LIGNITE AND ITS USES.*

By R. O. Wynne-Roberts.

The author, in another capacity, recently had the opportunity of collecting information regarding lignite and of presenting the same in a report to the government.

To-night it may be possible to supplement the report by discussing "Lignite and Its Uses" in a more general sense. It may, however, be necessary to incidentally refer to one or two items in the report because it is unavoidable.

Countless ages ago there were swamps and shallow lakes in which marsh-loving plants grow, deep waters in which algae flourished and aquatic mosses spread over the surface in tangled mats which, under the prehistoric condition, were such that these plants grow with a succulent freedom and rapidity unknown in later days. These plants died and fell into the water and by some preserving action of the water were gradually embalmed and fossilized. In course of time the deposit accumulated, fermentation took place and the vegetable matter was gradually altered in composition and character. This in time, and under increased temperature and pressure, became peat and afterwards converted into lignite and perhaps eventually became coal.

Coal is admitted to be the fossil remains of vegetation that flourished in the carboniferous period of the world's history, while lignite is that of the cretaceous and tertiary periods which are far more recent.

The nature of the compounds which go to build up coal of different kinds is still more or less a mystery, despite the fact that scientists have been investigating this subject for over 100 years. In nature there is a wonderful cycle of processes in continuous action by which the atmosphere is purified of the products of life and decay, through assimulation by vegetation, and under the influence of the sun's ray, the growing plant builds up its tissues from the carbon, hydrogen and oxygen, renders latent and storing the solar energy, and in the countless ages they were gradually converted into fuel.

According to Prof. Vivian Lewis, all the plants which were fossilized consisted of sedges and reeds, tree ferns, club mosses and trees akin to pine. The spores of club mosses of to-day give off a substance of so resinous in its nature as to resist the action of water and perhaps this has contributed to the preservation of plants in water. With some forms of vegetation the essential oils undergo oxidation and form resin and, these being more resistant to change, accumulate in masses of decaying vegetable matter so that large quantities of them are found in peat and lignite beds of Germany in a fossilized but little changed state, but whether they are to be found in this province, no information is yet to hand.

Peat, then, is merely decomposed vegetable matter, consisting chiefly of decayed moss and water plants, and is the lowest grade of fuel recognized in the classification of coals. It varies from yellowish or brown fibrous substance in which leaves and tissues of the plants are quite perfectly preserved through different stages of maceration to a dark brown colored material, in which little of the original structure can be recognized. Peat, after drying, is used for making coke, in gas producers, as domestic fuel, and in some countries it is briquetted. In the province of Schleswig-Holstein, a central power plant has been erected to supply electricity to 60 communities lying within a circle of 16 miles, and all power necessary is furnished by gas producers run entirely on peat.

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Dr. Berguis, of Hanover, recently made some experiments in the artificial formation of coal. He made an apparatus consisting of a bomb bored out of a block of steel and having a coned lid, etc. He placed peat containing 85 per cent. of water in this bomb, and heated the same by an electric furnace to 660 degrees Fahrenheit and succeeded in obtaining coal similar to natural bituminous coal.

This experiment is confirmatory of the statement already made and it will be interesting to give the figures:

Material	Temperature in degree Fahrenheit	Time Taken Hours	Composition of the resultant Coal			
			Carbon	Oxygen	Hydrogen	Nitrogen
*Peat...	...	..	52.4	41.4	5.50	0.70
Peat....	480	8	74.3	19.4	5.20	1.07
Peat....	570	8	77.0	16.9	5.00	1.07
Peat....	645	8	81.2	13.3	4.65	0.89
Peat....	645	24	84.0	10.4	4.62	0.95
Peat....	660	11	85.2	10.4	4.50	....

* Composition of dry peat before treatment.

Lignite, again, is also formed by a mass of compressed and partly altered vegetable matter. Sometimes stems are found in it presenting the appearance of undecomposed wood. Lignite contains a larger proportion of oxygen than does coal. It is sometimes called fossil wood, wood coal and brown coal. Some lignite, however, so closely resembles good bituminous coal as to be indistinguishable. There are many varieties of lignite, ranging from soft and plastic substance that can be spaded like peat, to hard layers which have to be blasted. Some contain more than 40 per cent. of water. Its color ranges from brown to pitch black.

According to the 1911 report of the Canadian Commission of Conservation, there are 7,500 square miles and 20,000 tons of lignite in Saskatchewan, of which about two-thirds are located in the southeast portion.

The map exhibited will show the district where lignite deposits are found. That on the west is known as the Belly River formation and that on the south as Laramie formation. There appears to be in the neighborhood of Estevan, several lignite deposits down to a depth of about 600 feet; whether such layers extend into other parts of the province it is difficult to say, but it is probable they do.

Before discussing the uses of lignite, it will be desirable to refer to its quality. The quality of any fuel is dependent on the proportion of combustibles it contains. These consist of fixed carbon, and volatile matter. Sulphur is a combustible, but owing to its being present in lignite in such small quantities, it can be ignored. The impurities consist of shale clay and other inconsumable materials which give rise to ash, and this differs greatly with various kinds of fuel. Some fuels are now used containing over half their weight of impurities. Another item which has an important bearing on the use of lignite is the quantity of water which it contains.

Fixed Carbon.—Vegetable tissues are composed of carbon, hydrogen and oxygen. As these tissues, in the formation of coal, are not exposed to atmospheric conditions but are altered out of contact with air, the three chemical elements named rearranged themselves. For instance, carbon combining with oxygen forms carbon dioxide; carbon and hydrogen formed inflammable gas and hydrogen with oxygen formed water. The conditions which facilitate the formation and escape of these gases also favor the formation of coal having a high percentage of fixed carbon. Such conditions are pressure, heat, folding and erosion of the local bearing strata. So, in the Rockies, where great disturbances have occurred by tilting of the rocks, folding of the bed plane, and generally causing a tremendous pressure to take place, the coals found there have a higher percentage of fixed car-