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Earthquake repeat on normal faults: new insights from *in-situ* ^{36}Cl exposure dating, Central Apennines, Italy

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We know very little of the repeat times and modes of large earthquakes on faults; seismicity catalogs are much too short for such repetitions to be recorded. This inhibits our ability to predict the time, location, and size of future events. One chance however to learn how major earthquakes have repeated in the past, is to analyze their surface geological record, if any. We propose to analyze such a record on a few target-faults to seek identifying, dating and measuring the large earthquake ruptures that have broken these faults in the last 10-20 kyrs, with the particular objective to determine how these major ruptures have followed in space and time on individual faults and within fault systems. We focus on normal faults, for those are the only ones to provide a complete geological record of their past major ruptures: as earthquakes repeat on a normal fault, the fault plane is progressively exhumed and exposed at the free air, forming a clear escarpment at the surface. Provided that this escarpment is preserved from erosion, which is generally the case for young escarpments ($<$10-20 kyrs), its surface holds the complete record of the successive ruptures (and possible aseismic slip) as they have broken the ground surface. We have started to analyze such a record on 6 neighboring faults in the Fucino area, central Italy, where seismic activity is intense (M$\sim$7 in 1915, 30000 deaths). Faults offset limestone rocks and form high ($\sim$400 m) cumulative escarpments, whose youngest parts (10-20 kyrs) are well preserved in the form of 10-20 m high, steep scarps running all along the fault lengths (10-20 km). The surface of these Holocene scarps holds the memory of the major earthquakes that broke the faults over the last 10-20 kyrs. That memory can be recovered by dating in great detail the exhumation history of the scarp surfaces, and this can be done using ^{36}Cl cosmogenic dating (Benedetti et al. 2002, Palumbo et al. 2004). Following that

objective, we have sampled each fault scarp along a series of top to base, continuous, vertical transects, regularly spaced along the faults (every $\sim$3 km). A number of $\sim$60 samples per transect has been collected, with a total amounting several hundreds. We are now in the process of measuring the *in situ* ^{36}Cl concentration of these samples. We will present the preliminary results of this work. It is important to note that this type of study, dealing with the dating of the entire fault scarp surfaces, hence with the recovery of the entire earthquake histories, has never been done before. It is clear that it will result in a major step forward our understanding of the earthquake repeat process.

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