

contain more than 75% of quartz being uncommon. Locally recrystallization has produced very coarse grained varieties of these rocks, the quartz appearing in large sheets and bunches. But such are usually interbanded with layers in which much pyroxene is associated with the quartz.

Garnet is often a very abundant mineral in these rocks, though more abundant in the more feldspathic varieties than in those purely quartzose. Graphite is more apt to appear in the rusty-weathering gneisses. In certain beds garnet becomes the predominant mineral, but these make small bulk in the series as a whole. Sillimanite is also found mainly in the quartzose gneisses, perhaps specially in those rich in garnet. At times it is only sparingly present as microscopic inclusions in the quartz, at other times it becomes quite abundant and is in larger needles.

In the more basic gneisses pyroxene is usually the most abundant dark mineral, though biotite and phlogopite micas are also frequent, some very micaceous bands occurring. Aside from frequent narrow bands of amphibolite, hornblende is a relatively rare mineral in the Grenville rocks. These amphibolites may be sedimentary, but seem to the writer more likely to represent original igneous dikes or sheets intruded into the series. Since, however, there is considerable variation in their appearance and make-up, they may be partly of one origin and partly of the other.

These Grenville rocks have the composition of sandstone, shales and limestones and their intergradations, and have a wholly different mineralogy from any known igneous rocks, whether metamorphosed or not. Under metamorphism they seem to have wholly recrystallized and to have been greatly stretched in one direction, giving rise to the foliation, and drawing out such igneous rocks as had been intruded into them into parallel bands with a foliation in common with them. The limestones were the most plastic of the beds under metamorphism, and, where the rocks have been most compressed, have often been so squeezed as to comport themselves much like igneous rocks, pressing into fractures in, and inclosing a number of fragments of, the more brittle inclosing rocks, producing combinations which have a strong external