

EXPERIMENTAL DETERMINATION OF Cl-SODALITE – WATER ISOTOPE OXYGEN FRACTIONATION FACTOR

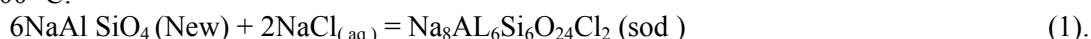
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The fractionation factor (ΔO^{18}) temperature dependence was experimentally established in the Cl-sodalite - H_2O system as a development of intra- and infrastructural oxygen isotope effects. The results were applied for the aqueous fluid nature and temperature associated with sodalite-bearing mineral assemblages.

Several samples of Cl-sodalities were synthesised according to the following reaction in range of 300 - 700 °C:



The natural nepheline restified in NaCl melt at 900°C and nepheline gel were used as starting materials and a small charge of natural thin powdered Cl-bearing sodalite was taken as a priming. Solution composition was specified by the mixture of NaCl and distilled water. The hydrothermal high-pressure devices with the external heating and cold sutter were used for the mineral synthesis, the accuracy of temperature and pressure control being correspondingly $\pm 5^\circ C$ and ± 50 bar. AU runs were performed in platinum ampules. The oxygen fugacity was controlled by Ni - NiO buffer. In order to support a definite NaCl concentration in fluid the "large ampule" technique was applied, the latter being characterized by sample / fluid ratio of 1/5 -: 1/20.

The products of each run were analyzed by the immersion and X-ray methods by use of "Camebax" microprobe with "Link" energy-dispersion detector. The elementary cell parameters for some samples were determined by HZG-4 diffractometer within the constant scanning regime. Silicon of spectral purity ($a = 5.4307$ [Å]) was applied as an internal standard. The elementary cell parameter improvement was performed by 10 - 17 reflection within 7 - 39 angle intervals.

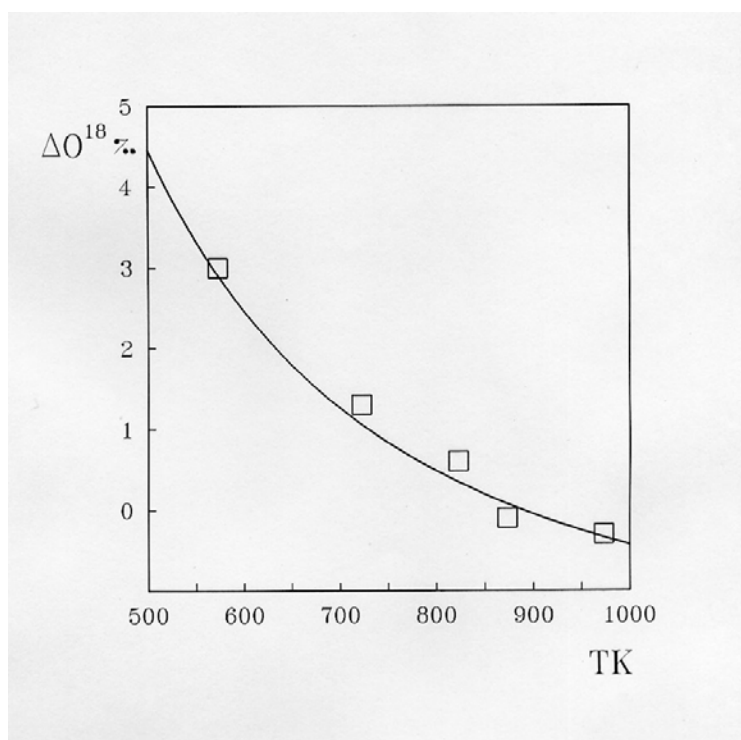


Fig.1. The dependence $\Delta^{18}O$ value from temperature

The isotope equilibrium reaction in the mineral - water system at the hydrothermal conditions is mostly convenient to carry out at the excess water. This allows excluding the additional oxygen isotopic determination of water after the end of experiment. Synthesis of Cl- sodalites was accomplished in the field of rather high NaCl concentration. The water phase excess could not be used because of the restricted volume of platinum ampules. Thus we had to evaluate the isotope oxygen fractionation factor ($\Delta^{18}\text{O}$) on base of isotopic balance:

$$\Delta^{18}\text{O}_{\text{Cl-sod-water}} = (1 + 1/r) \delta^{18}\text{O}_{\text{sod}} - 1/r \delta^{18}\text{O}_{\text{gel}} - \delta^{18}\text{O}_{\text{water}} \quad (2),$$

where $\delta^{18}\text{O}_{\text{sod}}$ - oxygen isotopic composition in every sample of synthesised Cl- sodalite;

$\delta^{18}\text{O}_{\text{gel}}$ and $\delta^{18}\text{O}_{\text{water}}$ - oxygen isotopic composition of gel and distilled water [initial components of synthesis reaction (1)];

r - water/gel oxygen ratio.

The analytical form of the temperature dependence was obtained on the base of experimental data and calculations from (2):

$$\Delta^{18}\text{O}_{\text{Cl-sod-water}} = 1.63 (106/T^2) - 2.1 \quad (3).$$

This temperature dependence (fig.1) could be applied for the development of new isotopic geothermometer in Cl-sodalite -mineral system in the study of sodalite-bearing mineral assemblage formation. The isotopic thermometry is indispensably based on the condition of paragenetic mineral interrelations.

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