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CONTRASTING DAWSONITE OCCURRENCES FROM MONT ST-BRUNO, QUEBEC

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Abstract

A feldspathic dyke at Mont St-Bruno contains dawsonite, principally in vugs, associated with fluorite, calcite, dolomite and aragonite in a typical hydrothermal assemblage. The dawsonite occurs as blades with satin lustre and fine striae, in contrast to the fine acicular crystals of dawsonite in rosettes occurring along a joint plane in black hornfels previously found at Mont St-Bruno. The two varieties of dawsonite illustrate the various geological environments in which dawsonite can form even in a small area.

Sommaire

Un dyke feldspathique du mont St-Bruno contient un assemblage typiquement hydrothermal de dawsonite, fluorine, calcite, dolomite et aragonite. La dawsonite se présente en lames à éclat satiné, finement striées, très différentes des aiguilles délicates en rosettes précédemment trouvées, dans le plan d'une diaclase, dans une cornéenne noire de la même localité. Les deux variétés de dawsonite du mont St-Bruno nous apportent la preuve que ce minéral peut se former dans des conditions géologiques différentes, même dans une région de petite superficie.

(Traduit par la Rédaction)

Introduction

Unlike the quarries at nearby Mont St-Hilaire, those at Mont St-Bruno (Fig. 1) contain few rare minerals. However, Mandarino & Harris (1965) announced the discovery of dawsonite from the Richelieu Paving Company quarry, Mont St-Bruno, indicating that this area has, at least in a limited way, been subject to petrological influences similar to those of other Monteregian rocks. Dawsonite found recently at the Dulude quarry, Mont St-Bruno, has mineral associations and a mode of occurrence which differ from those of the dawsonite described in 1965.

The main body of Mont St-Bruno is a Lower Cretaceous peridotite pluton intruded into Ordovician Lorraine siltstone and shale; these have been strongly hornfelsed (Currie 1976). Like other Monteregian hills, particularly Mont Royal, Mont St-Bruno has numerous dykes and sills of various compositions (Philpotts 1976). The newly discovered material was collected from vugs in a feldspathic aphanitic dyke and in layered parts of the dyke.

Petrography of the Dyke

The main part of the massive dyke rock is light tan, altered and aphanitic. It is microscopically porphyritic with two distinct sizes of phenocrysts, both of which contribute to a marked trachytic texture. The larger phenocrysts, apparently first-generation, are 0.05 × 0.3 mm plagioclase laths that comprise about 20 vol. % of the rock. All are variably altered, some intensely. Extinction angles and refractive indices indicate that the plagioclase is albite of composition An_8. The principal alteration product, kaolinite, is accompanied by carbonate, usually calcite, commonly ringed by fine blades of dawsonite. All occur in elongated masses along the 010 direction of the host plagioclase. Many of these larger phenocrysts contain core areas of purple fluorite.

The second-generation phenocrysts, 0.007 × 0.02 mm, comprise 50% of the rock and are now rectangular areas of massive ankerite, commonly fringed and intergrown with blades of dawsonite. The matrix, comprising about 25% of the rock, seems to have been fine-grained microlitic feldspar, now largely kaolinitized and containing scattered grains of ankerite.

Euhedral "augite" phenocrysts (less than 1 %), 0.65 × 1.0 mm, are altered completely to a mixture of ankerite and clear, uniaxial negative analcime. The augite inheritance is deduced from the typical clinopyroxene cross-sections. Smaller euhedral grains, less than 1 %, of similar analcime were also noted in the groundmass. All the analcime grains are definitely secondary: not only were they seen as fresh grains in altered groundmass but also in the altered "augite".

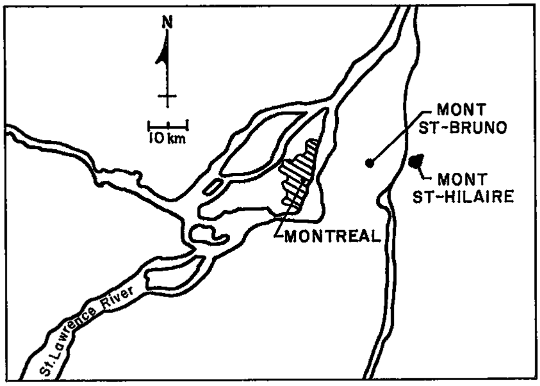

FIG. 1. Map showing the location of Mont St-Bruno in the Montreal area.

"Orthoclase" occurs as subordinate (< 1%) euhedral crystals that attain 0.3 × 0.4 mm; although completely altered to a felted mass of kaolinite with minor carbonate, the orthoclase parentage is inferred from the characteristic bipyramidal cross-sections.

Mineralogy of the Vugs

The dawsonite–fluorite vugs in the material studied range from completely crystal-filled vugs 2 cm across up to partly filled vugs 3 cm across. Most larger vugs consist of a very pale bluish crust 1 to 5 mm thick, principally of close-packed feldspar crystals, some of which show patchy microcline-type twinning. The crust is usually followed by massive spar calcite (n 1.658) coated and partly intergrown with aggregates of purple fluorite and clear dawsonite blades; these have a satin lustre and fine striae apparently representing the perfect cleavage parallel to 110. A few of these blade-like crystals are widely separated single grains, but most are clusters of randomly oriented or, occasionally, radially oriented blades. Characteristically, the dawsonite pierces fluorite cubes and bridges the space between them, or is intergrown with rhombs of dolomite and the late scalenohedra of calcite (Fig. 2). Similar dawsonite occurs in Montreal-area material (Stevenson & Stevenson 1977) and at Terlano, Italy (Corazza *et al.* 1977).

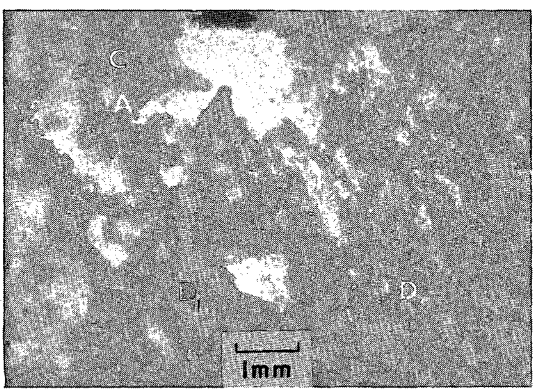

FIG. 2. Encrustations in a vug in altered feldspathic dyke, Dulude quarry, Mont St-Bruno. C: crystals of scalenohedral calcite; A: dusting of very fine aragonite crystals on scalenohedra of calcite; D_1: coarsely bladed dawsonite growing in open vug; D_2: encrustation of randomly oriented dawsonite crystals on joint plane leading out from open vug. Redpath Museum No. *NS2385C*.

Dawsonite crystals in the open vugs attain 5 × 1 × 0.5 mm. Several crystals have the forms {100} and {110}, and a few rare terminated crystals show {001} and {011}. On joint planes that commonly lead away from open vugs, dawsonite occurs as mats of randomly oriented crystals mostly 0.25 to 0.5 mm long. Close-packed, well-defined rosettes characteristic of the Mont Royal type-locality were not seen.

In the altered dyke away from the open vugs, dawsonite also occurs in completely filled vugs 0.25 mm in diameter, or as replacements within the larger first-generation plagioclase phenocrysts. In both cases the dawsonite occurs either as closely packed aggregates consisting entirely of very fine dawsonite blades (0.01 × 0.002 to 0.3 × 0.006 mm), or as fine blades intergrown with calcite or fluorite.

Almost cubic rhombs of water-clear dolomite, 1.0 to 2.0 mm across, are commonly associated with the fluorite and dawsonite as a late mineral. The mineral has an ω index of 1.685; it is thus a rather pure dolomite.

Conspicuous in many of the vugs are barrel-shaped milky white calcite scalenohedra up to 5 mm in length, principally on a base of spar calcite, but also on fluorite and on dawsonite blades (Fig. 2). Commonly seen on the scalenohedra of calcite and the rhombs of dolomite are tufts of aragonite, scattered cubes of fluorite charged with carbonaceous material, pyrite and marcasite. These small cubes of fluorite on the calcite scalenohedra represent a very late-stage second-generation fluorite. They indicate how very long a time hydrothermal solutions were active in the production of the dawsonite–fluorite assemblage of minerals. It is very probable that the carbonaceous material in this fluorite was derived by late solutions from the hornfelsed Lorraine shales, the prevailing country rock in the quarry.

The mineralogy of the smaller vugs is similar to that of the larger vugs: fluorite, dawsonite and calcite are usually present. The carbonate is calcite and not the ankerite seen in the altered feldspars of the dyke rock. All the smaller vugs are joined with the larger vugs by rough joint planes coated and principally filled with dawsonite and calcite, commonly with fluorite. Where small vugs, amoeba-like tentacles from the vugs, and joining veinlets are abundant, the rock really becomes, on a small scale, a replacement breccia of disconnected dyke-rock areas and breccia remnants in a matrix of vug and vein fillings.

The alteration of the dyke rock where it forms the matrix of these vugs is much the same as in the more massive dyke rock, but more intense. Kaolinite alteration is widespread, particularly in residual plagioclase phenocrysts extending into the vugs. These plagioclases are completely kaolinitized, suggesting that kaolinitization was part of the vug mineralization. Fluorite occurs as core material within the plagioclase, surrounded by calcite and this surrounded by abundant felted kaolinite and irregular areas of clear albite. Only minor amounts of dawsonite were noted in such assemblages; it is probable that most of the alumina was taken up by the kaolinitization of the feldspar and none was left for the later dawsonite.

Comparison with Richelieu Paving Quarry Dawsonite

In contrast to the dawsonite from the Dulude quarry, that collected from the Richelieu Paving Company quarry occurs as beautiful close-packed coalesced rosettes 0.5 cm in diameter on a prominent sharp-walled joint plane in black hornfels (Fig. 3). In the specimen we studied, massive tan carbonate and groups of water-clear well-cleaved dolomite are interstitial to the rosettes. A narrow band of comb quartz, 0.04 to 1.0 mm wide, occurs in planes between the country rock hornfels and the dolomite. No fluorite was seen with the dawsonite rosettes. Elsewhere in the specimen, the hornfels was cut by narrow sharp-walled joints filled with comb quartz and carbonate; no dawsonite was seen in these joints.

Conclusons

The Dulude quarry dawsonite closely resembles the specimens studied from the Francon quarry and the University Street locality, both adjacent to Mont Royal, and specimens from

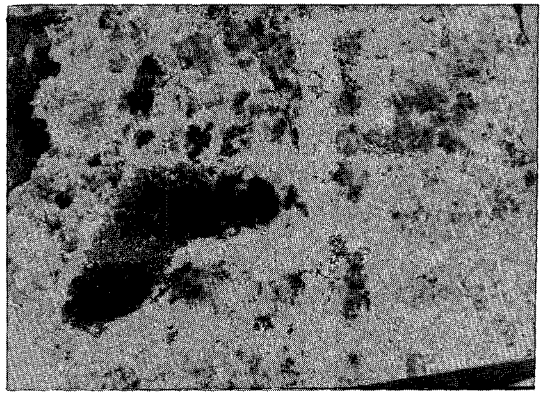

FIG. 3. Coalescing rosettes of dawsonite on joint plane in specimen of black hornfels. Richelieu Paving Company quarry. Specimen 7 cm across. Redpath Museum No. 2382*C*.

Mont St-Hilaire. In all these localities, individual crystals of dawsonite associated with fluorite occur in vugs in feldspathic dykes (Sabina 1976; Stevenson & Stevenson 1977). The Richelieu Paving quarry dawsonite, with its excellent rosettes confined largely to the joint plane, is similar to the original type-locality dawsonite described by Harrington (1875) from the McGill University campus, on the flanks of Mont Royal.

The two St-Bruno occurrences illustrate the fact that if the requisite chemical constituents are present in the fluid phase and pH and $P(CO_2)$ maintained, dawsonite can form in different specialized geological environments. These two places must have provided an alkaline environment relatively rich in sodium, aluminum and CO_2 and deficient in strong acidic radicals. In the dyke locality, aluminum may have been contributed locally as a result of the observed widespread destruction of the feldspars.

Acknowledgements

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References

CURRIE, K. L. (1976): The alkaline rocks of Canada. *Geol. Surv. Can. Bull.* **239**.

CORAZZA, E., SABELLI, C. & VANNUCCI, S. (1977): Dawsonite: new mineralogical data and structure refinement. *Neues Jahrb. Mineral. Monatsh.*, 381-397.

HARRINGTON, B. J. (1875): Notes on dawsonite, a new carbonate. *Can. Natur. Quart. J. Sci. (New Ser.)* 7, 305-309.

MANDARINO, J. A. & HARRIS, D. C. (1965): New Canadian mineral occurrences: eucryptite, pollucite, rozenite, epsomite, dawsonite, fairchildite and bütschliite. *Can. Mineral.* 8, 377-381.

PHILPOTTS, A. R. (1976): Petrography of Mounts Saint-Bruno and Rougemont. *Québec Ministère Rich. Nat. Rep. ES*-**16**.

SABINA, A. P. (1976): The Francon quarry, a mineral locality. *Geol. Surv. Can. Pap.* **76-1B**, 15-19.

STEVENSON, J. S. & STEVENSON, L. S. (1977): Dawsonite-fluorite relationships at Montreal-area localities. *Can. Mineral.* **15**, 117-120.

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