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Formation of cataclasites in shallow-subsurface settings - meteoric diagenetic processes control fault rock formation at seismogenic faults in the Abruzzi Apennines, Italy

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To understand the interaction of surface and tectonic processes during the formation of fault rocks, we studied two faults located in the Abruzzi Appenines NE of L'Aquila, that have been active in historical time.

The south-dipping Assergi fault is at least 17 km long, with an offset of 2.5 km in its central part. Over most of its extent, the fault is evident by a scarp. Present day morphology is related to selective erosion, as the fault scarp is covered in some areas by lithified talus deposits. The talus is, however, in many places involved in the faulting. The Campo Imperatore fault is about 30 km long, with an offset of 2 km. The fault is located a few km north of the Assergi fault and has approximately the same orientation. It seems to be complimentary to the Assergi fault: where the offset across the Assergi fault diminishes, throw of the Campo Imperatore fault increases. The fault scarp of the Campo Imperatore fault is partly covered by active alluvial fans, but older lithified fans are offset by related antithetic faults.

Both faults have several meters of fault rocks; The fault rocks of the Campo Imperatore fault are kakirites. Cataclasites of the Assergi fault vary in thickness between 15 and 3 meters, which is related to the presence of Riedel shears that offset the boundary between the host rock and the fault rock. Within the cataclasites diffuse Riedel planes crosscut the fault rocks and offset diffuse or sharp planes parallel to the main fault that can be closely spaced. Diffuse zones parallel to the main fault show karstic vugs produced by meteoric dissolution. The vugs may be lined or filled by calcite cement, and/or with internal sediments (e. g., lime mud, vadose silt, dissolution clasts of cataclasite). Meteoric dissolution guided by the main faults also resulted in large karstic pores filled with collapse breccias and flowstones; clasts of flowstones and flowstone-cemented breccias, in turn, locally became reworked into cataclasites.

Presence or absence of solution and precipitation processes control the formation of cataclasites at the Assergi fault and kakirites at the Campo Imperatore fault, respectively. Processes shaping the fault rocks of the investigated faults are therefore not only tectonic processes controlling the crushing of rock, but also diagenetic processes. Under these conditions, which are probably widespread, cataclasites may form near the surface. Surface processes can control the appearance of fault rocks of seismogenic faults.