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SEISMOLOGICAL ANALYSIS OF THE 1917 MONTERCHI EARTHQUAKE (CENTRAL APENNINES, ITALY) FOR SEISMOTECTONIC IMPLICATIONS

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On April 26, 1917 at 9:35:59 (GMT) an earthquake occurred in the Sansepolcro Basin (the northernmost portion of the High Tiber Valley - Italy) producing large damages and fatalities. This event, noted as Monterchi earthquake, is well constrained in the Catalogue of Strong Italian Earthquakes (Boschi et al., 2000) by 134 felt reports locations, mainly distributed on the right side of the Tiber Valley, mostly affecting the towns of Monterchi, Citerna and surrounding localities. The maximum and epicentral intensity was determined as Io=IX-X degree of the MCS scale corresponding to an equivalent magnitude of Me=6 that define this event as the most important of the region.

The Sansepolcro Basin was generated on the hanging-wall of the Altotiberina Fault (ATF) system. The ATF system is composed by an E-dipping low-angle normal fault, active at least since the Late Pliocene, that represents one of the main regional detachments of the Northern Apennines, and its antithetic W-dipping high-angle normal faults (Barchi, et al., 2009, Boncio et al., 2000). Although the southern part of the ATF was demonstrated to creep (Piccinini et al., 2003), its capability to generate strong or moderate earthquakes is still debated and the historical seismicity that affected the region was not associated to specific geologic sources.

For these reasons the study of the Monterchi earthquake plays an important role in the debate. On this light, many authors tried to define the main seismic source parameters through the analysis of historical seismograms and respective bulletins. Preliminary results were presented at previous ECEES, ESC and EGU congresses (Caciagli et al., 2006, Ciaccio et al., 2008, Bernardi et al., 2009). In all these works the hypocentre of the Monterchi earthquake has been substantially unresolved, because of the absolute P and S-phases use, and, for this reason, its epicentre was located 20 km North of the macroseismic one.

Concerning the focal mechanism, Bernardi et al. (2009) proposed a moment tensor solution for the Monterchi event, based on almost horizontal recordings from 4 stations situated in a very small azimuthal range. Independently of the validity of the normal fault mechanism proposed by Bernardi et al (2009) their conclusions fit perfectly in the context of the seismotectonic setting of the ATF, but do not account for the discrepancy between the instrumental and the macroseismic epicentres.

Today, 49 seismograms from 19 different Euro-Mediterranean observatories are available in the database of the SISMOS Project – INGV (http://sismos.rm.ingv.it/)

The BAAS (British Association for Advancement of Sciences) bulletin of 1917, although if incomplete because of the 1st World War, reports a list of 21 seismological observatories that recorded the P and S-phases for this earthquake. Additionally to this database, we included additional arrival-times deriving from further seismic bulletins not contained in the BAAS reports and from directly

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digitizing original historical seismograms. An incisive approach to analyse these different data allows us to obtain a new, robust and consistent hypocentral solution, coherent with the macroseismic data, in particular by using S-P travel time differences for recordings where the absolute timing is uncertain.

An accurate research on the technical characteristics of the recording historical seismometers (period, damping, gain etc), including the analysis of the instrumental natural period recorded in some seismograms, allows to deconvolute the original digitized seismic traces in order to evaluate the potential of moment tensor inversion, to determine the main seismic parameters (Mo, Mw, Circular Fault Radius), and to implement the solution in the framework of the regional tectonic setting.

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