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Experimental constraints on the physical properties of melange rocks and their relationship to arc magmas

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Melange rocks are physical mixtures of metasediments, eclogites, and serpentinized ultramafic rocks formed from deformation-assisted mixing and fluid-rock interactions along the slab-mantle interface. An increasing number of field, geochemical and experimental studies have argued that these rocks could play a major role in mass transfer from the slab to the overlying mantle and the formation of arc magmas. First, we will present experimental evidence that melting of peridotite hybridized by melange rocks produces melts that carry both the major and trace element signatures observed in a variety of natural arc magmas [1]. Based on a first study we conducted using melange rocks from Syros (Greece), we propose that differences in the nature and relative contributions of melanges hybridizing the peridotite mantle wedge produce a range of primary arc magmas, from tholeiitic to calc-alkaline. Therefore, assimilation of melanges into the wedge may play a key role in transferring subduction signatures from the slab to erupted arc magmas. Second, we will explore the fate and petrophysical properties (solidus, density) of melange rocks as they descend along the slab-top during subduction. New high-pressure, high-temperature experiments will investigate density and mineralogical variations of melange rocks from Syros (Greece) and Catalina Schist (USA) at 1.5 and 2.5 GPa, and provide new constraints on the ability of melange rocks to physically migrate by buoyancy from the slab-top to the overlying mantle.

[1]. Codillo E., Le Roux V., Marschall H., (2018) Arc-like magmas generated by melange-peridotite interaction in the mantle wedge. Nature Communications 9, 2864