

pumice. Finally, it may be pointed out that just as the lapilli of compact basic glasses are abundant in a pelagic deposit, so are the splinters of obsidian, properly so called, rare in the same soundings or dredgings.

*Volcanic Ashes.*—The minuter glassy and mineral particles of a volcanic eruption are usually called volcanic ashes, and differ only from the lapilli, with which indeed they are often associated, by their smaller dimensions. They may, however, occur without these larger fragments, and they have as a general rule a much wider dispersion; indeed their distribution in deep-sea deposits is as extensive as that of pumice. By casting the eye down the columns of mineral particles in the Tables of Chapter II., it may be seen that fragments which might be called volcanic ashes are much more widely distributed than the lapilli or fragments of rocks. This arises from the circumstance that these volcanic mineral particles may have a double origin: they may have been projected as isolated grains by subaerial or submarine eruptions, or they may be derived from the mechanical disintegration or the chemical decomposition of pumice or lapilli, of which they formerly were constituent parts. In other words, they may be volcanic ashes in the proper sense of the term, or the residue of pumice and of lapilli more or less destroyed. All that was said at the commencement of this chapter with regard to the distribution of pumice applies equally to these incoherent particles. It will suffice to recall the phenomena witnessed in Iceland in 1874 and in Krakatoa in 1883, together with many similar instances, with reference to the projection of ashes, to understand the vast extent over which these particles may be spread. Granted the origin of these fragmental materials from the pulverisation of liquid lava, their transportation by air and by water, one would expect to find these volcanic dusts everywhere in the deep-sea deposits; and remembering the rapidity with which they must have cooled, they should be present as vitreous particles, with the minerals which were ejected with them, in more or less embryonic form, and generally covered with a vitreous coating. This is, in fact, what is observed in pelagic deposits.

It seems important here to recall what is understood by recent volcanic particles in opposition to mineral particles derived from the decomposition of ancient rocks of continental origin, which make up the larger part of terrigenous deposits. The researches of the last few years seem to have shown that the subdivision, before generally admitted, into Tertiary and Post-Tertiary volcanic rocks, and into Plutonic or Pre-Tertiary rocks, cannot now be maintained. If we have, however, designated as recent rocks those spoken of up to this point in the present chapter, it is only because their position at the bottom of the sea and their lithological nature appear to require this classification. We seem to be justified in regarding these volcanic ashes as recent volcanic products like the pumice and the lapilli, with which they are associated in deep-sea deposits. It becomes very difficult to make this distinction among the mineral particles, especially when the products of recent eruptions are mixed in the terrigenous muds with the debris of