

GRICEITE, LiF, A NEW MINERAL SPECIES FROM MONT SAINT-HILAIRE, QUEBEC

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ABSTRACT

Griceite, ideally LiF, a new mineral species from the Poudrette quarry, Mont Saint-Hilaire, Quebec, occurs in sodalite inclusions near the periphery of massive hornfels in association with ussingite, analcime and villiaumite. Griceite is bright to dull white, inclining to pale yellow, and occurs as fine-grained botryoidal aggregates, as fine-grained powders, as irregular (~0.1 to 1.0 mm) inclusions in villiaumite, and as possible pseudomorphs displaying pseudotetragonal or pseudomonoclinic symmetry. Griceite is translucent to opaque with a dull to vitreous luster, white streak, hardness ~4.5, and good {100} cleavage. A few specimens display uneven to conchoidal fracture. Griceite is isotropic, n 1.3986 (5), and fluoresces light yellow in shortwave ultraviolet light in some specimens. By analogy with synthetic LiF, griceite is cubic, space group $Fm\bar{3}m$. The refined unit-cell parameter a is 4.0293(2) Å, V 65.415(9) Å³. The strongest three X-ray powder-diffraction lines [d in Å(hkl)] are 2.324(9)(111), 2.013(10)(200) and 1.414(5)(220). Wet-chemical analysis gave Li 24.72, F 72.20, Al 0.06, Ca 0.03, Mn 0.01, Fe 0.03 total 97.05 wt.%, corresponding to Li_{0.97}F_{1.03}, ideally LiF; D_{mes} 2.62, D_{calc} 2.67 g/cm³, with $Z = 4$. Griceite is named for Joel Denison Grice, Curator of Minerals, National Museum of Natural Sciences in Ottawa.

Keywords: griceite, Poudrette quarry, Mont Saint-Hilaire, Quebec, lithium fluoride, new mineral species, X-ray data, chemical analysis.

SOMMAIRE

La gricéite, de formule idéale LiF, nouvelle espèce minérale de la carrière de Poudrette, mont Saint-Hilaire, Québec, se trouve associée à ussingite, analcime et villiaumite dans des inclusions de sodalite situées près de la périphérie de cornéennes massives. La gricéite est d'un blanc brillant à terne, tirant sur le jaune pâle, et se présente sous forme d'agrégats botryodaux et de poudres à granulométrie fine, d'inclusions irrégulières (~0.1 à 1 mm) dans la villiaumite, et parfois sous forme de pseudomorphes à symétrie pseudotétragonale ou pseudomonoclinique. La gricéite varie de translucide à opaque, possède un éclat variant de terne à vitreux, laisse un trait blanc, présente une dureté de ~4.5 et un clivage {100} bien défini. Quelques échantillons présentent une cassure irrégulière à conchoïdale. La gricéite est isotrope [n 1.3986(5)]; sous la lumière ultraviolette à

onde courte, certains échantillons montrent une fluorescence jaune pâle. Par analogie avec le LiF synthétique, la gricéite est cubique, groupe spatial $Fm\bar{3}m$. Le paramètre réticulaire a est 4.0293(2) Å, V 65.415(9) Å³. Les trois raies les plus intenses du cliché de diffraction (méthode des poudres) [d en Å(hkl)] sont: 2.324(9)(111), 2.013(10)(200) et 1.414(5)(220). L'analyse chimique par voie humide a donné Li 24.72, F 72.20, Al 0.06, Ca 0.03, Mn 0.01, Fe 0.03, pour un total de 97.05% (par poids), ce qui correspond à Li_{0.97}F_{1.03}, soit idéalement LiF. D_{mes} 2.62, D_{calc} 2.67, avec $Z = 4$. La gricéite doit son nom à Joel Denison Grice, conservateur de la section de minéralogie, Musée national des Sciences naturelles, à Ottawa.

Mots-clés: gricéite, carrière de Poudrette, mont Saint-Hilaire, Québec, fluorure de lithium, nouvelle espèce minérale, données de diffraction X, analyses chimiques.

INTRODUCTION

Griceite was found during routine X-ray examination of mineral specimens collected in the spring of 1985 from the Poudrette quarry, Mont Saint-Hilaire, Quebec. Thirty-seven species, including griceite, were identified in a section (1 m × 0.5 m × 0.25 m) of a sodalite inclusion in nepheline syenite.

Griceite is named in honor of Dr. Joel Denison Grice, Curator of Minerals at the National Museum of Natural Sciences in Ottawa. Cotype specimens of griceite (NMNS 52310, 52311, 52312, 52313) are preserved in the National Mineral Collection, National Museum of Natural Sciences, Ottawa. Cotype specimen M43055 is in the Royal Ontario Museum, Toronto. The mineral and mineral name have been approved by the Commission on New Minerals and Mineral Names, I.M.A. To date, approximately 30 specimens, each <1 mm in size, are known. Griceite is UK54 of Wight & Chao (1986).

OCCURRENCE

A massive (~100 m × 100 m × 20 m) hornfels unit, its contact zone, and accompanying inclusions and xenoliths were exposed during quarry operations

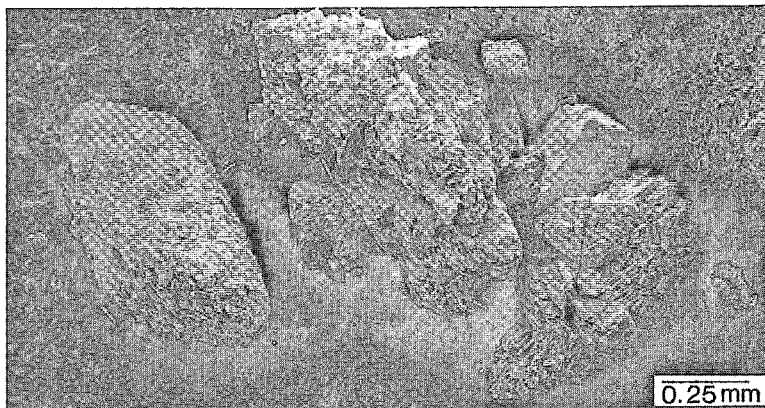


FIG. 1. Possible griceite pseudomorphs displaying pseudotetragonal or pseudomonoclinic morphology.

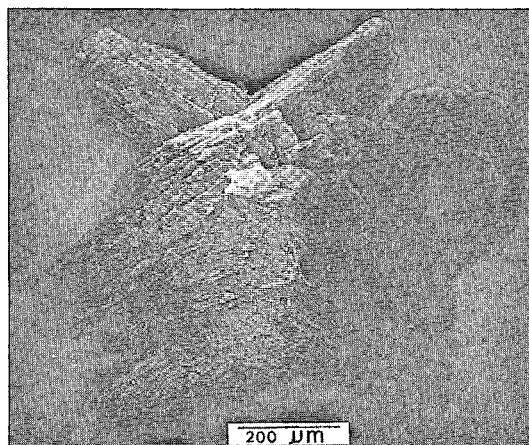


FIG. 2. A pseudomorph composed of griceite.

at the Poudrette quarry, Mont Saint-Hilaire, Quebec. Griceite was found in sodalite inclusions at the periphery of the contact zone of the hornfels, which is surrounded by nepheline syenite (Van Velthuizen, in prep.) On cotype specimen NMNS 52310, griceite occurs as late-stage <1 mm botryoidal aggregates on euhedral ussingite crystals associated with sodalite, eudialyte, sphalerite, serandite and lovozerite.

PHYSICAL PROPERTIES

Griceite occurs as fine-grained, bright to dull white, mm-size botryoidal aggregates, as fine-grained white powdery patches, as translucent irregular grains in villiaumite, and as possible pseudomorphs displaying pseudotetragonal or pseudomonoclinic symmetry (Figs. 1, 2). Most specimens display a com-

TABLE 1. X-RAY POWDER-DIFFRACTION DATA FOR GRICEITE

<i>hkl</i>	<i>d</i> _{calc}	<i>d</i> _{obs}	<i>I</i>
111	2.326	2.324	9*
200	2.014	2.013	10*
220	1.424	1.424	5*
311	1.214	1.213	1*
222	1.163	1.163	1*
400	1.007	1.007	<1*
331	0.924	0.924	1*
420	0.900	0.900	1*
422	0.822	0.822	<1*

CuK α radiation, cell dimension a 4.0293(2) Å, 114.6 mm Debye-Scherrer camera, visually estimated intensities. * diffraction lines used to refine the cell dimension.

pact fine-grained white powdery surface with a light yellow, light yellowish green, or light orange core. The mineral has a white streak, is translucent to opaque, and has a dull to vitreous luster. Griceite inclusions in villiaumite display good {100} cleavage; others display an uneven to conchoidal fracture. The hardness of griceite is ~4.5. The density, determined by flotation using bromoform diluted with butyl alcohol and measured on a Sartorius 2001 MP2 density balance, is 2.62 g/cm³. The calculated density for end-member LiF is 2.67 g/cm³. This difference may be due to the porous nature of the samples.

Optically, griceite is isotropic, $n = 1.3986(5)$ (measured in sodium light, $\lambda = 589.9$ nm). Some specimens of the mineral fluoresce light yellow in short-wave ultraviolet light. Visual identification is difficult because of the presence of other mineral spe-

cies similar in physical appearance, such as thermanatrite, analcime, dorfmanite and trona. Using the Gladstone–Dale constants (Mandarino 1979), the compatibility index is 0.0236, indicating good agreement of optical and physical data.

CHEMICAL COMPOSITION

A qualitative electron-microprobe wavelength-dispersion scan using a JEOL 733 Superprobe detected only F. Atomic-absorption spectrometric analysis of a 15-mg sample of griceite separated from several specimens gave Li 24.72, F 72.20, Al 0.06, Ca 0.03, Mn 0.01, Fe 0.03, total 97.05 wt.%. F was determined by the fluoride ion selective-electrode method. The low analytical total may be due to impurities. The formula of griceite, calculated on the basis of two atoms per formula unit, is $\text{Li}_{0.97}\text{F}_{1.03}$ or, ideally, LiF. The mineral is not attacked by 30% HCl and is insoluble in water.

CRYSTALLOGRAPHY

The preliminary characterization of griceite was done by X-ray powder-diffraction methods utilizing Ni-filtered $\text{CuK}\alpha$ radiation and a 114.6 mm Debye–Scherrer powder camera. The data are in close agreement with PDF 4–0857 for synthetic LiF. Most of the X-ray films contain extra lines attributable to contamination by cancrinite, acmite, albite, or zeolites.

Fragments of griceite, oriented using their rough cubic outline, were studied by the precession single-crystal method. Multiple spots (mosaic spread) were observed, indicating subparallel growth of crystallites. The maximum misalignment of the domains is $\sim 15^\circ$. Despite the mosaic nature of the griceite, its cubic symmetry was confirmed, with $a \approx 4.0 \text{ \AA}$. The systematic extinctions are consistent with space group $Fm\bar{3}m$, as reported in PDF 4–0857.

The unit-cell parameter $a 4.0293(2) \text{ \AA}$ [$V 65.415(9) \text{ \AA}^3$, and $Z = 4$] was refined by the least-squares method (Table 1), utilizing the program CELREF (Appleman & Evans 1973). Griceite is a member of the halite group.

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