

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/262291745>

New constraints on the ductile deformation associated to the Apenninic orogenesis in the carbonatic Pollino unit, Southern Apennines

Article in *Rendiconti Online Societa Geologica Italiana* · October 2012

CITATIONS

0

READS

109

4 authors:



Francesca Liberi

Regione Abruzzo

46 PUBLICATIONS 421 CITATIONS

[SEE PROFILE](#)



Francesco Iezzi

Università degli Studi G. d'Annunzio Chieti e Pescara

20 PUBLICATIONS 309 CITATIONS

[SEE PROFILE](#)



Francesco Brozzetti

Università degli Studi G. d'Annunzio Chieti e Pescara

118 PUBLICATIONS 1,840 CITATIONS

[SEE PROFILE](#)



Cirillo Daniele

Università degli Studi G. d'Annunzio Chieti e Pescara

57 PUBLICATIONS 377 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Neogene deformation complexity in the Adriatic foreland: New structural data from Tremiti Islands (Southern Italy) [View project](#)

New constraints on the ductile deformation associated to the Apenninic orogenesis in the carbonatic Pollino unit, Southern Apennines

FRANCESCA LIBERI (*), FRANCESCO IEZZI (*), FRANCESCO BROZZETTI (*) & DANIELE CIRILLO (*)

RIASSUNTO

Nuovi vincoli sulla deformazione duttile associata all'orogenesi appenninica nell'unità carbonatica del Pollino, Appennino meridionale

Nell'area di Campotenese è ben esposta la sovrapposizione dell'unità di Verbicaro sull'unità di Pollino. Essa è marcata dalla presenza di una zona di taglio duttile, lungo la quale vengono deformati i calcari riferibili alla porzione giurassico-miocenica inferiore dell'unità del Pollino. Sono state riconosciute due domini caratterizzati da diversi stili deformativi: uno contrassegnato da strutture tipicamente duttili e l'altro da strutture di ambiente fragile-duttile. Tuttavia, le associazioni strutturali e gli indicatori cinematici osservati consentono di ricostruire un'evoluzione tettonica tipica di una zona di sovrascorrimento con vergenza appenninica; tale zona di taglio si sviluppa in condizioni di seppellimento profondo o in ambiente di basso grado metamorfico, probabilmente a causa del notevole spessore raggiunto dalla pila orogenetica. Successivamente, un secondo evento deformativo, avvenuto in ambiente fragile, rielabora le strutture preesistenti. Infatti, il sovrascorrimento è caratterizzato da una spessa fascia cataclastica che si sviluppa entro le dolomie triassiche dell'unità superiore e dalla presenza di piani di sovrascorrimento immergenti a NW; le strie associate sono fortemente oblique e mostrano un senso di taglio verso NE, suggerendo un ruolo di rampa laterale per tale struttura.

E' importante sottolineare che, nella ricostruzione tettonica regionale proposta da IANNACE *et alii* (2007), tale sovrascorrimento contrassegna un gap metamorfico tra l'unità metamorfica di Verbicaro e l'unità non metamorfica del Pollino. Tuttavia, i dati di campagna e le analisi petrografiche, condotte su rocce appartenenti all'unità di Verbicaro affiorante nella zona di Campotenese, non mostrano evidenze di riequilibrio metamorfico. In particolare, le rocce basiche, che intrudono la sequenza carbonatica triassico-paleogenica dell'unità di Verbicaro, mostrano solo evidenze di processi di spilitizzazione.

KEY WORDS: *Apenninic orogenesis, calcaires plaquettes, Campotenese, ductile deformation in carbonates, Pollino unit.*

INTRODUCTION

The Calabria-Lucania boundary is characterized by a marked structural complexity, as tectonic units with different paleogeographic affinity come into contact. The uppermost Liguride units overlie several passive margin Triassic-lower Miocene carbonate successions that underwent different metamorphic conditions and structural evolutions during the Apenninic orogenesis. In fact, three tectonic units have been

described in the literature, the unmetamorphosed Verbicaro and Campotenese-Pollino units and the metamorphic San Donato unit (BOUSQUET & GRANDJAQUET, 1969; AMODIO-MORELLI *et alii*, 1976). Recently, a tectonostratigraphic revision has been proposed by IANNACE *et alii* (2007), in which the San Donato unit and part of the Verbicaro unit are grouped to form the metamorphic Lungro-Verbicaro unit.

In the Campotenese area, placed SW of the Pollino Massif, the superposition of the Verbicaro unit onto the Campotenese-Pollino unit is clearly exposed and marked by a ductile shear zone with a late brittle imprint (Fig. 2). The shear zone is characterized by the occurrence of highly deformed limestones, calcareous conglomerates, calcarenites and pelites. The French authors refer to these rocks as *calcaires plaquettes* (BOUSQUET & GRANDJAQUET, 1969). VITALE *et al.* (2007) interpreted them as the result of heterogeneous shear associated to ductile deformation, under sub-metamorphic conditions, on the carbonates of the Pollino unit.

STRUCTURAL ANALYSIS

The *calcaires plaquettes* are characterized by a pervasive foliation (Fig. 1) marked by the stretching and flattening of

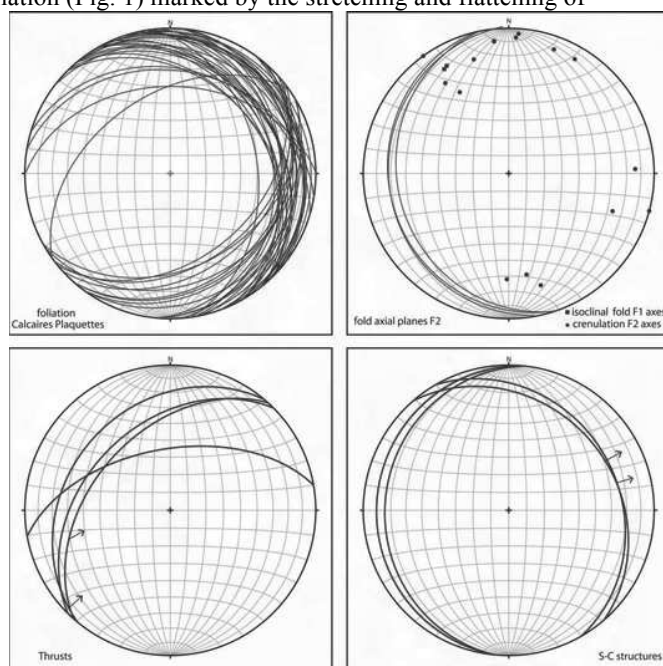


Fig. 1 – Stereographic projection of the analyzed structural elements and levels with different original textural features, re-

(*) Dipartimento di Studi Psicologici, Umanistici e del Territorio, Università degli Studi "G. d'Annunzio" - Chieti.

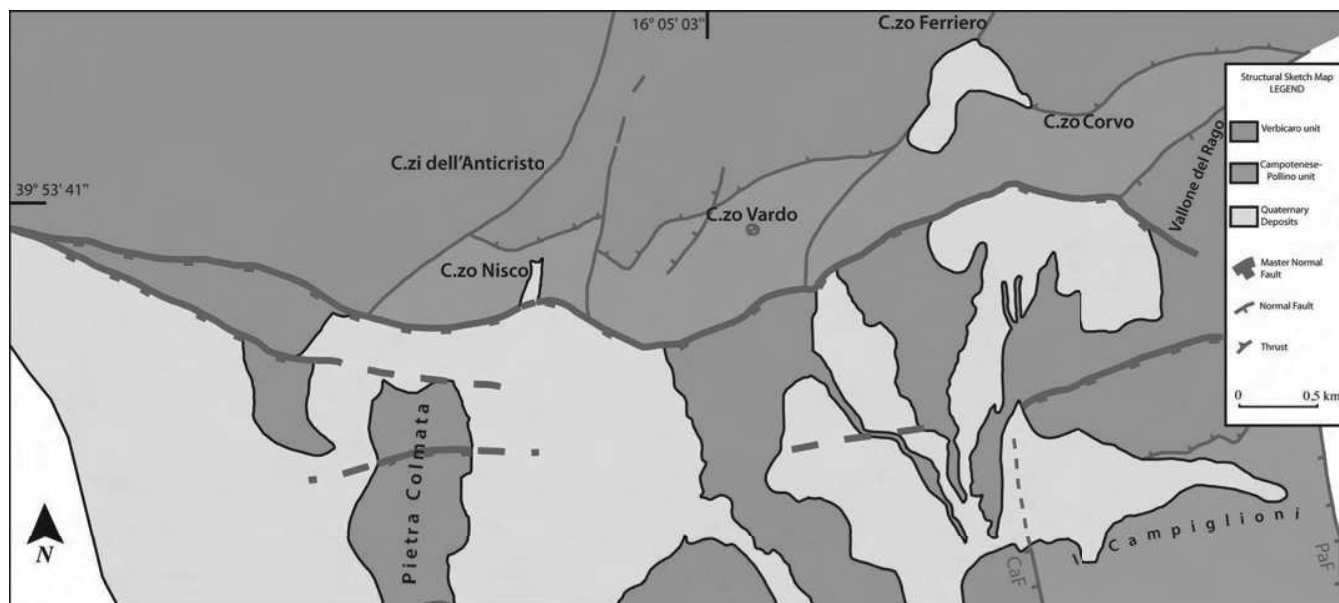


Fig. 2 – Geological sketch map of the Campotenesse area.

orienting of calcite-filled veins, development of isoclinal folds and sigma-type porphyroclasts indicating top-to-NE shear sense (Fig. 3a,b). The results is the near complete transposition of the primary structures. The microstructural analysis shows that intergrain accommodation, pressure solution and intracrystalline deformation (twinning) acted as deformation mechanism during this phase, indicating that temperature did not exceed 250°C. However, this statement need to be confirmed by further studies in order to constraint the pressure conditions also. The best exposed and preserved outcrops are placed between Cozzo vardo and Cozzo Nisco (Fig. 2), where a second deformation event, occurred at higher crustal levels, can

top-to-NE tectonic transport (Fig. 3c). Moving toward the east, a change of the deformation style and the decrease in deformation degree can be noticed. In fact, S-C structures, stylolitic surfaces and conjugate set of en-echelon veins, typical of the ductile-brittle transition, can be observed. In particular, the S-C bands point to NE sense of shear (Fig. 1 and 3d). The geometric relationships existing between the domains characterized by different deformation style are unclear; at present they are juxtaposed by an high-angle west-dipping transtensional fault placed east of Cozzo Vardo (Fig. 2).

CONCLUSIONS

In the Campotenesse area, the superposition of the Verbicario unit onto the Campotenesse-Pollino unit is marked by a ductile shear zone along which the Jurassic-lower Miocene carbonate sequence of the Pollino unit is strongly deformed. Two domains, characterized by different deformation style, can be recognized. Nevertheless, the observed structural associations and the kinematic indicators depict a tectonic evolution coherent with the development of a thrust zone, with an Apenninic vergence, in deep burial or very low-grade metamorphic conditions, likely due to the thickness of the overriding orogenic pile. Later, the ductile shear zone underwent brittle re-working during the late stages of thrust sheet emplacement, during which the second deformation event occurred. In fact, the thrust zone is characterized by a thick cataclastic layers within the Triassic dolomites of the upper unit and by the occurrence of NW-dipping planes, showing oblique sense of shear toward NE, that likely acted as lateral ramps. It is important to stress that in the regional geological reconstruction proposed by IANNACE ET AL. (2007), this contact marks a metamorphic gap existing between the uppermost metamorphic Verbicario unit and the unmetamorphosed Pollino



Fig. 3 – a) and b) ductile deformation in the *calcaires plaquettes*; c) asymmetric folding in the *calcaires plaquettes*; d) S-C structures in the domain not affected by ductile deformation.

be observed ; it is characterized by the development of asymmetric folds with NW-SE-trending axes (Fig. 1) and of associated SW-dipping axial plane foliation, that give a general

unit. Nevertheless, field and petrographic analyses performed on the rocks belonging to the upper unit do not display evidences of metamorphic re-equilibration. In particular, the basic rocks intruding the Triassic-Paleogene carbonate sequence of the Verbicaro unit show only evidences of spilitization processes.

REFERENCES

- AMODIO MORELLI L., BONARDI G., COLONNA V., DIETRICH D., GIUNTA G., IPPOLITO F., LIGUORI V., LORENZONI S. *et al.* (1976) - *L'arco Calabro-peloritano nell'orogene appenninico-magrebide*. Mem. Soc. Geol. It., **17**, 1-60.
- BOUSQUET J-C. & GRANDJAQUET C. *Structure de l'Appennin calabro-lucanien (Italie meridionale)*, C.R. Acad. Sci. Paris, **264**, 204-207.
- IANNACE, A., VITALE, S., D'ERRICO, MAZZOLI, S., DI STASO, A., MACAIONE, E., MESSINA, A., REDDY, S.M., SOMMA, R., ZAMPARELLI, V., ZATTIN, M., BONARDI, G., 2007. *The carbonate tectonic units of northern Calabria (Italy): A record of Apulian paleomargin evolution and Miocene convergence, continental crust subduction, and exhumation of HP-LT rocks*. Journal of the Geological Society London **64**, 1165-1186..
- VITALE S., IANNACE A. & MAZZOLI S. (2007) – *Strain variation within a major carbonate thrust sheet of the Apennine collisional belt, northern Calabria, southern Italy*. In: Ries a., Butler R. & Graham R.H. (eds.). *Deformation of the Continental Crust: The Legacy of Mike Coward*. Geological Society of London, Special Publications, **272**, 143-154.