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Tectonic impact of anatexis on collision zones dynamics : insights from numerical modelling

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Partial melting reactions constitute a first order weakening process in the continental crust involed in collision zones. It can act as a possible decoupling mechanism within the lithosphere and therefore influence the dynamics of continental subduction-collision. The Western Gneiss Region, Norwegian Caledonides, exhibits a direct relationship between eclogites occurrences and partial melting textures in the surrounding gneiss. This fact implies that partial melting is associated with part of the exhumation of High Pressure (HP) rocks.
Several metamorphic reactions produce silicate melts at different PT conditions, depending mainly on the availability of aqueous fluids. Even if most of the partial melting textures observed in hot orogens relate to water-absent dehydration melting, evidences of water-present partial melting of gneiss and eclogites at HP in the Western Gneiss Region, suggest that water-present melting reactions may play a role in fostering HP metamorphic rocks exhumation. Another question arising from experimental rheological studies relies in quantifying the amount of liquid phase necessary to trigger strength drops of migmatites (i.e. the Rheologically Critical Melt Percentage, RCMP). Proposed values span from very low percentages close to 1% up to 20-30%, when migmatites turn to diatexites.
In this study, we employ lithospheric scale numerical experiments, to compare the effects of water-present or dehydration partial melting reactions on continental collision systems. The two-dimensional thermo-mechanical experiments explore the extent of melt-weakening by allowing a wide range viscosity variations (9 orders of magnitude). The model set-up is representative of the Scandian collision and its sensitivity to the initial Moho temperature, the value of RCMP, and the buoyancy of the extracted melts, was investigated.