Geophysical Research Abstracts
Vol. 21, EGU2019-9444, 2019
EGU General Assembly 2019


# Brittle/ductile deformation of eclogites: insights from numerical models

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How rocks deform at depth during lithospheric convergence and what are the magnitudes of stress levels they experience during burial/exhumation processes constitute fundamental questions for refining our vision of short-term (i.e. seismicity) and long-term tectonic processes in the Earth's lithosphere. Field evidence showing the coexistence of both brittle and ductile deformation at high pressure – low temperature (*HP-LT*) conditions particularly fuel this debates. We here present a set of 2D numerical experiments of eclogitic rock deformation by simple shear performed at cm-scale. The deformed medium is composed of two mineral phases: omphacite and garnet. We carried out a series of experiments at *HP-LT* condition (i.e. 2.0 GPa - 550°C) for different background strain rates (from $10^{-14}$ $s^{-1}$ to $10^{-8}$ $s^{-1}$) and for different garnet proportions (up to 55%). Results show that fracturing of the entire eclogite rock can occur under *HP-LT* conditions for strain rates larger than $\sim 10^{-10}$ $s^{-1}$. It suggests that observations of brittle features in eclogites does not necessarily mean that they underwent extreme strain rate (i.e. seismic). We also explore the ranges of parameters where garnet and omphacite are deforming with a different deformation style (i.e.frictional vs. viscous) and discuss our modelling results at the light of naturally deformed eclogitic samples. This study also illustrates that effective stress levels sustained by rocks can be high at these *P-T* conditions. They reach up to ~1 GPa for an entirely fractured eclogite and up to ~500 MPa for rocks presenting fractured garnet. The implications arising from these results for our understanding of the processes occurring in subduction zones will be discussed.