taking the form of the elongated internal nucleus. The internal zones are brownish, marked by deeper coloured lines of separation, due to infiltration of manganese; then the palagonite affects a whiter tint, followed by other well-marked zones of a greenish colour. Finally the external zones become more vague, take on a soapy aspect, and become charged with matters containing manganese, but through this brownish mass the ill-defined external limits of the original vitreous fragment can be traced. These various zones are especially well seen under the microscope, but, as we have already pointed out, they can be observed on a macroscopic examination.

When these vitreous fragments in process of decomposition are studied in transmitted light, the stages of the alteration are still more evident. The altered substances are not only seen to penetrate and to modify the vitreous mass, but the decomposition only attacks the easily alterable glass, and does not generally affect the embedded crystals. This is well shown in Pl. XVI. figs. 3 and 4, where the palagonite is seen with its characteristic tint to advance into the glass while leaving the crystals of olivine intact and in place. Pl. XVII. fig. 3 gives a similar example, but here little lamellæ of plagioclase remain as witnesses of the primitive nature of the substance in which they are enveloped. This figure, which represents the nucleus of a manganese nodule, from Station 302, 1450 fathoms, South Pacific, shows the zonary aspect of the brown palagonite formed at the expense of a brownish homogeneous volcanic glass, shown in the lower two-thirds of the figure, this glass being especially rich in small crystals of plagioclase. In the interior it has not undergone alteration, but the fractures are seen to be infiltrated with manganese. In the palagonitic zones the same felspathic lamellæ are observed as in the vitreous portion; at the lower part of the figure a crystal of plagioclase is seen, one-half of which is in the altered and the other half in the unaltered portion of the rock. In this figure the striking contrast between the glass without structure and the concretionary texture of the decomposed portion is well represented.

In certain cases the alteration has reached a much more advanced stage, as represented, for instance, in Pl. XVII. fig. 1. The vitreous matter, which formerly occupied the whole of the space, has been so far decomposed that there now remain only two isolated vitreous fragments, characterised by their greyish tint; all the other portions of the specimen have been transformed into yellowish palagonite. In the same figure manganese is seen to be infiltrated into the fractures, and presents, especially at the upper part of the figure, a dendritic arrangement. It also often happens that the secondary substance has penetrated to the very centre of the vitreous fragment, as represented in Pl. XVII. figs. 2 and 4; in these cases nothing remains of the basic glass, and it is observed that the perlitic structure is sometimes developed in a remarkable manner. No better example of this could be produced than that shown in Pl. XVII. fig. 4, where each of the sinuous and more or less curvilinear fissures preserves its parallelism; the fissures