

First-order and subsidiary faults controlling the time-space evolution of the Central Italy 2016 seismic sequence - a multi-source data detailed 3D reconstruction

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The Central Italy 2016 seismic sequence, with its three major events (24 August, M_w 6.0/6.2; 26 October M_w 5.9/6.0; 30 October M_w 6.5/6.6), activated a well-known active west-dipping extensional fault alignment of central Italy (Vettore-Gorzano faults, VEGO). Soon after the first event, based on geological, interferometric and at that moment available seismological data, a preliminary 3D fault model of VEGO was built. Such a model is here updated and improved at the light of a large amount of relocated earthquake data (time interval 24 August to 30 November 2016, $0.1 \leq M_L \leq 6.5$, *Chiaraluce et al., submitted to SRL*) plus additional geological information. The 3D modeling was done using the software package MOVE from the Midland Valley. All the available data were taken into consideration (surface traces, fault-slip data, primary co-seismic surface fractures, geological maps and cross-sections, hypocentral locations and focal mechanisms of both background seismicity and seismic sequences).

The VEGO geometric configuration did not substantially changed with respect to the previous model, but some additional structures involved in the sequence were reconstructed. In particular, four additional faults are well evident:

1. a NE-dipping normal fault (dip-angle 50°) antithetic to Vettore Fault, located at depths between 1 and 5 km;
2. a WNW dipping plane (dip-angle 30°) located at depth between 1 and 4 km within the Vettore footwall volume; this structure represents a splay of the late Miocene Sibillini thrust, which is evidently cross-cut and dislocated by the Vettore normal fault;
3. a SW-dipping normal fault representing an unknown northward prosecution of the VEGO alignment, where since 26 October a relevant seismic activity was released;
4. an unknown east-dipping low-angle detachment, where VEGO detaches at a depth of about 10-11 km. An uninterrupted microseismic activity has illuminated such a detachment not only during the overall sequence, but also in the previous months.

At the light of the reconstructed geometric pattern integrated with the evidences of primary co-seismic fractures, it results evident that the Central Italy seismic sequence represents a “classic”, although complex, intra-Apennine normal-faulting event, reactivating a long-term quiescent seismogenic alignment (e.g. VEGO). The reactivated and inverted compressional structures are confined at shallow depth within the Vettore footwall, and in no way control the major events of the sequence.

Conversely, an important regional role is played by the east-dipping detachment. It represents the missing geometric link between the Altotiberina LANF of northern Umbria and the recently discovered LANF of Latium-Abruzzi.