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Do metamorphic reactions influence the subducting dynamic?

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Many large-scale dynamic processes, from continental rifting to plate subduction, are intimately linked to metamorphic reactions. During rifting, phase transformations in the rising lithospheric mantle cause uplift. At convergent margins metamorphic reactions help make plate subduction self-sustained and may also facilitate plate bending and trigger intra-slab earthquakes. This close relation between geodynamic processes and metamorphic reactions is, in spite of appearances, yet poorly understood. For example, during the subduction-collision processes, rocks will be exposed to changing temperature, pressures and stress regimes and they may undergo metamorphism or partial melting. Meanwhile less attention has been paid to other important aspects of the metamorphic processes. The formation of different kind of rocks (amphibolites, eclogites, granulites. . .) can lead to dramatic changes in petrophysical properties (Bousquet et al., 2005). When reacting rocks expand and contract, the volume changes will set up in the surrounding material. Modeling several cases of subduction for different types of rocks (granites, sediments, mafic and ultramafic rocks. . .), we explore implications

1) on the dynamic of the subduction. Hence computing changes of physical properties of rocks as well quantity of released fluids by dynamic modeling of metamorphic reactions, we will show that some subductions are more propitious to exhume (U)HP rocks and thus to obstruct the subduction dynamic the while others are more propitious to produce heavier rocks and self-sustained subduction. In the meantime as Lallemand et al. (2005) have demonstrated that the slab dip does not correlate with the age of subducting lithosphere, we show that this slab dip is mainly controlled by the dynamic of the subducting lithosphere.

3) on the dynamic of the mantle wedge. In many subductions, the upper plate thinning seems to be controlled by the dehydration reactions (Arcay et al., 2006). We test influence of bulk composition of the lithosphere to estimate the back-arc dynamic. Preliminary results suggest that the appearance of amphiboles within the lithosphere favors local convection and formation of back-arc basin.

We conclude that changes associated to the metamorphism as an alternative to changes attributed solely to compositional differences, and have a strong influence on the deformation of the subduction back-arc