An Alternate Perspective:Plagioclase Megacrysts and Their Inclusions

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We study melt inclusions to gain insight into the character and provenance of primitive magmas. Over the past 30 years, our community has generated a growing body of knowledge based on melt inclusion analysis. The majority of that data comes from inclusions hosted in olivine. However, there are limits to what we can learn from olivine hosted inclusions. Olivine hosted inclusions can only be used to understand deep seated processes if they make it to the surface, and the significant density contrast with basaltic magmas raises the prospect of sampling bias. In addition, olivine deforms quickly (~30 min.) if heated at low pressure [1], creating issues with regards to the migration of volatiles within the inclusion.

MI in plagioclase megacrysts provide a relatively untapped resource with regards to the character of primitive magmas. The reason for the emphasis on olivine is based on a number of assumptions. First, that olivine is the exclusive liquidus phase for most primitive magmas, and that plagioclase is not normally in equilibrium with high Mg magmas. Second, plagioclase “leaks”, resulting in loss of volatiles from the inclusions. Third, diffusive equlibration of inclusion and host prevents us from obtaining an unmodified vision of the melt at the time of entrapment.

We present evidence from plagioclase megacrysts and their inclusions documenting that plagioclase can be used, together with data from other phases and the suite of erupted lavas, to obtain a broader view of the character of magmas present at depth [2, 3]. There are issues that need to be dealt with concerning crystal relaxation if the inclusions are homogenized at low pressure. However, our data indicates that plagioclase is a more robust host than olivine, is an important phase early in the crystallization sequence and is more likely to be sampled from depth due to the lower density contrast with basaltic magma.

[1] Schiavi et al (2016) *Geochim Cosmochim Acta*, **172**, 1-21 [2] Drignon et al. (2019) *Geochem Geophys Geosyst*., **20**, 109-199. [3] Nielsen et al. (2020) *Geochem Geophys Geosyst.,* **21,** e2019GC008638