,y*) and vertical (*x,z*) planes. FP—fault plane. (C) Fault reactivation with transpre
NNW-SSE Africa-Eurasia convergence that induced diffuse uplift and basin inversion along the margin. St
zontal (*x,y*) and vertical (*x,z*) planes indicate dominant strike-slip component, according to the hypothesis
normal faults, not well-oriented under compression, is easier than formation of new, favorably oriented th

Zitellini et al., (Geology 2020)

The little explored Tunisia

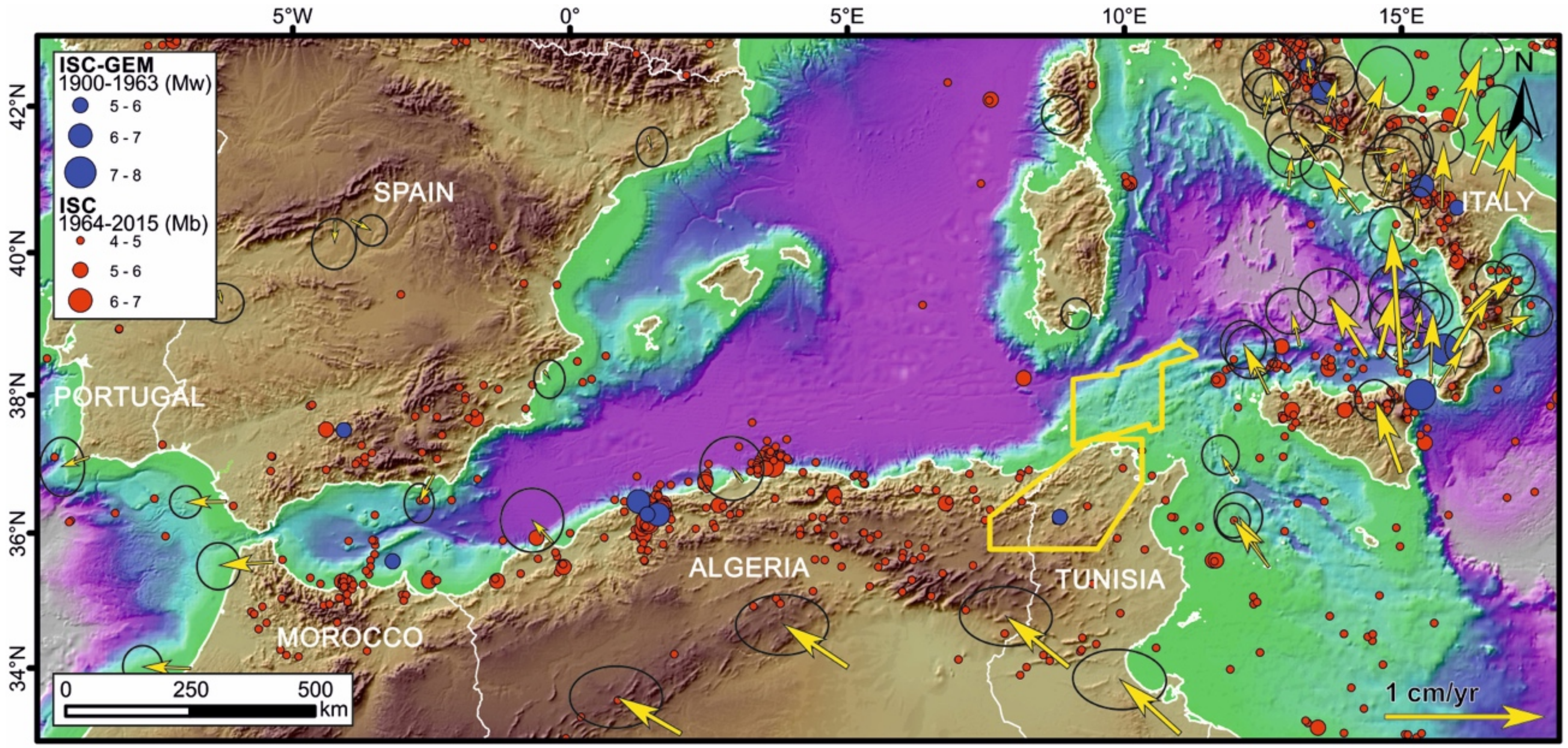


Figure 8.4. *Seismicity distribution and present-day GPS motions of the western Mediterranean region. Blue circles are from the ISC-GEM catalogue (ISC-GEM, 2018) and red circles from the ISC (ISC, 2018). The yellow polygons show the location of the study areas (onshore and offshore). Yellow arrows depict horizontal velocities (with 95% error ellipses) given with respect to the Eurasian plate (modified from Serpelloni et al, 2007), along the Nubia Eurasia boundary in the western Mediterranean.*

Camafort et al. (Geomorphology 2020, submitted to tectonics 2020; and in prep.)

The little explored Tunisia

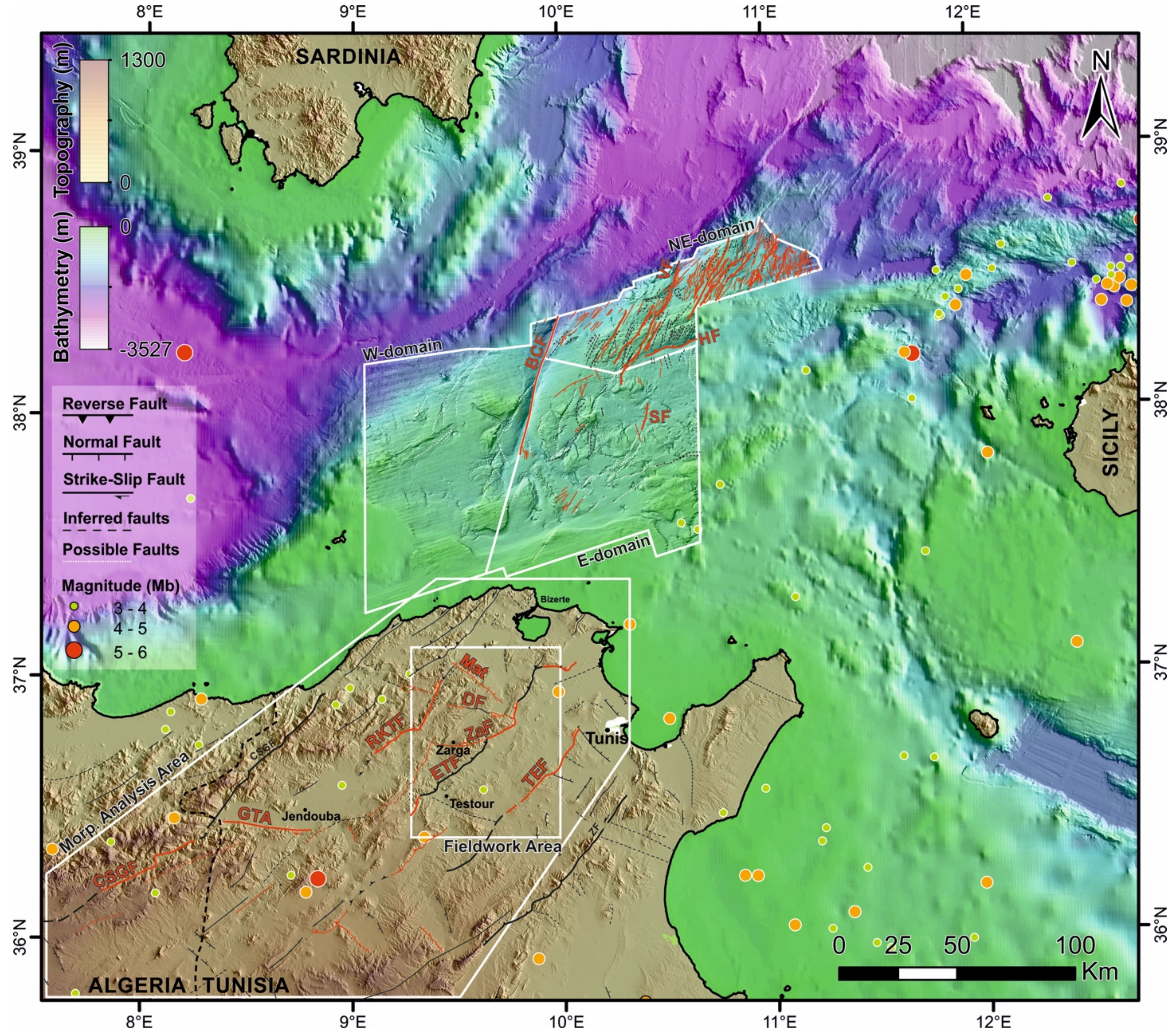


Figure 8.1. *Topography, bathymetry and active faults of the North Tunisian land and continental margin (red faults). Epicentres of magnitude M_b between 3 and 6 are from the International Seismological Centre (ISC, 2018). The location of the study areas (onshore and offshore) are represented by white polygons. The white rectangle depicts the fieldwork area. Dashed line depicts the boundary between Algeria and Tunisia. Tectonic structures onshore include data from Melki et al. (2012), Bahrouni et al. (2014) and Rabaute and Chamot-Rooke (2015), as well as our own field data. Mat: Mateur fault, Df: Dkhila fault, ZaF: Zarga fault, CSGF: Cap Serrat-Gardimaou fault, RKTF: Ral El Korane-Thibar fault, ETF: El Alia-Teboursouk fault, TEF: Tunis-Ellès fault, ZF: Zaghouan fault, GTA: Ghardimaou-Thibar accident, SF: Samia fault, HF: Hayat fault, VF: Valeria fault, BCF: Bizerte Canyon fault .*

Active fault map from On-offshore Tunisia from morphometric analysis of DEM onshore and interpretation of high-resolution bathymetry and seismic data offshore

Current Reactivation of early Miocene trust fault and late Miocene normal faults from Tyrrhenian opening

Camafort et al. (Geomorphology 2020, submitted to tectonics 2020; and in prep.)

1. Extension has ended in the Tyrrhenian Backarc
2. The entire Tyrrhenian is under compression
3. Inherited Tyrrhenian structures reactivated as thrust, strike slip and associated folding
4. North Tunisia has a wide onshore region of faulting with anomalously-low seismic activity
5. North Tunisia Offshore has a south region of little tectonic activity.
6. North Tunisia Offshore has a northern region of widespread tectonic activity.
7. The regional tectonics support that slab rollback has stopped and the entire region is affected by Africa - Europe collision.