Mafic crust recycling in subduction systems. Constraints from numerical models

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The mafic lithologies present in subduction zones have been given a key role in the generation of evolved magmatic products in arc systems. Indeed, melting hydrous basaltic crust lead to the formation of Si-rich magmas, that are potentially an important mechanism for continental crust growth. Melting of hydrated mafic lithologies, either as part of the slab or in the lower arc crust, requires specific conditions, such as a strong thermal gradient due to anomalously young slabs, high mantle temperature (an analogy to early earth setting) or heat input from incoming primitive magmas for the arc crust. Our limited understanding of the role of pre-existing mafic lithologies in the making of evolved crustal matertial illustrates the complexity of these processes. Furthermore, primitive mantle melts and their fractionated products also lead to evolved magmas that contributes to the making of continents.

To decipher the role of the pre-existing mafic crust in making evolved magmas, we present numericals models that are coupled with a thermodynamic database, allowing forward models of the petrological products of subduction systems. Here we present the fate of mafic lithologies in both the subducting and overriding plate. A first part will be dedicated to subduction models that constrain slab devolatilization conditions, in the context of understanding the factors that control mafic crust melting; and a second focusing on the role of a pre-existing mafic crust in the lowermost part of an arc that is affected by incoming primitive melts, which quantifies the relative proportion of the pre-existing crust in making the evolved magmas.