NEW GEOMORPHOLOGICAL AND STRATIGRAPHICAL CONSTRAINTS TO THE RECENT TECTONIC ACTIVITY OF THE CALORE RIVER FAULT SYSTEM

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Introduction. The Calore river valley, is located within the axis of the Campanian sector of the Southern Apennines fold-and-thrust belt, which is the result of compressional tectonics mainly active during the Tertiary (Patacca and Scandone, 2007). This portion of the Apennine chain hosted many strong earthquakes; e.g.,: 1805 Molise, 1456 Molise, 1688 Sannio, 1732 Irpinia, 1980 Irpinia, 1857 Basilicata (Gruppo di lavoro CPTI, 1999). Di Bucci *et al*., 2005 investigated subsurface and surface geological data in this area and found several surficial geological features, which they interpreted as the result of cumulative ground effects of past earthquakes. In particular the Authors put out in evidence the latest Pleistocene brittle deformation and suggested a NE dipping main fault related to a NW-SE oriented active extensional system (Calore River fault system: CRFS) as the potential seismogenic fault of the 1688 Sannio earthquake. In the present study new data on the recent activity of this fault system, coming from recent field and remote sensing surveys, are presented.

Materials and method. During a recent field survey in the area surrounding Paupisi village, carried out after the October 2015 flash flood (Santo *et al*., 2016, in print), several new stratigraphic outcrops were discovered, which may help in reconstruct the recent tectonic activity of this fault system. In addition, an UAV survey, with relative photo-interpretation was planned. The survey covered an area of 13 km at 500 m of height with a calibrated digital camera of 14 Mpx, producing 823 photographs in 7 overlapping photo-strips with a very high resolution of nearly 0.5 cm on ground shown in the UAV orthomosaic. Using the high resolution of the drone images and a 1:5000 topographic map derived from a Li.DAR survey (1x1 m. cell) provided by the Italian Ministry of the Environment, a detailed geomorphological analysis of the main surface indicators of active faulting was firstly elaborated. Then we validated it in the field. For chemical analysis of the main tephra layers, the selected samples were overdried, sieved with 1f interval sieves to define grain-size distribution, and fragments were counted under a binocular microscope to determine the lithological components. Major-element analyses on pumice fragments, glass shards and crystals were performed on a SEM JEOL JSM 5310 (15kV, ZAF Correction Routine) with EDS at the Interdepartmental Centre for Geomineralogical Analysis (CISAG) at the University of Naples Federico II.

Results. The study area is located along the northern slope of Mt. Camposauro (1390 m a.s.l.), a morphostructural carbonate ridge, surrounded by a thick Pleistocene talus consisting of carbonate breccias and alluvial fans (Fig. 1A). We investigated in detail this piedmont area in the surrounding of Paupisi village, looking for geomorphic and stratigraphic evidences of recent tectonic activity. The oldest alluvial fans are Middle to Late Pleistocene in age (Ispra, 2010) and crossed by several tectonic fault scarps mainly N70 oriented. These scarps are the most evident surface expression of the Calore river fault and separates the oldest fans from the youngest ones. Another important fingerprint of the tectonic activity of this fault system is the presence of several collapse sinkholes (near Solopaca and Telese village) which are aligned according to the main tectonic directions and are in coincidence with important mineral springs (Santo *et al*., 2011).

The focus of this note is the tectonic scarp clearly visible south of the little S. Pietro village, trending SW-NE and affecting the slope talus (Fig.1B). The scarp is up to 40 m high and cuts the oldest alluvial fans made up by coarse carbonate conglomerate, mainly characterized by a debris flow facies, interbedded with paleosoils and pyroclastic deposits. In site P we described a 10 meters exposed stratigraphic sections and sampled for tephrostratigraphy the grey pyroclastic layer located in the upper part (Fig. 2A). This layer shows at the base a pumiceous level 10 cm

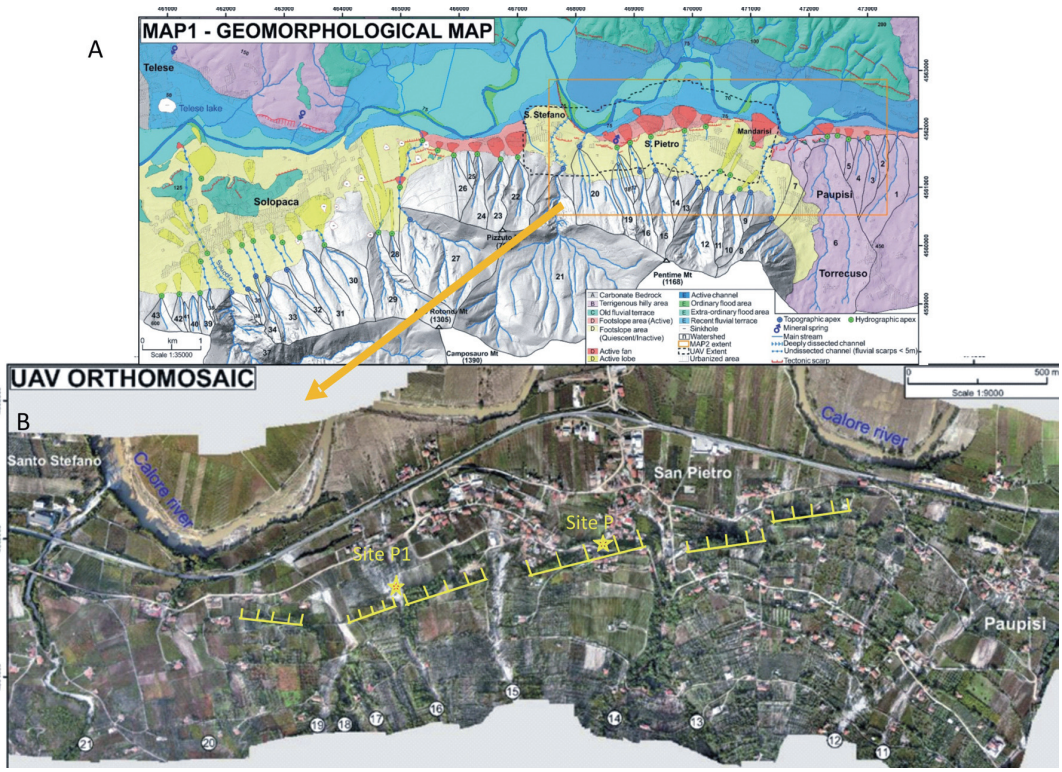

Fig. 1 – A) Geomorphological map of the study area, B) UAV orthomosaic. In yellow the fault scarp under study; the Stars indicate the stratigraphic sections.

thick passing upwards to fine ashes (60 cm). The maximum diameter of the pumices ranges between 1 and 1.5 cm, testifying to an high intensity of the eruptive event. The chemical analysis shows a fonolitic composition which may be correlated with the most ancient products of the Campania volcanic zone. More in detail the best fitting is with the level Sep5 found inside the S.Marco Evangelista core (Santangelo *et al.*, 2010) and stratigraphically constrained to the time interval between 105 e 130 ka.

Moving westwards along the main fault scarp, in the site P1 (Fig. 3A) as well as in another points along its trace, it was possible to observe that other minor scarps are associated with it. In site P1 one of this secondary scarp clearly cuts the youngest fan generation and shows an height of at least 4 m (Fig. 3B). The deposits of the fan are made up by carbonate conglomerates showing a debris flow facies, interbedded with paleosoils and tephra layers. We sampled the tephra layers P1a, made up by fall pumices 10 cm thick (Fig. 2B). The chemical composition of this sample fits well with that of the Neapolitan Yellow Tuff, aged at 14.9 +/- 0.3 ka (Deino *et al.*, 2004). The products of this eruption according to Cole e Scarpati (1993) have a dispersion axis towards NE, which is compatible with the location of Paupisi in respect of the source area (Phlaegrean Fileds).

Discussion and conclusions. The scarp located in the surrounding of Paupisi is described here for the first time and is interpreted as a tectonic one. It is around 2 km long, is clearly recognizable for its straightness and represent one of the best preserved surface expression of the Calore river Fault system. This scarp is at least 40 meters high and the collected data testify to an age younger than 100 ka. It also shows clear evidence of recent tectonic activity (younger than 15 ka), represented by minor scarps up to 4 m high, cutting the youngest fan generation. The collected data suggest that the area has been repeatedly interested in the past

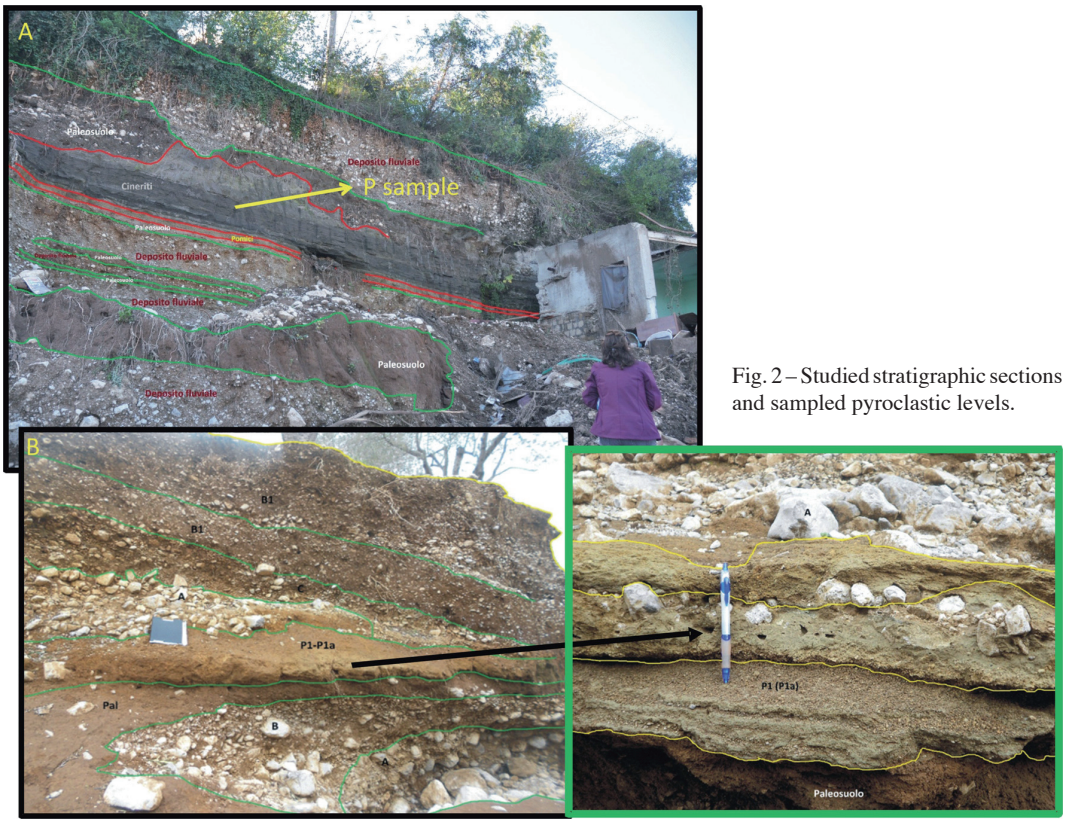

Fig. 2 – Studied stratigraphic sections and sampled pyroclastic levels.

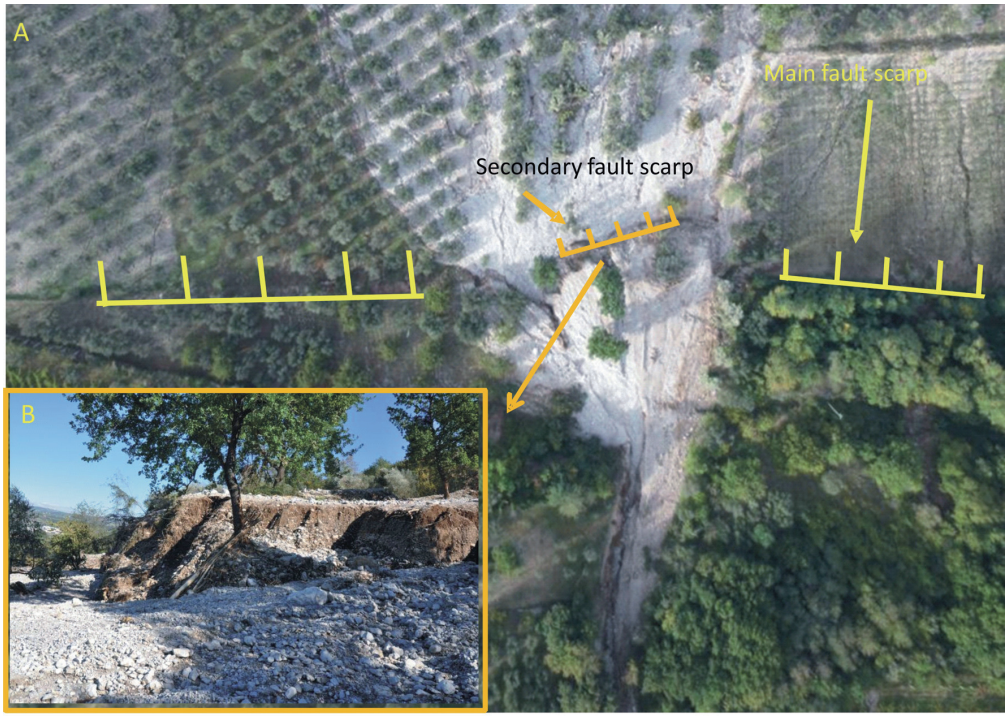

Fig. 3 – Recent fault scarp cutting the youngest generation of fans.

by strong earthquakes capable to originated significant surface effects such as surface faulting. In association with all the other evidences collected by previous papers, it is thus possible to adfirm that the Calore river fault systems can be considered as one of the most important seismogenetic zone of southern Apennines.

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