

tion. Only the other day it was announced that the hitherto rare metal tantalum had been found in great abundance at a single spot in Australia. The cause of this local or circumscribed occurrence of certain metals has not yet been explained, any more than the reason why the specific gravity of the whole earth is more than twice as great as that of the average materials which form the crust. The latter fact is probably owing to the existence of various heavy metals at great depths and the former to the occasional ejection of one or more of these from great depths, especially during early periods of the earth's history.

Some of the shafts in the Cobalt district have been sunk in the agglomerate and the associated slaty ash rock and arkose, and this rock formation is supposed to have a total thickness of upwards of three hundred feet. It is traversed by two sets of vertical joint planes, recalling the jointed structure of argillites, clay slates, etc. One of these sets has an average course of north-east southwest and the other is at right angles to this. The silver-bearing part of the district is also traversed by fissures or planes of disturbance, along which, from time to time, the rocks were crushed by slight movements, under great pressure, forming spaces in which mineralizing waters could rise from considerable depths. The agglomerate and perhaps the whole of the crust of the earth to the very surface would probably have an elevated temperature at that time, while the waters from a depth would be still hotter. On approaching the surface they would be relieved of pressure and somewhat cooled.

The reason why some mining men, on visiting the district in the earlier days, did not appear to be favorably impressed, seems to have arisen from the fact that nearly all the veins were small; few of them were well marked or continuous for any considerable distance. In fact, most of them lacked the typical character of good fissure veins of the ordinary kind. When development had proceeded far enough and a sufficient number of openings had been made to enable one to properly observe the phenomena, it became evident that the supply of ore did not depend upon the individual small veins, but that there was some more general kind of mineralization. This the writer believes to be connected with the above planes of fracture or disturbance which are more continuous and deeply seated than the small individual veins on and near their course. The fissure plane may, in places, be indicated by only a small vein or a dry fault without any vein matter or gangue, but the wall rock itself along such sections of the general fissure will often be found to be rich in silver for some inches or even a foot or two inward from the line of fracture. Small cracks and branch veins running out from the main fissure may carry the silver to a great distance into the country rock.

If the above view be correct, a continuous production of the silver is to be looked for by following these vertical zones of crushing and disturbance. Among these planes, the temporary formation and subsequent breaking up of veins, from time to time, was only one of the phenomena of their history. In some instances especially where the line of fracture has been nearly straight, the vein or group of veins has not been thus broken up, but has preserved its continuity for some distance and has become enlarged or has produced new parallel veins by widening of the fissure. La Rose vein or group of veins appears to be of this character.

On the other hand, there are usually many minor irregularities in both the horizontal and vertical course of the lines of dislocation, and at any new movement of

the walls there would be a fresh breaking up of the materials which had accumulated along these lines and new spaces would be found for further mineralization. This repeated brecciation has resulted in what we now see in the "mines" opened on these lines of disturbance. Both the vein matter and the wall rock are much split and broken up; dislocated fragments are cemented together along lines of small faults and there are many miniature horses surrounded with the cementing gangue. Secondary dislocations, branching from the main one, are often rich in silver, which may also penetrate into the shattered wall rock and form a body of rich ore, even if the vein matter be of insignificant amount or altogether wanting. The foregoing explanation of the formation of the mineralized zones and of the mode of occurrence of the silver in the Cobalt district was given in the writer's report on the district, published in the Summary Report of the Geological Survey for 1905.

The volcanic nature of the fragmental rock of the Cobalt district is manifest both in fresh fracture, and on every weathered surface. One of the localities where this is particularly convincing is the south-facing slope of the hill near opening 12, 13, 15 and 21 of the Nipissing Mines Company and not far from the power house at the shore of Peterson Lake, on lot R. L. 404. Here the rocks have been well exposed by recent hydraulic washing and show very distinctly their volcanic or plutonic character. Areas of different varieties of diabase and agglomerate are mixed together and cut by dykes which have evidently been formed before the masses which they traverse had been completely hardened by cooling. At the contact, some of the dykes became amalgamated with the rocks they penetrate and have no sharp line of division. The smaller dykes are in some instances broken and interrupted, as if by the movement or flow of the semi-fluid mass into which they had been intruded. The weathered surfaces of different adjoining small areas of the diabase present different shades of color and different degrees of texture. Some of the brecciated parts show large inclusions; some are irregularly charged with the brecciated debris, while other parts are quite free from it. A cherty rock, having lines of foliation, is associated with the foregoing. A few small veins containing smaltite and argentite traverse the diabase and the agglomerate at this locality. Lines showing limited faulting or dislocation also occur in these rocks.

Up to the present time, twelve or more different metals, either native or combined with one another or with other elements, have been found in these rocks, and this fact alone would point to an igneous rather than a sedimentary origin of the matrix.

In connection with the supposition that some of the rocks of the Cobalt district may be co-related with those which have been called Keewatin, at the Lake of the Woods, and the unfounded theory that the Keewatin rocks are not argentiferous, the fact may be mentioned that the leading feature of these Lake of the Woods rocks is the prevalence of greenstones, having a concentric spheroidal structure. On the Lawson property, which lies immediately southwest of Kerr Lake, the writer found, near the centre of the lot, an exposure of a dark greenish gray, rather fine-grained diabase, having a conspicuously concretionary structure. The sections of the spheroids are nearly circular and vary from six inches to three feet in diameter, the average being two feet. This rock is here cut by a well-defined vein of smaltite with silver, and several other silver-bearing veins occur in the immediate vicinity.

The foregoing opinions as to the Cobalt district have