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Myrmekite in Belt Supergroup metasedimentary rocks—northeast border zone of the Idaho Batholith

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Introduction

Some petrologists consider myrmekite[1] to be definitive of an igneous history for the rock in which it occurs (for example, see Hibbard, 1979). This paper describes myrmekite which is common in amphibolite facies metamorphic rocks in northern Idaho and western Montana. This myrmekite is not an inherited igneous feature, but instead is of metamorphic origin.

The metasedimentary rocks were originally mapped by Nold (1968) and are the equivalents of the Proterozoic Belt Supergroup, specifically the Prichard Formation, mainly argillite and siltstone, the Ravalli Group, mainly quartzites, and the Wallace Formation, which is a carbonate-bearing siltstone. The total thickness of this portion of the stratigraphic section is estimated to exceed 10,000 meters. These rocks were regionally metamorphosed and intruded by granitic plutons of the Idaho Batholith during Mesozoic and Cenozoic time. Metamorphism ranges from lower greenschist to upper amphibolite facies and myrmekite is confined to amphibolite-facies rocks.

Myrmekite in Belt metasediments

The rocks were divided into three metamorphic units as follows: (1) pelitic schist and quartzofeldspathic gneiss, (2) micaceous quartzite, and (3) calc-silicate gneiss and calc-schist. These units correlate, respectively, with the three Belt Supergroup units described above. These correlations are based on overall similarity of chemical composition and, in addition, the younger two units were effectively traced in the field from the low- to the high-grade terrane. Other indications of sedimentary parentage are that all three metamorphic units show relict sedimentary bedding and that the quartzite unit contains readily identifiable crossbedding (preserved well enough that it was used to determine stratigraphic tops).

Thirty to fifty thin sections were cut from samples of each unit and 20 to 30 percent of the sections contain at least a trace of myrmekite with amounts in individual samples of as much as three percent. In the pelitic schist-gneiss unit and micaceous quartzite unit the most common mineral assemblage is quartz–plagioclase–k-feldspar–muscovite–biotite$\pm$sillimanite. Sillimanite in equilibrium with muscovite indicates that these rocks fall within the sillimanite-muscovite zone of the amphibolite facies. Photomicrographs of myrmekite from these two units are shown in Figures 1A, B, C, and D. In the calc-silicate gneiss unit the most common mineral assemblage is quartz–plagioclase–K-feldspar–diopside–hornblende–biotite$\pm$scapolite, epidote and calcite. This assemblage is characteristic of the middle to upper amphibolite facies of regional metamorphism. Figures 1E and F show myrmekite from this unit.

Most of the rocks with myrmekite contain only a trace amount and it is usually present as a bulbous invasion of an adjacent K-feldspar crystal (Figs. 1C and D), suggesting late replacement of K-feldspar by myrmekite (Phillips, 1980). In a few specimens, plagioclase with well-developed albite twinning is myrmekitic (Figs. 1A, B, E) and is, like the above occurrence, usually in contact with K-feldspar. Some of the myrmekite shows considerable sericite alteration (Fig. 1F), perhaps of retrograde origin.

Discussion

Myrmekite is widely distributed in trace amounts in these Beltain metasedimentary rocks in which there is considerable variation in the chemistry and mineralogy of the rock units. Most metamorphic myrmekite described in the literature is reported to occur in high-grade pelitic schists and quartzofeldspathic gneisses. In this sequence of rocks, however, myrmekite is as common in the calc-silicate gneisses as in the above rock types. In spite of the fact that the intergrowth occurs in rocks of widely varying composition, it is usually found in contact with K-feldspar. The few instances where no adjacent K-feldspar is visible may be a consequence of viewing the specimen in only two dimensions in the plane of the thin section. Myrmekite within metamorphic rocks has been reported by numerous authors (for example, see Ashworth, 1972, Barker, 1970, Phillips, 1980, Williams et al., 1954, Nold, 1981, Johnson, 1947, and Phillips et al., 1972).

No evidence has been developed by the author to choose between the two popular theories of myrmekite origin, the exsolution model (Schwantke, 1909) and the replacement model (Becke, 1908) and that is not the intent of this paper. Rather, it is emphasized that myrmekite, still considered by some authors to be strictly igneous, also originates during metamorphism.

[1]A wormy intergrowth of quartz in sodic plagioclase (commonly oligoclase), usually in contact with K-feldspar

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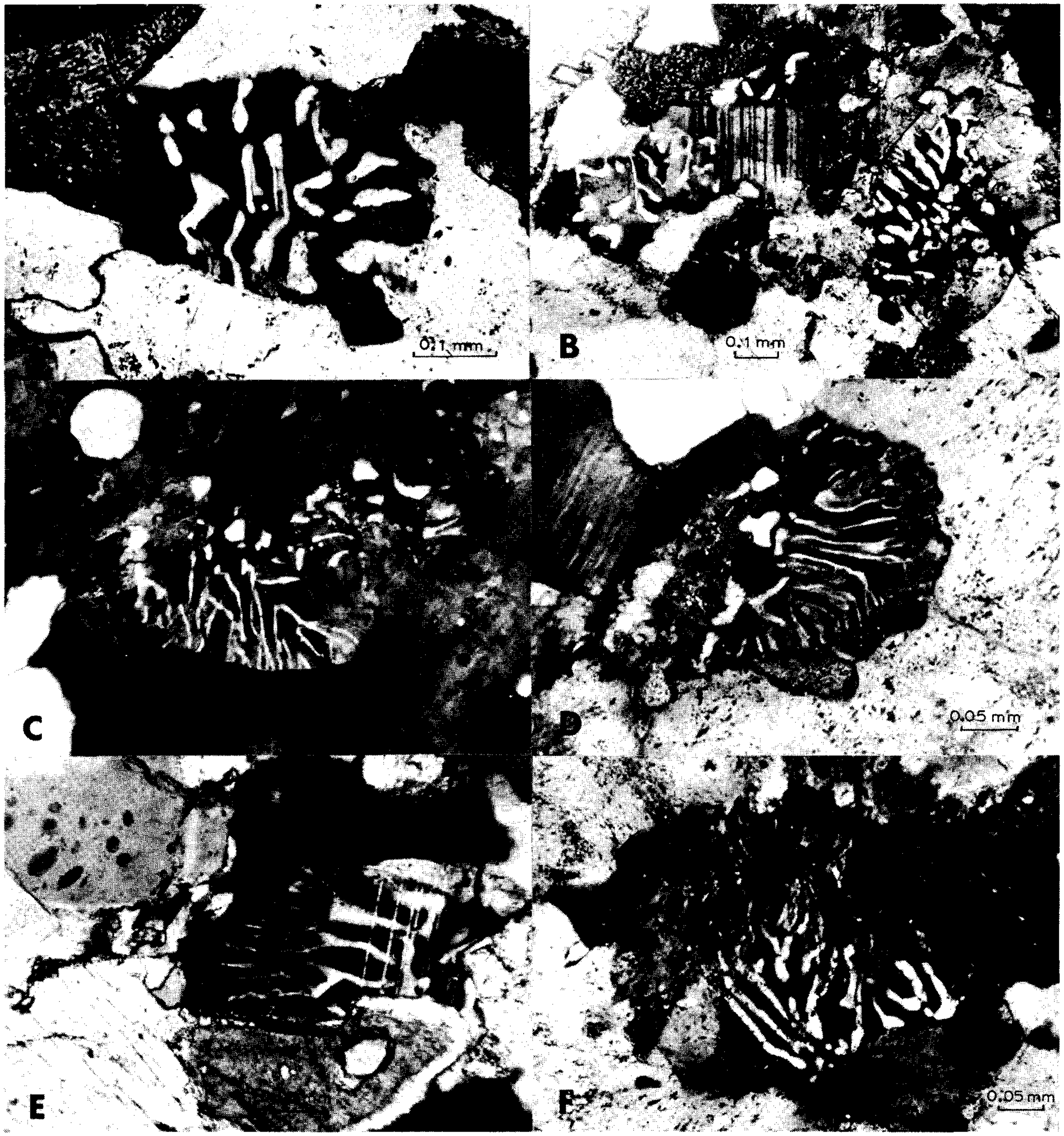

Fig. 1. (A) Myrmekite from the pelitic schist-gneiss unit, surrounded by K-feldspar and biotite. Twinning visible within myrmekitic plagioclase. (B) Myrmekitic plagioclase crystals in pelitic schist-gneiss unit. (C–D) Bulbous myrmekite invading K-feldspar. Micaceous quartzite unit. (E) Dendritic myrmekite showing twinning; in contact with hornblende and K-feldspar. Calc-silicate gneiss unit. (F) Myrmekite surrounded by K-feldspar. Calc-silicate gneiss unit.

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