

silica as a cementing material the quartzites were formed. The interstratified clay sediments were not so readily permeated by the silicifying solutions, so acted on by heat and pressure chiefly they were changed into slates intercalated in thin beds with the quartzites. Similarly heat and pressure changed the Halifax sedimentaries into slates, placed conformably on the quartzites.

These disturbances and metamorphic agencies were directly caused by the intrusion of the granite magma beneath, and took place at a period generally admitted to be later than Devonian. After intrusion of the granite magma which, it must be remembered, was resting under the great pressure exerted by the Meguma series above, a gradual crystallization took place and the various minerals of the granite separated from the magma, until there was left as a final portion excessive quantities of hot water under great pressure and charged chiefly with silica in solution. Finally great convulsions opened fissures extending towards the surface into which these waters poured, and on their upward way were forced laterally through openings formed by the tearing apart of the various thin slaty strata met on the upward course. Silica was deposited in these openings, both the vertical and the horizontal ones, resulting in the one instance in the formation of the fissure veins of quartz, with direct lateral branches forming the so-called bedded leads. There can be no question that practically all of the bedded veins are of a common origin and source and are direct branches of certain of the more prominent fissures, for they clearly branch from the fissures and neither cut nor are cut by them.

At some subsequent period other fissures were opened, cutting directly through the bedded veins as well as the older fissures, and were filled with solutions bearing silica, gold and other minerals. These later disturbances caused faulting, shearing, and fracturing, and many of the bedded veins and earlier fissures were faulted. It seems very probable that in connection with these later disturbances many of the richer ore-shoots were formed. The statement of practical miners has appeared in print and several have told me verbally that in their experience in mining in Nova Scotia, while working in zones of faulting, they have generally found the richest ore under the faults, and that a vein which was rich up to a fault was very often barren when located again above and beyond the fault.

In connection with the anticlines of Nova Scotia we find at several localities that the rocks have been forced up into the form of domes, and in the Caribou district we find existing perhaps the most perfect of these domes. It is evident that some powerful force exerted from below forced the rock formations into the shape which gives them their name, nor is it difficult to explain what force formed them. At various localities in granite formations there exist very perfect domes or bosses of granite from which all formerly existing rock which covered them has been eroded. It is also not infrequently the case that granite domes have other rock formations covering their sides more or less completely, and still other domes of which only the very tops have been exposed by erosion of the rock formerly covering them, and so on by an almost complete series of intergradations existing in various parts of the world. It seems very certain that the domes of Nova Scotia, existing on the anticlinal folds, owe their shape to the existence of granite domes beneath which

were forced up but never subsequently exposed by erosion.

At various places throughout the Meguma series of Nova Scotia, granite outcrops, having been exposed by erosion, and granite dikes also are not uncommon. It is also very certain that granite exists, at no great depth everywhere beneath the rocks of the Meguma series. While partial erosion has exposed the granite in many places, there seems to be no locality in the province where the slates and quartzites both have been eroded sufficiently to expose the granite on one of the domes.

It is quite generally agreed by the authorities that all gold was primarily of magmatic origin, and it is likewise quite certain that the gold of Nova Scotia originated in the granite magma beneath, and, carried up by ascending waters, was finally deposited in the sedimentary formations above. Even as this paper is being written there has come into my hands an article which records the finding of gold in the granite formations southwest of Halifax about the head of Terence Bay and at Pennant. While particulars of the find are lacking, I am inclined to predict that any payable ore which has been or may be found in these granite formations will be in quartz veins or quartz segregations derived from the granite magma.

The natural solvents of gold are more numerous than commonly supposed, and the several naturally occurring solvents which have the power of dissolving gold at ordinary temperature and pressure have their solvent power increased proportionately by increased temperature and pressure. If such salts as ferric chloride, ferric sulphate, cupric chloride, cupric sulphate or any of the alkaline sulphides are dissolved in water then the resulting solutions are capable of dissolving gold, especially when heated with gold under pressure. Sodium carbonate solution containing dissolved carbon dioxide, and sodium silicate solution containing sodium sulphide or sulphhydrate or other alkaline sulphides also dissolve gold. The presence of any compound capable of liberating oxygen, such, for instance, as manganese dioxide in acid solution, increases the solvent power of certain of the before-mentioned solutions for gold, while heat and pressure likewise increase their solvent power.

In the Meguma formations of Nova Scotia we find an abundance of pyrite, pyrrhotite, arsenopyrite and other sulphides which, when brought in contact with descending waters containing oxygen from the air dissolved therein, become oxidized, and soluble salts are formed capable of dissolving gold. Manganese dioxide is also common in the rocks of the Meguma formation, being more or less generally and finely disseminated, especially in the slates. The sulphur of the metallic sulphides named is first attacked and oxidized, and the finally resulting sulphuric acid attacks the iron, copper and other metallic elements of the sulphides, forming at first, in the case of iron, ferrous sulphate and finally by oxidation ferric sulphate, a gold solvent. The descending waters also contain some sodium chloride which, acted on by the sulphuric acid formed, sets free hydrochloric acid, and in the presence of manganese dioxide, chlorine, a solvent of gold. Ferric chloride is also formed and other solvents of gold as well by the complex series of chemical reactions resulting between the descending waters and the metallic sulphides they encounter.

These surface waters descend through various cracks, seams, joint planes, lateral fissures and through the pores of the rocks, becoming charged with solvents