more characteristic of the South belt, and silver may form an important part of the values.

4. Arsenopyrite, pyrrhotite, pyrite, molybdenite, a little chalcopyrite, bismuthinite, and free gold, as impregnations particularly in and around pegmatitic and aplitic dikes of alkali syenite.

5. Gold bearing quartz veins.

**Gangue.**—The gangue is chiefly more or less altered country rock with some quartz and locally a little calcite. The country rock may be altered to quartz associated with secondary biotite in bands. Hornblende and chlorite are extensively developed in places. Muscovite, tourmaline, garnet, wollastonite and epidote also occur, and zeolites, chiefly anthophyllite and chabazite, are frequently found.

**Ore.**—The typical ore consists of more or less altered rock matter with reticulating veins and irregular masses of pyrrhotite, and varying amounts of chalcopyrite with perhaps a little quartz, the sulphides forming from 50 to 65 per cent. of the mass. There are all transitions from the solid sulphides forming massive shoots of ore on the one hand to rock matter or gangue on the other, with little apparent mineralization. In cases, however, lightly mineralized gangue may carry high gold values.

The values are largely gold with some copper and a little silver. The gold values do not appear to be dependent on the presence of any one mineral, though in many cases ore rich in chalcopyrite is rich in gold. The pyrrhotite, though gold bearing in some instances, is as a rule very low grade. An average analysis of the ore from the large producers gives—gold 0.5 oz. per ton, silver 0.3 oz. per ton, copper 0.9 per cent., iron 22 per cent., silica 37 per cent, sulphur 10.8 per cent., lime 4.2 per cent., aluminum 14.9 per cent. The ore from near the surface yielded the higher values, but the proportion of free gold does not appear to decrease with depth and high-grade ore bodies are still encountered at the lowest developed levels.

Oxidation extends downwards only a few feet from the surface. Secondary enrichment is a minor feature, but is found at several points well below the zone of weathering.

**Lodes.**—The chief lodes or veins have a general easterly trend and northerly dip with an associated fault system trending north and south. The LeRoi-Centre Star main and south lodes and the Josie lode strike about N. 60° E. The LeRoi north vein, the War Eagle vein, and the Centre Star north veins strike N. 70° W., and appear to be off-shoots of the main lodes. The dips are to the north ranging from 60° to 70° with local flattenings.

The main LeRoi-Centre Star lode is at least 4,000 feet long, with a thickness varying from a mere crack to over 130 feet. The maximum thickness cannot in many instances be determined owing to the lack of sharply defined walls. Between ore shoots it is sometimes very difficult to trace the lode, particularly where the continuity is broken by faults and dikes.

**Ore Shoots.**—The ore shoots vary greatly in size and shape, lenticular bodies being the more common. Some are very irregular at one termination, especially when forming against a dike or fault. In such cases the shoot either develops an enormously increased thickness or an L-shaped body is formed by the ore turning sharply and following the plane of the fault or dike. The pitch varies from vertical to a pronounced easterly or westerly direction dependent upon purely local conditions. In size the shoots vary from a foot to 130 feet in thickness and from 50 to 500 feet in length. One of the largest shoots was stoped for 590 feet vertically and averaged 50 feet in length and 56 feet in thickness.

The higher grades of ore are often confined to certain bands in the shoot parallel to the trend of the lode. They either occur in the body of the shoot or on the hanging or foot wall sides. These bands may also change their relative positions suddenly and follow other though parallel planes in the shoots.

The pay ore is sometimes bounded by a fissure or fault plane. More often, however, there is no sharply defined wall, but a transition, usually rapid, from commercial ore to "waste" or nearly barren rock.

The positions of shoots are usually along contacts between the lode and fault planes with impervious walls or dikes. In the case of the dikes, the shoots usually form on the under side. When the mashing or shearing of the rock is such that the metal bearing solutions are restricted within zones of reasonable width, other things being equal, the conditions are favourable for the formation of productive ore shoots. The importance of the shoot is oftimes accentuated by the development of a system of cross fractures emanating from the wall rock.

In the LeRoi, shoots have been found along the contact of the augite porphyrite series and the coarse monzonite and diorite porphyry.

**Origin.**—Ore deposition began subsequent to the extensive intrusions of alkali syenite and continued up to the period of injection of the last system of dikes. It is thought probable that the deposits are closely related to the alkali syenite.

The deposits were formed through the agency of ascending aqueous mineral-bearing solutions of high temperature which gradually replaced the primary minerals of the country rocks, particularly the feldspar.

Certain minerals in small quantities, such as garnet, wollastonite, epidote, amphibole, pyroxene and magnetite suggest an approach to the conditions under which contact metamorphic deposits are formed. Other minerals are characteristic of hydrothermal action such as tourmaline, muscovite, chlorite and zeolites. The paragenesis of the minerals has not been worked out, but pyrrhotite is cut by veinlets of chalcopyrite though in many cases the two minerals appear to have been contemporaneous.

The values so far have not greatly decreased with depth, though this is not apparent in the production since more lower grade ore can now be mined than formerly, because of reduced smelting charges. The evidence though not conclusive, is strongly in favour of almost the entire deposition being due to ascending solutions, though possibly at two or more periods. In the first period, the diking and faulting phenomenon accompanying the formation of the lodes formed barriers which afforded favourable conditions for the precipitation of copper and gold. A favourable area for deposition appears to be the underside of dikes. In the second period, ascending solutions of different composition may have deposited new minerals in the ores or concentrated at successively higher levels, the values of the ore minerals formerly deposited.

If a zone of true secondary enrichment ever existed, it was swept away during the heavy erosion accomplished by the Cordilleran ice sheets.

The success that has attended the vigorous development policy of the operating companies, gives no indication that the productivity of the lodes is near the end, nor even on the wane, but on the other hand, gives every encouragement to the view that ore bodies will be found at much greater depths than the levels now being exploited.