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Meteoric diagenesis of ultracataclasites records late-stage fault movement, central Apennines, Italy.

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The central Apennines of Italy consist mainly of Meso-Cainozoic carbonate rocks from shallow-water platform to pelagic environments. During the Late Miocene, these rocks became deformed into a foreland-directed fold-and-thrust belt, followed by Plio-Pleistocene surface uplift and normal faulting. Normal faulting persists til present, and controls surface topography. Formerly deeper-buried sectors of normal faults that now are exposed at surface are characterized by levels of carbonate-lithic cataclasites and, along fault cores, by ultracataclasites. In thin section, the ultracataclasites commonly contain unsharply-delimited, more translucent patches of microspar to pseudospar crystal fabric indicative of aqueous recrystallization of a former gouge (sparry ultracataclasites). Co-variant stable isotope data of oxygen and carbon widely scattered along the meteoric water line indicate lithification/recrystallization of ultracataclasites in meteoric-derived pore waters, and under variable degrees of rock buffering. Sparry ultracataclasites, in turn, may have been involved in cataclasis and provide intraclasts floating within younger ultracataclasites.
In addition, the ultracataclasites are riddled with dissolution vugs that are lined or filled with calcite cement. A further porosity typical of ultracataclasites is represented by sheet pores subparallel to fault cores; the sheet pores result from dissolution widening of joints, and also are lined with calcite cement. Within the groundmass of (sparry) ultracataclasites, floating rafts of calcite crystal clusters record fault movement subsequent to cement growth. Many sheet pores formerly lined by calcite cement are collapsed and lined by sharply capped cements in contact to overlying ultracataclasite; larger sectors of former cement pore-linings may be literally peeled off their substrate and float within ultracataclastic groundmass. The described fabrics record late-stage fault movement and indicate that the ultracataclastic groundmass was of semilithified (‚firm') consistence while calcite cement grew in pores, i.e. the fault cores remained relatively soft while their diagenetic overprint by dissolution and cement precipitation proceeded. The gouge to become an ultracataclasite lithified only slowly as a result of (i) very low permeability and (ii) a low diagenetic potential of the low-magnesium calcitic to dolomitic rock powder.