V33C-0167 Conditions of two-feldspar saturation in a high-silica rhyolite: a comparison between phase equilibrium experiments and a rhyolite-MELTS phase diagram of a Valles Caldera obsidian

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15:10 - 19:30

Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Few experimental phase equilibria exist in the literature for high-silica rhyolites (HSR) that are saturated in two-feldspars, with sanidine as the predominant mineral phase (e.g., Yellowstone, Valles). As a result, studies on evolved, sanidine-rich magmas must rely on models to calculate magma storage conditions. It is currently unknown if models can be extrapolated to these HSRs owing to the lack of two-feldspar HSR equilibrium experiments in their calibrations. We present a phase diagram for an HSR from Valles Caldera based on cold-seal experiments conducted from 700-875°C, 25-300 MPa and compare our feldspar in-curves with those estimated by Rhyolite-MELTS (R-MELTs) (Gualda et al., 2012) for the same HSR. We use two starting materials: powdered aphyric obsidian, and a hydrated glass synthesized from the powdered obsidian. We assess phase abundance via BSE images, least squares minimization of EMPA analyses, and Rietveld refinements of XRD patterns. We utilize XRD to identify phase in-curves at low crystallinity (e.g., <5%), where a single polished section of run product may not provide enough area to identify phases. Fe-Ti oxides crystallize in all experiments; magnetite is most abundant. Sanidine and anorthoclase co-saturate along an in-curve from 850°C, 25 MPa to 750°C, 230MPa, followed by quartz and then clinopyroxene. Biotite saturates at ≤725°C and ≥150 MPa. Both feldspars saturate at crystallinities ≥5% in our experiments. R-MELTS overestimates plagioclase saturation by 25°C to 35°C, where the greatest difference occurs at ≥90 MPa. R-MELTS accurately predicts the sanidine in-curve within ~10°C, at <70 MPa, but underestimates the sanidine in-curve by 25°C when >70 MPa. R-MELTS predicts two-feldspar saturation 35°C lower than our current results at >90MPa, but has reasonable agreement with our results (within 10°C) at ≤90MPa. Thus, for a sample saturated in two-feldspars, stored at pressures >90 MPa (e.g., >4 wt% H_2O), R-MELTS could indicate storage conditions that are colder than actual conditions. R-MELTS predicts two-feldspar saturation at >84% crystals, which markedly contrasts with our observations (≥5% crystals) and suggests that R-MELTS may not accurately predict phase equilibrium for crystal-poor HSRs saturated in two-feldspars (e.g., <5-29% crystals; Valles).

First Author

G

Magdalen Grismer
New Mexico Institute of Mining and Technology

Authors

W

Laura E Waters
New Mexico Institute of Mining and Technology

M

Gordon M Moore
Jacobs Technology, NASA Johnson Space Center

F

Gabriela A Farfan
National Museum of Natural History, Smithsonian Institution

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