THE NATURE OF THE ALBITE PORPHYROBLASTS IN THE HOOSAC SCHIST, CHESTER DOME, VERMONT

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The Hoosac Formation is a Cambrian unit near the boundary between the Precambrian basement and the Paleozoic cover sequence. Beneath the Hoosac is the Tyson Formation which it not always present. The Hoosac consists of a pelitic schist with large albite porphyroblasts; within this albite schist is a more aluminous horizon which does not contain albite porphyroblasts and at high grades contains kyanite and staurolite. The typical mineral assemblage for the Hoosac at higher grades is: albite, biotite, garnet, quartz, clinozoisite, muscovite, paragonite, along with the accessory minerals tourmaline, apatite, and titanite (Thompson et al, 1977). Two orogenies have affected the Hoosac Formation, the Taconian orogeny, of medium pressure and in the Ordovician period, and the Acadian orogeny, of lower pressure and in Devonian period (Thompson et al, 1986).

The author collected samples of the Hoosac Formation from a range of geographic localities, grades and compositions. I examined these samples by using a petrographic microscope and an electron microprobe, noting textural and chemical characteristics of the phases.

The albite porphyroblasts in the Hoosac grew late in the metamorphic history of the rock, as asserted by Jack Cheney (personal communication); I have found evidence to support this assertion. Many of the albites have foliation abutting against them indicating post-tectonic growth of the feldspars. In some cases the albite porphyroblast has overgrown the foliation, as one can see in fig. 1 where the inclusions mimick the folds in the foliation; this proves that the albite grew after the deformation of the foliation. Most of the samples contain the same phases in the matrix as are inclusions in the albites, therefore all of the phases were present before the growth of the albites. To further substantiate this claim, microprobe data will be obtained to compare the compositions of the inclusions to the phases in the matrix.

I have created a reaction space to represent the possible ways by which matter could be transferred in the Hoosac. This reaction space was developed by the method described by J. B. Thompson (1982b). The additive components of the system are: quartz, muscovite, biotite, plagioclase, garnet, and epidote. The system components are: SiO_2, FeO, MgO, CaO, Al_2O_3, KAl_3O_5, $NaAl_3O_5$, Fe_2O_3, and H_2O. The exchange components of the system are: NaK_{-1} in muscovite, NaK_{-1} in biotite, $NaSiCa_{-1}Al_{-1}$ in plagioclase, and $MgFe_{-1}$ in garnet. The ways matter could be exchanged in this system, when open to the exchange of H_2O, can defined by any linear combination of the following linearly independent net transfer reactions:

(1) $SiO_2 + 4\,Ca_2Al_3Si_3O_{12}(OH) = 5\,CaAl_2Si_2O_8 + Fe_3Al_2Si_3O_{12} + 2H_2O + 3\,CaFe_{-1}$(garnet)

(2) $KAl_3Si_3O_{12}(OH)_2 + 2Fe_3Al_2Si_3O_{12} + 3CaFe_{-1}$(garnet) $= KFe_3AlSi_3O_{10}(OH)_2 + 3CaAl_2Si_2O_8$

(3) $KAl_3Si_3O_{12}(OH)_2 + 3SiO_2 + KFe_3AlSi_3O_{10}(OH)_2 + 2NaK_{-1} = Fe_3Al_2Si_3O_{12} + 2\,CaAl_2Si_2O_8 + 2\,H_2O + 2\,NaSiCa_{-1}Al_{-1}$

These reactions can define the axes to a reaction space which defines all possible matter exchange in the Hoosac. Any reaction in the defined assemblage is a linear combination of equations (1), (2), and/or (3). The reaction polyhedron is constructed for a specific bulk composition; the faces of the polyhedron represent the elimination of a specific phase, thus all possible assemblages are contained within the reaction polyhedron. All of the reactions within the rock must take place within this polyhedron. Textural evidence can then be used to determine the path taken by the rock within the reaction space.

Many of the albite porphyroblasts of the Hoosac display peristerite exsolution which is so coarse that is visible under a petrographic microscope. The exsolved phase has a different extinction angle than the remainder of the porphyroblast, and may form elliptical blebs like those described by Raith (1969) (fig.2). These blebs may be exsolved quartz formed from the excess Si released in going from albite to a more calcic plagioclase. as described by Cooper (1972). Even if these elliptical features are quartz, there is still optically distinguishable peristerite where the more calcic phase surrounds the inclusions and rims the porphyroblast (fig.3). Data from the electron microprobe documented the peristerite miscibility gap in proving that there were two distinct plagioclase compositions within a single porphyroblast. The compositions of the exsolved phases are An_{1-2}, albite, and An_{14-25}, oligoclase. The composition of exsolved phases may indicate the pressure of metamorphism because the peristerite solvus shifts toward more albitic compositions with increased pressure, and the albite-rich limb is very steep, so temperature of metamorphism will have a negligible effect (Maruyama et al., 1982).

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Fig. 1 Albite which has overgrown folded foliation. 75x, xpl, L5K.

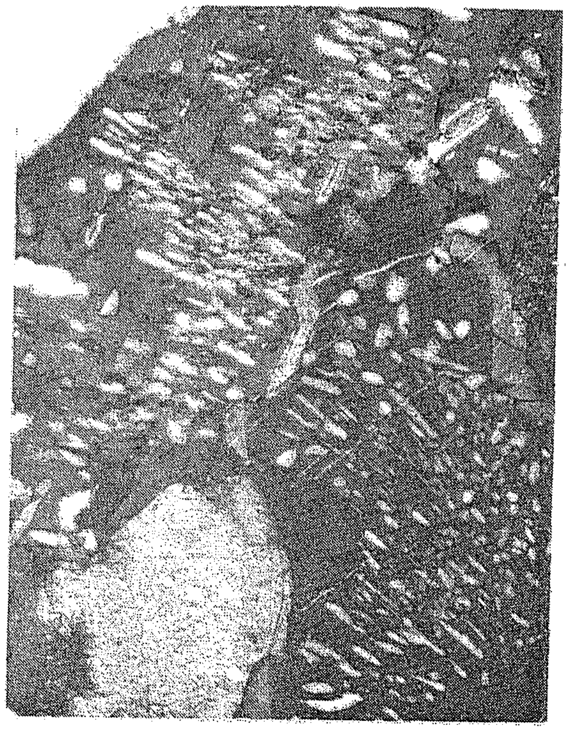

Fig. 2 Albite containing bleb-like intergrowths. 600x, xpl, L2A1.

Fig. 3 Albite showing peristerite exsolution with the more calcic phase surrounding the inclusions and rimming the crystal. (The calcic areas are not at extinction.) 75x, xpl, L3E.