Plate kinematic relationship between the Tyrrhenian basin and the Apennine chain (Central Mediterranean)

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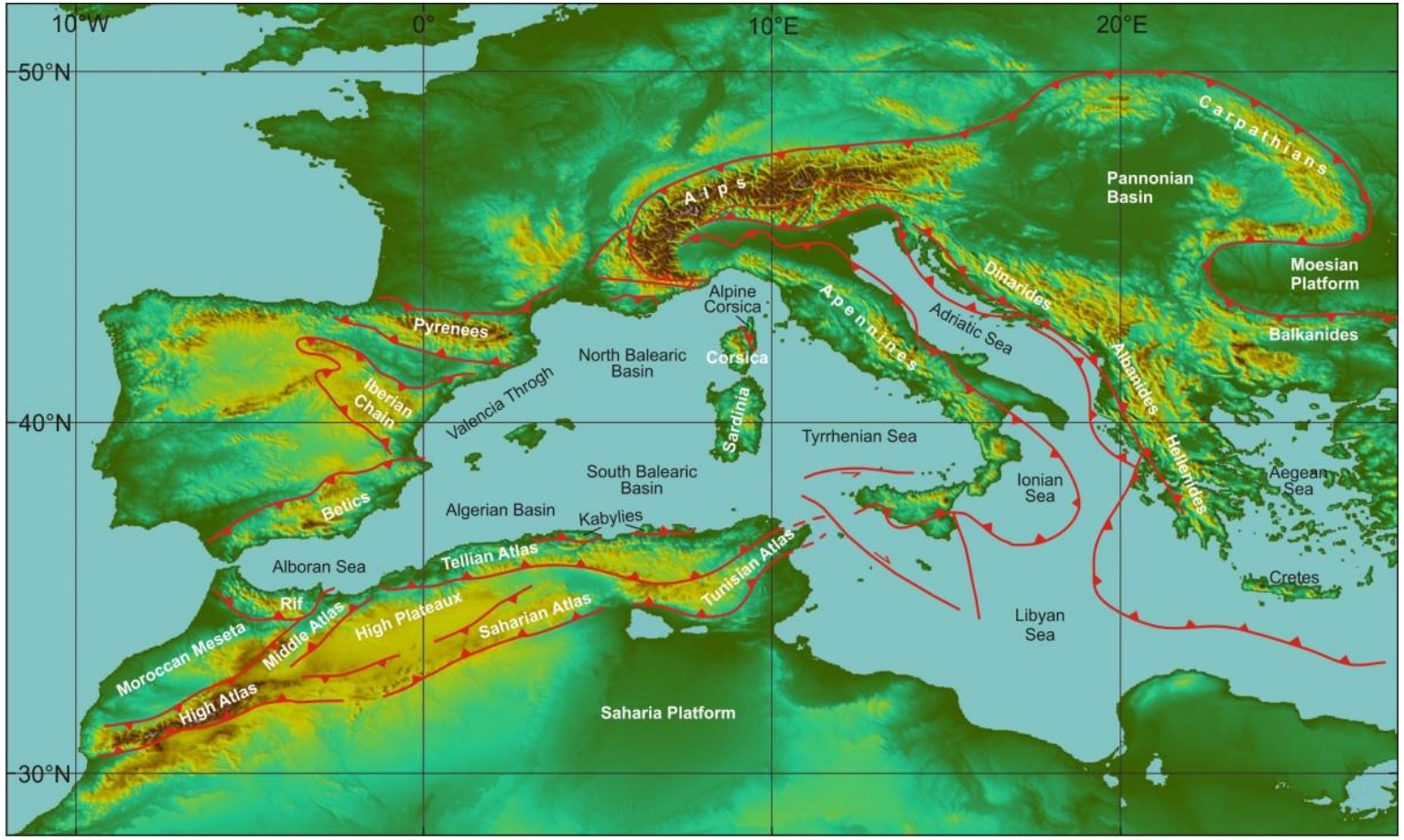

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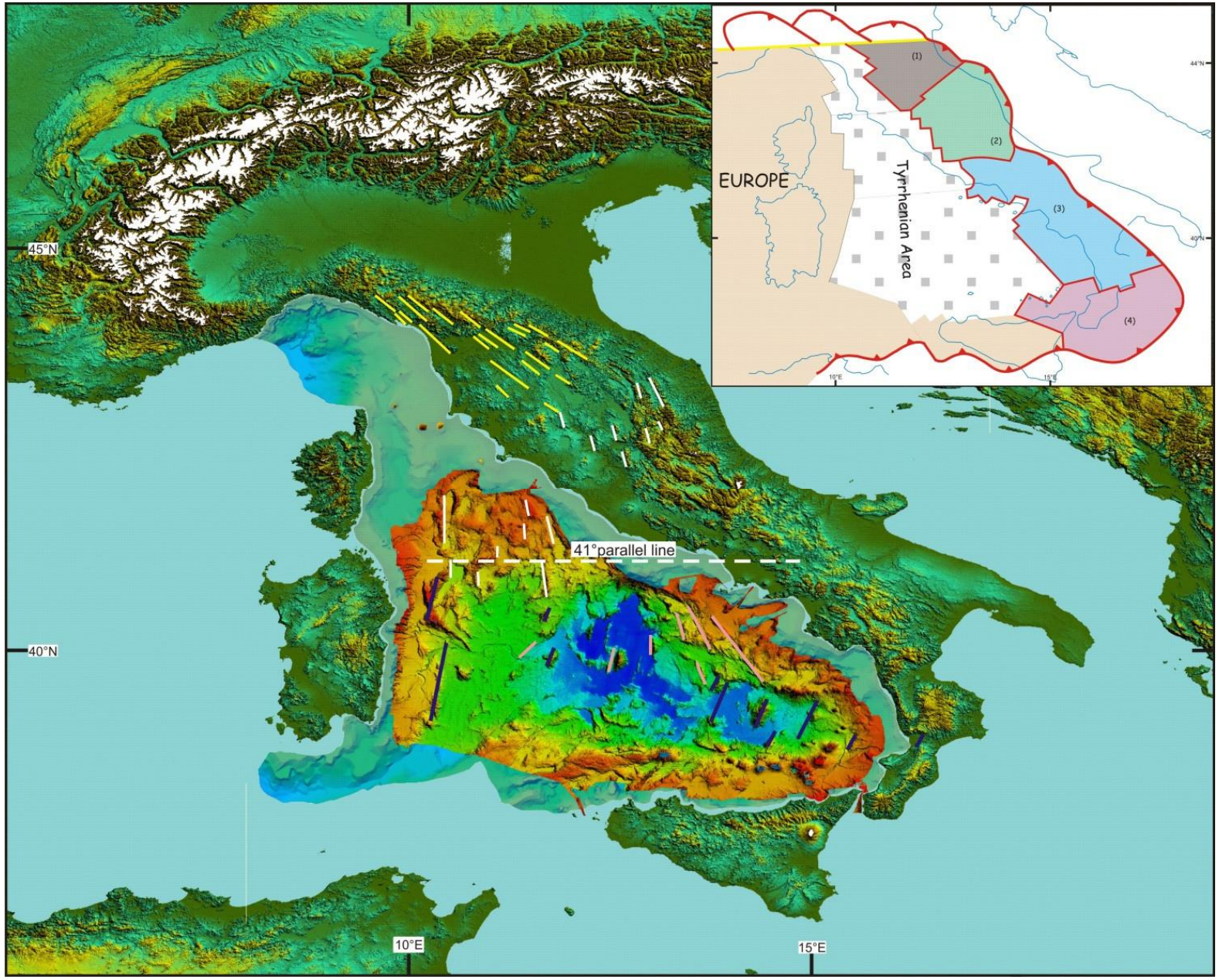
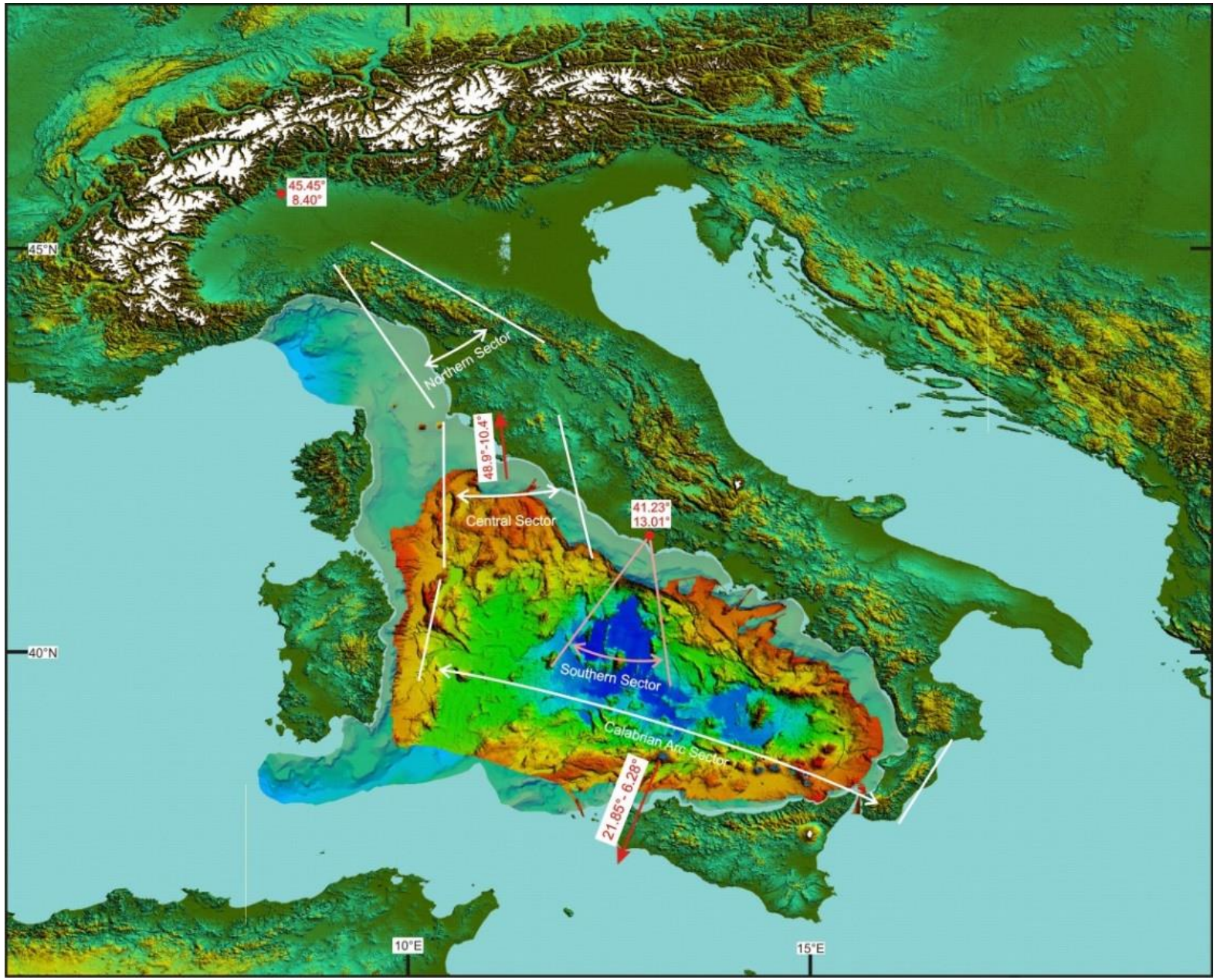
The fragmentation of the Adriatic plate and the sinking of the remnant Alpine Tethys and Ionian lithosphere give rise to passive subduction processes that, together with the collision of the African and European plates, characterize the Central Mediterranean area.
Circum - Mediterranean mountain ranges and Alboran, Balearic, Tyrrhenian and Hellenic back-arc basins are formed in this complex deformation system.
The evolution of the geodynamic processes that guided the opening of the Tyrrhenian basin and the contemporary formation of the Apennine chain are described in this work using the plate kinematics technique.
The study area has been divided into polygons (crustal blocks of microplates) after careful observation of the regional structures. The polygons are distinguished on the basis of the direction of the Tyrrhenian extension and the boundaries between them coincide with the large structures that characterize the Tyrrhenian-Apennine area.
The Tyrrhenian extension directions are indicators of the Euler poles of the individual polygons, in the Sardo-Corso block reference frame. The velocity ratios were determined by the slip vectors of the structures (plate boundaries) that separates the polygons. The rotation time and angle are determined respectively: using the stratigraphic records of the syn-rift sequences and comparing the crustal balance with the speed ratios.
At the end including the new kinematic framework in the global rotation model we were able to reconstruct the tectonic evolution of the central Mediterranean during the opening of the Tyrrhenian basin.



Morpho-tectonic map of the Tyrrhenian-Apennine system showing lineaments that can be grouped into fan-shaped sets characterizing specific sectors. Lineaments of the Northern Apennine sector are in (yellow; white lines) are for northern Tyrrhenian basin and Central Apennine sector; (blue and pink lines) are for Calabrian and Southern sectors respectively. The multibeam bathymetry is after [63]. The insert box shows the deformable blocks identified: (1) Northern sector in (dark beige), (2) Central Sector in (green), (3) southern sector in (blue); (4) Calabrian Arc Sector in (pink). Dotted areas are in extension; (white dotted) area is the extended Tyrrhenian area.



Morpho-tectonic map and multibeam bathymetry of the Tyrrhenian-Apennine system, showing extension directions in the Tyrrhenian Basin. (White and pink lines) show extension started respectively 19 Ma and 7 Ma. (Red points) are Euler poles. (Red arrows) indicate the Euler poles out of the figure, coordinates of these poles are shown. Real angle of rotation is shown for each pole.

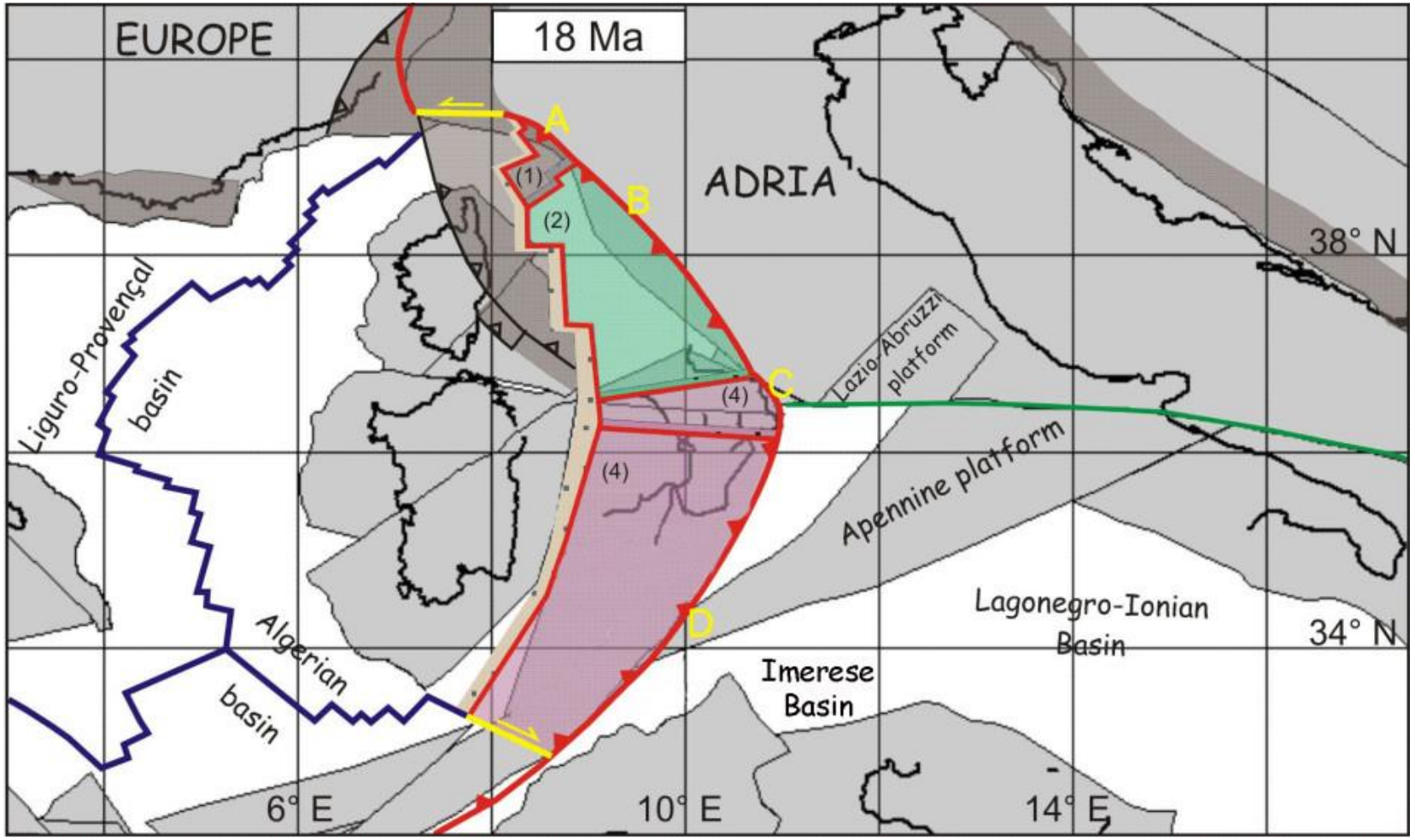


Plate reconstruction of the western Mediterranean region at 18 Ma. The distribution of the continental lithosphere is shown in (gray). Present-day coastlines are shown for reference. Strike–slip faults are shown in (yellow). (Green line) is an E-W directed strike-slip structure that separated Adria from Apulia from the late Cretaceous to the Eocene. (Red) lines are divergent boundaries, red lines with triangles are convergent boundaries. A: northern Apennine arc, B: central Apennine arc, C: northern Calabrian arc, D: southern Calabrian arc. The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Calabrian Arc Sector (4) is in (pink). (Light brown dotted) area is the extended area.

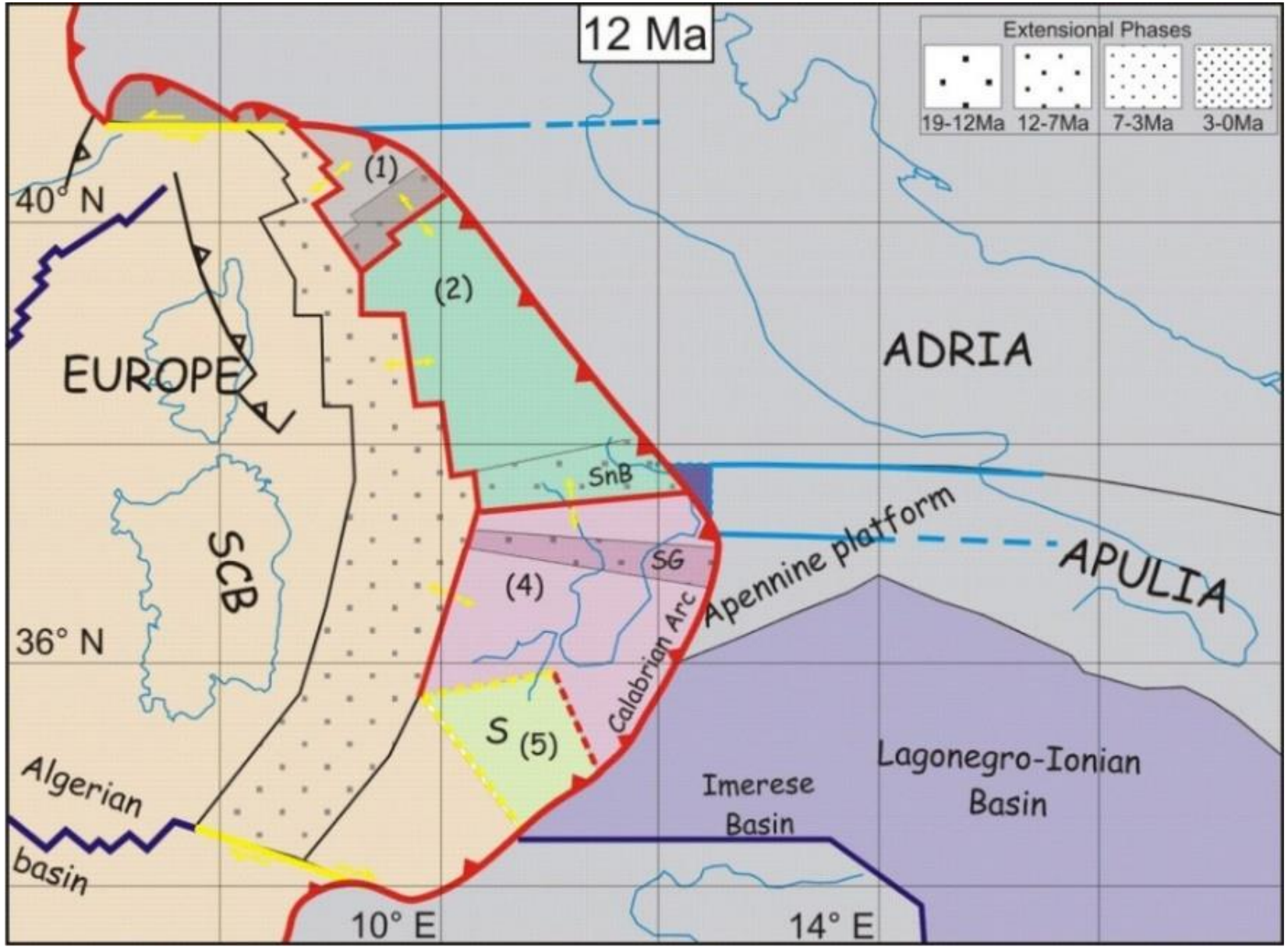


Plate reconstruction of the western Mediterranean region at 12 Ma.
The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Calabrian Arc Sector (4) is in (pink), the Sicilian Sector in light (green) (5). Dotted areas are in extension (see upper right legend). Dashed lines are incipient boundaries. (Red lines) are active boundaries. (Black lines) are inactive boundaries. (Yellow lines) are strike-slip faults. (Light blue lines) are transfer faults on the continental lithosphere and (light blue dotted lines) are the Jurassic COB (Continent Ocean Boundary).
(Dark blue lines) are the Middle-Triassic COB. (Yellow arrows) indicate direction of extension. S: Sicily, SCB: Sardinian-Corsican block, SG: Squillace Gulf, SnB: Sannio basin.

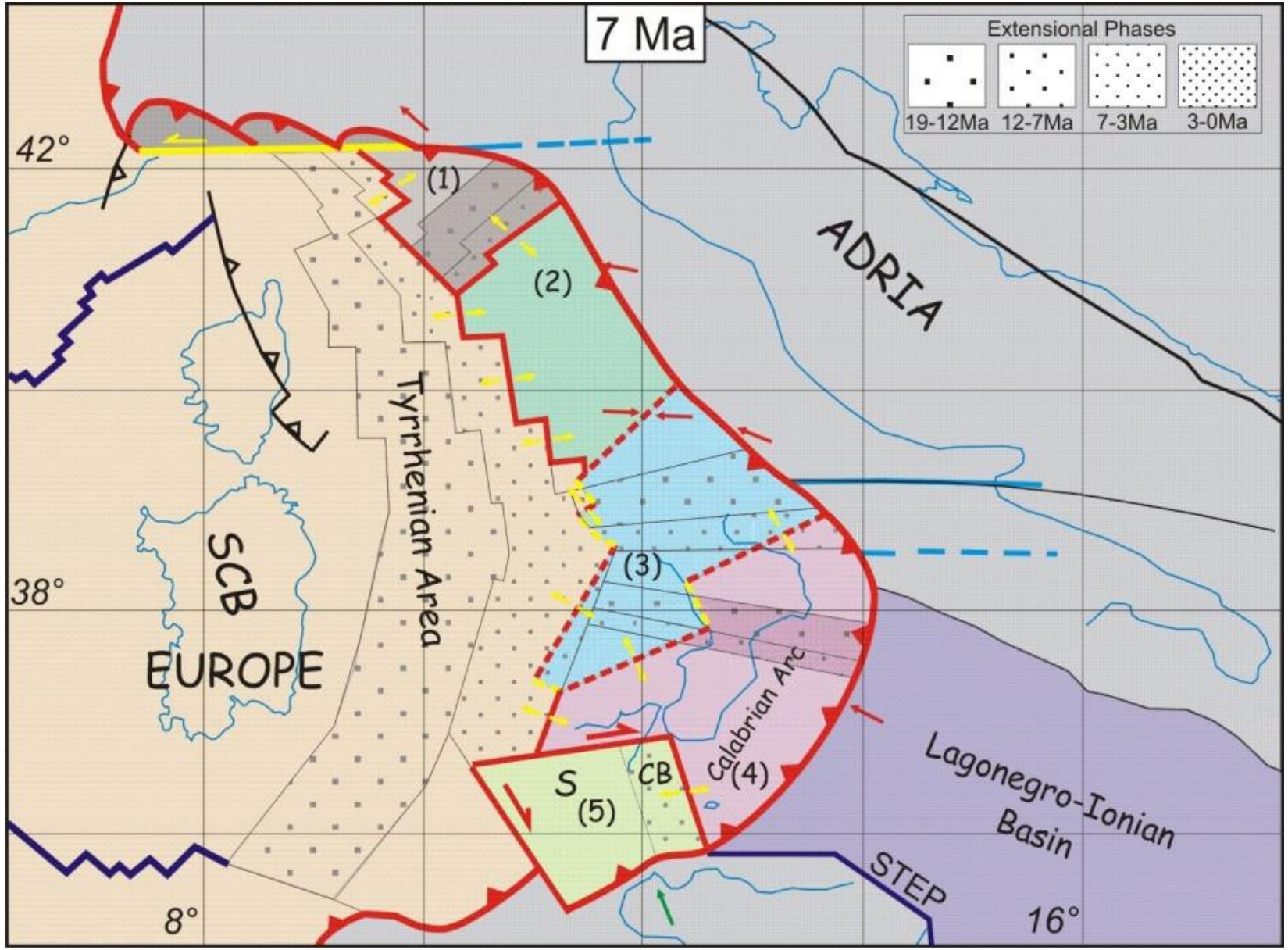


Plate reconstruction of the western Mediterranean region at 7 Ma.
The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Southern Sector (3) is in (light blue); the Calabrian Arc Sector (4) is in (pink), the Sicilian Sector in (light green) (5). (Dotted areas) are in extension (see upper right legend). (Dotted lines) are incipient boundaries. (Red lines) are active boundaries. (Black lines) are inactive boundaries. (Yellow lines) are strike-slip faults. (Light blue lines) are transfer faults on the continental lithosphere. (Dark blue lines) are the Middle-Triassic COB. (Red arrows) are the velocity vectors between Adria and the adjacent sector. CB, Caltanissetta Basin; S: Sicily, SCB: Sardinian-Corsican block.

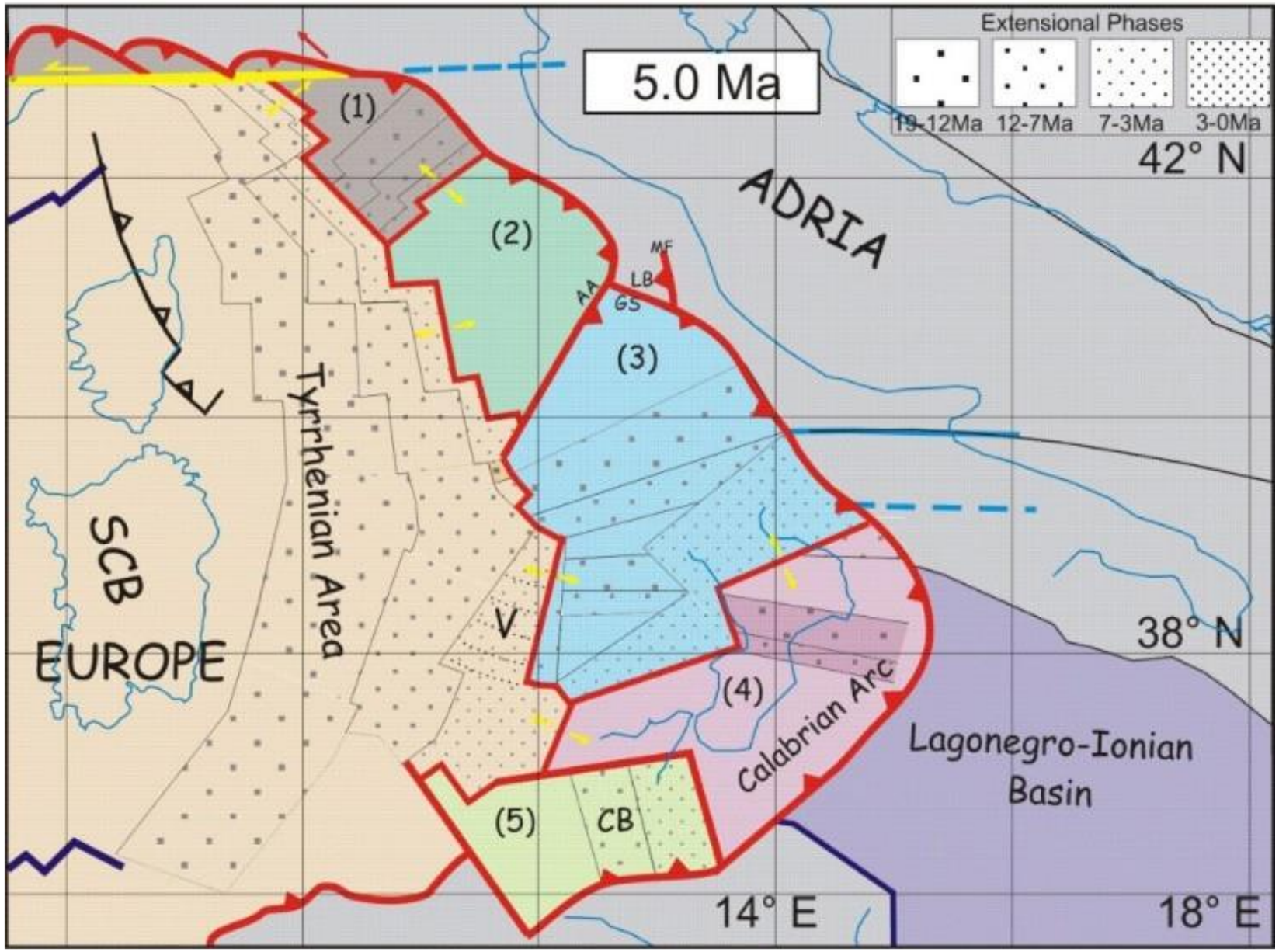


Plate reconstruction of the western Mediterranean region at 5 Ma.
The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Southern Sector (3) is in (light blue); the Calabrian Arc Sector (4) is in (pink), the Sicilian Sector in (light green) (5). (Dotted areas) are in extension (see upper right legend). (Red lines) are active boundaries. (Black lines) are inactive boundaries. (Yellow lines) are strike-slip faults. (Light blue lines) are transfer faults on the continental lithosphere. (Dark blue lines) are the Middle-Triassic COB. (Red arrows) are the velocity vectors between Adria and the adjacent sector. AA: Ancona-Anzio line; CB: Caltanissetta Basin; GS: Gran Sasso Front; LB: Laga Basin; MF: Montagna dei Fiori, SCB: Sardinian-Corsican block; V: Vavilov basin.

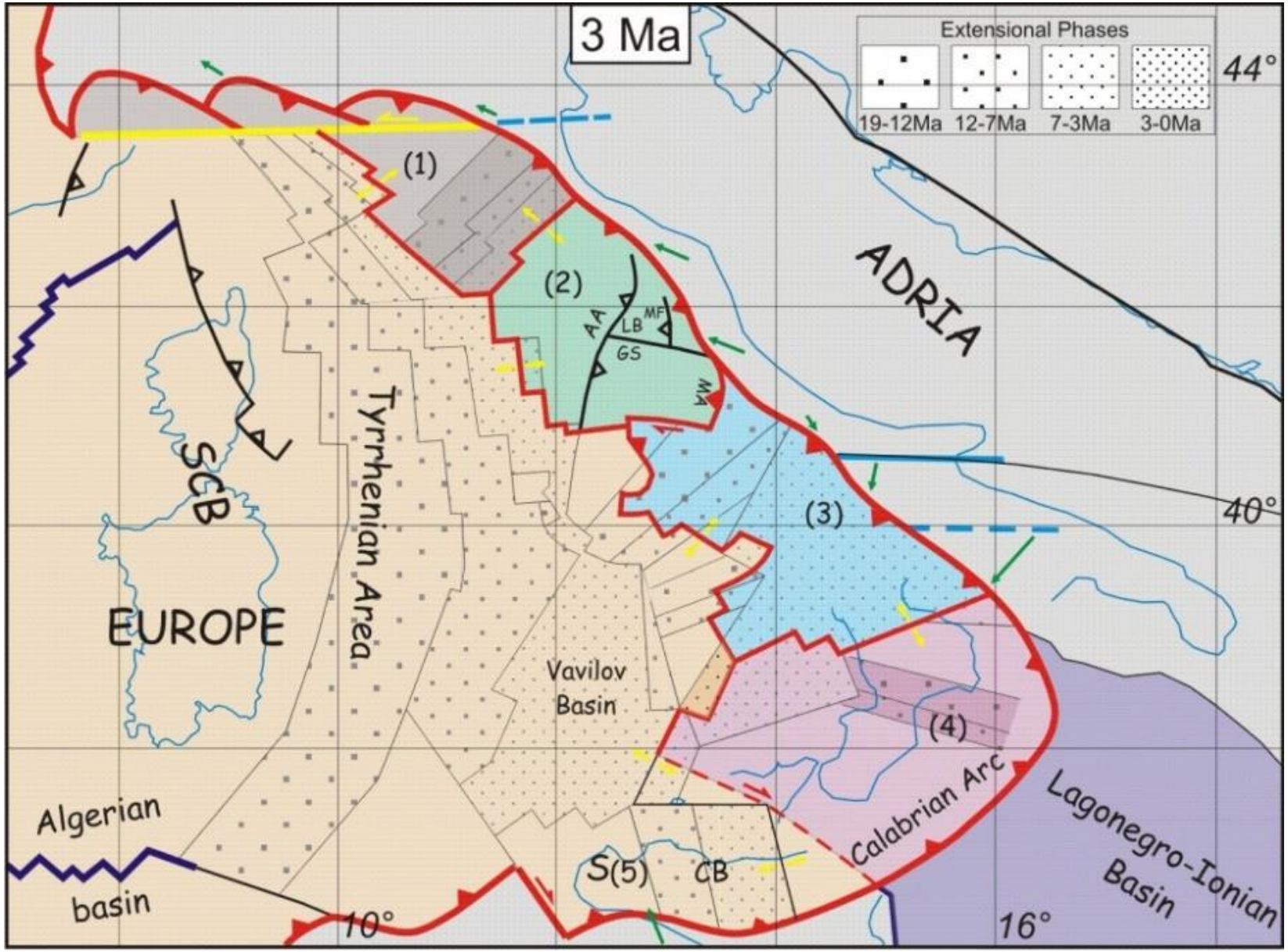


Plate reconstruction of the western Mediterranean region at 3 Ma.
The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Southern Sector (3) is in (light blue); the Calabrian Arc Sector (4) is in (pink), the Sicilian Sector in (light green) (5). (Dashed lines) are incipient boundaries (Dotted areas) are in extension (see upper right legend). (Red lines) are active boundaries. (Black lines) are inactive boundaries. (Yellow lines) are strike-slip faults. (Light blue lines) are transfer faults on the continental lithosphere. (Dark blue lines) are the Middle-Triassic COB. (Green arrows) are the velocity vectors between Adria and the adjacent sector.
A-A: Ancona-Anzio line; CB: Caltanissetta Basin, GS: Gran Sasso Front; LB: Laga Basin; MA: Maiella Front; MF: Montagna dei Fiori; S: Sicily; SCB: Sardinian-Corsican block, TL: Taormina Line.

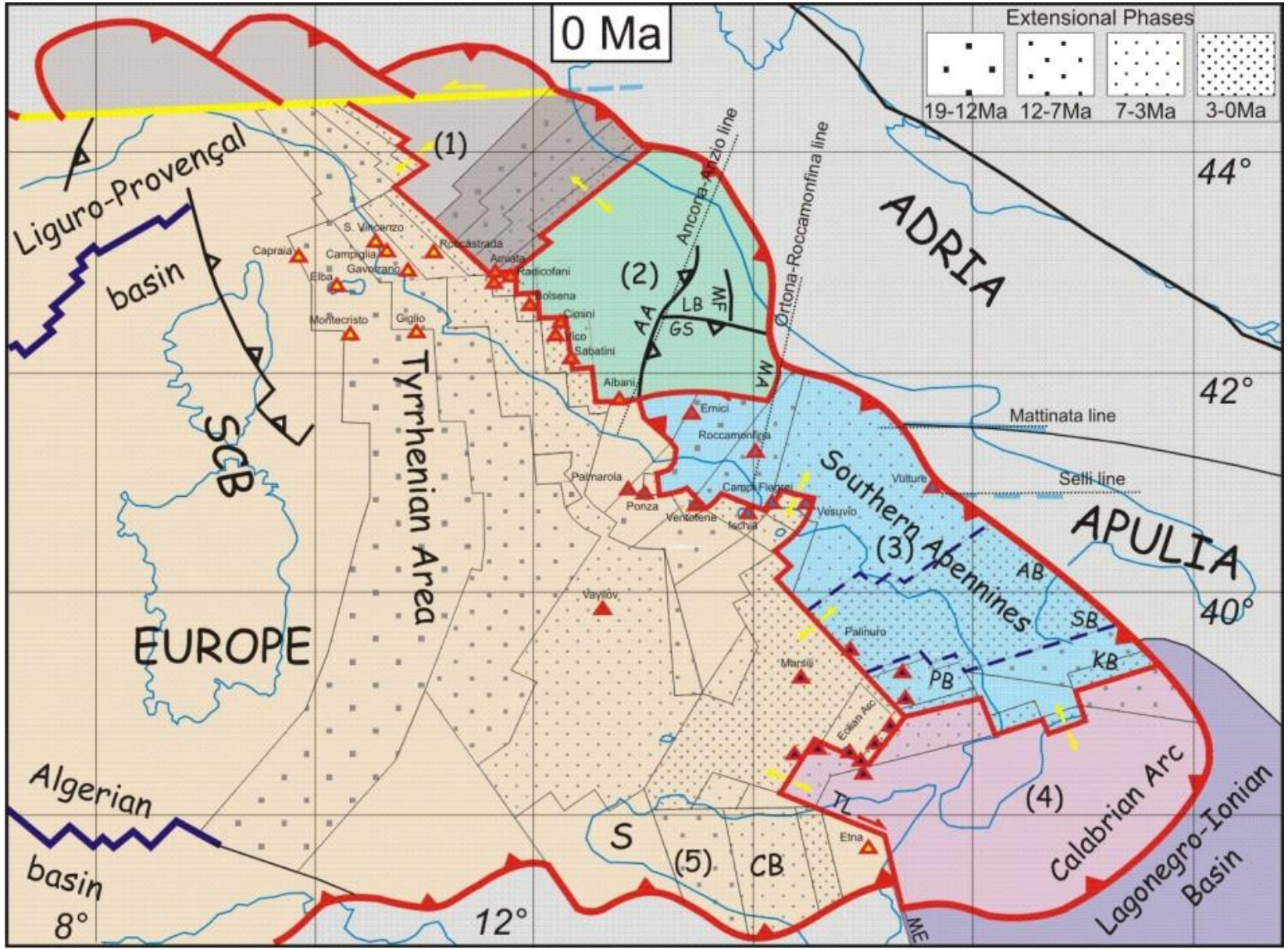


Plate reconstruction of the western Mediterranean region at 0 Ma.
Triangles are volcanoes: the Tuscan province is in filled in (yellow), the Roman province is in orange, the Campanian province is in (blue), the Aeolian Arc with Marsili and Palinuro is in (black). The Northern Sector (1) is shown in (dark beige); the Central Sector (2) is in (green); the Southern Sector (3) is in (light blue); the Calabrian Arc Sector (4) is in (pink), the Sicilian Sector in (light green) (5). (Dotted areas) are in extension (see upper right legend). (Red lines) are active boundaries. (Black lines) are inactive boundaries. (Yellow lines) are strike-slip faults. (Light blue lines) transfer faults on the continental lithosphere. (Dark blue lines) are the Middle-Triassic COB and transfer faults on the continental lithosphere. Blue dashed lines identify the area of the Southern Apennine exhumed from 7 Ma. A-A: Ancona-Anzio line; AB: St. Arcangelo Basin; CB, Caltanissetta Basin, KB: Crotone Basin; GS: Gran Sasso Front; LB: Laga Basin; MA: Maiella Front; MF: Montagna dei Fiori; PB: Paola Basin; S: Sicily; SB:Sibari Basin; SCB: Sardinian-Corsican block, TL: Taormina Line.

Thanks for your attention

How to **cite** the work:

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