

OCCURRENCE, OPTICAL PROPERTIES AND CHEMICAL
COMPOSITION OF HUTTONITE

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INTRODUCTION

During a detailed study of a series of Recent and sub-Recent beach and fluvio-glacial sands and gravels from South Westland, New Zealand, the writer observed a mineral of unique properties in an assemblage that consisted in the main of scheelite, cassiterite, usually a tantalian variety, uranothorite, zircon, ilmenite, and gold. After having determined the mineral to be a thorium silicate with physical properties quite distinct from those of tetragonal thorite, the writer handed over a small sample of pure material to Professor Adolf Pabst of the University of California with the suggestion that it might be profitable to examine this more fully. Professor Pabst very kindly agreed to undertake a crystallographic study of the mineral with the result that he has found the mineral to be monoclinic with the same symmetry as monazite.

OCCURRENCE

Huttonite has been recognized in sands from Harihari, Saltwater Creek, Okarito, Five Mile Beach, Bruce Bay, north and south of the mouth of the Waikukupa River, and Gillespie's Beach, but it appeared to be more plentiful in the Gillespie's Beach area than elsewhere. In each of these occurrences it is concentrated in the finer size fractions and careful searching did not reveal any grains with diameters in excess of 0.20 mm., but at the same time, it showed that it was more plentiful in the -60 +120 and -120 +230—mesh screenings than in -230—mesh material.

PHYSICAL PROPERTIES

In a preliminary survey of sands from South Westland the writer mistook huttonite for scheelite but after closer observation found it to differ from the associated scheelite in a number of ways, chief among which are the following:

- (1) Consistent biaxial character although the optic axial angle is small.
- (2) A distinct cleavage or parting nearly normal to the acute bisectrix causes preferred orientation of the anhedral grains when mounted in refractive index media. In the interference figure obtained from such a grain the point of emergence of the optic axis lay at or just outside the edge of the field of view. A second cleavage is present but its orientation relative to the first was not known; this appears to be orthopinacoidal cleavage, according to Pabst.

- (3) A moderate dispersion of the optic axes with $r < v$ is a distinctive feature of huttonite. The preferred orientation with Bx_a nearly normal to the microscope stage, combined with the small optic axial angle, makes the dispersion more obvious than it might otherwise be.
- (4) Grains of huttonite have a profound and rapid effect on the emulsion of nuclear track plates when embedded therein.
- (5) Ultraviolet light of short wave-length (2540 Å) produces a distinctive fluorescence in both minerals, a characteristic blue color for scheelite, and a dull white color with a pink tinge for huttonite.

When it was realized that some mineral quite distinct from scheelite was present, an attempt was made to isolate it and this end was achieved fairly readily since it was concentrated with scheelite, zircon, apatite, and cassiterite, when the sands containing it were fractionated first in methylene iodide and subsequently electromagnetically. By careful adjustment of field strengths huttonite may be almost entirely segregated from the associated constituents just mentioned. But it was found that an absolutely pure sample could only be prepared by hand-picking in oblique illumination beneath a binocular microscope.

Since both huttonite and scheelite have a similar aspect beneath a binocular microscope satisfactory differentiation between the two minerals may be accomplished in either of two ways:

- (a) If the concentrate is treated with boiling HCl for two or three minutes a canary yellow coating of the trioxide is produced on the surfaces of the scheelite; huttonite is quite unaffected by such treatment. The acid-treated material is then hand-picked in oblique illumination from an ordinary light source.
- (b) In short wave-length ultraviolet light, *vis.* 2540 Å., scheelite fluoresces with a distinctive blue color, zircon, with a golden yellow color, whereas huttonite exhibits a faint, but distinct, dull white color with a pink tinge. In this instance hand-picking may be carried out in oblique illumination from a source of ultraviolet light.

The following properties have been determined for huttonite from Gillespie's Beach:

$$\begin{aligned}\alpha &= 1.898^* \pm 0.003 \\ \beta &= 1.900 \text{ (by calc.)} \\ \gamma &= 1.922 \\ \gamma - \alpha &= 0.024\end{aligned}$$

Dispersion: Moderate with $r < v$

$$2V = 25^\circ \pm 1^\circ.$$

Optic sign: Positive.

Color: Colorless to very pale cream.

$$D_{20}^c = 7.1 \pm 0.1$$

* Refractive indices for scheelite from Gillespie's Beach.

$$\alpha = 1.919; \gamma = 1.935; \gamma - \alpha = 0.016$$

CHEMICAL PROPERTIES

A small sample of carefully purified material, was partially analyzed by Mr. F. T. Seelye, and subsequently a second sample with identical physical properties, and separated from the same source, was analyzed by the present writer. These analyses are combined and set out in Table 1.

TABLE 1. ANALYSIS OF HUTTONITE, GILLESPIE'S BEACH, SOUTH WESTLAND, NEW ZEALAND

ThO ₂	76.6
UO ₂	nil.
SiO ₂	19.7
Fe ₂ O ₃	1.2
CaO	nil.
MgO	nil.
MnO	trace
P ₂ O ₅	trace
Ce ₂ O ₃ etc.	2.6
H ₂ O (total)	nil.
	<u>100.1</u>

The mineral appears to be completely unaffected after treatment with hot concentrated hydrochloric acid for fifteen minutes, but the very finely powdered material is slowly dissolved by repeated evaporations in concentrated sulfuric acid. A fusion with sodium carbonate must be carried out with the greatest care since a portion of the powder invariably remains after solution of the fusion cake; this residue must be reground and refused with carbonate once again.

PROVENANCE OF HUTTONITE

Huttonite has not been found *in situ* but on account of the nature of the associated heavy minerals, the ultimate source could only have been the low-grade schists or the associated but sparsely distributed pegmatitic veins of the alpine range a few miles to the east of the Bruce Bay-Gillespie's Beach area. Neither huttonite nor uranothorite has been recognized so far as a constituent of these rocks but since none of the pegmatite veins examined are of the complex type, and both the schists and radioactive mineral sands have considerable lateral extent, the source for these two minerals is believed to be the schists.

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