system. Increased costs must be incurred in the distribution of the gas compared with those incurred in the case of straight coal gas.

On one matter to which public attention has recently been directed we would remark that the possibility of converting the comparatively large percentage of carbon monoxide in water gas into carbon dioxide or methane is by no means a novel proposition either from the scientific or industrial point of view. Sabatier and his co-workers showed, many years ago, that in the presence of nickel, cobalt, or palladium, carbon monoxide and hydrogen at 230-400° C. react to form methane and water, thus: $\text{CO} + 3\text{H}_2 = \text{CH}_4 + \text{H}_2\text{O}$. This hydrogenation is subject to the important objection from the technical point of view that while hydrogen must be present in excess, an equal volume of hydrogen must be added to water gas to provide the mixture theoretically necessary. This hydrogen can be derived from water gas, and the net result is that the yield of methane is only about 15 per cent. of the total water gas employed. Sabatier pointed out that by passing water gas over nickel at 400-500° C. the following reaction occurred: $3\text{CO} + 3\text{H}_2 = \text{CH}_4 + \text{H}_2\text{O} + \text{C} + \text{CO}_2$. The carbon deposited on the catalyst may, at the same temperature, be caused to react with steam to form a mixture of hydrogen, methane, and carbon dioxide, whereby the catalyst is regenerated for use in the first phase of the process. Sabatier further suggested that both phases might be combined by passing water-gas and steam over a nickel catalyst at 400-500° C., when the following reaction occurs: $5\text{CO} + 5\text{H}_2 + \text{H}_2\text{O} = 2\text{CH}_4 + 2\text{H}_2 + 3\text{CO}_2$.

These various reactions are summarised in a recent paper by Drs. E. F. Armstrong and T. P. Hilditch, read before the Royal Society (see *NATURE*, February 3, p. 168), in which they direct attention to a reaction between carbon monoxide and hydrogen which has hitherto apparently escaped notice. They find that

the action between equal volumes of carbon monoxide and hydrogen in the presence of nickel or a similar catalyst at temperatures below 300° is in the main represented by $2\text{CO} + 2\text{H}_2 = \text{CO}_2 + \text{CH}_4$. It will be noticed that the gases carbon monoxide and hydrogen participate in the reaction very approximately in the relative proportions in which they are present in blue water gas, (43 per cent. CO , 48 per cent. H_2). The reaction, though never complete, proceeds to a very considerable extent, and the authors consider the process may be of value in gas practice as the proportion of methane is 25 per cent. of the water gas decomposed, whereas by any of the other processes referred to the maximum possible yield is only 20 per cent.

The idea of the technical utilisation of the first reaction referred to above for the production of methane, and the application of the reversible reaction $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$ for the production of hydrogen has recently been revived in connexion with the Tully plants. It must be realised that little if any actual large-scale operations of this nature have hitherto been carried out. Considerable experience is necessary for the successful operation of catalytic plants operated at relatively high temperatures and dealing with the huge volume constituting a day's make of towns' gas in the case of even one of the smaller gas companies. It is contemplated that the plant required would be of the same nature as that designed for the catalytic purification of gas from sulphur compounds which is in successful operation in the works of the South Metropolitan Gas Company. Operating charges would possibly amount to about $\frac{1}{4}$ d. per therm. It is questionable whether it would be technically feasible to remove the carbon dioxide produced. A suitable catalyst has been prepared, and small-scale operations in a plant capable of treating 200 cubic feet of gas per hour have been carried out. Large-scale operations constitute a much more difficult proposition.

Obituary.

MR. F. W. HARMER.

BY the death on April 24 of Mr. Frederic William Harmer, within a few days of the completion of his eighty-eighth year, the county of Norfolk loses one of its most distinguished sons and East Anglia the penultimate survivor of a band of amateur and professional geologists to whom science is under deep obligations, not merely for the elucidation of local problems, but for the establishment of principles and of methods of research of European or even wider application.

Mr. Harmer, descended from a stock the most ancient in Norfolk, was early imbued with a love of science, especially of geology, and the fortunate chance of a meeting in 1864 with Searles V. Wood the younger directed his enthusiasm and energy along lines of research that, with one significant break, he followed to the end of his long and useful life. The two friends embarked upon the study of the records of the Ice Age, and, in pursuance of Wood's conviction that accurate mapping of the glacial deposits was essential to the decipherment of their story, the task—never before attempted—was undertaken, and in the course of a few years an area of 2000 square miles was mapped on

the scale of one inch to the mile. Harmer's share was the county of Norfolk and the northern parts of Suffolk.

Wood told the present writer that the young officers of the Geological Survey with whom he was often in conflict ought to be grateful to him and his friend because their demonstration of the practicability of mapping drift deposits had compelled the Survey to increase its staff. Copies of the map, claimed by its authors to be the first of its kind ever produced, have been deposited in the library of the Geological Society and in the Museums at Norwich and Ipswich, and a lithographed reduction of the eastern portion was appended by Wood to one of the supplements to his father's great monograph of the Crag Mollusca.

The period of his association with Wood, of whom Mr. Harmer always spoke with touching reverence and affection, was brought to a premature close by the complete breakdown of Wood's health ending with his death in the early 'eighties. The loss of his friend and master acted as an effective damper upon Mr. Harmer's geological activities, and for more than a decade he threw his energies into business and the multifarious duties of municipal life.

The meeting of the British Association at Ipswich in 1895 was marked by the reappearance of Mr. Harmer, to the great surprise of a generation that had come to regard his work as finished. He presented two important papers upon the Coralline and Red Crag, which were received with great interest and attention by newcomers in the field of Pliocene geology and also by distinguished workers from France and Belgium present at the meeting.

From this time until the end of his life Mr. Harmer's interest and activity never flagged. He again took to the field and contributed many important papers to the Geological Society and other bodies. In Pliocene geology his achievements were many and valuable. The discovery of a deposit of Red Crag at Little Oakley, which yielded to his minute and pertinacious investigation a fauna of unparalleled richness, led him to a general review of the Pliocene geology of East Anglia, giving definiteness to the opinion long held by workers in that field that the deposits of Red Crag age marked successive stages in the withdrawal of the North Sea from south to north.

A discussion of the fragmentary Upper Tertiary patches of Lenham gave occasion for the correlation of the British Pliocenes with those of Belgium and Holland. His achievements in this field of study have the enthusiastic recognition of the geologists of Holland, Belgium, and France.

The remarkable contrast presented by the contemporary Pliocene deposits of the two sides of the North Sea in regard to the abundance of shells led to investigations of great moment. Premising that shells are cast up in profusion on the Dutch coast by the prevalence of onshore winds, Mr. Harmer showed that in Pliocene times the western shores received the shelly beaches. He proceeded from this to an elaborate discussion of the meteorology of the Pliocene and Glacial Periods, the first attempt by any man of science to apply the methods and results of modern meteorology to the solution of geological problems. This pioneer work has been followed up by many writers, notably in the recent book "The Evolution of Climate" by Mr. C. E. P. Brooks, to whom Harmer's work was apparently unknown.

The many additions to the Molluscan fauna of the Upper Tertiaries rendered necessary the resumption of the work of description interrupted by the death of the elder Searles Wood. Mr. Harmer undertook the task, and it is gratifying to know that shortly before the accident by which his death was accelerated he had revised the final proofs of the last of a series of supplements to the monograph on the Crag Mollusca published by the Palæontographical Society.

The great value of Mr. Harmer's work was recognised by his geological brethren; from the Geological Society he received the Murchison medal; he was elected successively Membre Associé Étranger and Membre Honoraire of the Belgian Geological Society; and the University of Cambridge conferred upon him the honorary degree of M.A.

Two of Mr. Harmer's sons adopted a scientific career, in which they have attained very high distinction; the elder, Sir Sidney F. Harmer, is well known as the director of the Natural History Department of the British Museum; the other, Mr. William Douglas

Harmer, called at a very early age to the position of warden of St. Bartholomew's Hospital—always regarded as a presage of future distinction—is now the senior surgeon in the throat department of the hospital.

PERCY F. KENDALL.

MR. M. DE C. S. SALTER.

THE death on May 21, after a short illness, of Mr. Mortyn de Carle Sowerby Salter, at the early age of forty-two, removes from the scientific world an extremely able worker just at the moment when the mastery he had attained in his special field of study had brought him in sight of important achievements. The son of Mr. M. J. Salter, he was educated at Bancroft's school, and passed directly, at the age of sixteen years, to an assistantship in the British Rainfall Organisation under its founder Mr. G. J. Symons. Here he developed an aptitude for statistics and a patience with detailed routine which enabled him later to grasp the scientific principles underlying the distribution of rain and develop an enthusiasm for research combined with sagacity in the practical application of his knowledge.

Mr. Salter became my chief assistant at Camden Square in 1907, and from 1912 onwards relieved me of the whole responsibility for the accuracy of the annual rainfall tables in "British Rainfall." In 1914 he was appointed assistant-director and in 1918 joint-director of the Organisation, and on the transfer to the Meteorological Office of the Air Ministry in 1919 he became the first superintendent-in-charge, and was thus able to make the transition from private to official management easy for the five thousand voluntary observers.

Mr. Salter's health was always precarious, but he was nevertheless an indefatigable worker, and to the fact that no Medical Board would pass him for any form of military service is probably due the survival of the long-established system of rainfall investigation throughout the years of the War.

Mr. Salter served on the council of the Royal Meteorological Society and as a vice-president for many years; and he was an active member of the Institution of Water Engineers. He contributed numerous papers to these societies and to the *Meteorological Magazine*, of which he was joint-editor since 1913. He took a considerable part in the compilation of annual rainfall maps of the British Isles and of large-scale rainfall maps of many counties and other areas in co-operation with me, and after my retirement he carried the rainfall mapping of the country far towards completion. His little book "The Rainfall of the British Isles," published in 1921, gives an excellent account of the existing state of knowledge on the subject. In a paper on the fluctuations of annual rainfall considered cartographically, in collaboration with Mr. J. Glasspoole, read to the Royal Meteorological Society during his last illness, Mr. Salter gave an important discussion of the regional relations of rainfall and atmospheric pressure full of promise for future development.

For twenty-three years I found Mr. Salter a loyal fellow-worker and faithful friend, keenly intelligent, absolutely trustworthy, full of sympathy and con-