

After the above description of basic glasses and of palagonite, it is important to show that our determinations are supported in all points by the results of chemical analysis. We give first the analyses of three compact, black, vitreous fragments from Stations 276, 285, and 302, all in the South Pacific. The fragments analysed presented all the characters above indicated for fragments of compact basic glass, in which by means of the lens small crystals of olivine alone could be distinguished.

Station.	Depth in Fathoms.	No.	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	CaO	MgO	K <sub>2</sub> O	Na <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Total.
276	2350	93	46.76	17.71	1.73	10.92	0.44	11.56	10.37	0.17	1.83	...	101.49
285	2375	82	49.97	11.68	2.45	10.60	traces	11.20	12.84	0.25	1.60	0.33	100.92
302	1450	95	46.84	17.78	1.64	10.79	0.34	11.87	9.24	0.28	2.02	...	100.80

It is evident, after the examination of the above figures, that the determination of these fragments as belonging to the basic glasses is established in an incontestable manner; they must be referred to the lithological family comprising the basalts.

It remains now to indicate the results of the analysis of the palagonitic matter which covered the fragment made use of in Analysis No. 93.

Station.	Depth in Fathoms.	No.	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Mn <sub>2</sub> O <sub>3</sub>	CaO	MgO	K <sub>2</sub> O	Na <sub>2</sub> O	H <sub>2</sub> O	Total.
276	2350	94	44.73	16.26	14.57	2.89	1.88	2.23	4.02	4.50	9.56	100.64

In comparing this analysis with that of the anhydrous silicate (Analysis No. 93) from which this palagonitic matter was derived, it may be observed that the latter is produced by the hydration of the former; it contains, in fact, 9.56 per cent. of water. The transformation which has taken place seems to tend to the formation of a zeolitic substance; lime and magnesia are eliminated, the protoxide of iron passes into peroxide, alkalis derived from the action of sea-water enter into combination, the quantity of alumina remaining almost constant.

*Palagonitic Tufas.*—This name was introduced by Sartorius von Waltershausen to designate certain tufas found in Iceland, Sicily, Galapagos Islands, and other regions, composed principally of fragments of basic volcanic glass, like those described above, along with other volcanic lapilli chiefly belonging to the basic series. These tufas are known to have been deposited under water, and in some cases the materials were probably derived from submarine eruptions.<sup>1</sup> In many regions of the deep sea tufas in every way analogous to these palagonitic tufas were discovered by the Challenger Expedition, associated with extensive depositions of peroxide of manganese, and frequently forming the nuclei of manganese nodules.

<sup>1</sup> See A. Penck, "Ueber Palagonit- und Basalttuffe," *Zeitsch. d. d. geol. Gesellsch.*, 1879, pp. 504-577.