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Textural and compositional record of crystal-melt segregation in a "*dynamic mush*" and its association with a caldera-forming eruption

FRANCY ROXANA QUIROZ-VALLE[1], LUCAS MARTINS LINO[1], SILVIO R F VLACH[2] AND MIGUEL ANGELO STIPP BASEI[3]

[1]Geosciences Institute, University of São Paulo
[2]Instituto de Geociências, Universidade de São Paulo
[3]Institute of Geosciences, University of São Paulo

Presenting Author: francy.valle@usp.br

The origin of crystal-poor, high-silica rhyolitic magmas (>70 wt.% SiO2) has been recently considered to result from fractionation of intermediate parental compositions at relatively high crystallinities in shallow magma reservoirs. Such mechanism is of outmost importance in our understanding of how these high-silica rhyolitic liquids and associate ore deposits might form, as well as the largest and most catastrophic eruptions on Earth. However, the counterpart associated with these high-silica magmas constitute their '*missing*' silicic cumulates within the mid- to upper-crust, possibly disguised among felsic plutons. In this contribution we introduce the "*dynamic mush model*" aiming to explain the textures and compositional patterns recorded within the Campo Alegre-Corupá plutonic-volcanic system in southern Brazil. Therefore, our quantitative textural measurements and thermodynamic models support the origin of high-silica rhyolitic compositions as fractionated melts from a magma suspension/mush reservoir in the upper-crust (~200 MPa), resulting in a granitic cupola in the plutonic record and a thick pyroclastic sequence associated with a caldera in the volcanic realm. On the other hand, syenites and minor mela-syenites represent their complementary silicic and ultra-mafic cumulates, formed at relatively lower initial crystal contents (~10-30 vol.%) after the extraction of high amounts of interstitial liquids (~47-80 vol.%). Although several studies suggest that the optimal crystal content for crystal-liquid segregation might occur between ~50-70 vol.% (extraction peak), our results support an early process of fractionation within a dynamic and/or turbulent environment. The low crystal contents in a dynamic magma reservoir assembled under high-accretion rates can result in crystal aggregates formed by *syneussis*, representing the building blocks of the silicic cumulates that sunk to the lower crystallization front. These mechanisms can account for the efficiency required to result in large volumes of eruptible high-silica magmas, and the relatively high accretion rates necessary to build "pools" of crystal-poor magma in the upper-crust. Depending on the initial contents of volatiles, the efficiency of crystal-melt segregation is accompanied by an enhanced probability of primary fragmentation of the residual magmas, possibly explaining the relationship between a syenitic-granitic pluton with a significant, crystal-poor volcanic sequence associated with the development of a caldera volcano.