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Carbonation by fluid-rock interactions at High-Pressure conditions: implications for Carbon cycling in subduction zones

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Carbonate-bearing lithologies are the main carbon carrier into subduction zones. Their evolution during metamorphism largely controls the fate of carbon regulating its fluxes between shallow and deep reservoirs. In subduction zones, most works have focused on subtractive processes responsible for carbon release from subducting slabs. As an example, several recent works have stressed on the importance of carbonate dissolution as a mean to mobilize large amounts of carbon in subduction zones. By contrast, little is known on additive processes such as rock carbonation at high-pressure (HP) conditions. At shallow depths (e.g. ocean floor and shallow subduction zones, i.e. <40 km), carbonation of mafic and ultramafic rocks deeply contributes to the regulation of carbon fluxes between the geo-biosphere and the atmosphere. We report the occurrence of eclogite-facies marbles associated with metasomatic systems in HP metamorphic unit in Alpine Corsica (France). We performed a field-based study on metasomatic marbles. We will present the petrology and geochemistry that characterize carbonate metasomatism together with fluid inclusions study and pseudosection modeling. Altogether, we bring strong evidences for the precipitation of these carbonate-rich assemblages from carbonic fluids during HP metamorphism. We propose that rock carbonation can occur at HP conditions by either vein-injection or chemical replacement mechanisms. Rock carbonation indicates that carbonic fluids produced by decarbonation reactions and carbonate dissolution may not be directly transferred to the mantle wedge, but may have a preferential and complex pathway within the slab and along slab/mantle interface. Rock carbonation by fluid-rock interactions has a potentially great impact on the residence time of carbon and oxygen and on carbonates isotopic signature in subduction zones. Lastly, carbonation may modulate the emission of CO_2 at volcanic arcs over geological time scales.