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Constraining the stability of carbonates and low-grade metamorphic phases in the martian crust

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Carbonates are of special interest for the habitability potential on Mars since they are linked to both the water an inorganic carbon cycles. Better constraints on the stabilities of carbonates and low-grade metamorphic minerals as a fucntion of fluid variations in the martian upper crust are hence crucial to understand subsurface conditions and to identify potential habitable environments. We use phase equilibria modelling to study the effect of fluid compositions and present constraints on the stability of prehnite, zeolites, serpentine, talc, and carbonates during low-grade metamorphism in the martian crust using a martian basalt and an ultramafic cumulate as starting compositions. Our models suggest that prehnite, zeolites, and serpentine have formed in a CO_2-poor environment on Mars implying that fluids during their formation either did not contain high amounts of CO_2 or had degassed. Carbonates and potentially talc would have formed in the presene of a CO_2-bearing fluid and therefore at different alteration stages.

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