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Holocene surface faulting at Monte Netto, Brescia, and the Christmas 1222 (Io = IX MCS) earthquake in the Po Plain, Italy: what does it mean “blind fault”?

A.M. Michetti (1), A. Berlusconi (1), F. Livio (1), G. Sileo (1), A. Zerboni (2), M. Cremaschi (2), L. Trombino (2), K. Mueller (3), E. Vittori (4), C. Carcano (5), S. Rogledi (5)

1. Dipartimento di Scienze Chimiche e Ambientali, Università dell’Insubria, Via Valleggio 11, Como, Italy
2. Dipartimento di Scienze della Terra "A. Desio", Università Statale di Milano, Via Mangiagalli 34, Milano, Italy
3. University of Colorado, Boulder, CO, USA
4. APAT, Dipartimento Difesa del Suolo/Servizio Geologico d’Italia, Via V. Brancati, 48, 00144, Roma
5. ENI Exploration & Production, S. Donato Milanese (MI)

alessandro.michetti@uninsubria.it / Fax: +39.031326230 / Phone: +39.031326231

The identification of Holocene surface faulting at Monte Netto, near Brescia, within the epicentral area of the Christmas 1222 (epicentral intensity IX in the MCS scale, that in the seismotectonic setting of the Lombardia Southern Alps can be related with a Mw of 6 to 6.5; Magri & Molin, 1986; Guidoboni, 1996; Serva, 1990; Guidoboni & Comastri, 2005; Sileo et al., 2007) earthquake, holds significant implications in terms of A) the hazard for surface faulting in the Po Plain, B) the seismic hazard in Lombardia and nearby region of Northern Italy, C) the criteria for identification of capable faults (sensu IAEA, 2002; Michetti et al., 2005) in active compressional tectonic environments, in particular as related to the siting of critical facilities such as civilian nuclear power plants.

In the framework of a project on the ongoing deformation and seismic potential of the Lombardia Southern Alps, based on the review of literature data, reinterpretation of extensive subsurface information in the Po Plain made available courtesy of ENI E&P, regional geomorphic analyses, and detailed field mapping at selected sites, we mapped several Quaternary tectonic structure in the N Po Plain between Varese and Brescia. In particular, we confirmed that 3 isolated hills (Colli di Castenedolo e Ciliverghe, and Monte Netto of Capriano del Colle) SW of Lake Garda are the geomorphic expression of late Quaternary growing anticlines, as already suggested by the Authors (Desio, 1965; Baroni & Cremaschi, 1986). We show that these structures are controlled by E-W trending, out-of-sequence backthrust, that has been characterized for the first time during this project in terms of geometry and rates of recent deformation.

A quarry excavation at Monte Netto allowed to conduct preliminary paleoseismological analyses, supported by new trenching, and pedostratigraphic and paleoetnological data, on ca. 150 m long, 7 m high, N-S and E-W trending trench walls. Two secondary decametric anticlines have been exposed, affecting a mid to late Pleistocene sequence of fluvial gravels and sands, paleosols, and loess deposits. The culmination of the N anticline is characterized by a well-preserved paleoliquefaction feature associated with bending-moment faults, which offset all the sequence up to the Holocene surficial soil. The stratigraphic and structural characters of the observed surface faulting and liquefaction clearly show that these features were generated during strong local earthquakes, and are consistent with the environmental effects of an earthquake like the Dec. 25, 1222, Brescia event. This give proofs for the first time of paleosesimic surface faulting phenomena clearly connected to a typical compressional structure in the Po Plain Foredeep. Careful interpretation of the high-quality ENI E&P seismic reflection profile across Monte Netto clearly shows in fact that surface folding and faulting are geometrically linked to a secondary flexural slip fault at a depth of ca. 2 km, controlled in turn by the slip of the main Capriano del Colle backthrust at a depth of ca. 5 km beneath the excavated site.

This show that the term “blind fault” is seldom of practical use, if not totally misleading, for the evaluation of seismic hazards, especially in regions characterized by moderate seismicity and active crustal shortening.