POSSIBLE UNSLIPPED SEGMENTS IN THE M. VETTORE FAULT SYSTEM

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Introduction. On October 30, 2016, in Central Italy, immediately north of the epicentral area of the August 24 event a strong eartquake (Mw = 6.5) reactivated the northern sector of the Monte Vettore Fault System (MVFS). Our local geodetic network was fully affected by the new event and therefore we performed a second campaign soon after (November 11-13, 2016) (Fig. 1 and Tab. 1) (De Guidi *et al.*, in press).

The measured deformation (with 95% confidence errors) was characterised by both horizontal and vertical movements. In particular, the east benchmark VTE1 documents 312 mm of eastward horizontal displacement and 29 mm of upward motion, while the VTE2 282 mm of eastward horizontal displacement and 67 mm of upward component of motion. On the contrary, all three western benchmarks recorded westward horizontal displacements (419, 288 and 26 mm) and subsidence (707, 288 and 769 mm) for stations VTW5, VTW4 and VTW3, respectively. Similar to Wilkinson *et al.* (2017) and the results of the DInSAR technique (http://www.irea.cnr.it/index.php?option=com_k2&view=item&id=761:nuovi-risultati-sul-terremoto-del-30-ottobre-2016-ottenuti-dai-radar-dei-satelliti-sentinel-1), we documented ca. 730 mm of ENE-WSW lengthening on a distance of 7 km in correspondence of the northern sector of the Mt. Vettore Fault Segment, while the off-fault vertical displacement between footwall and hanging-wall blocks was 736 mm, confirming the overall consistency of the different approaches and datasets (Fig. 2).

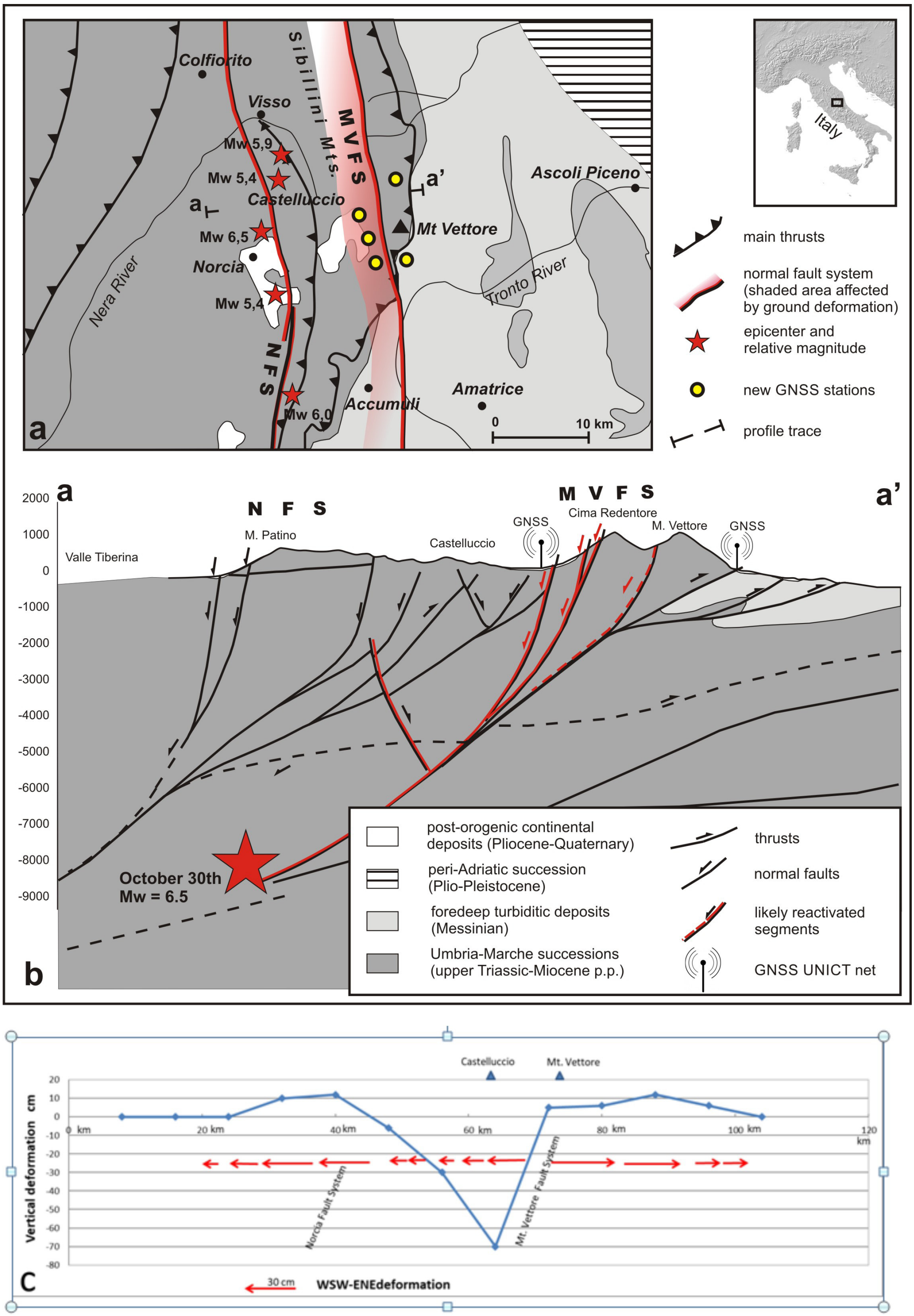

Fig. 1 - Simplified seismotectonic map of central Apennines (a) and geological profile across the epicentral area (b). The location of the major event (October 30) is from GdL INGV (2016), while the main geostructural features are modified from Pierantoni *et al*. (2013) and Mantovani *et al*. (2011). (c) Semi-quantitative analysis of west-east deformation transect obtained by DInSAR technique and GNSS measurement

Tab. 1 - Three components co-seismic displacements and relative uncertainties estimated for the GNSS stations of the UNICT network. Coordinates are WGS84 east and north, respectively. All displacement (disp) and uncertainty (unc) values are in millimeters. For all stations, the cut-off angle is 15°, the troposphere model is the Goad-Goodmar and the meteo model used is NRLMSISE. The table can be download as ASCII file on the INGVRING web page (http://ring.gm.ingv.it).

ID	Station	Longitudine	Latitudine	$disp_{N-S}$	$disp_{E-W}$	$disp_{UP}$	unc_{N-S}	unc_{E-W}	unc_{UP}
VTE1	FOCE_SENTIERO	13° 15′ 57,45166″	42° 51′ 57,04340″	141	312	29	15.5	16.5	44.0
VTE2	PRETARE	13° 16′ 33,20959″	42° 47′ 56,56780″	60	282	67	19.0	16.5	46.0
VTW3	QUARTUCCIOLO	13° 14′ 46,41153″	42° 47′ 56,57032″	198	26	-349	15.5	14.5	36.0
VTW4	COLLE_CURINA	13° 13′ 55,01245″	42° 48′ 59,62491″	102	288	-769	15.5	15.0	36.0
VTW5	CASTELLUCCIO_VALLE	13° 12′ 56,20423″	42° 49′ 54,89014″	353	418	-707	15.0	13.5	37.5

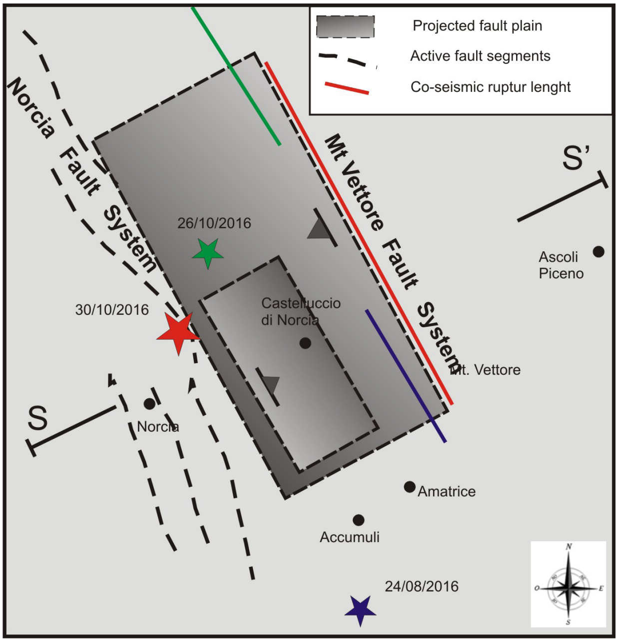

Fig. 2 - Schematic seismotectonic map: coloured lines indicate the sectors of the fault system along which coseismic ruptures occurred associated to the three main seismic events. S-S' represent the trace of sections in Fig. 1 (from EMERGEO W.G., 2016, modified).

Discussion and conclusion. The distribution of events occurred respectively before and after the Mw 6.5 mainshock, depict a simple shear geometry of normal fault segments characterised to the east by principal west facing normal fault and to the west by a blind antithetic fault segment. This frame concurs to adjust the ca. E-W-trending extensional deformation (Figs. 1b and 1c). The rupture width (thickness of seismogenic layer), referred to the dip dimension of the part of this antithetic fault segment that moved during the late October sequence, extends from about 6 km-depth to 2 km below sea level and it is length few kilometre (Figs. 1b and 2) (EMERGEO W.G., 2016)

The semi quantitative deformation analysis along a schematic west-east transect (Fig. 1c), indicates on the footwall of the blind antithetic fault segment (Fig. 1b) both horizontal and vertical differential deformation with maximum values of about 400 and 120 mm, respectively. The east margin of this deformed area intersects the upward extension of antithetic Mt Vettore fault system. We think that the blind antithetic sliding that occurred in correspondence of the Castelluccio plain released only partially the upper crustal stress, whereas in the upper part of the antithetic fault (from 2 km to the ground surface) regional stress could have been accommodated by aseismic ductile deformation along an incipient detachment within the surficial sedimentary succession. Alternatively, the deformation recorded at the surface across the antithetic fault (Fig. 1c) could be still elastic and therefore it could be released by a future event (Fig. 1c). Based on these evidence and following the stress-triggering concept (Stein *et al.*, 1999; Steacy *et al.*, 2005). In the attempt to verify this hypothesis we installed new benchmarks in strategic positions for monitoring possible pre-seismic deformation associated with the antithetic Castelluccio Fault.

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