29. *Hypersthene in a Rock of Amphibolite Facies from Tanzawa Mountainland, Kanagawa Prefecture, Japan.*

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Hypersthene occurring as a constituent of a rock of amphibolite facies was studied chemically and optically with the result described in the present paper.

The rock occurs near the junction of quartz-diorite and the amphibolite derived from basic volcanic rocks of the Misaka series¹⁾ (older Miocene), about 150 m. south of the small village of Hôkizawa, Tanzawa mountainland, Kanagawa Prefecture, central Japan.

Where the normal amphibolite of dark green colour comes into direct contact with the plutonic mass, there occur occasionally irregular patches made up of ill-defined alternate bands of dark brown and dark green colours. Within these patches are found network veinlets and pockets of quartz-dioritic material, suggesting a considerable amount of metasomatic change.

Microscopical examination reveals that the dark brown bands are rich in hypersthene and cummingtonite, while the dark green ones are rich in green hornblende, grading to the normal amphibolite of the surrounding zone.

The investigated specimen (H. K. 39051409a) consists of a granoblastic aggregate of plagioclase (An 58-48), hypersthene, cummingtonite, green hornblende, and magnetite. The different kinds of the ferromagnesian silicate minerals tend to concentrate in different bands. In some parts of the slides, cum-

Hypersthene-amphibolite showing poikiloblastic hypersthene, granular plagioclase, and hornblende (left above). $\times 62$

1) Ken-ichi Sugi: Jap. Jour. Geol. Geogr., Vol. 9, 1931. p. 126.

mingtonite and hypersthene grow up in such a coarseness as to include numerous grains of plagioclase in poikiloblastic fashion (see the annexed photograph).

Cummingtonite and green hornblende form parallel intergrowth, while hypersthene is often enclosed by the former amphibole. According to K. Sugi¹⁾, the normal amphibolite of the area is made up of green hornblende and plagioclase ranging in composition from An₈₅ to An₅₈. The more sodic nature of the investigated rock may have been resulted from the metasomatism by the quartz-diorite magma.

The hypersthene was separated from the rock by the electromagnetic mineral separator and Clerici's solution. The pure material thus obtained was chemically analysed by Kakuzô Tada and Masa-aki Huzimoto, with the result given in Table 1 (I), together with the calculated number of metal atoms on the basis of six oxygen atoms and the metasilicate ratio. In the same table, three chemical analyses of hypersthene from volcanic rocks are cited for comparison (II-IV).

Table 1.

	I	II	III	IV	No. of metal atoms for I.		
SiO ₂	53.20	52.45	53.32	53.51	Si 1.969	0.031 0.022	2.000
Al ₂ O ₃	1.15	1.83	0.88	0.40	Al 0.053		
Fe ₂ O ₃	none	1.21	0.71	1.50	Fe ⁺⁺ 0.668		
FeO	21.64	18.92	19.91	19.57	Mg 1.250	0.031 0.022	1.999
MgO	22.50	21.85	23.26	23.12	Ca 0.031		
CaO	0.82	0.60	0.74	0.86	Ti 0.004		
Na ₂ O	n. d.	0.35	n. d.	n. d.	Mn 0.024		
K ₂ O	n. d.	0.07	n. d.	n. d.			
H ₂ O+	n. d.	n. d.	n. d.	n. d.			
H ₂ O-	n. d.	n. d.	n. d.	n. d.			
TiO ₂	0.13	0.37	0.05	0.06			
P ₂ O ₅	n. d.	—	n. d.	n. d.			
MnO	0.78	0.86	1.22	1.05			
Total	100.22	98.51	100.09	100.07			
Wt. %	Wo 2	1	2	2			
	En 57	59	59	59			
	Fs 41	40	39	39			

- I. Hypersthene from amphibolite (H. K. 39051409a). Hôkizawa, Kanagawa Prefecture. Analysts, K. Tada and M. Huzimoto.
- II. Hypersthene (phenocrysts) from hypersthene-hornblende-andesite (pumice). North-eastern foot of Hutatu-dake, Haruna volcano, Gunma Prefecture. Analysts, George Kozima and Sadakatu Taneda: Jour. Geol. Soc. Japan, Vol. 52, 1946, p. 61.
- III. Hypersthene (phenocrysts) from hypersthene-hornblende-dacite (tuff). (H. K. 37061901). Near Kentyô-zi, Kamakura city, Kanagawa Prefecture. Analysts, K. Tada and M. Huzimoto. H. Kuno: Jour. Geol. Soc. Japan, Vol. 48, 1941, p. 227.
- IV. Hypersthene (phenocrysts) from oxyhornblende-augite-hypersthene-andesite (tuff). Sitisei-zan, north Formosa. Analysts, K. Tada and M. Huzimoto. H. Kuno: Jour. Geol. Soc. Japan, Vol. 48, 1941, p. 227.

1) K. Sugi: op. cit., p. 119.

These hypersthenees are chosen not only because they are similar in the ratio En:Fs to the hypersthene from the amphibolite but also because they occur in rocks showing nearly the same mineral assemblage as the former rock (hypersthene-hornblende-plagioclase-magnetite ($\pm$ augite)).

No marked difference can be noted between the pyrogenic hypersthenees and that of the amphibolite in the amounts of Al_2O_3 , Fe_2O_3 , CaO, TiO_2 , and MnO.

The optical properties of the present hypersthene are shown in Table 2, together with those of the hypersthenees above cited. In these properties, the four hypersthenees show a marked similarity to one another, except that the hypersthene from the amphibolite is slightly higher in birefringence $\gamma - \alpha$ than the others.

Table 2.

I.			II.	III.	IV.
Min.	Max.	Aver.	Aver.	Aver.	Aver.
$\beta = 1.692$	1.694	1.693	1.692	1.695	1.694
$\beta = 1.703$	1.705	1.704	1.701	1.704	1.703
$\gamma = 1.708$	1.710	1.709	1.706	1.707	1.707
$\gamma - \alpha =$		0.016	0.014	0.012	0.013
$(-)2V = 57^\circ$	59°	58°	60°	64°	60°
$\rho > v$ distinct			$\rho > v$	$\rho > v$	$\rho > v$
Pleochroism distinct:			Pleochroism distinct.		
X—pale reddish brown					
Y—pale greenish brown					
Z—pale green					
$X > Y > Z$					

I—IV refer to those of Table 1.

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