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Water in leucite: an experimental study

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The study of magmatic/volcanic volatiles is based on the determination of H_2O and CO_2 in glasses, assuming they represent the main volatiles reservoirs of volcanic rocks . However, recent works show that some volcanic nominally anhydrous minerals (NAMs) do contain water ($\pm$ CO_2). Leucite ($KAlSi_2O_6$) is an anhydrous mineral typical of potassium-rich basic lavas [1]. Recently [2] and [3] studied, using FTIR spectroscopy, a large number of leucites from all volcanic areas of the Roman Comagmatic Region and showed that they typically contain significant amounts, up to several thousand ppm, of structurally bound water.

We report here preliminary results of an experimental study aimed at defining pressure and temperature conditions controlling the solubility of H_2O into the leucite framework. Experiments were performed in a non end-loaded piston cylinder apparatus, with T in the range 400-800˚C and P in the range 200-500 MPa. Leucite fragments were used as starting materials. The fragments were pre-heated at 600 ˚C and atmospheric pressure in order to abtain completely dehydrated starting material [4]. The anhydrous grains were then introduced in platinum tubes with excess distilled water and run. Single-crystal micro FTIR was used as a technique to analyse the experimental products.

Preliminary data show that significant water amounts (650-950 ppm) diffuse into leucite at these conditions. FTIR images show that the crystals run under these conditions for 4 hours are homogeneously hydrated, suggesting a fast H_2O diffusion through the feldspathoid matrix, as also suggested by the dehydration experiments done by [4] at 1 atm.

References

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