

As was the case for andalusite, this dumortierite rock is used in its original state without concentration; in fact, owing to its fine grain and intimate relation to the muscovite, concentration would probably be impossible.

ACKNOWLEDGMENT

Like andalusite, the discovery and development of this dumortierite deposit and its rise to the rank of a mineral of commercial importance, are both largely the direct result of patient and persistent search for the seemingly impossible thing, and too much credit in this connection can not be given Dr. J. A. Jeffery, President of the Champion Porcelain Company.

LITHIOPHILITE AND OTHER RARE PHOSPHATES FROM PORTLAND, CONNECTICUT*

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In studying the mineralogy and paragenesis of the pegmatite at the Strickland Quarry, Collins Hill, Portland, Connecticut, several lithium minerals associated with the manganese phosphates were found. The minerals occurring together are spodumene, lepidolite, manganapatite, lithiophilite, dickinsonite and hureaulite in albite and quartz. Only very small amounts of dickinsonite and hureaulite are found with the lithiophilite which is itself not abundant. W. G. Foye¹ has reported the occurrence of lithiophilite from this locality but gives no data.

Through the generosity of Professor Foye of Wesleyan University, the large specimen of lithiophilite (Wesleyan Museum No. 10615) was placed at the writer's disposal for chemical study. The specimen consists of a large mass of light orange colored lithiophilite without crystal form, in platy albite with muscovite, quartz and a very little dickinsonite as accessory minerals.

Pure material for analysis was separated very easily by hand picking and examining the fragments under the microscope to insure a homogeneous sample. Examination showed the indices of refraction to be between 1.66 1.67. The analysis follows:

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¹ W. G. Foye, *Am. Mineral.*, 5, 120 (1920).

	I	II	Mean	Ratios	
MnO	40.20	40.05	40.13	0.566	} .639 = 2.02
FeO	5.05	5.27	5.16	0.072	
CaO	0.07	0.09	0.08	0.001	
Li ₂ O	8.63	8.59	8.61	0.288	} .319 = 1.01
Na ₂ O	0.53	0.45	0.49	0.008	
H ₂ O	0.41	0.41	0.41	0.023	
P ₂ O ₅	44.91	44.90	44.90	0.316	= 1
Insoluble	0.16	0.15	0.16		
	99.96	99.91	99.94		

Formula: $\text{Li}_2\text{O} \cdot 2(\text{Mn,Fe})\text{O} \cdot \text{P}_2\text{O}_5$ or $\text{Li}(\text{Mn,Fe})\text{PO}_4$.

In order to record the complete method for the analysis of phosphates containing FeO, MnO, CaO, MgO the details for their separation are also given.

To determine the constituents, other than the alkalis and water, dissolve about 1 gm. in HCl, filter off the insoluble residue, wash and weigh it; add some HNO₃ to the filtrate and remove the acids by evaporation. Take up in water with addition of a little HNO₃, if necessary; precipitate while hot with Na₂CO₃, filter and wash moderately. The filtrate, which is called A, may be slightly turbid without objection. Dry the precipitate, ignite in platinum, burning the filter paper separately and fuse with 4-5 parts of Na₂CO₃ or K₂CO₃. (In case the substance has no insoluble residue it is fused directly with Na₂CO₃.) Treat the mass with hot water, adding a few drops of alcohol in order to reduce manganic acid. Filter and wash with hot water. The filtrate is added to A, the combined solution is acidified with HCl, heated to boiling until CO₂ is removed, then a slight excess of NH₄OH is added and the small precipitate of phosphate is collected and washed. The filtrate is called B. The small precipitate is dissolved in HCl, as is also the main residue of oxides obtained by fusion and the solutions are united. Nearly all the acid is removed by evaporation and a precipitation of basic ferric acetate is made in the usual manner. This precipitate contains a little phosphate. Dry it, ignite it separately from the paper and fuse it with alkaline carbonate to which a very little KNO₃ is added. Treat the mass with hot water, filter and wash. This filtrate is called C. Dissolve the residue of Fe₂O₃ in HCl, precipitate with NH₄OH, wash free from chlorides, weigh Fe₂O₃ and calculate FeO. The filtrate from the Fe(OH)₃ should be treated with (NH₄)₂S, and if traces of MnS separate after standing they should be collected, dissolved in

HCl and added to the main manganese solution mentioned beyond, just before precipitating with HNa_2PO_4 .

Acidify the solution C, boil off CO_2 and add it to B. Determine P_2O_5 in the united solution with magnesium mixture as usual, or better determine P_2O_5 in a separate sample with molybdic acid mixture.

Heat the filtrate and washings from the basic ferric acetate precipitate, after all the iron has been removed, without diminishing the original volume by concentration, and add a rather large volume of bromine water. Heat upon the steam bath until the precipitate becomes flocculent, filter and wash with hot water. Test the filtrate by adding more bromine water and some sodium acetate, and then determine any CaO and MgO that it may contain by the usual methods.

Dissolve the MnO_2 precipitate in SO_2 and warm water upon the filter, then determine MnO in the usual way as $\text{Mn}_2\text{P}_2\text{O}_7$. Alkalies are determined in the usual manner. H_2O is determined by the method of Penfield or by heating in a combustion tube and collecting the water in weighed CaCl_2 and P_2O_5 tubes.

S. L. Penfield² pointed out the isomorphism between triphylite and lithiophilite. Recently K. K. Landes³ has found the lithiophilite from Buckfield, Maine, to be very near the pure lithiophilite end member with only 2.94% FeO. The material from Portland, Connecticut is another link in the isomorphous series.

On one specimen of spodumene there were small masses of lithiophilite containing small, micaceous flakes of green dickinsonite. The indices of refraction of the dickinsonite were slightly above and below 1.66. The mineral showed the perfect basal cleavage. Not enough material was available for a chemical study.

The rare mineral hureaulite was identified on one specimen in very small quantities with lithiophilite. The hureaulite is deep orange-red in color and its indices of refraction are between 1.65 and 1.66. The mineral easily fuses to an orange non-magnetic globule. A partial quantitative analysis was made on a very small sample (0.03 gm.) and the hureaulite from Portland, Connecticut, proved to be almost identical chemically with the Branchville material described by Brush and Dana.⁴

² S. L. Penfield, *Am. Jour. Sci.*, **17**, 226-9 (1879).

³ K. K. Landes, *Am. Mineral.*, **10**, 382-3 (1925).

⁴ Brush and Dana, *Am. Jour. Sci.*, **39**, 207-11 (1890).

Occurring near the lithiophilite is dark bluish-green apatite. A sample was selected by careful hand picking and the manganese determined. There was 8.52% MnO present. Associated with the apatite were albite, quartz, columbite and muscovite.

When more of these phosphates are found it is hoped that a complete chemical investigation may be undertaken. In conclusion I wish to express my thanks to Professor W. G. Foye for the lithiophilite for analysis and to Professor H. W. Foote for his advice and encouragement during this investigation.

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences of Philadelphia, February 11, 1926

A stated meeting of the Philadelphia Mineralogical Society, attended by twenty-one members and six visitors, was held on the above date. Vice-president H. W. Arndt presided.

An amendment to the By-Laws, providing that hereafter stated meetings shall be held on the first Thursday instead of the second Thursday of each month, was unanimously adopted. It will go into effect with the April meeting.

The society was then addressed on the subject of *Mining Districts in Michigan and Ontario* by the secretary, who described his experiences in collecting minerals while attending the summer session of the University of Michigan at Ann Arbor in 1925, and a subsequent three weeks trip through the iron and copper districts of northern Michigan and the nickel and silver regions of Ontario, returning to Philadelphia by way of Toronto and Niagara Falls.

Among the localities visited from Ann Arbor were Maybee, Monroe, and Oakwood, Michigan, and the crystal cave on the island of Put-in-Bay, in Lake Erie.

The speaker then travelled northward to Ishpeming, Michigan, and visited the Holmes Mine of the Cleveland Cliffs Iron Company. In the Keweenaw Peninsula copper district, centered about Houghton, Michigan, many mines were found to be closed down, but a few specimens were collected.

In the Sudbury nickel district of Ontario the Creighton and Worthington Mines were visited, as were also the smelters of the International and the Mond Nickel Companies. At Cobalt, Ontario, many specimens were collected from the dumps and stamp mill of the Nipissing Mine.

An enjoyable sojourn at the Frontier Mine, Silver Centre, Ontario, as the guest of the Mining Corporation of Canada, Ltd., was followed by an interesting three-day hike through the woods in the vicinity, after which the journey southward to Toronto was made by rail. After a visit to the Royal Ontario Museum of Mineralogy at Toronto, and a sojourn of a few days at Niagara Falls, the speaker returned to Philadelphia.

The talk was illustrated by numerous lantern slides and by a large number of specimens, including samples of celestite, halite, iron ores, native copper, copper arsenides, pentlandite, gersdorffite, niccolite, smaltite, wire silver, and argentite.

HORACE R. BLANK, *Secretary*