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# Earthquakes as a trigger of fluid-driven metamorphism and shear zone development

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Fluid-consuming metamorphism is often associated with fluid introduction along zones of localized deformation such as faults and shear zones. In such zones, disequilibrium metamorphism usually produces fine-grained hydrous minerals and/or carbonates which leads to a pronounced reaction-driven weakening (Jamtveit et al., 2016). Continued deformation and reaction at lower stress conditions within faults or shear zones will in most cases obliterate features formed during the earlier stages. Information about the initial stages of coupled deformation and metamorphism is therefore often lost from zones of localized deformation.
Valuable information about these stages can, however, be obtained from microstructures recorded by the less deformed wall rocks. Microstructural observations from wall rock minerals surrounding faults formed by deep crustal earthquakes from the Bergen Arcs, Norway (Austrheim et al., 2017) and the HP-LT terrain of Alpine Corsica record massive fragmentation, a high density of inclusions, and other features previously described from impact-related shock metamorphism. This reflects very high stresses during the initial stages of metamorphism. Some of these features are also observed in and near faults from other localities where no independent evidence for seismic slip (such as pseudotachylites) are observed and may indicate that fluid-driven metamorphism along localized deformation zones is often initiated by earthquakes.

Jamtveit, B., Austrheim, H., and Putnis, A., 2016, Disequilibrium metamorphism of stressed lithosphere. Earth-Science Reviews, 154, 1-13
Austrheim, H., Dunkel, K.G., Plümper, O., Ildefonse, B., Liu, Y., and Jamtveit, B., 2017, Fragmentation of wall rock garnets during deep crustal earthquakes. Science Advances (in press)