



Relationships between fault network and seismicity in the internal sector of the Cottian Alps (italian western Alps)

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Introduction

In the internal sector of the Cottian Alps, at the limit with the Po Plain, focal mechanisms denoting thrust solutions, with ipocentre at deep crustal levels, are prevalent whereas moving towards the axial sector of the chain extensional solutions, with ipocentre at shallower crustal levels, prevail (Eva and Solarino,1998). In order to realize a seismotectonic model an integrated approach between remote sensing, structural analysis and seismotectonics has been planned for the most internal sector of the Cottian Alps, where a continental slice unit (the Dora-Maira Unit), belonging to the Penninic Domain, outcrops. The Dora-Maira Unit presents a complex structural sin-to late metamorphic Alpine evolution, characterized by at least four deformation phases that strongly influenced the geometry of the chain (Cadoppi et al., 2002).

Post-metamorphic evolution

The structures related to the post-metamorphic structural evolution of this sector are represented by a complex fault network. Four main fault systems have been distinguished basing on their average strike in the studied area:

1) *N-S/N20E fault system*, comprising high to medium angle faults and subordina-
tely low angle faults. High to medium angle faults are characterized by normal and

transpressive movements, reach plurikilometric length and are associated to cataclasites and tectonic breccias of thickness up to 80 meters. Low angle faults are characterized by thrust movements, reach hectometric length, display duplex geometries and are associated to tectonic breccias and foliated cataclasites of thickness up to 1 m.

2) *N40E-N60E fault system*, characterized by medium to high angle faults reaching kilometric length. These faults are associated to oblique, strike-slip movements (with prevalence of left-lateral on right-lateral movements) and subordinately normal movements. Fault rocks associated to these faults are mainly tectonic breccias and gouge of thickness up to 1 m.

3) *N70E-N90E fault system*, comprising high angle faults and low angle faults. High angle faults are characterized by normal, transpressive and subordinately left-lateral movement, reach kilometric length and are associated to tectonic breccias and gouge of thickness up to 1-2 metres. Low angle faults are characterized by thrust movements, limited lateral persistence, and display duplex geometries with fault rocks mainly represented by foliated cataclasites.

4) *N120E-145E fault system*, characterized by medium to high angle faults that reach kilometric length. These faults are associated to left-lateral and normal movements. Fault rocks associated are mainly represented by tectonic breccias and by foliated cataclasites of thickness up to 1-2 metres.

Remote sensing study allowed to recognize four lineament systems, listed according to their density distribution: *Ln1 system (N30E-N60E)*, *Ln2 system (N10W-N20E)*, *Ln3 (N120E-N140E)*, *Ln4 (N80E-N100E)*. Lineaments were, furthermore, analysed statistically according to azimuthal frequencies, azimuthal frequencies for cumulative length, and length classes. Though at present a regional structural and geometrical model is still lacking, lineament and fault patterns seems to be similar.

Conclusions

These data should be consistent with a post-metamorphic structural evolution characterized by a NW-SE extension, attested by normal and left-lateral movement on N70E-N90E, N40E-N60E, N120E-145E and right-normal and normal on N/S-N20E. An earlier event characterized by an E-W compression should be suggested by right-lateral movement on N40E-N60E fault system. This evolution seems to be in good agreement either with the distribution of the focal mechanism that indicate a transpressional regime at depth and an extensional regime at shallow crustal levels.

Moreover, in the studied area, the distribution of present seismicity seems to be concentrated along the N-S/N20E fault system, which shows evidence of recent activity (Collo and Giardino, 1997).

References

Cadoppi P., Tallone S., Scambelluri M., Federico L., Capponi G., Crispini L., Piccardi G.B., Rampone E. e Romairone A.; 2002: Esumazione di crosta continentale e di litosfera oceanica subdotte. Escursione B2, 13-14/9/2002, 81ma Riunione Estiva della Società Geologica Italiana, Torino, 10-12/9/2002, 92 pp.

Collo G. and Giardino M.; 1997: Deformation of "Villafranchian" lacustrine sediments in the Chisone Valley (Western Alps, Italy). *J. Geodynamics*, 24, 281-292

Eva E. and Solarino S.; 1998: Variation of stress directions in the western Alpine arc. *Geophys. J. Int.*, 135, 438-448.