the ice, is a problem which can not be studied to advantage anywhere better than in Greenland, where similar conditions now prevail as once obtained in the glaciated area of both the northern and the southern hemisphere. These are only a few of the most important botanical questions which have to be solved at an arctic station.

The resident investigator should make detailed meteorological observations. Near the proposed site for the laboratory are mountains 2,000 to 3,000 feet high, and easily accessible. Mr. Porsild proposes to place self-registering instruments in a hut on the top of the mountain, so that simultaneous readings could be had from near sea level and from the high mountain—a matter of great consequence. In this connection also phenological observations would be taken.

Among the problems of geological interest, for the study of which Greenland offers special advantages, may be mentioned the study of glaciation, and of the extremely rapid erosion, that takes place in the northern part of the country. Certain parts of the coast are known to be sinking, in the basaltic regions of north Greenland earthquakes are not infrequent, and a trained observer, living in the country the whole year round and supplied with necessary instruments, could do good service by obtaining data on these phenomena. Large collections of plant fossils have already been brought home from these regions, but still much remains to be done in paleontological research.

Of zoological subjects especially plankton studies could be undertaken, and a series of observations of the periodicity of plankton, together with data on salinity and temperature of the sea water would be of considerable interest for an understanding of the animal life in the high arctic seas.

Mr. Porsild, who is now connected with the botanical department of the University of Copenhagen, has already done good work in the study of arctic plant life, and if he undertakes the work of the resident investigator, it can be taken for granted that results of permanent value to biological science will follow the founding of the new institution. The plan of establishing an arctic biological station in north Greenland, as proposed by Mr. Porsild, has received the endorsement of all the scientific institutions in Denmark, and the hearty approval of scientists in northern Europe. It now remains to be seen whether the Danish government is aware of the importance of this proposal and willing to take the necessary steps for its realization.

PEHR OLSSON-SEFFER.

STANFORD UNIVERSITY, CAL.,
December 5, 1904.

SPECIAL ARTICLES.

THE DEXTER, KANSAS, NITROGEN GAS WELL.*

DURING the first half of 1903 parties drilling for oil or gas at Dexter, Kansas, came into a gas sand at a depth of about 400 feet which yielded a large amount of gas. It was soon closed in and an attempt was made to burn it, as natural gas is usually burned, for generating steam for drilling purposes. Much to the surprise of parties interested, it would not burn. Later it was found that when a fire was already kindled in a fire box or an engine and the gas turned on, as is usually done with natural gas, it would begin to burn, and would develop sufficient heat to generate steam moderately well. But as soon as the coal or other fuel in the fire box was consumed the gas would no longer burn. A cylinder of the gas was shipped to the University of Kansas later during the summer and was partially examined by different members of the chemical and geological departments.

This peculiar gas obtained from the ground in a manner similar to the way natural gas is ordinarily obtained, and in a region where gas might reasonably be expected, at once became an object of great interest. The owners of the well, who had spent their money in developing it, did not wish it given great publicity. But newspaper men wrote it up and oil and gas men generally spoke of it as a well of 'hot air.' Accordingly, the state geologist deemed it of sufficient interest to warrant a careful investigation. On his advice the well

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was opened up and allowed to flow freely through an 8¼-inch pipe for eleven days, and then through a 3-inch pipe three days more. The gas was again tested by trying to burn it in boilers, stoves and other places. But it was found to have practically the same character as when first obtained. During this long flow the well 'drilled itself in' to a considerable extent; that is, the escaping gas broke the upper part of the gas-bearing sandstone, blew the particles out through the casing and thereby deepened the hole. The static pressure of the gas at present is 120 pounds, and the flowage capacity, measured by the ordinary method using the pitot tube and Robinson's tables, is reported to be seven million cubic feet per twenty-four hours. These measurements have not been verified by the state survey, but the parties making them are so well known it is safe to assume they are approximately correct.

An ordinary gas-receiving cylinder with an opening at each end was now shipped down to the well and was filled with gas by the ordinary replacement method, the cylinder first being filled with water. The full pressure of the well was admitted to the cylinder, the valves securely closed, and the same shipped to Lawrence for analysis. The analysis of the gas was made by the junior author of this article and gave results as follows:

Oxygen	0.20
Carbon dioxide	0.00
Carbon monoxide	0.00
Methane, CH_4	15.02
Hydrogen	0.80
Nitrogen	71.89
Inert residue	12.09
Total	100.00

The analysis was carried out chiefly by means of the well-known methods given in Hempel's 'Gas Analysis.'

Methane was determined by combustion of the gas with pure oxygen and measurement of the resulting contraction, and also of the carbon dioxide formed in the combustion. Hydrogen was absorbed in a palladium tube; carbon dioxide was tested for with a potassium hydrate pipette and carbon monoxide with ammoniacal cuprous chloride solution. For the determination of oxygen a phosphorus pipette was used. The residual gas left unabsorbed after all the above operations was treated by the method used by Ramsay and Rayleigh in the separation of argon from atmospheric nitrogen (*Journal of London Chemical Society,* 1897, 181). The residue was mixed with an excess of pure oxygen and confined in a tube over mercury. A small quantity of a strong solution of potassium hydroxide was introduced into the tube over the mercury and a spark from an induction coil was passed through the mixture for about sixty hours. The nitrogen peroxide formed in the operation was absorbed by the solution of potassium hydroxide. The sparking was continued for several hours after all contraction in the volume of the gas had ceased, and the residue was then removed from the tube and passed into a phosphorus pipette filled with fresh phosphorus. Here it was kept for several hours to insure the complete absorption of the excess oxygen. The residue which failed to be absorbed was then measured. This constitutes the portion which is designated in the analysis as inert residue. No examination into the constitution of this residue has yet been made, because of lack of time, and until this is done nothing can be said concerning its composition, save that there is a possibility of its containing argon or other inert gaseous elements which have been found in atmospheric air.

The investigation of the inert gases will be carried out as soon as time will permit.

Geologically the mouth of the well is in the Permian, and the gas-bearing sandstone is close to the division line between the Upper Coal Measures and the Lower Permian. No caves or underground caverns of any importance ever have been found in this part of the state. The formations are a mixture of alternating beds of limestone and shale, with comparatively small amounts of sandstone found here and there in the shale. The gas itself, it should be remembered, occurs in sandstone in the same manner that ordinary natural gas occurs in other sandstones farther east. Naturally one is led to inquire whence this large amount of nitrogen which has already flowed from the well, an amount equal to not less than 125 million cubic feet measured at atmospheric pressure. A little farther east in the state there are hundreds of natural gas wells which produce a natural gas similar to that of Indiana, Ohio and Pennsylvania. For comparison a few analyses from different places in the state are here added, made by Professor E. H. S. Bailey, of the University of Kansas, years ago.

CHEMICAL COMPOSITION OF KANSAS NATURAL GAS. EXPRESSED IN PER CENTS.

Components of Gas.	Paola.	Osawatamie.	Iola.	Cherryvale.	Coffeyville.	Independence.
Hydrogen, H.........	0.00	0.00	0.00	0.00	0.00	0.00
Oxygen, O..............	0.45	trace	0.45	0.22	0.12	trace
Nitrogen...............	2.34	0.60	7.76	5.94	2.21	3.28
Carbon m-oxide, CO.	1.57	1.33	1.23	1.16	0.91	0.33
Carbon dioxide, CO_2	0.33	0.22	0.90	0.22	0.00	0.44
Ethylene series, C_2H_4, etc............	0.11	0.22	0.00	0.00	0.35	0.67
Marsh gas, CH_4......	95.20	97.63	89.66	92.46	96.41	95.28

It will be seen from the above table that oxygen is present in small quantities in almost all the samples analyzed and that nitrogen is present in all of them, reaching to a little over seven per cent. in gas from Iola. It is possible, of course, that a small amount of air was left in the gathering flask, but not probable. If so the amount of oxygen present would correspond to a proportionate amount of nitrogen, much less than is given in the table. Therefore, we may conclude that traces of nitrogen are usually present in Kansas natural gas. Carbon monoxide and carbon dioxide also are present in small quantity, but almost all the volume is marsh gas, CH_4, which reaches 97.63 per cent. in one sample. But in the Dexter gas no oxides of carbon could be found.

If we assume that the Dexter gas represents a volume of air which in some way was embedded hundreds of feet beneath the surface, then a number of interesting inquiries are presented, such as: What became of the oxygen? If it was consumed or absorbed by organic matter then why is the gas totally void of the oxides of carbon which are found present in small quantities in almost all natural gases? Is it possible that ground water absorbed the oxygen from a mass of air, leaving large quantities of nitrogen unabsorbed? Under ordinary conditions the ratio of absorption for oxygen and nitrogen by water is different from the ratio between the two gases in the atmosphere. It is possible that ground water simply absorbed the oxygen, leaving a residue of nitrogen unabsorbed. It must be confessed this hardly looks probable. But even if it is possible the most important question yet remains, namely, how did so large a volume of air become entombed in the ground? The writers hereof are unable to advance any views on this phase of the subject.

ERASMUS HAWORTH,
D. F. MCFARLAND.

COMMENT.

Under the view that the earth's atmosphere and hydrosphere represent volatile matter forced out from the interior of the shrinking globe, the Dexter nitrogen supply is simple and natural. It is one of many indications that the interior supply of gases is not exhausted and that the atmosphere is still growing.

H. L. FAIRCHILD.

THE TEACHING OF AGRICULTURE IN SOUTH CAROLINA.

CLEMSON AGRICULTURAL COLLEGE of South Carolina has recently completed a commodious building for the purpose of teaching the sciences related to agriculture. This building was dedicated to its use on August 9, by appropriate exercises. On that occasion Hon. J. E. Tindal, of South Carolina, delivered an address and dedicated the building to the prosecution of agricultural sciences. There was present a large audience of farmers and prominent men from different portions of South Carolina and neighboring states. The following is a synopsis of Mr. Tindal's speech:

The dedication of the building, he said, marks the seeming completion of the college. This building was put up last because the work of agriculture could be carried on better than could the work of other departments