

THE NATURAL ASSOCIATIONS OF GOLD.

Because in some senses the geology and metallurgy of gold are simple in principle there are many simple facts that are either overlooked or not co-ordinated.

To the current number of *Economic Geology*, Mr. Francis Church Lincoln contributes a long monograph on the natural associations of gold, dividing his subject into two parts—the associations of gold with rocks, and the associations of gold with minerals.

It is impracticable to touch upon more than a few features of Mr. Lincoln's paper. All of it deserves close study.

Discussing the impregnation and replacement of rock in the neighbourhood of a vein, the writer points out that in all probability the extent of these phenomena is not yet fully appreciated. Gold reported as primary may in reality be secondary. Samples that are taken at a safe distance from known mineralization may really represent rock that has undergone secondary enrichment. Microscopic examination of thin sections is the only certain means of determination.

The assayer's "trace" usually means less than ten cents per ton avoirdupois, equivalent to 166 milligrams per metric ton. In 46 tabulated assays of igneous rocks only four are recognized as absolutely indicating primary gold. The rest are set down as either "probable" or "possible." Of 25 of these rocks, seven are basic, six are intermediate, and twelve acid. Disregarding abnormally high results, the normal gold content of these igneous rocks appears to be between 60 and 80 milligrams per metric ton. The distribution of gold seems to be somewhat even, irrespective of the chemical composition of the rocks. But the data collected are too incomplete to admit of drawing definite conclusions. What evidence there is tends to prove an irregular distribution of minute amounts of gold and silver in igneous rocks, the gold averaging about four cents per ton avoirdupois, and the silver about six cents. There is no marked difference in gold content as between acid and basic igneous rocks, while in silver content basic rocks are probably slightly higher than acid rocks.

Sea water, sub-crustal waters, rock salt, clays, coal, and many organic substances contain gold in ponderable amounts. One coal has been reported from Wyoming containing \$1 to \$5 per ton.

Gold occurs in sedimentary rocks almost universally. From determinations reported the value is roughly one cent per ton. The general conclusion appears to warrant that the coarser the rock the higher the gold content.

The origin of gold in completely metamorphosed rocks is a matter of speculation. Primary gold has been mined in metamorphic rocks and has been won commercially from important placer deposits.

Generally, no evidence can be adduced to show that the gold of igneous rocks segregates in the more basic

or the more acid members. It has been seen that there are few authentic occurrences of primary gold in igneous rock. The concentration of 3½ cents in gold per ton in the same ratios that have obtained in known magmatic segregations of iron, nickel, and chromium, would develop ores running from a few cents to \$144 per ton. No such segregations of gold have been found. The Klondike gold has been estimated by Mr. Lincoln to represent a saving of 2 cents per ton of rock (sedimentaries) eroded. But no commercially important placers derived from igneous rocks are known. Thus the assumption of extensive magmatic segregation of gold in igneous rocks is not justified by available facts.

We have outlined above, with many serious gaps, the trend of the first section of Mr. Lincoln's article—the section dealing with associations of gold with rocks. The last paragraph synthesises the geologic history of gold—the distribution through the igneous magma, the concentration by erosion, the formation of coarse- or fine-textured rocks with higher gold content, the metamorphism of these sedimentaries, etc. It is pointed out that, though of economic interest, veins are quantitatively unimportant.

The second part of the paper space does not permit us to cover. A lengthy discussion of the mineral associations of gold, well illustrated with diagrams and photogravures of rock slides, is followed by conclusions that briefly outline results so far attained. As throwing light upon the extraordinary richness of many ores in which no gold is visible either to the unaided eye or under the microscope, it is suggested that the same relations exist between gold and other minerals on a sub-microscopic scale as exist on microscopic and macroscopic scales.

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Few more instructive essays have appeared than this of Mr. Lincoln's. It should be read and digested.

THE DIFFUSION OF CAPITAL.

Mining booms are not unmitigated evils. They stir up public interest, and are instrumental in disseminating all kinds of mining news. From the Rossland boom there have survived several strong organizations. Likewise has the Cobalt boom brought into existence scores of prosperous operating companies. Both booms taught their lesson, and both brought ultimate good to the country. This does not by any means imply that we approve the boomster.

Looking back over the rise of Cobalt there are many incidents that, considered together, prove that New Ontario has done considerably more for Old Ontario than has the Old for the New. The impressive array of new houses built by Cobalt money in the best residential sections of Toronto, not to speak of multitudinous motor cars, is direct evidence. Some millions of dollars of money made in Cobalt have been invested in real estate in Toronto. Montreal, also, can