

## Catching a collapsing solidification front through thermal gradient experiments

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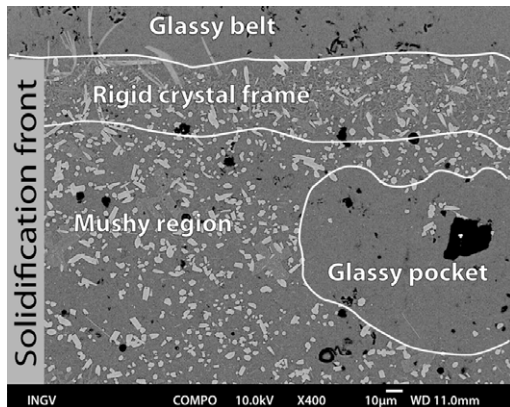
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Large explosive eruptions commonly emplace differentiated (i.e. rhyolite, phonolite), crystal-poor juveniles. This is a well-known paradox in volcanology, considering that magmatic differentiation implies crystallization and that crystal-melt separation processes (e.g. crystal settling) are more efficient in high-temperature, primitive magmas. Conversely, differentiated, crystal-poor juveniles are usually associated to shallow, thermally-zoned feeding systems. Here, the generation of differentiated, crystal-poor magmas may be explained throughout the development of a 'solidification front' [1] at the roof of the chamber. Although natural evidences and theoretical models support the solidification front concept, its capability to originate differentiated, crystal-poor magmas remains unconstrained.

By experimentally investigating the formation of a solidification front in a thermally zoned environment we demonstrate its capability to originate glassy belts and pockets phonolitic in composition (figure 1). We recognize in the instability and collapse of rigid crystal frame the driving mechanism producing segregation and upward accumulation of crystal-poor melts and suggest this model may apply to thermally zoned magma chambers.



**Figure 1:** Solidification front obtained in a thermal gradient experiment performed at 300 MPa and T ranging 1000-850°C. The glassy belt (top, cooler zone of the capsule) is phonolitic in composition.

[1] Marsh (2002) *Geochim. Cosmochim. Acta* **66**, 2211–2229.

## Promoting As release by aerobic water infiltration into Holocene aquifer, Bangladesh

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In order to investigate the timing of As release in the Holocene groundwater aquifer, Sonargaon, Bangladesh, age of groundwaters were determined using <sup>3</sup>He/<sup>4</sup>He ratio. Among the ten well waters collected from the active recharging zone of the Holocene aquifer within 300 m diameters, the lowest <sup>3</sup>He/<sup>4</sup>He ratio was found in the groundwater containing highest concentration of As >1000 µg/L. Groundwater giving the highest <sup>3</sup>He/<sup>4</sup>He ratio contained <1µg/L As. Compared with the historical tritium unit in the air of New Delhi, the former groundwater was recharged after 1980, while, the latter was before 1970. As concentration of the groundwater increases decreasing <sup>3</sup>He/<sup>4</sup>He ratio, indicating that the As release started after 1980.

In this area, the As contaminated Holocene aquifer directly contacts to As-free Pleistocene aquifer due to lack of the Pleistocene impermeable clay layer. Presumably, the As release is triggered by increasing infiltration of groundwater into the Holocene aquifer in association with the increasing withdrawal of groundwaters from the Pleistocene aquifer to cause drastic change of the Holocene aquifer condition.

Fe rich chlorite was found to be a primary source of As, and this mineral was oxidized to precipitate goethite in the aquifer. Thus, the rapid infiltration of aerobic water into the Holocene reducing aquifer is the trigger to cause oxidation-decomposition of the As-bearing chlorite.