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WEDDELLITE FROM LUTTERWORTH TOWNSHIP, HALIBURTON COUNTY, ONTARIO

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ABSTRACT

Weddellite, $CaC_2O_4 \cdot (2+x)\ H_2O$, has been identified by X-ray powder diffraction from specimens found at the east side of Moore lake, in Lutterworth Township, Haliburton County, near Norland, Ontario. The mineral occurs as snow-white spherical aggregates up to 0.5 mm in diameter with altered amphibole and mica on marble. Oxalic acid produced by lichens presumably reacted with calcite to form weddellite, which probably is much more common than was formerly suspected.

Keywords: weddellite, calcium oxalate dihydrate, Norland, Haliburton County, Ontario, lichens.

SOMMAIRE

La weddellite, $CaC_2O_4 \cdot (2+x)\ H_2O$, a été identifiée à l'aide de la diffraction sur poudre à partir d'échantillons provenant de la rive est du lac Moore, dans le canton de Lutterworth, comté de Haliburton, près de Norland, en Ontario. Le minéral, associé à une amphibole et un mica altérés, se présente sur un marbre sous forme d'agrégats sphériques blanc-neige, pouvant atteindre 0.5 mm de diamètre. On peut supposer que l'acide oxalique produit par les lichens a réagi avec la calcite pour former la weddellite; celle-ci pourrait être beaucoup plus répandue qu'on ne l'avait pensé.

(Traduit par la Rédaction)

Mots-clés: weddellite, oxalate de calcium dihydraté, Norland, comté de Haliburton, Ontario, lichens.

INTRODUCTION

In 1970, several specimens from the Norland area of Ontario were submitted for identification to the Department of Mineralogy, Royal Ontario Museum by Miss Gayl Gibson of Toronto. A small amount of white material on some of the specimens gave X-ray powder-diffraction patterns identical to that given by weddellite, $CaC_2O_4 \cdot (2+x)H_2O$, (PDF 17-541). All that was known of the locality is that the specimens were collected on the east side of Moore Lake in Lutterworth Township, Haliburton County, Ontario; the closest large town is Norland, which is at the intersection of highways 35 and 503, about 55 km east of Orillia. Because the Ontario weddellite had not been observed *in situ,* no report was made of the occurrence at the time, although it was included in the compilation by Satterly (1977). Several visits to the area over the next few years failed to locate the occurrence.

DESCRIPTION OF SPECIMENS

Two specimens of the Ontario weddellite have been preserved in the mineral collections of the Royal Ontario Museum (numbers M29902 and M30238). They are very similar in appearance and are made up principally of calcite and altered amphibole and mica. The weddellite occurs as snow-white spherical aggregates dispersed unevenly on the surface of the specimens. The maximun diameter of the individual aggregates is 0.5 mm.

ORIGIN OF THE WEDDELLITE

Although it is considered a rare mineral, weddellite has been reported from a relatively large number of localities since it was first discovered in the Weddell Sea off the coast of Antarctica by Bannister & Hey (1936). In most of the occurrences summarized by Mandarino & Witt (1983), the weddellite has formed through organic processes such as pathological irregularities in the urinary tract of certain mammals, in plants that produce large quantities of oxalic acid and in bottom sediments where decaying organic material is present. The occurrence of weddellite on Precambrian rocks in Ontario seemed out of place in this general scheme.

After the identification in 1970, it was decided not to clean the specimens in case the somewhat loosely adhering weddellite might be removed along with any soil and other loose material. Consequently, the specimens appear quite dirty. Some of this dirt consists of decayed lichens and moss, which may have played an important part in the formation of the weddellite. Weddellite and whewellite ($CaC_2O_4 \cdot H_2O$) on Cretaceous ophiolitic rocks in the Appenines near Modena, Italy, were considered by Tirelli (1977) to have formed through the decay of

vegetal matter. Wilson *et al.* (1980) showed that an occurrence in Scotland of the rare oxalate *glushinskite* $MgC_2O_4 \cdot 4H_2O$ was due to the action of oxalic acid upon a serpentinite; the oxalic acid was produced by the lichen *Lecanora atra,* found growing on the outcrop. A detailed study of the weathering of the serpentinite by the lichen has been published by Wilson *et al.* (1981), who found both weddellite and whewellite as well as glushinskite in the lichen-derived material. Jones *et al.* (1980) noted the formation of weddellite and whewellite from the decomposition of labradorite induced by oxalic acid produced by a lichen *(Pertusaria corallina)* covering a basalt in Scotland. Graustein *et al.* (1977) showed that weddellite and whewellite occur in association with various fungi in the litter layer of forest soils from five widely separated locations in the U.S.A.

Long before any of these reports, Braconnot (1825) found, growing on a limestone, a lichen of which calcium oxalate made up nearly half the weight. Liebig (1853) named a similar material, which was found as a coating on the marble of the Parthenon in Athens, "thierschite" but its exact composition was unknown. Frondel (1962) studied an authentic specimen of Liebig's "thierschite" and found that the substance consists of "desiccated vegetal material, perhaps a lichen, that contained embedded microscopic grains of whewellite." Thus, thierschite is, in part, whewellite. Bannister & Hey (1936) examined a lichen spore which also contained crystals of whewellite.

Acting on the theory that lichens may have been the primary agent that caused the formation of the Ontario weddellite, another trip was taken to Lutterworth Township, to search for lichen-covered marble outcrops. At the first such outcrop visited near the east arm of Moore Lake, an extremely luxuriant growth of moss and lichens was observed. The moss was identified as *Thuidium abietinum* (Hedw.) B.S.G. and the blue-green lichen as *Lepraria finkii* (B. de Lesd.) R. Harris by Prof. J. Krug of the Department of Botany, University of Toronto. On a vertical surface of the marble, just below the moss- and lichen-covered area, was an abundance of white, powdery material. Although some of this adhered to the marble, much of it was quite intimately associated with the lichens. X-ray powder-diffraction patterns of this material showed that it is indeed weddellite. The exact location of the occurrence is on the south end of the peninsula between Moore Lake and East Moore Lake, in Lot 24, Concession V, Lutterworth Township, Haliburton County. The locality is about 8 km north of Norland, Ontario.

Conclusions

There is little doubt that the weddellite from Lutterworth Township was formed by oxalic acid secreted by lichens. This oxalic acid reacted with the calcite in the marble and produced the weddellite. While collecting other minerals over the years, the author has seen similar clumps of white, powdery material associated with lichens; this material probably consists of weddellite or other oxalates. Further studies of lichen-covered specimens of various kinds of rocks probably will disclose other occurrences of known oxalate minerals and possibly even new ones. In any case, weddellite and whewellite probably are much more common than was formerly thought.

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References

Bannister, F.A. & Hey, M.H. (1936): Report on some crystalline components of the Weddell Sea deposits. *Discovery Reports* **13,** 60-69.

Braconnot, H. (1825): De la présence de l'oxalate de chaux dans le règne minéral; existence du même sel en quantité énorme dans les plantes de la famille des lichens, et moyen avantageux d'en extraire l'acide oxalique. *Annales Chim. Physique* **28,** 318-322.

Frondel, C. (1962): Thierschite (= whewellite). *Amer. Mineral.* **47,** 786.

Graustein, W.C., Cromack, K. & Sollins, P. (1977): Calcium oxalate: occurrence in soils and effect on nutrient and geochemical cycles. *Science* **198,** 1252-1254.

Jones, D., Wilson, M.J. & Tait, J.M. (1980): Weathering of a basalt by *Pertusaria corallina. Lichenol.* **12,** 277-289.

Liebig, J. (1853): Ueber den Thierschit. *Ann. Chem. Pharm. (Liebig)* **86,** 113-115.

MANDARINO, J.A. & WITT, N.V. (1983): Weddellite from Biggs, Oregon, U.S.A. *Can. Mineral.* **21,** 503-508.

SATTERLY, J. (1977): A catalogue of the Ontario localities represented by the mineral collection of the Royal Ontario Museum. *Ont. Geol. Surv. Misc. Pap.* **MP70.**

TIRELLI, G. (1977): Weddellite e whewellite dell'Appennini modenese. *Mineral. Petrog. Acta* **21,** 93-100.

WILSON, M.J., JONES, D. & MCHARDY, W.J. (1981): The weathering of serpentinite by *Lecanora atra*. *Lichenol.* **13,** 167-176.

_____, _____ & RUSSELL, J.D. (1980): Glushinskite, a naturally occurring magnesium oxalate. *Mineral. Mag.* **43,** 837-840.

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