

New experimental technique for P-V-T measurements of crustal fluids around critical point

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The equation of state (EOS) of crustal fluids (H₂O-CO₂-NaCl) over the wide range of P and T is the most important for understanding geochemical processes. However, in the region P<100 MPa and 350°C<T<600°C, SUPCRT92 [1] which is most available calculation program cannot estimate the thermodynamic properties of high salinity solution with high CO₂ concentrations because of the effects of charged species. The EOS that is specified for high saline H₂O-CO₂-NaCl (>25wt%) systems has not been also established yet, because experiments have not been done successfully around the critical point.

Now we have developed a new apparatus; a mini-piston/cylinder system set in the pressure vessel of our tri-axial deformation apparatus. V is measured by monitoring the motion of the mini-piston, and T is measured by a thermocouple continuously and synchronously. This apparatus serves for the experiments on high saline crustal fluids with high CO₂ concentrations under the conditions up to 200 MPa and 600°C. We verified the performance of our apparatus by comparing our experimental data for pure water and H₂O-10 or 20 mol%CO₂ with the calculated values from the preexisting EOS [2] over the P-T conditions attainable. Our experimental data are consistent with preexisting EOS within accuracy of about 1%. Our innovative experimental technique will establish the EOS of any kind of crustal fluids in the near future.

References

- [1] Johnson J.W., Oelkers E.H. and Helgeson H.C. (1992) *Computers and Geosci.* **18**, 986-990.
- [2] Duan Z., Möller N. and Weare J.H. (1995) *GCA* **59**, 2869-2882.