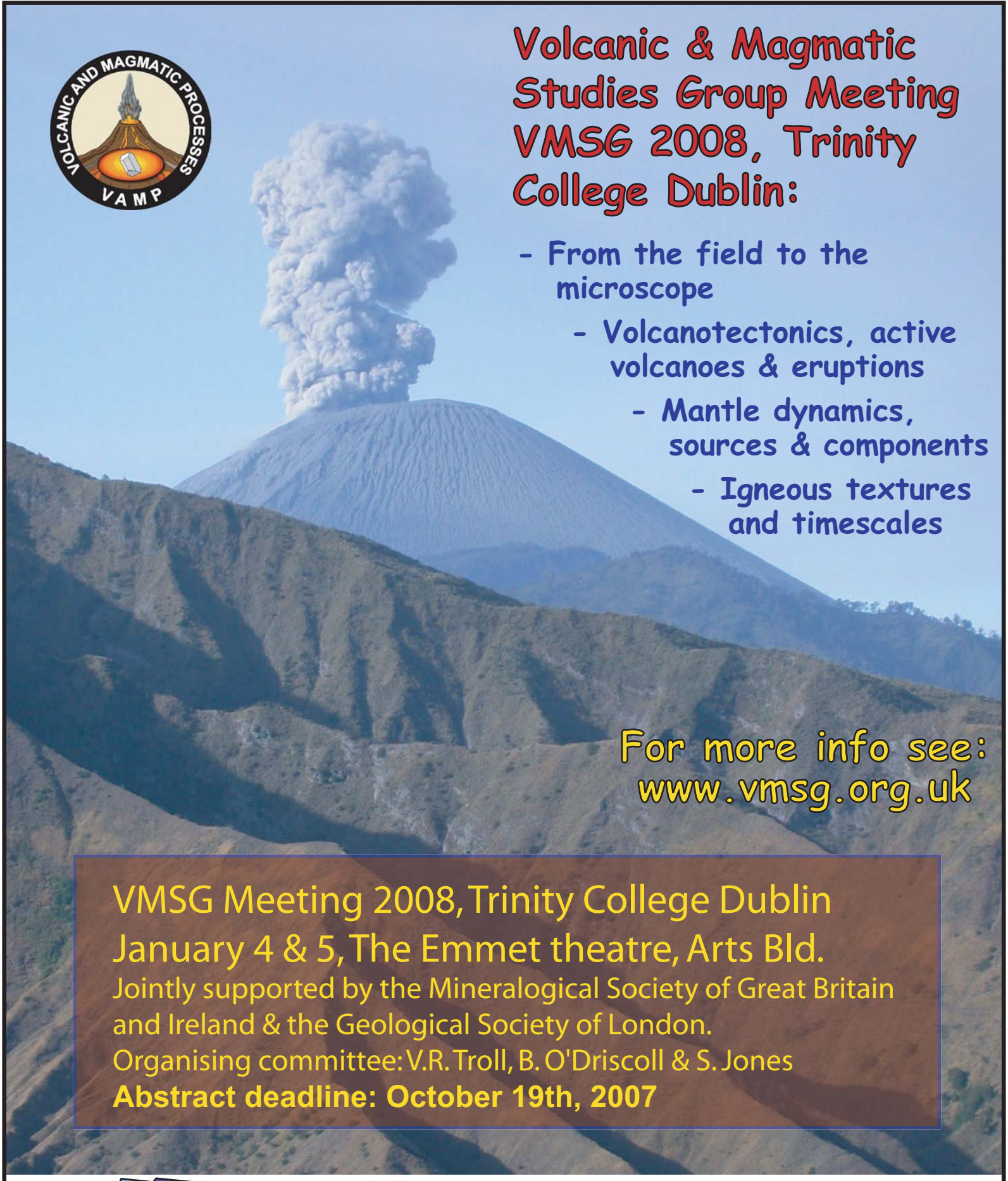

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Hydrothermal alteration in the Miocene Tejeda Caldera, Gran Canaria, Canary Islands: insights from mineralogy, elemental and stable isotope geochemistry.

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Rhyolite-trachyte tuffs deposited within the Miocene Tejeda caldera (Mogán Group 14-13.3Ma) show evidence of severe hydrothermal alteration. The altered tuffs are restricted to a peripheral zone directly inside the caldera margin, and occur at four distinct horizons within the mid-upper Mogán ignimbrite succession. All altered horizons are characterised by pervasive intermediate argillic-phyllic alteration (illite/smectite ± muscovite ± zeolites ± analcime ± adularia) and silicification (microcrystalline quartz ± amorphous silica), indicative of low-temperature (<250-300˚C) near-neutral pH conditions. Additional quartz, calcite and late-stage kaolinite veins in mid-Mogán tuffs and breccias may reflect fault-controlled upwelling of boiling hydrothermal fluids, and a transition to more acidic, steam-heated conditions at depth.

Ca, Rb, Sr, and Pb are generally enriched in the altered intra-caldera tuffs relative to unaltered extra-caldera ignimbrites, reflecting strong mobilization and subsequent incorporation of these elements in Ca-zeolites and clay minerals during fluid-rock interaction. Na, K, and Ba are severely depleted in the altered tuffs, indicative of acid-attack and base cation leaching from e.g. primary anorthoclase and plagioclase. Zr, Nb and Y were dominantly refractory during fluid-rock interaction, and are relatively enriched in all altered samples.

The altered intra-caldera tuffs (n=65) have higher $\delta^{18}O$ values than equivalent unaltered extra-caldera ignimbrites, reflecting an overall low-temperature near-surface environment in which local meteoric water (δD ca. -15‰, $\delta^{18}O$ ca. -3‰) was the dominant fluid source. An overall decrease in $\delta^{18}O$ from upper- to mid- Mogán altered tuffs is consistent with an increase in fluid temperature with stratigraphic depth. Unaltered ignimbrites have δD values of -110 to -168‰ (n=6) and $\leq$0.2wt% H_2O, indicative of Rayleigh-type H_2O-exsolution. In contrast, altered tuffs have δD values of -52 to -117‰ (n=75) and up to 4wt% H_2O, reflecting interaction with steam (δD << -15‰) or an evolved, low-δD fluid. Apparently unaltered ignimbrites between altered horizons (n=13), and shield basalts directly outside the caldera margin (n=6), have elevated δD and H_2O values relative to equivalent unaltered rocks, indicative of minor alteration.

Supported by numerical modelling, our Gran Canaria data reflect an intrusion-related, structurally controlled epithermal system, in which fluids and/or vapours migrated through intra-caldera tuffs via channelised, porous flow. This study may help to unravel the complex processes of fluid-rock interaction characteristic of both active and fossil caldera-hosted epithermal systems that are presently inaccessible or poorly exposed.