

PS Late Dolomitization in Basin Limestones of the Southern Apennines Fold and Thrust Belt (Italy)*

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Abstract

The Triassic pelagic carbonates of the Lagonegro Units of southern Apennines fold and thrust belt are frequently dolomitized, both on outcrops and in the subsurface. Field survey and analyses of cuttings from oil wells has shown that the dolomites belong to two different generations. In the Lucania area they have fabrics and petrographic features typical of zebra or saddle dolomites, whereas to the north fine crystalline replacive dolomites prevail. The latter dolomites are genetically linked to the widespread, climatically controlled early diagenetic replacement which characterized the Norian shallow carbonate seas of western Tethys.

A comprehensive regional study is in progress on the saddle type dolomites to better define the relationships of fluid flows with the structural history of the tectonic belt. Field data indicates that the zebra fabrics were controlled by the regular bedding of the micritic limestones, resulting in replacement and void-filling events in a dilatational stress-field favoured by an overpressured fluid regime.

$\delta^{13}\text{C}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ values overlap those of the Upper Triassic seawater, whereas the $\delta^{18}\text{O}$ values are depleted compared to the coeval seawater. Fluid salinities were in the range 2-6 wt % NaCl eq, whereas, homogenisation temperatures corrected for the maximum burial hydrostatic pressure indicate dolomite formation below 115°C. Thus, even by taking the maximum possible trapping conditions the fluids had temperatures below those of peak burial (130-160°C). They better fit to a second phase of deformation, occurring after the exhumation had begun and before the succession passed the isotherm of 100-110°C (apatite fission track data from literature) between 5 and 4 Ma under 3-4 km of burial.

It is suggested that dolomitization was due to formations waters squeezed out from surrounding lithologies and partially diluted by meteoric waters driven downward from the already exposed part of the accretionary prism. Further geochemical and fluid inclusion analyses are in progress in order to constrain the fluid flow paths and evolution during the stacking of the different tectonic units. It can be argued that this fluid-

flux in the belt possibly also affected the Miocene foreland, represented by the Apulian Platform carbonates, now buried below the nappe stack, which host the major oil fields of continental Europe.



Late Dolomitization in Basin Limestones of the Southern Apennines Fold and Thrust Belt (Italy)



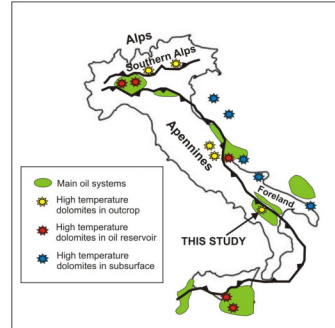
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RESEARCH TOPIC:

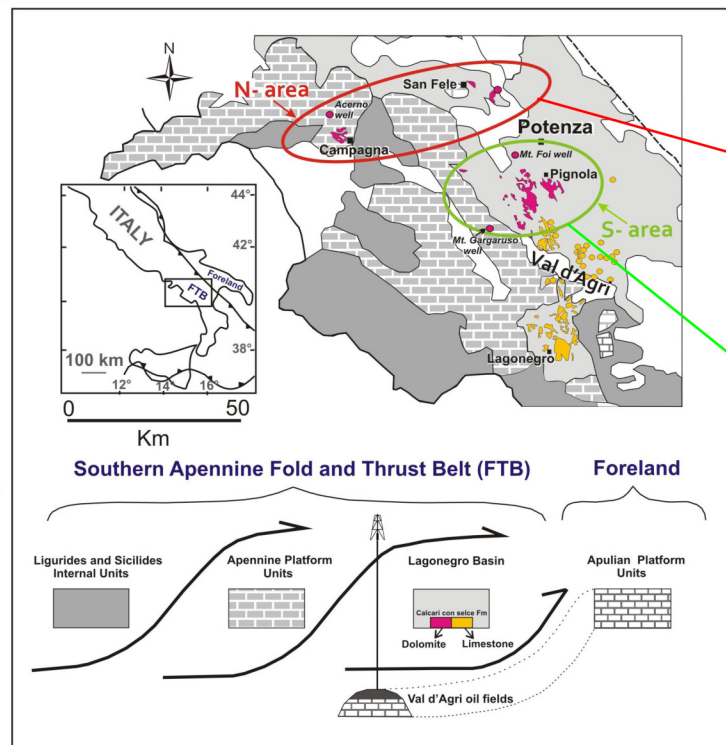
- In the Triassic pelagic *Calcarei con selce* (Cherty Limestones) Formation of the Lagonegro succession (Southern Apennines, Italy) dolomites are widespread.
- A systematic regional study on Lagonegro dolomites distribution has been carried out both on outcrops and on subsurface samples.
- This dolomitization could be part of a major fluid-flow event affecting the Apulian carbonates in the subsurface (Murgia et al., 2004) which host the major oil fields of continental Europe.



modified after Bertello et al., 2010 and Ronchi et al., 2011

AIMS OF THE WORK:

- to evaluate the extension of the dolomitization phenomenon
- to characterize the chemical-physical diagenetic environment
- to provide new constraints to the understanding of the relationships between fluid-flow and the structural history of the tectonic belt.



FIELD OBSERVATIONS

NORTHERN AREA → well-bedded and massive dolomites, often fabric-retentive

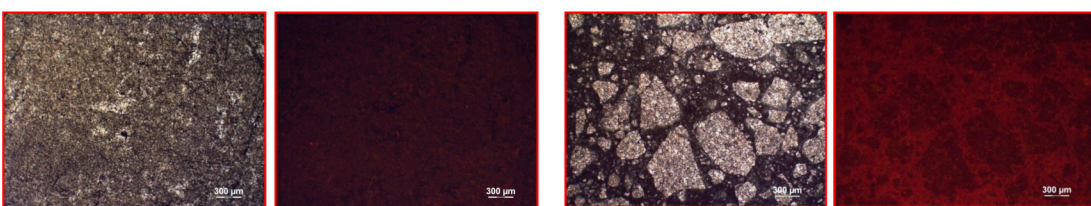


SOUTHERN AREA → fabric-destructive dolomites displaying "zebra" structures and hydraulic breccias

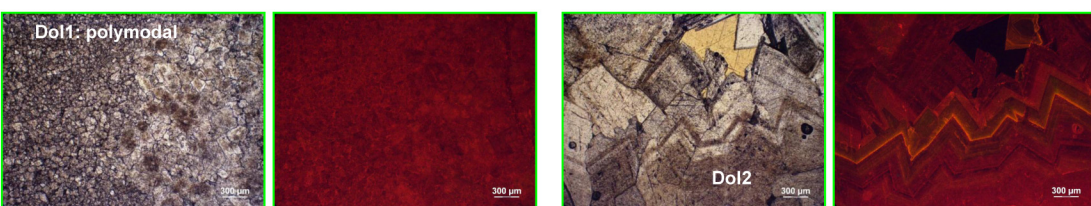


PETROGRAPHY

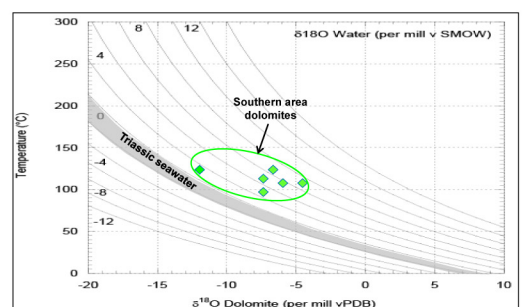
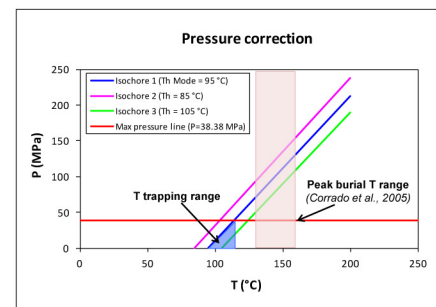
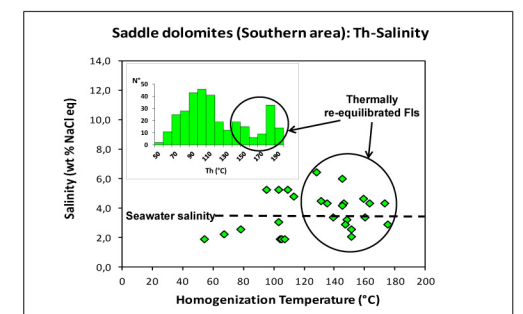
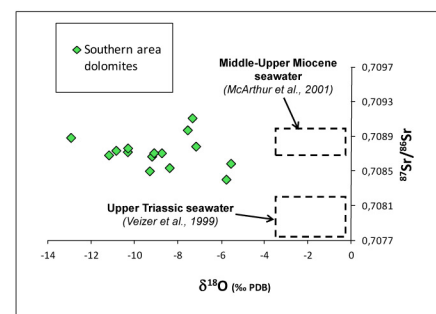
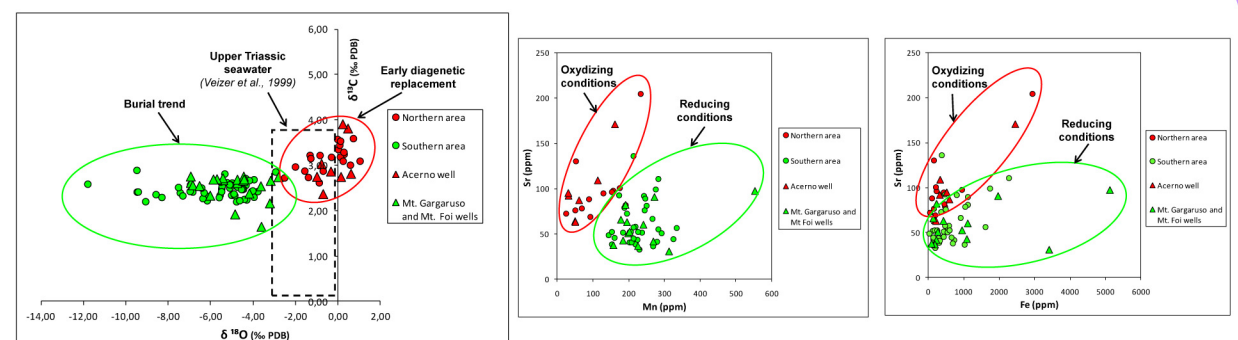
NORTHERN AREA → fine crystalline, replacive, from dull red to non luminescent dolomite.



SOUTHERN AREA → fine crystalline, replacive (Dol1) and void-filling, saddle (Dol2) dolomites, both dull red luminescent



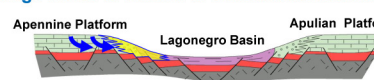
GEOCHEMISTRY



CONCLUSIONS

Two different types of dolomite, having a different origin:

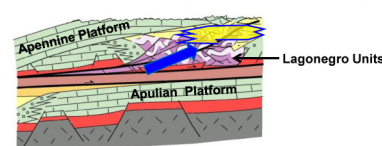
• **Northern area** → Early dolomite, possibly related to a large reflux of marine or marine-derived oxidizing fluids from the Norian platform margins towards the proximal basin.



• **Southern area** → Late burial dolomite, resulting from a large scale "squeeze" fluid-flow during Southern Apennines fold and thrust belt formation (Neogene).

- Structural evidence (pre-dolomitization cleavage) and integration of dolomite temperature (105-125°C) with available thermal data (Corrado et al., 2005) into the regional deformation history, suggest that the fluid-flow took place after maximum burial (130-160°C), in early stages of exhumation, between 5 and 4 Ma and under 3-4 km of burial.

- Fluids sources: or formation waters, diluted with fresh waters delivered during the smectite-illite transformation at depth, squeezed out from the surrounding Triassic and Cretaceous fine-clastic formations, or Miocene marine pore-waters expelled from the deeper *mélange* units.



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