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Seismotectonics investigations in the internal Cottian Alps (Italian Western Alps)

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The inner Cottian Alps represent an area of a low- to moderate- magnitude seismicity (Eva et al., 1990) even though some historical earthquakes reached VIII degree of the Mercalli's scale. Although the frame of seismicity is quite well known, the relation between faults and earthquake sources is still under debate. The low deformation rates and the occurrence of several glacial-interglacial cycles during the Pleistocene partly masked the geomorphological evidences of the recent tectonic activity. Recent studies based on field mapping and structural analysis (Balestro et al., 2009; Perrone et al., 2009) allowed characterizing the size and extension of the regional-scale faults dissecting this area of the Western Alps. Here, we combine the results of these novel studies and updated seismological data with the aim to investigate the relations between mapped faults and seismic activity.
In the analyzed area both continental crust and oceanic tectonic units, belonging to the Penninic Domain of the Western Alps, crop out. The main brittle tectonic feature of this area is represented by the Lis-Trana Deformation Zone (LTZ), an N-S striking, steep structure that extends for about 35 km from the Lower Lanzo valleys to the Lower Sangone Valley. The occurrence of steep faults displacing the metamorphic basement, showed in seismic sections carried out for oil exploration (Bertotti & Mosca, 2009), suggests that the LTZ may be prolonged Southward beneath the Plio-Quaternary deposits of the Po Plain. West of the LTZ some other minor E-W and N-S faults are also present.
Zircon and apatite fission-track data indicate that the activity of these faults started since the Oligocene. Two main faulting stages characterize the post-metamorphic structural evolution of this area: the earlier (faulting stage A; Oligocene?-Early Miocene?) is associated to right-lateral movements along the LTZ and sinistral movements along E-W faults; the subsequent faulting stage (faulting stage B; post-Early Miocene) is related to transtensive/extensional movements along the LTZ and the development of minor sub-parallel N-S faults. This kinematic evolution fits in a model of dextral-transtension at regional scale.
The more recent activity of the LTZ may have caused the development of Pleistocene lacustrine basin, several hundred metres thick, in the Lower Chisone and Pellice valleys, which did not hosted glacial tongues. Along the LTZ, however, Pleistocene deposits showing evidence of brittle deformation were also found.
With the aim to better understand the relation between the current seismic activity and faults, an analysis was carried out by selecting the best located earthquakes (location error less than 3 km) recorded by the seismic network of the North Western Italy (RSNI). This selection is made necessary by the relatively small size of the structures under investigations in order to avoid fake attributions. In addition to get qualitative information about the seismogenic source, the focal mechanisms of four earthquakes occurring along the mapped faults were calculated sorting out the best locatable events among those occurred in the area.
The good geometric and kinematic agreement between structural and seismological data indicates a possible dependence of the seismicity of the inner Cottian Alps with the current tectonic activity of the LTZ and its associated minor structures.

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