

the submarine zeolites. Keeping in mind the whole range of facts furnished by the study of zeolitic rocks, and of the formation of contemporary zeolites, we may proceed to consider the origin of the little crystals of phillipsite from the clays of the Pacific. The dredgings and soundings in these zeolitic regions show an exceptional abundance of fragments or of lapilli of vesicular basalt, often with a highly-developed vitreous base. Almost all these rocks belong to the basic series, and among them are found types of the eruptive series poorest in silica. With these lapilli, which are always observed in a state of hydration and more or less advanced disaggregation, are associated, with remarkable constancy, fragments of palagonite representing one of the last phases in the hydration of basaltic volcanic glasses. Microscopic particles also observed in these clays must have been projected as volcanic ashes from submarine or subaerial eruptions, and have apparently come from eruptions that have covered the bottom of the sea with eminently alterable lapilli, similar to those just referred to. These particles are also generally of a basaltic nature, and their state of extreme division must render them in an exceptional degree favourable for attack by sea-water.

It is seen, then, not only that the rocks just enumerated are those in which, in geological formations, zeolites have been developed in a marked degree, but that they are especially represented by the vitreous varieties. Moreover, it is known, from observations of geological formations, and from experiments in the laboratory, that these vitreous varieties are precisely those which, as might be expected, offer the least resistance to the action of water, and that water transforms them, in part at least, with great facility into matters of a zeolitic nature. What may be expected to be the result of the action of water upon the rocks and minerals found on the bed of the Pacific? Evidently the same at the bottom of the sea as that observed in analogous rocks on the dry land, where we are able to follow the modifications there taking place. As we have already remarked, the minerals constituting the basalts and basaltic rocks in general undergo, under the influence of waters that attack them, a series of transformations produced with constancy in nature, which may be thus summarised. During the decomposition of these rocks the waters take away from the alkaline silicates almost all they contain of potash and soda, silica being at the same time liberated; in silicates with a base of lime, magnesia, iron, and manganese, almost the whole of the lime and of the iron is separated with a notable quantity of silica. These various elements tend to disappear from the primitive mass, being taken away by the waters, but sometimes the iron and the manganese remain in the residue of the decomposition in a high state of oxidation. As to the alumina entering into the composition of these silicates, a fraction of it is eliminated, but the greater part is concentrated in the residue, in retaining a certain portion of the silica, and in fixing a certain quantity of the water. The final product of this decomposition approaches more and more to a hydrated silicate of alumina, which constitutes an argillaceous mass containing always traces of