36. NOTE *on* NATURAL GAS *at* HEATHFIELD STATION (SUSSEX). By J. T. HEWITT, M.A., D.Sc., Ph.D. (Communicated by the PRESIDENT. Read June 8th, 1898.)

IN a boring made for water some months ago at Heathfield Railway-station (L. B. & S. C. R.) an outflow of natural gas was encountered. A cap provided with a cock was placed at the outlet of the boring, and thus the collection of a sample of the gas for analysis was an easy matter. Owing to the courtesy of Mr. R. J. Billinton, the Locomotive Engineer of the London, Brighton, & South Coast Railway, who not only gave me the necessary permission, but also placed every facility at my disposal, I was enabled to take a sample of the gas on Dec. 31st, 1897. Mr. Billinton further informed me that a bed of lignite had been encountered at a depth of about 300 feet; this was of considerable thickness, and was supposed to be the stratum in which the gas had its origin. He very kindly provided me with a specimen of this substance, which one can perhaps better regard as a shale; this also was analysed.

ANALYSIS OF THE GAS.

(*Hempel Method and Apparatus.*)

	Per cent.
Methane (CH_4)	91·9
Hydrogen (H_2)	7·2
Nitrogen (N_2)	0·9
	100·0

The gas was examined for oxygen, carbon dioxide, carbon monoxide, olefines, and hydrocarbon vapours; these were found to be absent.

ANALYSIS OF THE SHALE.

In the first place the shale was analysed according to the customary method of carrying out commercial analyses for coal. The following result was obtained:—

	Per cent.
Moisture	4·90
Volatile matter	15·55
Fixed carbon	1·74
Ash	77·81
	100·00

It should be pointed out that very little reliance can be placed on the numbers for volatile matter and fixed carbon, as, owing to the large amount and porous nature of the ash obtained, it is extremely easy to increase the percentage of volatile matter and diminish that of the fixed carbon, by the combustion of the latter, even with the lid firmly fixed on the platinum crucible in which the analysis is conducted.

Under these circumstances it was very desirable to make a full elementary analysis, which was carried out with a sample dried at 110° to 115° Centigr. In this case we have to deal with 18·18 per cent. of organic material and 81·82 per cent. of ash.

	Per cent.
Carbon	9·43
Hydrogen	1·83
Nitrogen	0·68
Sulphur	1·27
Oxygen (by difference)	4·97
Ash	81·82
	100·00

The sulphur is here reckoned with the organic material; considering, however, that on burning the shale the smell of sulphur dioxide is noticeable, and moreover that the ash contains some $2\frac{1}{2}$ per cent. of sulphur trioxide (as sulphates), it is very probable that the sulphur of the shale actually exists as pyrites. If so, this will make the oxygen percentage, obtained by difference, considerably too low. Taking the above figures, however, and making no correction for the oxidation of sulphides, we should obtain for the organic material of the shale the following result:—

	Per cent.	Per cent.
Carbon	9·43	51·87
Hydrogen	1·83	10·07
Nitrogen	0·68	3·74
Sulphur	1·27	6·99
Oxygen	4·97	27·33
	18·18	100·00

The ash gave the following results on analysis:—

	Per cent.
Silica (SiO_2)	59·72
Alumina (Al_2O_3)	24·40
Ferric oxide (Fe_2O_3)	7·03
Lime (CaO)	2·14
Magnesia (MgO)	0·96
Sulphur trioxide (SO_3)	2·54
Phosphorus pentoxide (P_2O_5)	absent
Alkalies and loss (by difference) on analysis	3·21
	100·00

In conclusion, I desire to express my cordial thanks to Mr. Billinton for the courtesy and kindness with which he placed material at my disposal in the course of this investigation.

Discussion (on the two preceding Papers).

Mr. J. E. Clark remarked that, in view of the strong divergence in the analyses, it would be of interest if the new method by liquefaction could be applied, by the co-operation of the Royal Institution. The idea of collecting the possible gas escaping at

the surface beneath ice was interesting. But would it be easy to get areas still enough to freeze, where the absence of all surface-generated marsh-gas could be guaranteed?

Mr. E. T. NEWTON, having seen specimens from the Heathfield boring, remarked on the difficulty of distinguishing between the Wealden and the Purbeck beds; but, judging from the few fossils identifiable, he thought that Mr. Dawson was correct in ascribing the beds met with at a depth of 353 feet to the Purbeck Series. He also spoke of the high pressure at which the gas escaped from the pipe, when the boring was visited by him about a fortnight before the reading of these papers.

Mr. C. E. MASTERMAN thanked the Fellows for their appreciation of his attempt to demonstrate the suitability of the gas for lighting by incandescent mantles. He explained the nature of the burners used, and said that he hoped shortly to be able to perfect the apparatus still further.

The PRESIDENT and Dr. ISAAC ROBERTS also spoke.

Mr. DAWSON said that the absence of the higher hydrocarbons in Dr. Hewitt's analysis could not be reconciled with the normal appearance of the gas, which could not be distinguished from the appearance of ordinary coal-gas, and burnt with a bright yellow flame, as might be seen from the sample now shown on the table. Assuming both analyses to be correct, then the gas must vary very considerably. Although variation had been noticed in the North American natural gas, it had scarcely been to this extent. The analyses of the lignite yielded results similar to those of most lignites. The bands of lignite at the particular horizon from which the analysed sample was taken were thin, and mixed with shale. Thicker beds (about 2 feet) had been met with at Waldron, but no gas had been discovered in them. He considered that the gas was probably derived from the underlying petroleum-bearing strata.

He wished to express his thanks to Mr. E. T. Newton, for the identification of the Purbeck fossils; to Messrs. Le Grand & Sutcliffe, Mr. C. O. Blaber, C.E., and Mr. John Lewis, C.E., for kindly supplying details and plans of borings; and to Mr. S. A. Woodhead, B.Sc., for his analysis.

Dr. HEWITT said, in reply to Mr. Dawson, the fact might be mentioned that vegetable matter, when buried, from the time of its death and through all stages until its final conversion into coal or anthracite, continuously gives off methane; this is shown in the occurrence of marsh-gas and of firedamp. Hence there is nothing absurd in the supposition that the gas actually arose from the clay-bed impregnated with vegetable matter, the analysis of a sample of which had been given. A natural gas having the composition given in the analysis might equally as well have arisen from a known bed containing organic matter as from a hypothetical petroleum-bearing deposit.