

NOTES AND NEWS

AMPHIBOLE FROM THE PURCELL SILLS, BRITISH COLUMBIA¹

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A great band of pre-Cambrian (Beltian) sediments, 30,000 feet or more thick, is exposed in the southeast corner of British Columbia. During late Beltian time these sediments were intruded by the Purcell sills and associated dykes.³

The Purcell sills vary in size from thin sheets of limited extent to huge bodies over a thousand feet thick and many miles long. The normal rock is a fine to medium grained diorite in which lath-shaped amphiboles appear conspicuously in a confused aggregate of plagioclase and accessory minerals. It has approximately the following average mineralogical composition:

Plagioclase.....	40%
Amphibole.....	50
Quartz.....	4
Ilmenite and magnetite.....	2
Other accessories.....	4
	<hr/>
	100%

Amphibole is the most abundant constituent and, in certain phases, forms over 70 per cent of the rock. It varies considerably in grain size, but frequently develops as plume-shaped crystals one to two inches long. As a preliminary examination showed it to differ considerably from any amphibole described in the literature, its optical properties were carefully determined in thin sections and by the oil immersion method as outlined by Larsen,⁴ and two partial chemical analyses were made.

The amphibole was found to be of two different types designated as "A" and "B," both of which never occur in the same sill.

¹ Published by permission of the Director of the Geological Survey of Canada.

² Balch Graduate School of the Geological Sciences, California Institute of Technology, Pasadena, California. Contribution No. 141.

³ Daly, R. A., North American Cordillera, 49th Parallel: *Geol. Sur. Can.*, Mem. **38**, 1913.

Schofield, S. J., Geology of the Cranbrook Map Area, B.C.: *Geol. Sur. Can.*, Mem. **76**, 1915.

Rice, H. M. A., Geology of the Cranbrook District, British Columbia: Unpublished Thesis, Calif. Inst. of Tech., 1934.

⁴ Larsen, Esper S., The Microscopic Determination of the Non-Opaque Minerals: *U. S. Geol. Sur.*, Bull. **679**, 1921.

The optical and chemical properties are given in the following tables:

CHEMICAL ANALYSES ⁵		
	Type "A"	Type "B"
SiO ₂	42.80%	44.66%
Al ₂ O ₃	11.26	12.64
Fe ₂ O ₃	15.06	15.13
FeO	14.21	8.85
MgO	3.82	4.85
CaO	10.08	10.70
Na ₂ O and K ₂ O	1.92	1.80
H ₂ O at 100°C.	0.16	0.15
H ₂ O at 300°C.	0.38	0.35
	99.69	99.13

The deficiency shown in both analyses is represented in part by manganese which, although not determined, is present in both types of amphibole.

OPTICAL PROPERTIES						
Type "A"						
	α	β	γ	$\gamma - \alpha$	Z/\C	Calculated 2V Sign
1. At base of sill.	1.661	1.674	1.676	.015	15°	43° neg.
115' from base.	1.662	1.679	1.684	.022	18°	57° "
Close to top.	1.666	1.678	1.688	.024	18°	84° "
2. Coarse-grained sill.	1.658	1.679	1.682	.024	17°	41° "
3. 61' from base.	1.660	1.677	1.681	.021	17°	51° "
114' from base.	1.660	1.678	1.683	.023	17°	55° "
4. From ore.	1.659	1.675	1.678	.019	17°	46° "
Average Type "A"	1.661	1.677	1.682	.021	17°	58° "
Type "B"						
5. Center of Sill.	1.644	1.656	1.663	.019	18°	76° neg.
Near top.	1.638	1.654	1.658	.020	18°	53° "
6. Large sill.	1.641	1.660	1.666	.025	19°	58° "
Average Type "B"	1.641	1.657	1.662	.021	18°	58° "

1. Sill about 225 feet thick near road four miles southwest of Cranbrook.
2. Sill crossing road two miles south of Aldridge.
3. Upper sill, about 200 feet thick, exposed in bluff northeast of Lumberton.
4. "Differentiate" ore from the Mystery Mine, Alki Creek, above St. Mary's Lake.
5. Lower sill exposed in bluff northeast of Lumberton.
6. Large sill from top of butte southeast of Sullivan concentrator.

⁵ Ed Eisenhauer, analyst.

Pleochroism		
	Type "A"	Type "B"
X	Pale yellow	Pale yellow
Y	Olive green	Olive green
Z	Greenish blue	Greenish blue

Absorption	
Y > Z > X	Y > Z > X

Both types resemble common hornblende, but have a higher iron content, a smaller extinction angle, a different pleochroism, and "B" lower indices of refraction. It is noteworthy that the relations $\text{Fe}_2\text{O}_3 > \text{FeO} > \text{Al}_2\text{O}_3$ (Type "A") and $\text{Fe}_2\text{O}_3 > \text{Al}_2\text{O}_3 > \text{FeO}$ (Type "B") are of rare occurrence in amphiboles of the hornblende group and have been reported only from alkaline rocks. In this case being described the rock is a normal diorite.

No varieties intermediate between the two types are known. "A" occurs in the sills in association with plagioclase varying from oligoclase to acid andesine (Ab 88 per cent to Ab 60 per cent), while "B" is found with plagioclase varying from basic andesine to acid labradorite (Ab 54 per cent to Ab 46 per cent).

In some of the Purcell sills small ore deposits occur composed almost entirely of chalcopyrite and pyrrhotite with amphibole as the only important gangue mineral. This amphibole is identical with type "A." The abundance of this mineral in the ore, its similarity with a primary constituent of the sills, and the fact that it is, in part at least, clearly cutting the sulphides suggest a close relationship between the ore and the sills.

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