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Experimental evidence of three coexisting immiscible fluids in synthetic granitic pegmatite

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ABSTRACT

We present an experimental study of synthetic peraluminous granite doped with H_2O, B, P, and F, which confirms that aluminosilicate melt, hydrous fluid, and hydrosaline melt (high-temperature brine) can stably coexist at 450–900 °C and 0.1–0.2 GPa in bulk compositions similar to those of natural granitic pegmatites. Hydrosaline melt is not quenchable, unstable at room conditions, and requires special techniques for synthesis and preservation. Raman spectroscopy and electron microprobe analyses of hydrosaline melt synthesized in our experiments show that it is composed of H_3BO_3, Na_3AlF_6, $AlPO_4$, H_2O, and aluminosilicate components. Aluminosilicate melt saturated in both hydrosaline liquid and hydrous fluid at 850 °C and 0.2 GPa contains 3.6 wt% F, 4.2 wt% P_2O_5, and 4 wt% B_2O_3. Natural hydrosaline melts have previously been found as inclusions trapped in rock-forming minerals. They are not restricted to granites and can be effective agents for enhanced crystal growth, metasomatism, and ore formation. In addition, hydrosaline melts may account for many characteristic features of rare-element and miarolitic pegmatites, such as giant size and perfect shapes of crystals in pegmatite cores, diverse mineralogy, and strong enrichment in rare elements.