and frequently form the nuclei of manganese nodules. From the closeness of their grain, and the minute dimensions of their constituent elements, it is hardly possible to identify the fragments with the naked eye; a large proportion of the constituent minerals occur also in an advanced state of decomposition. By microscopic examination it is found that the fragments are usually referable to felspathic basalts and kindred rocks; in some olivine is quite absent or a little hornblende is present, or they pass into augite-andesites; in others intercalation of a vitreous base may be observed, these fragments forming a transition to rocks in which such a base is abundantly developed. In all these, two varieties of structure may be distinguished, the one compact, the other porous. Generally the plagioclases are the constituents which have most energetically resisted decomposition; the infiltrated manganese, the altered olivine, and the vitreous base transformed into red spots, render conspicuous the crystals of felspar which stand out glassy and colourless from the matrix in which they are imbedded. The felspars are usually in the form in which they occur in basalts, but sometimes are in the form of rhombic lamellæ.[1] Some sections of the bisilicate are augite, others are seen whose extinctions indicate a pleochroic rhombic pyroxene. The magnetic iron has the same features as this mineral assumes in the basalts. The olivine is the mineral in which the decomposition is most advanced; in some instances the mineral would not be recognisable except for the crystallographic outlines of its sections; generally they are transformed into a reddish brown matter in which the cleavage lines may still be observed, but these sections have lost their optical properties. The vitreous base, when present, is altered to yellowish red irregular spots enclosed between the felspars and augites.

The great majority of the vitreous fragments must be considered as lapilli which have undergone submarine hydrochemical alteration, such as Sartorius von Walterhausen has observed in the palagonitic tuffs of Sicily. These lapilli rarely consist of a homogeneous glass without interposition of crystalline constituents (see Pl. O, fig. 8). The dredged specimens are sometimes composed of single fragments, sometimes of several cemented together by chemical action after their deposition. The aspect of these fragments, when not transformed into palagonite, is a blackish brilliant iridescent homogeneous glass. Thin slices under the microscope show crystallites and crystals of olivine, lamellæ and rhombic plates of plagioclase, crystals of augite, and rarely magnetic iron. The vitreous substance has seldom preserved its original characters; it is almost always transformed into a brownish red matter at the edges. The grains which have undergone this modification are the same as those described by Darwin, Von Walterhausen and Bunsen as forming the incoherent volcanic masses designated palagonitic tuffs. The fracture is resinoid with greasy lustre, and when the specimens were taken from the sea, the palagonitic matter could be cut away with a knife like new cheese. The different phases of decomposition show themselves from the circumference to the centre

[1] *Proc. Roy. Soc. Edin.*, vol. xii. p. 482, 1884.