

of recent years, establishing such an origin for the bulk of the serpentines at present known the world over.

There is a great variety of fissile, more or less glossy, rather soft, green schists, partly hornblendic and partly chloritic, the origin of which in some cases is closely fixed from the fact that they form the matrix of well characterized pebble and boulder conglomerates. In this case they must have been composed of epiclastic or pyroclastic material. The writer inclines to the opinion that they are of proximately pyroclastic origin from the fact that precisely similar schists, free of pebbles, are frequently associated with massive or only slightly schistose diabases, as if the tuffs of these extravasations. There are many other bedded green schists some of which can be shown to be squeezed and otherwise altered facies of diabase, while the precise origin of others is yet quite obscure.

The porphyroid schists, the felsite schists with quartz grains, and many of the nacreous sericite schists, represent squeezed, schistose and otherwise altered forms of quartz-porphyrries and petrographically allied rocks, and their tuffs, which, as before stated, enter not uncommonly into the composition of the volcanic portions of normal Paleozoic series. Some others of the sericitic schists may probably have been developed from sediments rich in orthoclase debris; but this, except where they pass over into rocks of the character of phyllites, is not so easily established as the direct derivation of many of them from the acid volcanic rocks.

*Original Characters and Metamorphism.*—From the foregoing statement, brief and incomplete as it is, of the broad lithological characters of the formations which constitute the Ontarian system, or upper division of the Archean, it must be apparent that, although there are rocks within it whose history is more or less obscured by the changes which they have undergone, the system is an assemblage of once normal rocks, all of which may be found even in their most altered phases in series of Paleozoic and later ages. This conclusion will not appear startlingly new to the very powerful school of American geologists, who have always claimed the metamorphic derivation of the whole of the Archean from normal rocks.

But, as will appear in the sequel, the metamorphic explanation of the whole of Archean phenomena is not tenable, and is only applicable, in the opinion of the writer, to its upper division, here designated the Ontarian system. Moreover, it is to be noted that the conclusion in question offers an important modification of the old view of the metamorphic development of such rocks as constitute this system, inasmuch as volcanic formations have scarcely been recognized in our leading American text-books as having a share in the composition of the older rock series. Much of the Archean was properly recognized as the alteration products of sediments, and the whole complex was therefore inferred or supposed to be of similar derivation from