

Volcanic Sand, 7 of Coral Mud, and 1 of Coral Sand. This enumeration indicates the wide, even the universal, distribution of these particles over the floor of the ocean.

*Recent Volcanic Minerals in General.*—After what has been stated above, there can be little doubt as to the mode of origin and relatively recent age of the numerous vitreous particles scattered over the floor of the ocean. It has been indicated that the mineral particles and the more or less complete crystals, which are mixed with these vitreous fragments in deep-sea deposits, have in all probability a similar age and origin, having been derived from the disintegration of the pumice and lapilli of submarine and subaerial eruptions. While this is probably the correct interpretation for the mineral particles of those pelagic deposits in which all, or nearly all, the inorganic residue is made up of volcanic products, it cannot be held to apply to those deep-sea deposits around continental shores, in which the fragments of crystalline, schisto-crystalline, clastic, and organic rocks of various ages make up a large part of the deposit.

With reference to the origin of the mineral particles, we, in all cases, rely principally upon their association with larger fragments of rocks containing these minerals in the same deposit or in the same region of the ocean. Thus, when we discover in the free state crystals of plagioclase and augite, still in part covered by vitreous matter, associated in the same deposits with palagonitic lapilli or altered pieces of pumice, we conclude that these isolated minerals are of the same age as, and have had a similar origin to, the fragments which accompany them. In the same manner, if we find orthoclase, mica, or quartz, for example, along with fragments of granite, gneiss, and schist, we are led to conclude that the minerals in a free state in the mud have been transported by the same agents that have carried the rocks accompanying them, to which we assign a continental origin. This distinction has all the more force remembering what has been said as to the universal distribution of volcanic materials in the form of pumice, lapilli, and ashes, and the more limited distribution of the terrigenous minerals, which are transported only to a relatively restricted zone surrounding continental shores.

In some cases continental fragments may be carried much further than here indicated, and may be mixed with the volcanic fragments which are characteristic of pelagic deposits. In these cases the distinction between minerals derived directly from continental rocks and those derived from volcanic products becomes exceedingly difficult, and we must then rely upon the peculiarities which the minerals present, especially the silicates of eruptive rocks, according as they have crystallised in rocks of the ancient or of the more recent series. We will point out the distinctive characters which may serve as a guide in this classification, but it must be remarked that these characters have no absolute value, and that between the same species of minerals constituting the two series of rocks the differences are rather quantitative than qualitative. However, when these special details are taken into consideration along with the mineralogical and lithological