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Investigating the dichotomous structure of the martian crust and the origin of felsic rocks

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The dichotomy of Mars is a striking feature with a Northern hemisphere that appears younger and lower in elevation by ∼6km than the Southern hemisphere. The nature of the dichotomous martian crust is still enigmatic. The recent discovery of differentiated rocks, all in the South, suggests that the southern crust might contain a non-negligible portion of felsic rocks.
A Monte-Carlo inversion using a parametrized thermal model for Mars with two different types of crusts, characteristic of each hemisphere, and fitting available constraints on present-day volcanism and elastic lithosphere thickness estimates, has led to the conclusion that the bulk crust of Mars is relatively enriched in radioelements (with an enrichment factor larger than ∼8 relatively to the primitive mantle) and that the southern crust is much thicker than that in the North (Thiriet et al, JGR, 2018). It is thus possible that felsic rocks found in the South derive from remelting of the lower part of this thick southern crust. Here, we evaluate the conditions that allow for melting of the lower southern crust in the Noachian.
We then appraise how geophysical measurements from the InSight mission can help further constrain these crustal models. In particular through simulation of wave-propagation and comparison with observations, we detail how the detection of the Moho and potentially lithosphere-asthenosphere boundaries below the InSight landing site using receiver function methods could place constraints on the composition and structure of the crust.

Thiriet, M., C. Michaut, D. Breuer and A.-C. Plesa, Hemispheric dichotomy in lithosphere thickness on Mars caused by differences in crustal structure and composition, J. Geophys. Res. 123, doi:10.1002/2017JE005431, 2018.