A Tale of Two Magmas: Petrological Insights into Mafic and Intermediate Plinian Volcanism at Volcán de Colima, México

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1. Introduction
Plinian eruptions of andesite to dacitic composition are well described in Central America; however, mafic to intermediate eruptions are less well documented. At Volcán de Colima we have the opportunity to study highly explosive mafic and intermediate eruptions from a single magma system, and the magmatic processes leading to these events.

2. Group I Mineralogy
- 10-25 wt% clinopyroxene + orthopyroxene + amphibole + Fe-Ti oxides + olivine
- Minor mineral zoning patterns and textures, together with minor chemical variations, reveal a complex crystallisation history involving multiple decrystallisation and magma mixing events.

3. Group II Mineralogy
- 10-15 wt% olivine + clinopyroxene + orthopyroxene + amphibole + Fe-Ti oxides + olivine
- Minor mineral zoning patterns and textures, together with minor chemical variations, reveal a complex crystallisation history involving multiple decrystallisation and magma mixing events.

4. Geothermometry & Hygrometry
- Eruption temperature and magmatic water contents for the Group I and Group II eruption deposits were estimated using mineral-mineral and mineral-melt geothermometry (Mg# and hydration)

5. Sr & Nd Isotopes
- Group I eruption deposits show little variation in 87Sr/86Sr and 143Nd/144Nd with Sr, 143Nd
- Group II eruption deposits and alkaline cinder cones show a wider range of 87Sr/86Sr and 143Nd
- The Group II magmas trend towards the more radiogenic Sr and less radiogenic Nd compositions of the alkaline magmas;
- Mass balance calculation between the Group I/cinder and the alkali andesine cinder cone and members reveals mixing between these two magma types at Volcán de Colima with up to 50% alkaline component in the Group II magmas.

6. Petrogenesis
- Fluids released from slab alter with mantle enriched metasomatic veins.

7. Conclusions and Possibilities for Future Work....
- The large-scale field deposits of Volcán de Colima can be divided into two Groups based on their mineralogy and geochemistry; Group I deposits are calc-alkaline melts derived from magmas comprising basaltic andesite and andesite; Group II deposits are mafic to intermediate melts derived from magmas comprising basaltic andesite and andesite.
- Sr and Nd isotope ratios reveal up to 50% alkaline magmas component in the Group II eruption deposits;
- Mass balance calculations between the Group I/cinder and the alkali andesine cinder cone and members reveals mixing between these two magma types at Volcán de Colima with up to 50% alkaline component in the Group II magmas.
- Quantify the rapid ascent rate by diffusion modelling;
- Geothermal modeling of the source region and the magmatic processes i.e. partial melting, assimilation and fractional crystallisation;
- Radiative transfer analysis for accurate water content estimates;