between 2·8 and 2·9; the greyish green powder is very magnetic, and always gives the reaction of manganese. There is a marked contrast in the hardness between the vitreous centre, which has a hardness of about 5, and the altered palagonitic envelope, which when dried may have a hardness of about 4; but when freshly taken from the sea this resinoid secondary substance can be cut with a knife like new cheese. The powder of the vitreous glass is attackable by acids, with separation of gelatinous silica, leaving a residue formed principally of minerals which had been enclosed in the vitreous mass. These minerals, however, are rarely visible to the naked eye, and consist of minute yellowish grains of olivine, augite, and some small lamellæ of plagioclase.

When seen by the naked eye, the central vitreous mass is almost always bordered or penetrated by the yellowish brown, resinoid, slightly transparent, palagonite. This secondary substance has not such a brilliant aspect as the glassy interior, sometimes even presenting an earthy aspect; it forms zones around the vitreous nucleus, and each zone is distinguished by a different colour, marking the progressive transformations of the basic glass. The unaltered centre is usually more or less irregular, but presents a form in relation with that of the whole fragment. It is evident that the decomposition has taken place from the periphery towards the centre, and that each stage is marked by the different coloured zones, which may be black-brown, red, red-brown, pale yellow or green, yellowish white, or almost colourless, the uncoloured portions having a soapy aspect. The external zones are in general paler and more delicate than those towards the interior; they are so thin in some cases that they can only be recognised under the microscope. The specimens collected at Station 302, 1450 fathoms, in the South Pacific, present this zonary character due to the decomposition of the basic glass in the greatest perfection, so that they resemble the finely-zoned structure of some agates. In vesicular specimens the progress of this decomposition is not so well shown as in the compact specimens; generally they are entirely transformed into palagonite, and no trace of the original glass has been left.

It has been already stated that these fragments frequently form the nuclei of manganese nodules, and it is interesting to observe that they are very rarely found without a more or less thick coating of manganese, whilst lapilli of felspathic basalt, of augitic or hornblendic andesite, or fragments of ancient rocks like gneiss and granites, are often found in the same deposits without any, or but a very slight, coating of manganese. This might be interpreted by supposing that these basic fragments had lain for a much longer time upon the bottom of the sea than the other fragments, and that the manganese had thus had time to deposit round them in much thicker layers, or it may be held that they are more rapidly altered, and yield in the process the concretionary manganese which covers them. It may even be, we think, that traces of these highly alterable basic glasses have been preserved in consequence of the manganese coatings having held together in position the fragments which, were they free, would crumble and