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Evidence of strong Quaternary earthquakes in the epicentral areaof the April 6th 2009 L'Aquila seismic event from sediment paleofluidization and overconsolidation

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The strong seismological potential of the Central Apennines, including the L'Aquila basin, is documented in the historical heritage of the past two millenia and by paleoseismological data. Despite the main active fault system network of Central Italy is well described and mapped, the April 6th 2009 L'Aquila event showed that Mw> 6.0 earthquakes can occur on fault zones characterized by subtlemorphotectonic evidence, like the Paganica Fault, whose seismic hazard potential may thus be overlooked. An additional source of uncertainty is provided by the evidence that in the L'Aquila region many active extensional fault systems developed by negative inversion of pre-existing contractional deformation structures. The resulting complex along-strike segmentation and overlap patterns are thus governed by the interplay between the modern extensional stress field and the structural inheritance and reduce the effectiveness of predictive scaling laws, which do not typically account for fault attributes produced by polyphased tectonics. This is particularly true in the L'Aquila region, where seismic activation of the northwestern half of the basin-boundary fault system has been proposed for the 1703 Mw $\sim$ 7.0 earthquake, whereas only the central segment was activated in 1461 and 2009, producing earthquakes with Mw $\sim$ 6.0 – 6.3. The reasons for this dual behaviour are still unclear despite many structural and paleoseismological studies.

Indirect evidence for paleoearthquake magnitude from ground shaking effects, like paleo-fluidization structures, can provide very useful complementary information on maximum expected earthquake intensities along active fault systems.In this work wedescribe in detail large paleo-fluidization-induced features associated with a previously unmapped extensional fault zone cutting through Quaternary strata. These sediments, including lacustrine lignites and mudstones, show a somehow enigmatic overconsolidation that we quantitatively describe, as well as their mineralogical and paleothermal properties. When inserted into the available seismotectonic framework, these new data have important implications on the relations among the structural architecture of the l'Aquila basin ,the epicentrallocation of the April 6th 2009 earthquake, and the inferred occurrence of strong earthquakes that affected the region in the past.