

## NEW MORPHOLOGICAL, STRATIGRAPHIC, STRUCTURAL AND PEDOLOGICAL DATA ON THE T. TRAVERSOLA DEFORMATION ZONE RECENT EVOLUTION (ASTI, PIEDMONT)

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ABSTRACT: Doglione A., Forno M. G. & Gattiglio M., *New morphological, stratigraphic, structural and pedological data on the T. Traversola deformation Zone recent evolution (Asti, Piedmont)*. (IT ISSN 0394-3356, 2011).

The new morphological, stratigraphic, structural and pedological data on the type-area Villafranchian Succession suggest the southern extension of the *T. Traversola* deformation Zone. This structure corresponds to the evident scarp that divides the Poirino Plateau by the Asti Reliefs. In the previous works the northern sector of the structure was, exclusively, recognized.

RIASSUNTO: Doglione A., Forno M. G. & Gattiglio M., Nuovi dati morfologici, stratigrafici, strutturali e pedologici sull'evoluzione recente della Zona di deformazione del T. Traversola. (IT ISSN 0394-3356, 2011)

*I nuovi dati morfologici, stratigrafici, strutturali e pedologici riguardanti la Successione Villafranchiana dell'area-tipo suggeriscono la prosecuzione verso sud della Zona di deformazione del T. Traversola, di cui in lavori precedenti era già segnalato il tratto settentrionale, corrispondente alla evidente scarpata che separa i Rilievi dell'Astigiano dall'Altopiano di Poirino.*

Key words: Asti Reliefs, deformation, Villafranchian Succession.

Parole chiave: Rilievi dell'Astigiano, deformazione, Successione Villafranchiana

The morphological evidence of the Tertiary Piedmont Basin (BTP) consists of hilly reliefs: the Turin Hill and the Monferrato Reliefs on the northern side; the Poirino Plateau, the Asti Reliefs and the Alessandria Plateau in the centre; and the Langhe Reliefs on the southern side.

The new research focuses on the central part of the BTP, which corresponds geologically to the Asti Syncline (4 in Fig. 1). This structure is made up of the littoral marine Asti Sands (Middle Pliocene) and the deltaic and fluvial type-area Villafranchian Succession (Middle Pliocene-Lower Pleistocene), together with a thin cover of subsequent fluvial sediments (Middle-Late Pleistocene), connected to the ancient courses of the Po and Tanaro rivers (5 and 6 in Fig. 1).

The pronounced N-S scarp breaking up the central part is one of the most significant geological features of the hilly area: it is 30 km long and 100 metres high on average, running along a generally straight line, with local-level segmentation. The scarp divides a west sector plain (Poirino Plateau) from a hilly east sector (Asti Reliefs).

The scarp, described by numerous authors, has been attributed to different geneses.

In the early geological literature (CASTIGLIONI, 1934; SACCO, 1917) the scarp was linked exclusively to the erosional phenomenon produced by the present course of the Tanaro River (8 in Fig. 1) and its tributary hydrographical network, following the deviation of the ancient course (6 in Fig. 1) during the Late Pleistocene.

In subsequent studies (FORNO, 1982; ALESSIO *et al.*, 1982; CARRARO & VALPREDÀ, 1991) the

different elevation of the Middle-Late Pleistocene fluvial sediments on the two sides of the scarp led to the presumption of the presence of a vertical displacement structural discontinuity corresponding to the scarp, explained as a "flexure".

In the recent literature (CARRARO *et al.*, 1996; BOANO *et al.*, 1997; BOANO & FORNO, 1999) a detailed geological survey of the Villafranchian Succession type-area gave rise to the interpretation that the northern segment of the scarp was connected to a structural discontinuity named "*T. Traversola* deformation Zone" (1 in Fig. 1). In this segment the structure has traces of a dextral strike-slip displacement and has different stratigraphic successions on the two sides. In the other segment of the scarp the structure was not recognized due to the scarcity of outcrops and the absence of structural evidence and stratigraphic elements. Indeed, recognition of strike-slip displacement structures in a sub-horizontal succession is obviously very difficult and this difficulty essentially resulted in a delay in the identification of the *T. Traversola* deformation Zone, despite its strong morphological evidence (Fig. 2).

Only through a detailed survey of the stratigraphic succession outcropping on both sides of the scarp and an interdisciplinary approach, comprising the collection of morphological, structural and pedological data, now being presented, has it been possible to identify a structure along the entire scarp.

Specifically, this research has enabled the

recognition of the structure's southern extension and the description of both its chronological reference and displacement type.

The new stratigraphic data collected show no vertical displacement and, instead, suggest the horizontal displacement of the Villafranchian Succession body along the scarp. There is also a cut in the continuity of the fluvial sediments connected to the ancient courses of the Po and Tanaro rivers. The deviation of these rivers, responsible for their present courses (7 and 8 in Fig. 1), has essentially been caused by the Pleistocene deformation.

The scarp's morphological features, with deep valleys draining in the opposite direction and an asymmetric transverse cross section, as well as

the depressions aligned along the scarp and the numerous landscapes, are described.

Meso-structural evidence suggests the horizontal displacement of the Asti Syncline axis (4 in Fig. 1) and detailed observations have permitted the identification of some metric fault surfaces, along the main structure.

The survey of soils involving the sediments on both sides of the scarp, on the other hand, have enabled the correlation of the corresponding geological bodies and identification of the relative movements.

Some evidence, already reported in the literature, supports the BTP uplift: the progressive transition from a marine to a continental environment, the deviation of the ancient rivers (5 and 6 in Fig. 1),

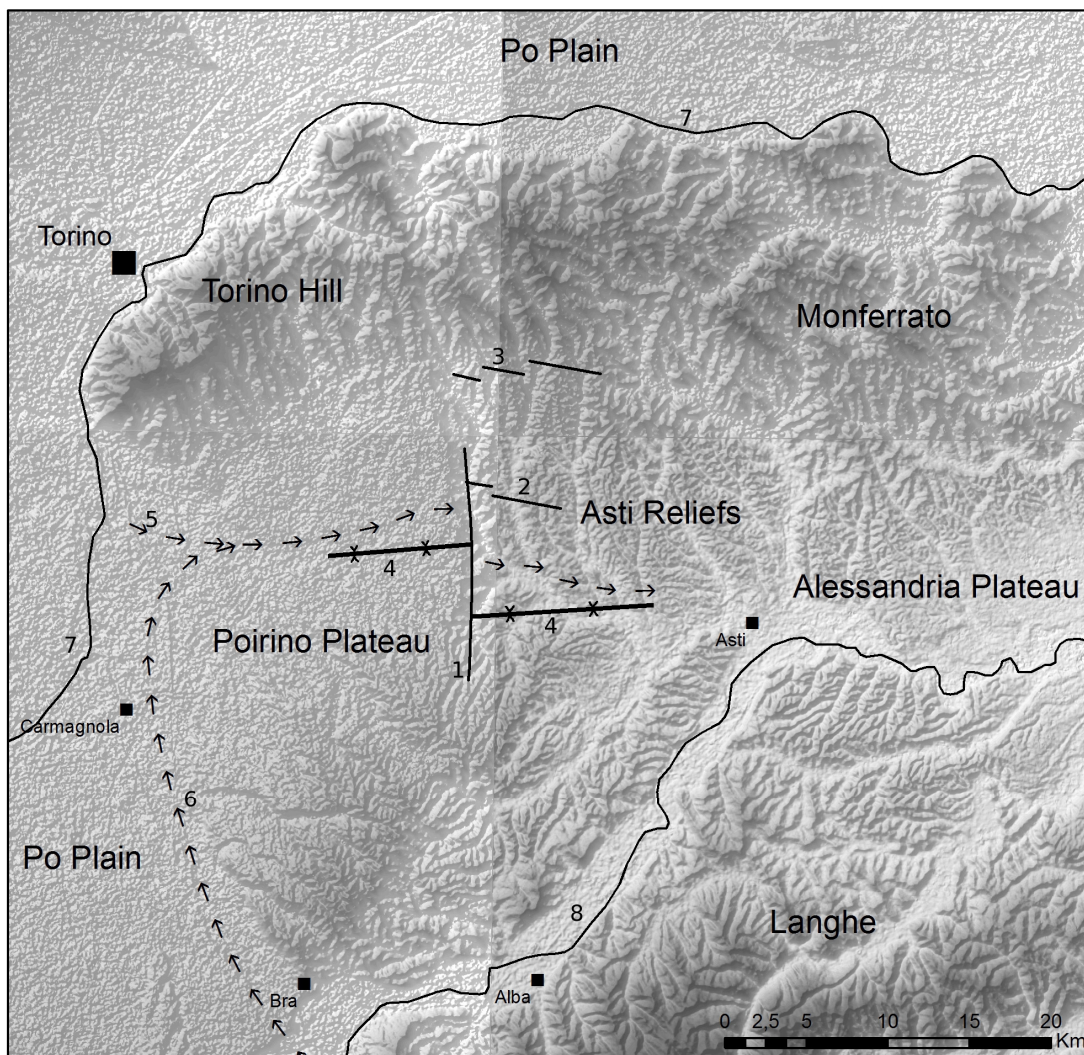


Fig. 1, Structural map of the studied area. 1) T. Traversola deformation Zone (prevailing dextral strike-slip displacement); 2) C. Fagliaverde fault Zone (prevailing vertical displacement); 3) Castelnuovo fault Zone (prevailing vertical displacement); 4) Asti Syncline axis; 5) Po River ancient course; 6) Tanaro River ancient course; 7) Po River present course; 8) Tanaro River present course. Earth Observing System Data and Information System (EOSDIS). 2009. Earth Observing System ClearingHouse (ECHO) / Warehouse Inventory Search Tool (WIST). Greenbelt, MD: EOSDIS, Goddard Space Flight Center (GSFC) National Aeronautics and Space Administration (NASA).

*Schema strutturale dell'area studiata.* 1) Zona di deformazione del T. Traversola (con movimento prevalentemente trascorrente destro); 2) Zona di faglia di Cascina Fagliaverde (con movimento prevalentemente verticale); 3) Zona di faglia di Castelnuovo (con movimento prevalentemente verticale); 4) asse della Sinclinale di Asti; 5) antico percorso del F. Po; 6) antico percorso del F. Tanaro; 7) percorso attuale del F. Po; 8) percorso attuale del F. Tanaro.



Fig. 2, The described scarp evidence  
*Evidenza della scarpata descritta*

the entrenchment of the ancient rivers in the east sector, the dissection of the east sector and the genesis of numerous landslides.

Other data also suggest some vertical displacement structures known as the *C. Fagliaverde* fault Zone and *Castelnuovo* fault Zone (2 and 3 in Fig. 1) (CARRARO ed., 1996; BOANO *et al.*, 1997; BOANO & FORNO, 1999). The most significant are: the vertical displacement of the type-area Villafranchian Succession (Middle Pliocene-Lower Pleistocene), the stratigraphic interference along the structures and the local presence of re-sedimented bodies.

Further data suggest, at least, the presence of a major strike-slip displacement structure; only a short segment of which has been reported in the literature (*op. cit.*). The most significant data are: the horizontal displacement of the Asti Syncline axis (4 in Fig. 1), the horizontal displacement of the Villafranchian body and the lateral sliding of rivers (ancient courses of the Po and Tanaro rivers (5 and 6 in Fig. 1).

In conclusion, the described scarp (Fig. 2) is the morphologic expression of an important and continuous deformation zone, characterized by main dextral strike-slip displacement, presumably localized near the scarp.

These new data explain an old observation (CASTIGLIONI, 1936) that reports the relative stability of the scarp over time: this observation was in conflict with the proposed genesis, connected exclusively to regressive fluvial erosion, and could not be explained. It was impossible to envisage how a high scarp, shaped in incoherent sediments, could not be affected by the regressive erosion.

In view of the reported observations it is highly likely that the exceptional morphologic expression of the *T. Traversola* deformation Zone and its relatively stable position are connected to its probable recent activity.

In the early Pliocene, the Apennine tectonic became to affect the Torino Hill inducing dextral activations of the *Rio Freddo* Deformation Zone (RFDZ) (PIANA & POLINO, 1995). This NNW-SSE deformation zone, developed a few kilometres NNE the studied area, divides the Torino Hill by

the Monferrato.

From middle Pliocene to present-day, the Torino Hill northward translation and uplift, induce a RFDZ dextral strike-slip tectonic (LAUBSCHER *et al.*, 1992; PIANA & POLINO, 1995). According to the new collected data, this tectonic activity can be responsible of the *T. Traversola* deformation Zone develop.

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