Geophysical Research Abstracts
Vol. 21, EGU2019-2923, 2019
EGU General Assembly 2019
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High Pressure Metamorphism Caused by Fluid Induced Weakening of Deep Continental Crust

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Studies of mineral equilibria in metamorphic rocks have given valuable insights into the tectonic processes operating at convergent plate margins during an orogeny. Geodynamic models simulating orogenesis and crustal thickening have been constrained by temperature and pressure estimates inferred from the mineral assemblages of the various lithologies involved along with age constrains from increasingly precise geochronological techniques. During such studies it is assumed that the pressure experienced by a given rock is uniquely related to its depth of burial. This assumption has been challenged by recent studies of high pressure (HP) and ultrahigh pressure (UHP) rocks. Here, we describe an example of Caledonian HP metamorphism from the Bergen Arcs in western Norway, and show that the associated formation of Caledonian eclogites at the expense of Proterozoic granulites was related to local pressure perturbations rather than burial, and that the HP metamorphism resulted from fluid-induced weakening of an initially dry and highly stressed lower crust when thrust upon the hyperextended margin of the Baltic shield.