

The Composition of Liquids Formed by Partial Melting of an Eclogite at High Temperatures and Pressures. A mixture consisting of 60 wt.% garnet and 40 wt.% omphacite was prepared from minerals separated from an eclogite nodule. The eclogite nodule was from the Roberts-Victor kimberlite pipe. This mixture was partially melted in graphite and/or iron capsules at pressures ranging up to 30 kb. The composition of the glass was determined by use of an electron microprobe. The initial composition was both olivine and hypersthene normative. Below 11 kb the eclogite recrystallized into an assemblage of olivine, orthopyroxene, clinopyroxene and plagioclase. Above 11 kb the solidus consists of garnet + clinopyroxene. Olivine appears on the liquidus below 11 kb, orthopyroxene appears between 11 and 20 kb, clinopyroxene is present on the liquidus at 25 kb and garnet is present at 30 kb. Glass is hypersthene normative at pressures below 8 kb throughout the melting interval. Above 8 kb glass is nepheline normative when only a small amount of liquid is formed and hypersthene normative when a large amount of liquid is formed.

Quartz-Coesite and Press Calibras.

Experiments were made on the quartz-coesite (Q-C) reaction to determine its feasibility as a calibrant for the piston-cylinder apparatus at high P-T. This reaction has several advantages; pure Q is easily obtained and C readily synthesized; the reaction can be reversed to within 0.1 kb of the equilibrium at  $T > 500^\circ\text{C}$ ; the reaction is quenchable allowing the same run time as for other quench runs; the slope of the reaction is 10 bar/ $^\circ\text{C}$  so that errors in precision of T do not seriously affect location of the curve. The only disadvantage, as with all other reactions at  $P > 20$  kb and  $T > 500^\circ\text{C}$ , is that the Q-C curve has not accurately located in a truly hydrostatic medium. Experiments using a PCA on Q-C at  $1100^\circ\text{C}$  confirm and amplify Green, Ringwood and Major's (1966) observation that a reversible P correction due to the strength of the medium is needed in addition to the irreversible (friction) correction. Green et al compared talc, talc/BN, AgCl/BN and found that the equilibrium P was reduced 2-3 kb by using the weaker AgCl/BN. My data tighten Green et al's reversals and suggest that an additional 1-2 kb correction is needed for the BN in the AgCl/BN cell, giving a 12-15% P correction to talc compression runs depending on the kind of talc used. The Q-C reaction has much to offer as an inter-laboratory calibrant, but difficulties in locating its correct position would be considerably eased if tight reversals were made in a hydrostatic gas apparatus.

MINERALOGY II (V)

Annapolis Room

Friday 0830h

Chairmen: D. E. APPLEMAN (U.S. Geological Survey, Washington, D. C.) and J. J. PAPIKE (State University of New York, Stony Brook, N. Y.)

Intervalence Electron Transfer Absorption in Silicates. Spectra and their temperature dependence have been measured on a series of layer and chain silicates with a view to further understanding the characteristic visible absorption due to ferrous-ferric electron transfer. Bands were observed at 16,000 and 14,000  $\text{cm}^{-1}$ . Band intensities increase at low temperatures as expected from increased orbital overlap. Relative band intensity can also be varied by controlling the oxygen fugacity and thus the ferric/ferrous ratio. The characteristic bands are narrow, highly polarized, and of low absolute intensity, comparable in shape and intensity to crystal field transitions. A new model for charge transfer absorption is proposed, based on Goodenough's narrow models. The absorption spectra and their properties can be explained by transitions between either (a) a partly filled  $\pi$  antibonding band and an empty  $\sigma$  band or (b) a delocalized  $t_{2g}$  non-bonding band and a narrow  $\sigma$  band. Both bands are derived mainly from d-orbitals and LaPorte's rule is only slightly violated.

Mossbauer Study of Iron Crystal Chemistry in Bornite. Naturally occurring bornite specimens have been studied using  $\text{Fe}^{57}$  Mossbauer resonance. The specimens exhibited symmetric doublet spectra with small splittings. These are interpreted as quadrupole doublets, arising from a non-zero electric field gradient at the Fe site. Previous workers had failed to observe this quadrupole splitting. From the measured isomer shifts and previous magnetic studies, the Fe ions are definitely identified as nominally  $\text{Fe}^{3+}$  and as probably having 4-fold coordination. The measured values of the quadrupole splitting and isomer shift w.r.t. Fe at 298 K are 0.20 and 0.39 mm/sec, respectively. Except for the second-order Doppler shift, the spectra are unchanged on going from 298 to 77 K. While the narrow linewidths, 0.25 mm/sec, of the quadrupole doublet indicate little variation in the local crystal chemistry of the Fe sites, a weak absorption peak at lower velocities would imply the presence of another species of Fe in the structure. This result is discussed in terms of order-disorder phenomena in bornites.

Ordering of Transition Metal Ions in Zoisite. Presence of very small amounts of  $\text{Mn}^{2+}$ ,  $\text{V}^{2+}$ ,  $\text{V}^{3+}$  and  $\text{Fe}^{3+}$  in zoisite has been studied by electron paramagnetic resonance and optical absorption spectroscopy. Two types of Ca-sites, Ca(1) and Ca(2), with symmetry  $m$ , are available for the divalent ions, the Ca(2)-07 polyhedra being the larger of the two. In a blue crystal from Tanzania, the  $\text{Mn}^{2+}$  ions are presumably ordered in the Ca(1) site, while  $\text{V}^{2+}$  occur on both Ca-sites, preferring Ca(2). However, the  $\text{V}^{2+}$  ions on the Ca(2) site are probably located slightly off the mirror plane. Two types of Al-sites, Al(I) and Al(II), occur in zoisite, with symmetry  $l$  and  $m$ , the average Al-O distances being 1.89 and 1.97 Å. The optical spectra of  $\text{V}^{3+}$  on both types of Al-sites may be identified from their band positions and intensities, and show a preference of  $\text{V}^{3+}$  for the

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