

into the nature of igneous rocks in general, and the processes which are at work during the cooling of molten magmas, by the solidification of which igneous rocks are produced.

Recent researches have shown more and more clearly that a fused mass of rock is very similar to any ordinary solution of salt or sugar in water or any other solvent. As the fused mass slowly cools one mineral after another crystallizes out, a definite order being always observed. The mineral containing the largest amount of base, such as iron, lime or magnesia, first separates out, then a series of other minerals containing less base, until finally there remains only a comparatively acid portion of the magma which may be considered as the solvent of the others, corresponding to the water of the saline solution above mentioned, which solvent may eventually crystallize itself. Thus, for example, in the case of a granite, we find that the various ores, magnetite, titanite iron ore, pyrites, etc., first separate out, then the mica or hornblende, then the feldspars, and finally the quartz. The ores, together with the mica and hornblende, may thus be considered as having been originally held in solution in the molten feldspars and quartz. Now it is known as the result of elaborate experiments on various saline solutions, that if a solution of any salt be heated and allowed to cool gradually the salt tends to concentrate in the cooler portions of the solution. It is also found that in concentrated saline solutions there is a certain tendency for the lower part of the fluid to become richer in salt than the upper portion, that is for the salt to settle toward the bottom. In the case of certain alloys also, as is well known, it is often impossible to obtain a homogeneous mass on casting, owing to the persistent way in which certain constituents of the alloy will concentrate toward the top or bottom of the bar or casting during cooling. Even in pig iron it is found that the amount of sulphur and phosphorous will vary considerably in the different portions of the same pig for similar reasons. This phenomenon in the case of alloys has long been known as liquitation.

In molten rock also a similar tendency to separate into portions differing in composition is clearly shown to exist by our geological studies of eruptive magmas, this tendency resulting in the separation of certain more basic parts of the magma from others which are less basic—that is to say, the dissolved or basic material concentrates in certain places and this gives rise to a lack of uniformity in the mass—part of it being richer