

granite, and permitting the acidic conditions to ascend to higher horizons. Also, the earliest vein minerals, chiefly quartz and pyrite, would tend to insulate the solution from the granite. And finally, increasing alkalinity of the solutions and lower temperature would lessen action on the granite at points further removed from the central source.

Applying the above reasoning to the facts of ore occurrence, it is found that chalcocite as a primary mineral is the latest important copper sulphide of the ores; it is, moreover, found only in association with the highly altered phases of the granite. From these facts the conclusion may be drawn that under the geologic conditions existing in Butte, the more acidic conditions were necessary for the deposition of this mineral. Similarly, enargite is associated with highly sericitized granite, and is therefore believed to have been deposited only under certain conditions pertaining to the temperature and relative alkalinity of the solution.

"Sphalerite, rhodochrosite, and galena are increasingly abundant toward the intermediate and peripheral zones, suggesting their formation under lower temperature conditions with relative high alkalinity. Quartz and pyrite are everywhere present, and evidently are formed under all conditions. Pyrite is more abundant in the central and intermediate zones than in the peripheral zone. Quartz is more prominent as a gangue mineral in the peripheral zone than elsewhere.

"Structurally there is no good evidence for distinct periods of mineralization in the Butte veins. It is here held that there was but one period of mineralization, varying in intensity, possibly, from time to time, with important changes in chemical character of solutions. But the mineralogical difference in vein material of the central, intermediate, and peripheral zones can be adequately explained, it is believed, by the reasoning herein set forth, which assumes that the copper mineralization indicates high temperature and acidic conditions versus lower temperature and alkaline conditions as the solutions migrated toward the peripheral fractures now represented by the manganese-silver veins.

"Concerning the formation of chalcocite there is much geologic evidence, mainly structural, to support the theory above outlined, which assigns to this mineral a primary origin from deep-seated waters."

The subject of chalcocite formation is of exceptional interest and is given special treatment by Mr. Sales. He does not agree with Mr. Weed, who considers the Butte chalcocite to be secondary.

"W. H. Weed has set forth some facts which, in his opinion, tend to prove the secondary origin of the Butte chalcocite. He observes generally that the old quartz-pyrite veins were originally of very low grade and they became commercially valuable through the later addition of enargite, bornite, chalcocite, and

other copper minerals. He believes that this copper mineralization followed various periods of faulting, the enargite and bornite being the first to appear, probably contemporaneous in a general way with the Blue and Steward fault system. Chalcocite, which forms the bonanza ores of the district, is thought by him to have been almost entirely a product of descending sulphide enrichment processes, acting at great depths, however, only where the older quartz-pyrite veins were crackled and broken by faults, thus permitting a ready passage for the downward-seeping waters. He cites many examples of such intersections of faults and older veins in support of this view, and maintains that the old quartz-pyrite veins are workable only where thus fractured.

The writer's own observations do not confirm Weed's conclusions as above outlined. Actual examination of a great many intersections of old quartz-pyrite veins by later faults have shown conclusively that as a general proposition the east-west veins are no richer at or near intersections with Blue vein faults than at other points along the vein except in cases where the fault vein ore shoots cross the older vein. It is extremely difficult to form even an approximate idea as to the extent of primary enrichment in the older veins due to the late faults of the Steward system. Mineralization processes were active in the early veins prior and subsequent to the Blue vein period, so that it is impossible to determine, in the absence of any characteristic minerals, what influence was exerted by the later faults upon the older veins. As might be expected, the fault vein intersections are usually accompanied by a breaking and shattering of both the older vein and the country rock in the immediate vicinity, thus developing favourable factors tending to greatly influence ore deposition at such points. In any case, where a chalcocite enrichment of a vein of the Anaconda system is shown to have resulted from the influence of an intersecting fissure of the Blue or Steward system there remains the strong probability that such enrichment is due to primary waters, if, as believed by the writer, the primary chalcocite was deposited in great quantities, after the appearance of these faults, not only within the faults themselves, but in the fractured older veins."

ASBESTOS MINING

The Black Lake, Thetford and adjoining districts in the Eastern Townships of the Province of Quebec, produce about 90 per cent. of the world's supply of asbestos. The industry is a large one; but of late years the financing in connection with the merging of several of the companies has brought it into well deserved disrepute. Overcapitalization accompanied by over production of the mineral, brought trouble to both those who were responsible for the manipulation and to those who were conducting their business on a sensible basis. The market did not absorb the un-