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pyMelt-PX: A semi-empirical Python tool to model bilithological pyroxenite-peridotite melting

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Oceanic crust formation is fundamental to our understanding of the processes shaping the Earth, but that understanding requires a thorough comprehension of the melting processes that produce oceanic crust. Although peridotite is the dominant lithology in the mantle, lithologic heterogeneities like pyroxenite may also play a significant role in generating magmas by partial melting. Pyroxenite is a minor but ubiquitous mantle component that can contribute a disproportionate amount of magma to crustal generation in mid-ocean ridge (MOR) and ocean island basalt (OI) settings. For instance, a solid mantle source composed of 5% pyroxenite and 95% peridotite could generate melt mixtures with pyroxenite's contribution as high as 40% in mid-ocean ridge settings and even higher in intraplate settings. Despite pyroxenite's disproportionate contribution to magma generation, however, most parameterizations for computational predictions of partial melting focus on peridotite, while there are comparatively few appropriate parameterizations for pyroxenite, and existing computational tools have limited flexibility for future applications. To help bridge this gap, we present *pyMeltPX,* a Python modeling script for computing partial melting of a bilithological pyroxenite-peridotite mantle source. *pyMeltPX* is based on the Excel calculator by Lambart et al. (2016), *Melt-PX,* and is semi-empirical, i.e., it uses both experimental and thermodynamic data to parameterize melting behavior. This approach better reproduces experimental data than purely thermodynamic models, particularly for pyroxenite and two-lithology melting scenarios. Like *Melt-PX,* our model uses pressure, temperature and bulk compositions to calculate the solid adiabat, degree of melting, oceanic crustal thickness, and pyroxenite contributions to crustal thickness, and is calibrated between F = 5% and the disappearance of clinopyroxene in pyroxenites.

Building on the *Melt-PX* Excel approach with an open-source Python script offers several advantages, including faster computation times for multiple pyroxenite compositions, and future flexibility and workflow integration with other Python computational models like *alphaMELTS for python, PetThermoTools,* and *pyUserCalc*.

References:

Lambart et al., (2016), JGR - Solid Earth. doi:10.1002/2015JB012762.