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Piston-cylinder calibration at 400 to 500 MPa: A comparison of using water solubility in albite melt and NaCl melting

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ABSTRACT

A crushable alumina-pyrex-NaCl solid-media assembly for the piston-cylinder apparatus was calibrated by NaCl melting at 500 MPa, 920 °C, and used to assess a new calibration technique based upon the solubility of water in albite melt at 400 to 500 MPa, 800 and 1200 °C. Use of the “difference from 100” technique to measure water solubility with the electron microprobe produces a calibration accuracy of ± 25 MPa. Both calibration techniques agree and demonstrate that the real pressure is 50 MPa greater than the nominal pressure. The water solubility in albite calibration is advantageous because it can be used to demonstrate that pressure, temperature, and time have no effect on the pressure calibration. Additionally, a single capsule containing albite + water can act as an in situ pressure monitor in solid-media assemblies containing other experiments. These calibrations demonstrate that the piston-cylinder apparatus can be used reliably at middle-to-upper crustal conditions for long-duration experiments.