ORIGIN AND MODE OF OCCURRENCE OF COPPER-DEPOSITS. 5

the furnace, and it must change its state to conform with those changed conditions. So, too, the eruptive rocks, coming in a liquid state from the interior of the earth's furnace, cannot endure unchanged the conditions which exist at or near the earth's surface. They are in an unstable condition, and must be made over into a more stable mineral composition. The agencies that produce that change appear in general to be the same as those which alter the sedimentary formations, namely, percolating waters chemically active, pressure, and heat or cold. The first stage is the change from a liquid or pasty mass into a solid one; later there comes a more or less variable alteration that extends throughout the entire mass, and causes variation in the mineral composition and structure—so much so that at times no trace of its original condition remains, unless it be its form or its relative position to other rocks.

It is in consequence of these changes that rocks which were originally peridotites or olivine rocks are now called serpentimes, actinolite-schists, tale-schists, dolomites and verde-antiques; and that formerly molten basalts are now designated melaphyrs, diabases, gabbros, diorites, eclogites, amphibolites, hornblendeschists, chlorite-schists, mica-schists, amygdaloids, traps, greenstones, variolites, granites, etc. It may here be said that schists result from the alteration of eruptive rocks, as well as by the change of sedimentary ones. It is alteration that causes rocks that were formerly andesites to be named phonolites, propylites, hornblende-porphyries, porphyrites, diabases, melaphyrs, diorites, granites, schists, etc. In the same way what were once trachytes now form felsites, phonolites, porphyries, granites, gneisses, etc.; while the rhyolites, in their alteration, form rocks called felsites, petrosilex, gueisses, granites, quartz-porphyrics, etc. It will be inferred from the above that the alteration of eruptive rocks produces, from forms that were originally distinct, forms that are now known by the same name; while, on the other hand, the varieties due to the various changes of a single rock-species are very numerous.*

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^{*} See Bull. Mus. Comp. Zool., 1878, V. pp. 39, 40, 275–287; 1880, V11., 1–164, 183–187, 3(1–565; Proc. Bos. Soc. Nat. Hist., 1877, XIX., 217–237, 309–316; 1880, XXI., 91–103, 243–274, 288–291; '883, XXII., 412–432, 485–489; 1884, XXIII., 197–211; Men. Mus. Comp. Zool., 1884, XI., 208 pp.; Am. Jour. Sci., 1884 (3) XVIII., 94–104; Science, 1883, I., 427-130, 541; 1884, III., 486, 487; 1V, 111; Bull. Mina, Geol. Surrey, No. 2, 159 pp.; Report of State Board of Geol. Sur., Mich., 1893, 196 pp.