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Early seismogenic faults of the 2016 Accumoli-Amatrice seismic sequence (Central Apennines, Italy)

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The seismic sequence which caused numerous deaths and extensive damage in the area between Amatrice and Norcia (Central Apennine, Italy) started the 24t August, 2016 with a MW = 6.0 earthquake and is ongoing. The earthquake area is strongly dissected by quaternary NW/NNW-SE/SSE (Apennine Fault Systems) and NE/NNE-SW/SSW (Antiapennine Fault Systems) fault systems. The main structure of the Central Apennines sector is the Cittareale-Celano Fault System (CCFS); it extends from the Marsica Range to Cittareale-Norcia and further and it is an high-angle and NE-dipping, deeply rooted in the crust (> 15 km), shear zone (Pierantoni et al, 2015). During the Pleistocene it has had extensional and left transtensive kinematic. The area of the 2016 seismic sequence is bounded on the W by a NE-dipping fault (CCFS Norcia branch) and on the E by the SW-dipping Mt Vettore (VFS) and Mt. Gorzano (GFS) fault systems.
Between these main fault systems other NW-SE striking, NE or SW-dipping, faults are present.
The NW/NNW-SE/SSE fault systems are locally displaced by quaternary transversal (NE/ENE-SW/WSW) fault systems. This seismic sequence began on 08/24/16 with a M = 6.0 earthquake, with epicenter near Accumuli village; after about an hour there was a M = 5.4 earthquake with epicenter near Norcia. The focal mechanism of these earthquakes are extensional with NNW-SSE/NW-SE axes and 450/ 500 nodal plans. According to initial seismic assessment, macroseismic data (EMERGEO, 2016) and INSAR and DPGS data many specialists felt from the first days after the main shock this seismic sequence was caused by activation of the NW-SE, SW-dipping Mt Vettore fault and further south by the analogous Mt. Gorzano fault. Recent publications of Michele et al (2016) based on high precision seismological data showed clearly that the early sequence was caused at least by two seismogenic faults; one, SW-dipping, is placed on the Mt Vettore western slope and the other, NE-dipping is located at the western edge of Norcia depression. To try to detect which of the two faults was effectively at the origin of this sequence were selected and taken into account earthquakes occurred within about an hour after the main shock. These earthquakes are arranged in two distinct clusters, confined (N, S and center) by transversal fault systems; the first (A) develops in the northern Accumoli-Norcia sector with a higher frequency of epicenters in an approximately NNW-SSE belt and the second (B) in the southern Amatrice sector with a higher frequency in an approximately NW-SE belt. A includes the main shock and the largest aftershock and B lower energy earthquakes, but overall deeper. Plotting in the depths of these earthquakes shows that most likely the first to be activated was the Norcia NE-dipping fault, ie a segment of CCFS; GFS / VFS would be activated after by accommodation. Finally, according to us the Celano-Cittareale structure activating periodically by segments, confined each time by transversal structures, caused the 2009 L'Aquila seismic sequence and other important historical sequences of Central Apennines and according to Deschamps et al (1981) that of Norcia 1979.