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Experimental investigation on the shallow partial melting of serpentinised ultramafic rocks: implication for the genesis of the primitive continental crust

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Which mechanisms led to the formation of the continental crust? Meteorite impact, subduction, rise of a hot basaltic material through a peridotitic proto-crust? All of these scenarios involve partial melting. In this study, we provide new experimental data to investigate and characterize how these serpentinized ultramafic products could have produced more differentiated melts through shallow partial melting at low pressures. Following the work of Borisova et al., 2021 [1] and Bernadet et al., 2025 [2], we conducted experimental runs of partial melting on serpentinized lherzolites and harzburgites from different places around the world. The experiments were carried out in internally heated pressure vessel (IHPV) at Orleans (ISTO) under conditions of 0.9 and 2 kbar, 1200°C, FMQ oxygen buffer for three days. The experimental products obtained after quenching are mainly composed of olivine, orthopyroxene, clinopyroxene, and a silicate melt produced by partial melting. In agreement with the experimental data produced in the study by Koepke et al., 2025 [3], the silicate melts produced in our experiments have compositions tending towards magnesium rich andesite and oceanic boninite according to the Pearce and Reagan, 2019 [4] classification diagram (Fig. 1). We investigate in-depth the trace element composition (by LA-ICPMS) and volatiles (by µRAMAN) present in our samples. These analyses allow us to determine the melting degree obtained and mineral-melt trace element partitioning and to compare the elemental composition of the melts to the one of the bulk continental crust.

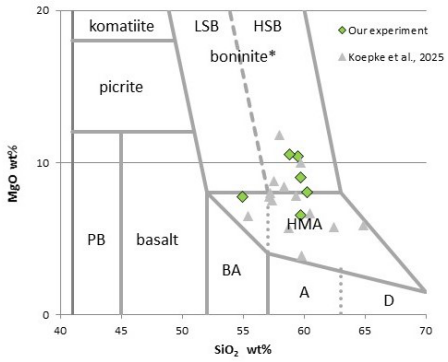

Figure 1: Composition of our experimental melts and those of the article by Koepke et al., 2025 plotted in the classification diagram of Pearce and Reagan, 2019.

[1] Borisova, A.Y., et al., (2021). Front. Earth Sci. 9
[2] Bernadet, J. et al., (2025), Sci. Adv. 11
[3] Koepke, J., Feig, S.T., Berndt, J. & Almeev, R.R., (2025), Lithos 498–499
[4] Pearce, J.A., & Reagan, M.K., (2019), Geosphere 15, 1008–1037