Analysis of a Manganese Nodule.[1]

By Professor A. Renard.

Station 276; 2350 fathoms, South Pacific.

I. 0·8271 grm. of substance dried at 100° gave 0·0787 grm. water (H_2O), 0·1600 grm. silica (SiO_2), 0·0264 grm. of lime (CaO), 0·0526 grm. alumina (Al_2O_3), 0·2208 grm. peroxide of iron (Fe_2O_3), 0·0148 grm. magnesia (MgO), 0·2354 grm. manganic oxide (Mn_2O_3) corresponding to 0·2189 grm. of manganous oxide (MnO), 0·0119 grm. nickel (Ni) corresponding to 0·0151 grm. oxide of nickel.

II. 0·1425 grm. of substance dried at 100° treated with hydrochloric acid and the resulting gas conducted into a solution of potassium iodide liberated iodine; 12 c.c. of potassium thiosulphate (1 c.c. = 0·937 c.c. of the standard solution); 1 c.c. of the standard solution = $\frac{Cl}{10}$ or $\frac{O}{20}$, whence 1 c.c. = 3·55 grms. of chlorine or 0·8 grm. of oxygen—

$$1000 : 0{\cdot}8 = 12 \times 0{\cdot}9377 : x.$$
$$\therefore\ 1000 : 0{\cdot}8 = 11{\cdot}24 : x.$$

$\therefore\ x = 0{\cdot}008992$ grm. of oxygen capable of liberating chlorine from hydrochloric acid, *i.e.*, 6·31 per cent. oxygen.

The atomic ratio of 0·384 O is required if Mn be present as MnO_2 and Ni as Ni_2O_3, but 0·394 O was the ratio observed—

	a	b	$\frac{a}{b}$
Manganous oxide,	26·46	MnO = 71	0·372
Nickel,	1·82	Ni = 74·8	0·024
Oxygen,	6·31	O = 16	0·394
			$0{\cdot}372 + \frac{0{\cdot}024}{2} = 0{\cdot}384$

The formula $MnO_2 + \frac{1}{2}H_2O$ requires 9·18 per cent. water. Consequently 26·46 per cent. manganous oxide, which corresponds to 32·42 per cent. manganese binoxide, is equivalent to 3·28 per cent. water.

26·7 per cent. ferric oxide require as limonite 4·50 per cent. water.

	I.	II.	
Water (H_2O),	9·51	...	9·51
Silica (SiO_2),	19·34	...	19·34
Lime (CaO),	3·19	...	3·19
Alumina (Al_2O_3),	6·36	...	6·36
Ferric oxide (Fe_2O_3),	26·70	...	26·70
Magnesia (MgO),	1·79	...	1·79
Manganous oxide (MnO),	26·46	...	26·46
Nickel oxide (NiO),	1·82	...	1·82
Oxygen (O_2),	...	6·31	6·31
			101·48

[1] In the remainder of this Appendix the symbols are used with their ordinary value, H = 1 and O = 16.—J. M.