

WATER FROM THE SIMPLON TUNNEL.

By ARTHUR GARFIELD LEVY, B.Sc.

A SAMPLE of water from one of the hot springs encountered during the construction of the Simplon tunnel between Switzerland and Italy, obtained from Mr. Francis Fox, the well-known engineer, was recently examined by the author in the laboratory of Mr. Bertram Blount. The spring was situated at a point between 9·1 and 9·4 kiloms. from the Italian end of the tunnel. It discharged water at the rate of 230 litres per second, the temperature of the water being 45·9° C.

The water itself was clear, colourless, and devoid of smell, and had a somewhat saline taste. It was free from organic matter and from chlorine, the total absence of the latter being rather remarkable.

The mineral constituents present are as follows :

				Grams per Litre.	Grains per Gall.
Silica	...	...	..	0·0102	0·71
Alumina and ferric oxide	...	...	...	0·0022	0·16
Calcium oxide	...	...	...	0·4910	34·37
Strontium oxide	...	...	...	0·0030	0·21
Magnesium oxide	...	...	...	0·0655	4·59
Potassium oxide	...	...	...	0·0050	0·35
Sodium oxide	...	...	...	0·0086	0·60
Carbon dioxide (combined)	...	...	...	0·0267	1·87
Sulphur trioxide	...	...	...	0·8000	56·00
				1·4122	98·86
Combined water and loss	...	...	...	0·1098	7·68
Total solids	...	...	...	1·5220	106·54

A trace of lithium was also present. No barium, cæsium, or rubidium could be detected by the spectroscope.

THE ANALYST.

From the above analysis the salts probably present in the water are calculated to be as follows :

			Grams per Litre.	Grains per Gall.
Calcium carbonate	...	...	0·0607	4·25
Strontium sulphate	...	...	0·0053	0·37
Calcium sulphate	...	...	1·1099	77·69
Magnesium sulphate	...	...	0·1965	13·77
Potassium sulphate	...	...	0·0092	0·65
Sodium sulphate	...	...	0·0170	1·27
Silica	...	...	0·0102	0·71
Alumina and ferric oxide	...	...	0·0022	0·16
			<hr/> 1·4110	<hr/> 98·77

The water is very rich in calcium sulphate, besides which there are present a considerable quantity of magnesium sulphate and small amounts of other salts.

An examination of the gases expelled by boiling the water showed it to contain only the ordinary constituents of the atmosphere, the quantities found being as follows :

			C.C. Dry Gas per Litre at 0°C. and 760 Mm.		Percentage on Total Gas.
Carbon dioxide	...	...	2·0	...	9·6
Oxygen	...	...	6·1	...	29·4
Nitrogen	...	...	12·3	...	59·1
Argon	...	...	0·4	...	1·9
Total	...	...	<hr/>20·8	...	<hr/> 100·0

The gases are evidently due to absorption from the air.

To Mr. Francis Fox for providing the opportunity to examine a water of considerable chemical interest, and to Professor Herbert Jackson for kindly making the necessary spectroscopic tests, I wish to offer my acknowledgments and thanks.

DISCUSSION.

Mr. BLOUNT said that, as this water was possibly entirely plutonic, having never seen the surface of the globe, something out of the common had been looked for in its results. The only interesting point, however, was the complete absence of chlorine. He had never met with a natural water before that was completely destitute of chlorine; it was unique.

The PRESIDENT (Mr. Bevan) inquired to what extent the water had been concentrated before the test for chlorine was made, and also whether the water had been tested for barium.

Mr. W. T. BURGESS remarked that, as a rule, the quantity of chlorine in natural water became less as the distance from the sea was greater. In France, for instance, it was possible to get rain-waters much freer from chlorine than in England, and possibly the distance from the sea which the water had to travel before being deposited as snow and subsequently melted might have some bearing on its freedom from chlorine.

Mr. FAIRLEY said that in Asia and in America it was possible to get much

farther from the sea than anywhere in Europe, but the Great Salt Lake of Utah and some of the lakes of Central Asia were exceedingly saline.

Mr. BLOUNT suggested that possibly those lakes were themselves the remains of ancient seas.

Mr. LEVY, in reply, said that chlorine was only looked for in the water as received, without any concentration. The tests, however, were allowed to stand for a very long time, in one case (using 250 c.c. of water) for four or five days. It was a difficult water to concentrate, because, on account of the large quantity of calcium sulphate present, a crust separated out. Professor Herbert Jackson had kindly made a spectroscopic examination of the sample, and had found in it a trace of lithium, but no barium or cæsium. Probably about 200 miles was the distance of the source of this water from the sea.* No doubt the altitude would also have to be taken into account. At the same time, to have attained so high a temperature in such a region, it must have travelled a considerable distance underground, and it was rather remarkable that it did not take up chlorine somewhere on its way.

