CURR-KL 68-0236 36

AMERICAN JOURNAL OF SCIENCE

Established in 1818 by Benjamin Silliman

THE FIRST SCIENTIFIC JOURNAL IN THE UNITED STATES

DEVOTED TO THE GEOLOGICAL SCIENCES AND TO RELATED FIELDS

Editors: JOHN RODGERS — JOHN H. OSTROM
Managing Editor: MARIE C. CASEY

Second-class postage PAID at New Haven, Conn. Published monthly, except July and September, at Kline Geology Laboratory, Yale University, New Haven, Conn. 06520.

Subscription rate $10 per year ($1.25 a number). Student rate $5 per year (application blanks available on request). Postage prepaid to the Americas; 60 cents per year outside the Americas.

The JOURNAL completed its *first* series of 50 volumes in 1845, its *second* series of 50 volumes in 1870, its *third* series of 50 volumes in 1895, its *fourth* series of 50 volumes in 1920, its *fifth* series of 36 volumes in 1938. Since 1938 the numbering by series has been discontinued, and volumes are annual and bear the whole numbers as of 1818, that for 1939 being volume 237.

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[AMERICAN JOURNAL OF SCIENCE, VOL. 266, MAY 1968, P. 321-341]

American Journal of Science

MAY 1968

ON THE SOLUBILITY OF ALBITE IN SUPERCRITICAL WATER IN THE RANGE 400 to 600°C and 750 to 3500 BARS

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ABSTRACT. The results of 64 determinations of the solubility of albite by a dynamic method are reported. The departures from equilibrium were experimentally evaluated. The solute, up to 0.3 percent by weight, is not isochemical with albite at any pressure or temperature in the range examined. The size and type of departures from isochemistry depend on pressure, temperature, and the rate of collection of the solutions. The solubility of albite in supercritical water can be quantitatively described by equations derived for non-ideal reaction mixtures. Qualitative calculations indicate that solutions may play an important petrologic role in regions surrounding dehydrating rock masses.

INTRODUCTION

A great many experimental systems of geologic interest contain one or more aqueous fluid phases. Experimental petrology however has generally concentrated on the solid phases, and relatively little is known about composition and properties of the coexisting aqueous solutions. The pioneering work of Morey and Hesselgesser (1951) and of Orville (1963) has shown that solutions in equilibrium with feldspars at elevated temperatures and pressures can produce important petrologic consequences. The present communication forms part of a systematic study of the solubility of the feldspars.

EXPERIMENTAL METHOD

Solubility was determined by a dynamic method similar to that of Morey and Hesselgesser (1951), utilizing two pressure vessels of Inconel X-750 with modified Bridgman seals and capacities of 80 and 120 milliliters respectively. The bomb, approximately 12 inches long, was placed in the central part of a 36 inch horizontal tube furnace whose temperature was adjusted by a recording controller connected to an iron-constantan thermocouple at the entrance to the bomb. A similar thermocouple at the exit of the bomb provided a check on the temperature, and reading of the two thermocouples did not differ by more than 3°C for any runs reported. Exploration at atmospheric pressure showed the interior of the bomb to be within 3°C of the temperature of the entrance thermocouple.

An air operated hydraulic pump, capable of maintaining 3500 bars pressure pumped distilled water through a 65 micron filter, into a heating tube, and thence into the bomb. Pressure, measured on a 12 inch Heise Bourdon gauge, fluctuated less than 25 bars during a run. The