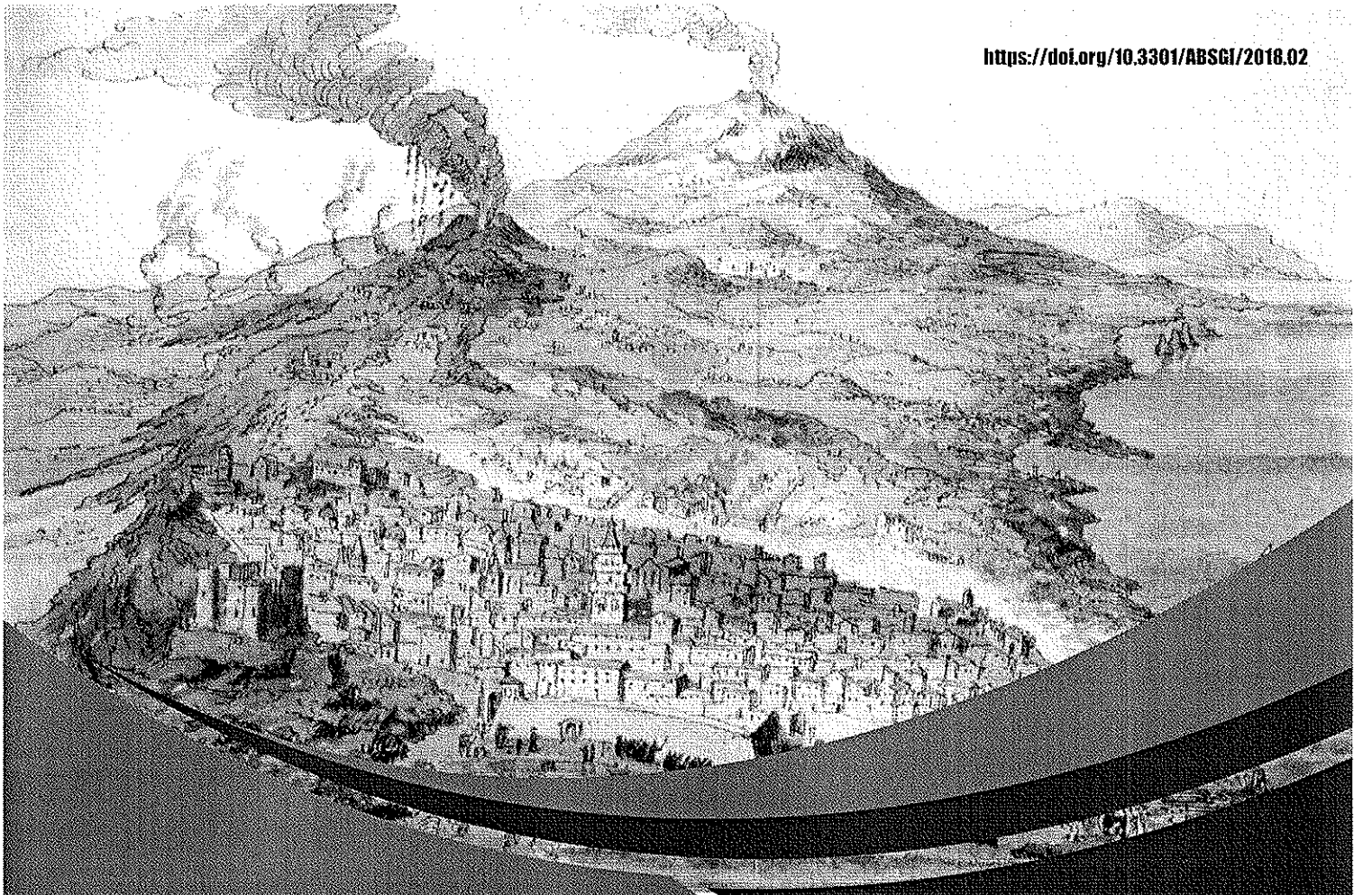
https://doi.org/10.3301/ABSGI/2018.02



Catania, 12-14 settembre 2018

ABSTRACT BOOK

a cura della Società Geologica Italiana

Congresso congiunto SGI-SIMP

CATANIA·2018
12-14 SETTEMBRE

CONGRESSO
SGI · SIMP

«Geosciences for the environment, natural hazards and cultural heritage»

Understanding paleomagnetic rotations in Sicily: Thrust vs. strike-slip tectonics

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Keywords: Paleomagnetic rotations, Sicily, Thrust faults.

The paleomagnetic investigation of the western Sicily Maghrebian belt has revealed since the 1970s that large clockwise (CW) rotations up to 140° with respect to the Hyblean-African foreland occurred synchronous with Tertiary shortening of the chain. The observation that rotations decrease stepwise from internal to external tectono-stratigraphic units led in the 1990s to a widely accepted model postulating that rotational thrust-sheet emplaced during forward orogenic propagation. More recently, other authors suggested that CW rotations from Sicily are conversely the result of late orogenic dextral strike-slip tectonics. Here we report on a paleomagnetic investigation of 30 Jurassic-Eocene sedimentary sites sampled mainly across the WNW-ESE Mt. Kumeta and Rocca Busambra ridges (Trapanese Unit), both bounded to the north by high-angle reverse faults with dextral strike-slip components. We find rotations of 110°-120° at faults of northern ridge margins, that decrease to 80°-90° at ~200 m to the south and rise again moving further south. Thus an excess rotation of 20°-40° due to dextral-strike slip shear is annulled to the regional rotational background of the Trapanese Unit at only 200 m from fault traces, translating to paleomagnetically-calculated strike-slip offsets not exceeding 600 m. Further north, seven sites sampled in the Imerese Unit, tectonically stacked above the Trapanese Unit, yield a ~130° rotation. Thus our data confirm that CW rotations in Sicily are predominantly related to thrust-sheet emplacement. Strike-slip tectonics has very limited relevance, and gives local rotations that fade out at only 200 m from fault planes.

No differential rotation occurred between the Panormide and Imerese units, both characterized by 130° rotation values and likely representing contiguous paleogeographic domains separated by secondary thrust faults. Considering data from Mt. Kumeta, we constrain at 80° the rotation of the Trapanese Unit. The upper Cretaceous-Eocene Scaglia cover of both Mt. Kumeta and Rocca Busambra records an additional 20°-30° rotation with respect to the Jurassic ridge backbones, implying that it was décolled from the substratum.

Assuming rigid nappe rotations and a rotation pole along the west Sicily coast, we derive (at a 13.5°E longitude) a total 230 km rotational shortening of the chain, and individual nappe displacements in the 20-120 km range, although further non-rotational shortening might have occurred. Thus paleomagnetism definitely represents a proof for the high allochthony of the Maghrebian chain of Sicily, consistently with recent seismic reflection data interpretations. By further assuming that rotations occurred during late Miocene thrusting events in the 12-5 Ma age window (except the Saccense Unit, later stacked onto the foreland), we derive an average 17°/Myr rotation rate, and a paleomagnetically-calculated average shortening rate of 3 cm/yr, that is again consistent with recent geological estimates.