of a fall of volcanic ashes, likewise obtained in the dredges, it is often impossible to say whether they came from a submarine or a subaerial eruption.

Pumice.—On account of its abundance and the wide area of its distribution, pumice merits the first consideration among the volcanic materials of marine deposits. This rock is merely a vesicular variety of a number of lithological species, and the wide distribution of this variety is dependent on its spongy structure. Mr Murray was the first to point out the important role played by pumice in the formation of pelagic deposits and in the origin of the soil of coral atolls,[1] and the same considerations, with further developments, were afterwards dwelt upon in a joint paper by ourselves.[2]

During the Challenger Expedition fragments of pumice were frequently taken in the tow-nets while floating on the surface of the sea, and were often found to be covered with Cirripeds and other marine animals. Long lines of pumice fragments were also observed on coral reefs just above high-water mark. From New Zealand, South America, Japan, and other countries, immense quantities of pumice are carried to the ocean by rivers. The Expedition, however, did not meet with any of those prodigious fields of floating pumice which have many times been recorded by voyagers as being so vast as to impede the progress of their ships,—for instance, after the famous eruption of Krakatoa in 1883,[3] and in the South Pacific in June and July 1878 by Captain Turpey, and by Captain Harrington in March 1879.[4] The pumice sent to us by Captain Turpey was dark-green in colour, and was believed to have been derived from a submarine eruption. The fragments of pumice, which float on the surface in great fields, or in long parallel lines, are carried enormous distances by oceanic currents, and, being rubbed and knocked against each other by the action of the waves, they ultimately assume a rounded appearance, as if they had been rolled like river pebbles. While this rubbing, knocking against each other, and rounding goes on, a very large number of the triturated fragments that are broken away from the outer surfaces fall as minute splinters to the bottom of the sea, contributing largely to the formation of pelagic deposits. The larger and smaller fragments of pumice slowly become waterlogged and sink to the bottom. Mr Murray

[1] Murray, *Proc. Roy. Soc. Edin.*, vol. ix. p. 247.

[2] Murray and Renard, *Proc. Roy. Soc. Edin.*, vol. xii. p. 495. See also Helge Bäckström, "Ueber angeschwemmte Bimsteine und Schlacken der nordeuropäischen Küsten," *Bihang till. K. Svenska Vet. Ak. Handl.*, Bd. xvi. Afd. 11, No. 5.

[3] The Bay of Lampoong, in the Strait of Sunda, was blocked by a vast accumulation of pumice projected in a few hours by the eruption of Krakatoa. This floating barrier of pumice had a length of 30 kilometres, a breadth of 1 kilometre, and a depth of 3 to 4 metres; it was raised about 1 metre above, and plunged 2 metres below, the surface of the water. These numbers indicate that at this point 150,000,000 cubic metres of volcanic matters were thus accumulated. This elastic and moving wall undulated with the flux and reflux of the waves, and the fragments of which it was formed were carried by currents to thousands of miles from the eruption, and scattered finally over the surface, and, as we now know, also over the bottom, of the ocean (*Comptes Rendus*, tom. xc. p. 1101, 1883). See also Charles Meldrum, *Brit. Ass. Report* for 1885, pp. 773–779, 1886; S. M. Rendall, *Nature*, vol. xxx. p. 288, 1884.

[4] Captain Turpey says that in some parts of the sea these pumice stones were in such large numbers that the small boats which the ship drew after it rose out of the water and were drawn along as if on a bed of rocks. Captain Harrington says that many of the patches assumed the appearance of islands, and were large enough to retard the progress of the vessel considerably, their appearance being alarming.