

SHORTER COMMUNICATIONS

COARSE-GRAINED RUTILE FROM NORTHERN NEWFOUNDLAND

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INTRODUCTION

Occurrences of rutile in metamorphic rocks of the Fleur de Lys Supergroup in White Bay, Newfoundland (50°N, 56°30'W) have been reported previously by Snelgrove (1938) and Betz (1948). Snelgrove mentions briefly that "rutile concentrations... are associated with pegmatite dykes which penetrate garnetiferous mica schists probably of Lower Paleozoic age. ... Ilmenite, rutile and hematite... occur in quartz veins and in schists as well as in granitic pegmatites. The chief localities are near Pigeon Island and Partridge Point." (Snelgrove 1938, p. 102) According to Betz (1948, p. 19), "rutile concentrations were prospected 30 to 40 years ago on Pigeon Island". Thus the rutile localities of White Bay have been known, at least to local inhabitants, since the early years of the century. The two localities mentioned in the early reports lie on the eastern shore of White Bay, about 25 miles (40 km) apart. (Pigeon Island: 49°51'50"N, 56°32'30"W; Partridge Point: 50°09'18"N, 56°09'30"W).

During the summer field-work of 1971, one of us (M.J. de W.) found several additional occurrences of rutile near Seal Cove, approximately 6 miles (10km) northeast of Pigeon Island. It is probable that other concentrations of the mineral are present in the Fleur de Lys metamorphic belt in the White Bay area. In view of the large size of some of the rutile crystals and the recent re-study of their tectonic environment (de Wit 1972), a brief description of the new localities appears warranted.

GEOLOGICAL SETTING

The rocks underlying the eastern shore of White Bay, from Partridge Point in the northeast to Hampden in the southwest, are part of the western division of the Fleur de Lys Super-

group (Church 1969). This group defines the western marginal zone of the Central Mobile Belt of the Appalachian fold belt in Newfoundland (Williams 1969). The rocks are part of a thick metasedimentary sequence, unconformably overlying a pre-Cambrian gneissose basement. Both were intensely deformed and metamorphosed in the Lower Paleozoic under conditions of the upper greenschist to lower amphibolite facies (de Wit 1972; de Wit in prep.).

The rutile crystals at the new localities are confined to thin tectonic inliers of the pre-Fleur de Lys gneisses, found in several places along the shore between Seal Cove and Big Cove (de Wit 1972); the best localities lie about 3 to 4 miles (5 to 6.5 km) south of Seal Cove. (Loc. A: 49°54'41"N, 56°26'00"W. Loc. B: 49°54'07"N, 56°26'33"W, Nat. Topog. Ser. 12 H/16 West, Baie Verte). The mineral occurs in structurally-produced metamorphic segregations, closely associated with the basic members of the gneisses.

Near Bear Cove (49°50'30"N, 56°34'00"W; 12 H/15 East, Jackson's Arm), minor concentrations of hematite or ilmenite and magnetite together with sphene and/or rutile occur within the metasediments of the Fleur de Lys Supergroup, where they are commonly confined to original bedding planes. The Fe-Ti minerals in these rocks are probably derived from the basement and are sedimentary in origin. Locally, these minerals were remobilized to form structurally-produced metamorphic segregations similar to those in the basic gneisses; these are probably the "granitic pegmatites" referred to by Snelgrove (1938).

Where the metasediments are calcareous, sphene is consistently more abundant than rutile, except where the latter has been protected by large garnet porphyroblasts; the main rutile concentrations are found in rocks relatively poor in calcium.

DESCRIPTION

The rutile forms up to 40% of the lens-like metamorphic segregations which are locally almost one meter across. The crystals are elongated,

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prismatic, dark reddish brown in color, with an adamantine to metallic lustre. They range in length from about 2 cm to over 10 cm; the largest crystal in our possession is 15 cm long and 2 cm thick. The crystals show distinct striation parallel to the c-axis, but their external morphology is not well-developed; many of them are slightly to strongly bent, and fracturing is common. Locally, individual crystals "fuse" together to form crudely platy or coarsely granular masses. The rutile is embedded in a granular matrix consisting of pale buff-colored albite and fine-to coarse-grained platy chlorite or chloritized biotite, with minor reddish garnet. In a few places, poorly-formed tabular crystals of albite reach 1 cm in length.

X-ray and physical data for the rutile are given in Table 1. Cell dimensions were calculated from diffractometer data obtained by triplicate step-scanning in steps of 0.01° over the (002) and (220) peaks, using Philips standard silicon disc for calibration before and after each scan; d -spacings calculated on the basis of these cell dimensions agree closely with spacings derived from measurement of diffraction angles obtained by three complete oscillations over the appropriate range on a Philips diffractometer. Intensities measured on the charts have been standardized to $I(110) = 100$.

The partial XRF analysis was done by Mr. J. Vahtra of Memorial University. Measured density is an average of six fragments, determined on a Berman density balance.

ORIGIN

Rutile is a relatively common mineral in metamorphic assemblages, but mainly under P-T

TABLE 1. RUTILE FROM SEAL COVE, WHITE BAY, NEWFOUNDLAND- X-RAY AND PHYSICAL DATA

hkl	$d_{\text{meas}}^{\text{\AA}}$	$d_{\text{calc}}^{\text{\AA}}$	I
110	3.244	3.245	100
101	2.483	2.485	37
200	2.293	2.295	5
111	2.184	2.185	19
210	2.052	2.052	6
211	1.686	1.686	35
220	1.623	1.623	16
002	1.478	1.478	5
310	1.451	1.451	4
301	1.359	1.359	9
112	1.346	1.345	5

$a=4.589_2 \pm 0.001_4$, $c=2.956_4 \pm 0.000_6 \text{\AA}$ (Philips diffractometer, Cu radiation, Ni filter).

S.G. (meas.) = 4.266 ± 0.022 , S.G. (calc.) = 4.261

Partial XRF analysis: total Fe as FeO 2.7%, MnO 0.2%, Nb 200 ppm.

conditions of the granulite facies (Winkler 1967), and seldom in such large crystals. One possible way of forming rutile is by oxidation and breakdown of ilmenite:

$4 \text{FeTiO}_3 + \text{O}_2 \rightarrow 4 \text{TiO}_2 + 2 \text{Fe}_2\text{O}_3$ (Buddington & Lindsley 1964). Disseminated Fe-Ti oxides are present in the basic gneisses of the basement; we believe that these minerals are the original source of both the coarse rutile and the detrital and recrystallized Fe-Ti oxides in the metasediments. Although magnetite and platy ilmenite are also found occasionally in metamorphic segregations, the minerals do not appear in close association with rutile. The formation of large crystals of rutile would thus require effective separation of Ti and Fe. It is possible that some of the iron produced by the breakdown of ilmenite may have been consumed by further reactions with silicate minerals, while Ti, in a low-calcium environment, could be transported in solution or by slow diffusion to areas of low pressure at the crests and troughs of folds; a long period of relatively uniform stress would be necessary to allow the growth of such large crystals.

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