The Early Stages of the Petrogenesis of Mid-Ocean Ridge (MOR) Magmas as Evidenced by Plagioclase Megacrysts and their Melt Inclusions (MI)

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Our understanding of the identity and magnitude of processes active in upper mantle relies heavily on compositional analyses of glassy basaltic lavas erupted onto the ocean floor and olivine-hosted melt inclusions (MI). However, aphyric lavas represent the final product of an array of multiple processes that obscure the primary geochemical signature.

The range of composition exhibited by plagioclase megacrysts and their MI are consistent with their representing an early stage in the differentiation of MORB magmas that are not normally sampled as glassy lavas [1]. This work focuses on understanding how those early stages of differentiation influence the geochemical signature of plagioclase megacrysts, their MI, and the associated lava suites. Our preliminary modeling indicate that both fractionation and differential degrees of partial melting influence the observed major and trace element signature. However, no single process or simple combination of processes accommodates the observed geochemical signature [2, 3, 4]. Here, we combined model results for major element phase equilibria based on MELTs and apply more complex models to the trace element trends including magma mixing, magma recharge, and a combination of fractionation and partial melting to calculate the boundaries of a solution space we can use to evaluate the relative roles of processes that control the early stages of MORB petrogenesis.

[1] Nielsen et al. (2020) *G3,* **21**, 1-24. [2] Lange et al. (2013) *Geochem G3,* **14**, 3382-3296. [3] Lewis et al. (2021) *Front. Earth Sci.*, **8**, 673-689. [4] Shaw, H. R. (1970) *Canadian Journal of Earth Sciences*

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