THE AMERICAN MINERALOGIST, VOL. 55, MARCH–APRIL, 1970

*P*2 OMPHACITE, INTERMEDIATE IN COMPOSITION BETWEEN JADEITE AND HEDENBERGITE, FROM METAMORPHOSED ACID VOLCANICS, BOUEHNDEP, NEW CALEDONIA

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ABSTRACT

*P*2 omphacite with the composition $Jd_{46}Hd_{42}Ac_2Di_4$ is described from metamorphosed acid volcanics within New Caledonian blueschists. Chemical composition, physical properties and X-ray data are given for the omphacite.

Although Clark and Papike's (1968) recent crystal-chemical definition of omphacite allows complete substitution of Fe^{2+} for Mg in the octahedral site, all previously described omphacites have consisted essentually of solid solutions between jadeite and diopside with only minor hedenbergitic and acmitic components. An omphacite intermediate between jadeite and hedenbergite has been found in the blueschists of northern New Caledonia.

The ferroan omphacite is widespread in the "Formation de Bouehndep," a formation of acid volcanics interstratified with pelitic schists and metamorphosed basic volcanics within the epidote subzone of Espirat (1963) (equivalent to the epidote-rutile blueschist facies of Taylor and Coleman, 1968). The complete assemblage of the Bouehndep rock is quartz—albite—K-feldspar—phengite—omphacite—sphene—pyrite; some specimens have in addition accessory almandine and ferroglaucophane (Black, 1970). Chemical analysis and C.I.P.W. norm for the host rock of the analysed omphacite are given in Table 1.

Omphacite occurs as light-green pleochroic crystals frequently zoned to a deeper green on the outer margins. Physical properties of the omphacite are: $\alpha=1.696$, $\beta=1.703$, $\gamma=1.720$, $\gamma\wedge c=46°$, $2V_\gamma=65-73°$, dispersion $r>v$, $\rho=3.43$. Errors are estimated to be ±0.002 for refractive indices, $\pm2°$ for angular measurements, and ±0.02 for density determinations.

Single crystal X-ray diffraction photographs were taken of two omphacite crystals and the following unit-cell parameters obtained:

Crystal 1. $a=9.594$ Å, $b=8.820$ Å, $c=5.272$ Å, $\beta=106°45'$
Crystal 2. $a=9.593$ Å, $b=8.819$ Å, $c=5.277$ Å, $\beta=106°55'$

Estimated errors are 0.3 percent for linear and 10′ for angular dimensions. Both crystals belonged to space group *P*2.

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TABLE 1. CHEMICAL COMPOSITION AND C.I.P.W. NORM OF OMPHACITE BEARING METAMORPHOSED ACID VOLCANIC (A.U. 9992)

SiO_2	78.8	Q	53.6
TiO_2	0.3	C	4.3
Al_2O_3	11.6	Or	11.7
Fe_2O_3	0.3	Ab	21.0
FeO	2.0	An	3.1
MnO	0.03	En	1.0
MgO	0.4	Fs	2.9
CaO	1.2	Mt	0.4
Na_2O	2.5	Il	0.6
K_2O	2.0	Ap	0.9
P_2O_5	0.4		
H_2O+	0.8		
H_2O-	0.2		
Total	100.53		

The omphacite was analyzed *in situ* in polished thin-sections with an A.R.L.-E.M.X. electron microprobe using natural analysed pyroxenes as standards. The crystals were zoned with an increase in iron and a decrease in aluminum towards their outer margins; other components showed little discernible variation. Maximum and minimum values obtained for iron and aluminum are: total iron as $FeO = 17.8 - 14.0$, and $Al_2O_3 = 13.0 - 8.7$ weight percent. Sufficient material was separated for a determination of the ferrous: ferric ratio of the omphacite. The combined results of the electron microprobe (average of 50 points) and the wet-chemical analysis are listed in Table 2.

Recalculation of the analysis into pyroxene components using the method of Edgar *et al.* (1969) gives a composition for the omphacite of $Jd_{46}Hd_{42}Ac_4Di_4$.

TABLE 2. CHEMICAL COMPOSITION OF BOUEHNDEP OMPHACITE

SiO_2	52.9	Si^{IV}	1.99	2.00
TiO_2	0.05	Al^{IV}	0.01	
Al_2O_3	11.1			
Fe_2O_3	3.0	Al^{VI}	0.48	1.03
FeO	13.1	Fe^{III}	0.08	
MnO	0.5	Fe^{II}	0.41	
MgO	0.7	Mn	0.02	
CaO	10.9	Mg	0.04	
Na_2O	7.1			
K_2O	—	Ca	0.44	0.96
Total	99.35	Na	0.52	

The occurrence of hedenbergitic rather than acmitic omphacite is undoubtably due to the unusually low $f(O_2)$ in the metamorphosed acid volcanics as is evidenced by the low oxidation ratio of the parent rock and by the presence of ferroglaucophane (Black, 1970).

*P*2 omphacite has been previously recorded only from rocks of basaltic composition and characteristically from "Type C eclogites" (Coleman *et al.*, 1965) associated with circumpacific blueschist belts (Clark and Papike, 1968). In New Caledonia, crystallization of *P*2 omphacite is relatively independent of bulk rock composition and the "eclogitic" assemblage *P*2 omphacite-almandine has been found in metamorphosed acid volcanics and pelites as well as in metamorphosed basaltic rocks, although the assemblage is confined to the high pressure relatively high temperature blueschist facies of Taylor and Coleman (1968) and can be regarded as diagnostic of crystallization in such a pressure-temperature environment. The widespread occurrence of *P*2 omphacite-almandine in a variety of high grade blueschist lithologies is also evidence that the "Type *C* eclogites" (metabasalts) of Coleman *et al.* (1965) have crystallized under the same physical conditions as the enclosing blueschists.

ACKNOWLEDGMENTS

I am grateful to Mrs J. A. Konnert (U. S. Geological Survey) for the single crystal X-ray data, to Mr. T. H. Wilson (Auckland University) for the bulk rock chemical analysis, and to Mr E. Jarosewich (U. S. National Museum) for the ferrous iron determination of the omphacite. This study was supported by a N.R.C.-S.I. Postdoctoral Research Associateship.

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