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Phase relations and pre-eruptive conditions at low f(O2) in Pantelleria peralkaline rhyolites

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The volcanic system of Pantelleria is an example of volcanism in a continental rift basin which over the years has attracted much researcher due to the different eruptive styles it exhibits, ranging from effusive to explosive. Investigating the cooling history as well as the magma transport dynamics of peralkaline rhyolitic magma is useful to understand the eruptive behaviour of the pantelleritic magma system.

The present work seeks to obtain information on the liquidus temperature of alkali feldspar in pantellerite from the Fastuca pumice fall unit (PAN13) under water-saturated conditions. Alkali feldspar is one of the most abundant crystalline phases in peralkaline rhyolitic melts as well as in evolved, alkali-rich magma compositions (e.g., trachyte, phonolite).

A series of water-saturated isobaric single-step cooling experiments were performed at reducing conditions (graphite filler rod, water P-medium, ~NNO-2) with final temperature range of 670 °C-880 °C and water pressure of 20-150 MPa. Phase equilibria show that clinopyroxene is the first liquidus phase always appearing by 750 °C, followed by alkali feldspar over the entire pressure and temperature (P-T) range investigated, with also the presence of aenigmatite crystallizing near the liquidus at P of 50 MPa. Providing experimental constraints on pre- and syn-eruptive magma crystallization is fundamental to better understand the eruptive dynamics of peralkaline rhyolitic magmas. This is important for volcanic hazard assessments of peralkaline rhyolitic magmatic systems.