Geophysical Research Abstracts
Vol. 20, EGU2018-4672, 2018
EGU General Assembly 2018

Reaction-induced faulting in granulite: New insights for the generation of intermediate-depth earthquakes in lower continental crust

Sarah Incel (1), Loïc Labrousse (2), Nadège Hilairet (3), Timm John (4), Julien Gasc (5), Yanbin Wang (6), Feng Shi (6), Torgeir B. Andersen (7), François Renard (1), Bjørn Jamtveit (1), and Alexandre Schubnel (5)

(1) University of Oslo, Physics of Geological Processes, Oslo, Norway (s.h.m.incel@geo.uio.no), (2) Université Pierre et Marie Curie, Paris, France, (3) CNRS - UMET, Université Lille 1, Villeneuve d'Ascq, France, (4) Freie Universität Berlin, Berlin, Germany, (5) Ecole Normale Supérieure Paris, Paris, France, (6) GeoSoilEnviroCARS, University of Chicago, Argonne, United States of America, (7) University of Oslo, Center of Earth Evolution and Dynamics, Oslo, Norway

Pseudotachylite-networks in granulites on Holsnøy in the Bergen Arcs, SW Norway, and seismic tomography of the Tibetan plateau reveal that earthquakes were triggered even at the high temperature/ high pressure conditions of the lower continental crust. Both, field and geophysical observations, demonstrate a strong link between the nucleation of intermediate-depth earthquakes and areas of partial eclogitization within nominally anhydrous granulitic lower crust. This study presents four deformation experiments performed on granulite samples from Holsnøy. To accelerate reaction kinetics, which is very slow in dry rocks, we applied confining pressures of 2.5-3 GPa and temperatures in the range 995-1225 K, significantly higher than the expected eclogitization conditions of the Bergen Arcs (pressure= 1.5-2 GPa, temperature= 923-973 K). Based on the mechanical data, micro- and nanostructural observations, and recorded acoustic emissions, we were able to correlate the degree of eclogitization to the rheological behavior of the samples. Depending on the net eclogitization rate relative to the deformation rate ($5 \times 10^{-5} s^{-1}$) the sample either behaved strong and ductile if no reaction occurred, mainly brittle when the rate of eclogitization was slow, or mostly weak ductile when the rate of eclogitization was fast. Our experimental results emphasize that shear localization due to grain size reduction triggered by the breakdown of plagioclase under eclogite-facies conditions lead to brittle failure accompanied by acoustic emissions. These and other experiments on a variety of lithologies suggest that there could be one common mechanism that triggers intermediate and deep earthquakes.