INSTRUMENTAL SEISMICITY GIVES INSIGHTS ON THE HISTORICAL EARTHQUAKES OF THE PINEROLO AREA

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The area around the town of Pinerolo has been struck, between 1300 and 1900, by some earthquakes of magnitude ranging from 4.5 to 5.5, the most important of which are the 1808 Valle del Pellice events. The seismic episode started on April 2, 1808 with the 4.9 and 5.7 events and lasted until October of the same year. In between, a 5.3 event occurred on April 16. Despite the limited

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number of casualties, the damages to public and private buildings were high. The more recent seismicity of the area is monitored by the Rete Sismica Nazionale Centralizzata (RSNC hereinafter), run by INGV, and since the '80 by the Regional Seismic network of Northwestern Italy (RSNI), operated by Dipteris. The location is improved by both the data exchange between the two agencies and by the addition of phase picks provided by the surrounding french and swiss networks. Gene-

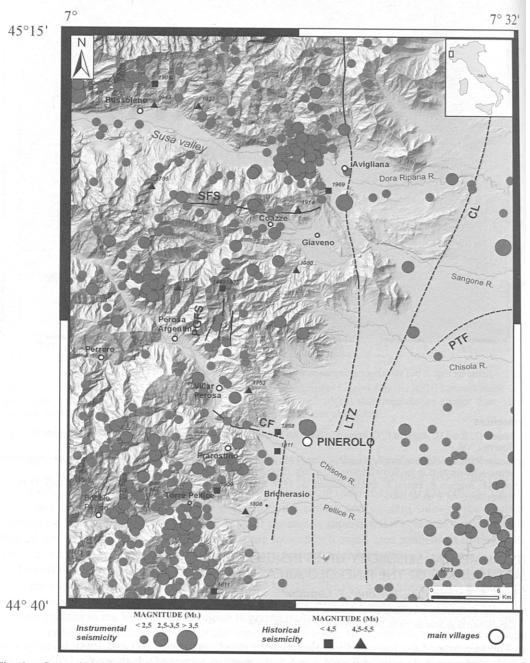


Fig. 1 - Comprehensive sketch of the area under study. Square and triangles historical earthquakes; circle instrumental seismicity, as in the RSNI database, located with routine procedure. Lines show the main tectonic features of the area based on recent geological surveys.

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rally speaking, the position of earthquakes within the catalogue is known with the precision required by a regional to national scale; the magnitude is low to moderate, seldom exceeding 3.5 Ml.

However the occurrence of major earthquakes in the past poses, in the frame of seismic hazard, the question about their exact coordinates and depth and the recognition of the seismogenic source responsible for those events. The studies based on macroseismic data (Camassi and Stucchi, 1997; Boschi et al., 2000) were indeed able to respond to some of these open problems, but more insights can also be derived from an accurate study of the more recent seismicity. In fact, the adoption of a precise location algorithm, the knowledge of a detailed field geological mapping and, above all, their coupling can concur to better constrain the structures likely responsible for seismic events and, in turn, to give information on their depth, geometry and source mechanisms.

In the area under study both continental (Dora-Maira) and ocean-derived units (Piemonte Zone) crop out. The main faults are represented by the Lis-Trana Deformation Zone (LTZ), which extends for about 35 km along the inner border of the Alpine chain, and by the postulated southern prolongation of the Canavese Line (Bigi et al. 1990; Mosca et al. 2009). West of the LTZ some others minor faults are present, including the E-W Chisone and Sangone Faults and the N-S striking Pinasca Gran-Dubbione fault system (PGFS) (Fig. 1). Recent works (Perrone et al.; in press) that integrated seismological, geological and structural data indicated the LTZ and the PGFS as possible seismogenic structures in this area, but to shed more lights on this hypothesis a more accurate seismotectonic study is needed. Since the analysis is conducted on structures that have length and width of the order of few km, the accuracy in the location of seismic events must be of the same order. We then selected a database for the period 1985-2010 in a square around the town of Pinerolo wide enough to include the proposed location for the main historical events and proceeded to a high precision location via the HypoDD code (Waldhauser and Ellsworth, 2000).

A detailed description of the methodology is beyond the scope of this paper, therefore only a brief summary of the basics and main features is given. In HypoDD the residuals between observed and theoretical travel-time differences are minimized for pairs of earthquakes at each station and the spatial offset between these events can be computed with high accuracy. The location method incorporates ordinary absolute travel-time measurements and/or cross correlation P and S wave differential travel-time measurements. This method is apparently independent from the velocity model, that must be mono-dimensional. For this reason, usage of HypoDD is feasible even when a good reference model is not available, since the algorithm used within is less sensitive to the velocity model; nevertheless, the performance of HypoDD is strictly linked to the number of available cross-correlations. In the area under study few stations are operating since the early '80, so the time overlapping would be large enough to ensure good performances of the location algorithm; on the other hand the little number of stations limits the total number of cross-correlations. As a consequence of the these constrains and of the precision required in the study, the initial database is greatly reduced after the location runs. Nevertheless, the seismic cross sections along the main seismicity clusters give interesting hints on the geometry of the faults and allow speculation on the relationships between the more recent and the historical seismicity.

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