TOPAZ EQUILIBRIUMS IN THE LIQUIDUS AREA OF THE SYSTEM Si-Al-Na-O-F AT 700-800°C AND WATER PRESSURE 1000 BARS

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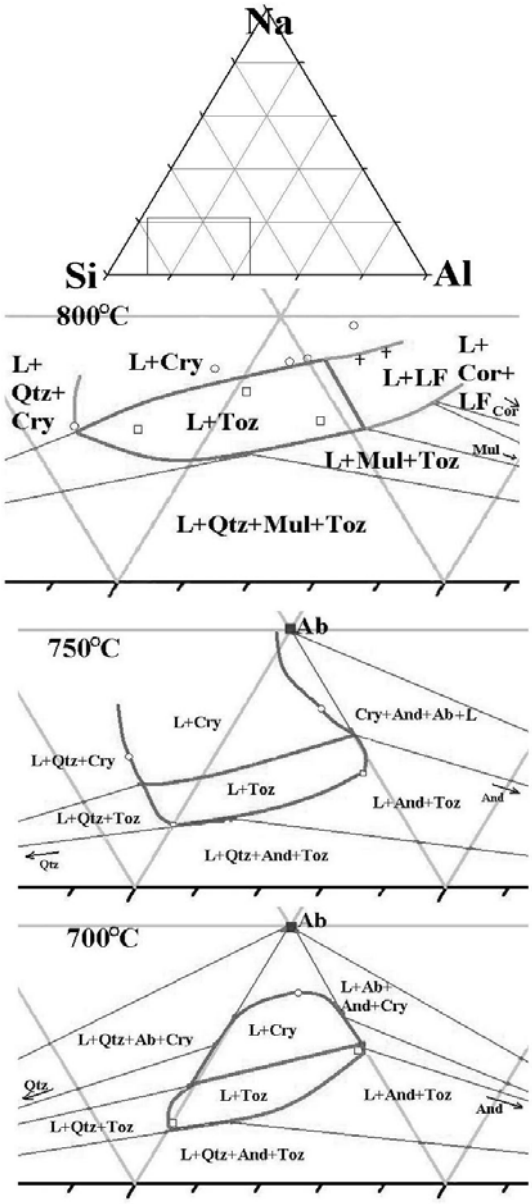

Fig.1. Isothermic diagrams of topaz eqilibriums at 800, 750 and 700°C.

Topaz (Toz) is a common mineral of rare-metal Al-supersaturated granites, ongonites, greisens, some pegmatites and some hydrothermal quartz veins.

Data of investigations of natural mineral assemblages and of previous experimental research make possible to predict the formation of topaz in the liquidus area of the H_2O-saturated Si-Al-Na-O-F system. This was really determined in the Na-pure part of the system at 800 [1], 750 and 700°C. Experiments have been carried out by a hydrothemal apparatus with a cold seal. As a rule topaz forms in run neadle crystals in the melt (L) up to 15 microns in lenghts and up to some microns in cross-section. Rarely it forms polygon grains with inclusions of other phases up to 40 microns in diameter.

The Toz+Qtz+Mul+L and Toz+Mul+Cor+L assemblages arise at 800°C (fig. 1). The topaz appearance in these assemblages sets a maximum limit of fluorine solubility of the melt. Topaz is changed by cryolite (Cry) when the melt added to Na, and by fluoride melt LF when it subtracted from Si. At 750 and 700°C a size of the L+Toz field decreases first of all owing to the expense of the quartz crystallization area. A field of albite (Ab) crystallization appears in the system. It divides the melt area into two parts: near the albite-quartz and albite-nepeline eutectics. Andalusite forms instead of the Qtz+Mul assemblage. Ab+And equilibrium substitute the LF-formation, but the appearance of andalusite affects negligible to the size of the L+Toz field.

Evidently a topaz composition is fixed in assemblages of three phases at the constant temperature and water pressure. The assemblages with quartz and alumina silicates (andalusite, sillimanite, kyanite or mullite) is of the most interest. The mole fraction of fluorine minal in topaz of these assemblages is minimal at distinctive conditions. According to previous experiments, calculations and data of investigations of natural assemblages it decrease with decreasing of temperature and increasing of water pressure.

The determination of a topaz and coexisting glass (quenched melt) compositions has been sometimes a problem because of size of an analyzed phase. The location of figurative points of analysis at the tie lines which connect points of individual phases (fig. 2) shows additivity of results obtained in these cases. Concentrations of all estimated elements are linear with each other with the high (0.99) reliability range. It is of methodical importance. It is possible to calculate compositions of melt and solid solution minerals, topaz in particular, and an accuracy of the F-determination in them by an extrapolation of approximated equations. In fig. 2 is one of examples of the determination of a melt composition by a cross-section of three straight lines.

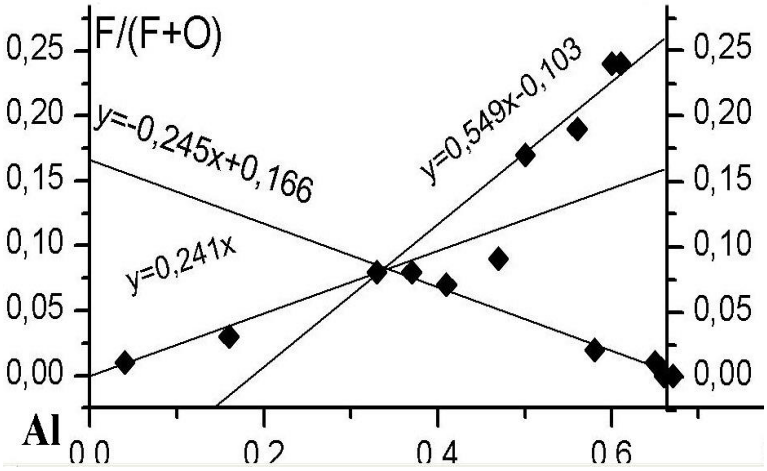

Fig.2. A determination of melt composition according data of analysis, if a size of individual phase is less than X-ray generation area.

form at 300°C.

The fluorine minal mole fraction of topaz which obtained in our experiments are not vary within error for 750°C (0,78±0,10 – assemblage with quartz and andalusite) and 800° (0,75±0,07 – with quartz and mullite), but is distinctly smaller at 700° (0,58±0,11). The data do not contradict to decreasing of the fluorine minal mole fraction of topaz with decreasing of temperature. As to quantitative aspect of this regularity there are very great inconsistencies between our data and the calculated diagram by M.Barton [2]. Topaz with mole fraction 0, 6 of fluorine minal syntheses at 700° should be

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