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More than 30 large earthquakes broke the Fucino faults (Central Italy) in synchrony in the last 12 ka, as revealed from in situ 36Cl exposure dating

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We recover the Holocene earthquake history of 7 large seismogenic normal faults belonging to the Fucino north and Fucino south systems in Central Italy. We collected 800 samples from the well-preserved limestone scarps of the faults and modeled their 36Cl concentrations to derive their seismic exhumation history. We found that > 30 large earthquakes broke the faults in synchrony over the last 12 ka. The 7 faults released strain over the same periods of time 12-9 ka, 5-3 ka and 2-1 ka. On all faults, the strain accumulation and release occurred in 3-6 ka long supercycles, each included a 3-5 ka-long phase of gentle ($\leq$ 1 mm/yr) strain accumulation in relative quiescence, followed by a cluster of 3-4 large earthquakes or earthquake sequences that released most of the strain in less than 1-2 ka. The large earthquakes repeated every 0.5 $\pm$ 0.3 ka during the paroxysmal phases and every 4.3 $\pm$ 0.9 ka between those phases. Earthquakes on the northern faults produced twice larger surface slips (2 m) and had larger magnitudes (Mw 6.2-6.7) than those on the southern faults (Mw 5.7-6.6). On most faults, the relative strain level was found to control the amount of slip and the time of occurrence of the next large earthquake. Faults entered a phase of clustered earthquake activity once they had reached a specific relative strain threshold. These results suggest that Tre Monti fault is the one most prone to break over the next century, with an estimated Mw 6.0-6.4. Our results document earthquake synchrony and clustering at a broader space and time scale than ever observed.