Journal of Geodynamics 81 (2014) 67–79

Contents lists available at ScienceDirect

Journal of Geodynamics

journal homepage: http://www.elsevier.com/locate/jog

Magnetic fabric of Plio-Pleistocene sediments from the Crotone fore-arc basin: Insights on the recent tectonic evolution of the Calabrian Arc (Italy)

Patrizia Macrì[a,*], Fabio Speranza[a], Luca Capraro[b]

[a] Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata 605, 00143 Rome, Italy
[b] Dipartimento di Geoscienze, Università di Padova, Via G. Gradenigo 6, 35131 Padova, Italy

ARTICLE INFO

Article history:
Received 3 April 2014
Received in revised form 30 June 2014
Accepted 17 July 2014
Available online 29 July 2014

Keywords:
Calabrian Arc
Anisotropy of magnetic susceptibility
Structural analysis
Fore-arc region

ABSTRACT

Low-field anisotropy of magnetic susceptibility (AMS) analyses were performed on 532 samples collected in 36 (mostly lower Pliocene to lower Pleistocene) marine clay sites from the Crotone basin, a fore-arc basin located on top of the external Calabrian accretionary wedge. The Crotone basin formed since mid-late Miocene under a predominant extensional tectonic regime, but it was influenced thereafter by complex interactions with NW–SE left-lateral strike-faults bounding the basin, which also yielded post-1.2 Ma ~30° counterclockwise block rotations. The basin is filled by continental to marine sediments yielding one of the thickest and best-exposed Neogene succession available worldwide. The deep-marine facies – represented by blue-grey marly clays gave the best results, as they both preserved a clear magnetic fabric, and provided accurate chronology based on previously published magnetostratigraphy and calcareous plankton (i.e. foraminifers and nannofossils) biostratigraphy. Magnetic susceptibility range and rock magnetic analyses both indicate that AMS reflects paramagnetic clay matrix crystal arrangement. The fabric is predominantly oblate to triaxial, the anisotropy degree low (<1.06), and the magnetic foliation mostly subparallel to bedding. Magnetic lineation is defined in 30 out of 36 sites (where the e12 angle is <35°). By also considering local structural analysis data, we find that magnetic fabric was generally acquired during the first tectonic phases occurring after sediment deposition, thus validating its use as temporally dependent strain proxy. Although most of the magnetic lineations trend NW–SE and are orthogonal to normal faults (as observed elsewhere in Calabria), few NE–SW compressive lineations show that the Neogene extensional regime of the Crotone basin was punctuated by compressive episodes. Finally, compressive lineations (prolate magnetic fabric) documented along the strike-slip fault bounding the basin to the south support the significance of Pleistocene strike-slip tectonics. Thus the Crotone basin shows a markedly different tectonics with respect to other internal and western basins of Calabria, as it yields a magnetic fabric still dominated by extensional tectonics but also revealing arc-normal shortening episodes and recent strike-slip fault activity. The tectonics documented in the Crotone basin is compatible with a continuous upper crustal structural reorganization occurring during the SE-migration of the Calabria terrane above the Ionian subduction system.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

The Calabrian Arc (Fig. 1) is located on top of a continuous, steeply NW dipping Ionian slab outlined by means of seismic tomography and deep seismicity (Selvaggi and Chiarabba, 1995; Lucente et al., 1999; Wortel and Spakman, 2000). During the Neogene, opening of back-arc basins in the Tyrrhenian Sea was related to a south-eastward drift of the Calabrian terrane, which occurred in a regime of slab pull and progressive retreat of the subducting Ionian oceanic lithosphere (Rossi and Sartori, 1981; Malinverno and Ryan, 1986; Lonergan and White, 1997; Wortel and Spakman, 2000; Faccenna et al., 2001). Back-arc extension and rifting in the southern Tyrrhenian Sea was synchronous with an outward migration of compressional fronts of the southern Apennines and Calabrian-Sicilian Maghrebides towards the Apulian-Hyblean foreland. Estimates of the oceanic extension rates in the Vavilov and Marsili basins indicate that the velocity of trench retreat was maximum during the Pliocene and early Pleistocene times (Mattei et al., 2002; Nicolosi et al., 2006).

* Corresponding author. Tel.: +39 0651860700.
E-mail address: patrizia.macri@ingv.it (P. Macrì).

http://dx.doi.org/10.1016/j.jog.2014.07.002
0264-3707/© 2014 Elsevier Ltd. All rights reserved.

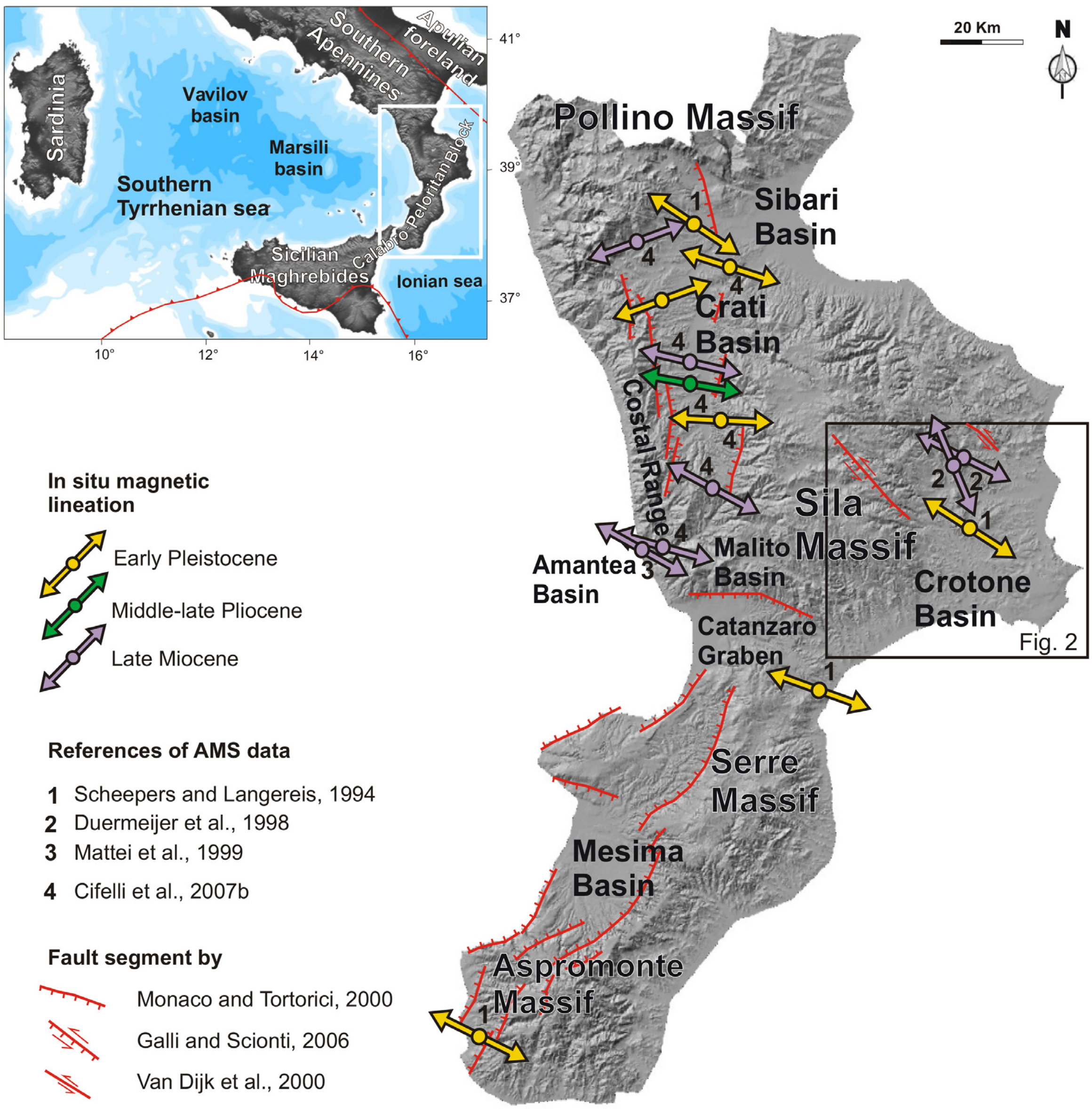

Fig. 1. Digital elevation model of the southern Tyrrhenian domain and main structural features of Calabria with the AMS magnetic lineations from previous authors reported for different age rocks.
For references see also review in Cifelli et al. (2007a).

The present-day horseshoe-like shape of the Calabrian Arc may be the consequence of both a geometrical evolution in time of the Ionian subduction system and interferences with the Maghrebide and Apennine chains (see Mattei et al., 2007 and Cifelli et al., 2007a for discussion). Both analogic and numerical models show that Ionian slab rollback yielded its curved shape (in plan view) and induced opposite-sense toroidal flows in the underlying mantle (see Funiciello et al., 2006; Schellart et al., 2007; Faccenna et al., 2010). Moreover recent quantitative geodynamic modelling shows that toroidal mantle flow around lateral slab edges dominates during rapid slab rollback with rapid trench retreat and backarc opening (Schellart and Moresi, 2013).

Indeed, our knowledge on the structure and tectonic evolution of the Calabrian accretionary wedge is still incomplete (e.g. Minelli and Faccenna, 2010). During mid-late Miocene to Pleistocene the Calabrian Arc predominantly experienced NW–SE extension, as documented by structural and anisotropy of magnetic susceptibility (AMS) investigations carried out in several sedimentary basins lying on top of the Calabrian terrane (Scheepers and Langereis, 1994; Duermeijer et al., 1998; Mattei et al., 1999; Cifelli et al., 2007b).

A major regional tectonic reorganization in the Tyrrhenian-Calabrian system took place during the early-middle Pleistocene, resulting in a significant decrease in subduction velocity below the Calabrian Arc and, therefore, in the extension rates of Tyrrhenian back-arc basins (Lucente et al., 1999; Patacca and Scandone, 2004; Goes et al., 2004). Moreover, during the Pleistocene, a rigid ∼20° clockwise (CW) rotation of the Calabria microplate occurred, and the extensional regime continued in the Calabrian Arc (Monaco and Tortorici, 2000).

The intense seismic activity along a well-defined Benioff zone provides evidence that subduction of the Ionian slab is still active below Calabria (Selvaggi and Chiarabba, 1995; Lucente et al., 1999; Wortel and Spakman, 2000), but no clear evidence exists on the present-day occurrence of back-arc spreading. GPS data show a present south-eastward Calabrian drifting (e.g. D'Agostino et al.,

Download English Version:

https://daneshyari.com/en/article/4688052

Download Persian Version:

https://daneshyari.com/article/4688052

Daneshyari.com