

The hydrographic studies can also be conducted by the U. S. Geological Survey and the state survey jointly, the former furnishing the instruments and supervision and the latter meeting the expense of the local observers. In return an expert hydrographer from the national bureau can furnish as required the necessary material for the state publications.

The statistical work can be carried on by the state geologist in the double capacity of agent for the U. S. Geological Survey and official representative for the state. The Federal forms and franks result in a great saving to the state bureau, while the U. S. Geological Survey obtains the advantage of an agent with a knowledge of local conditions and personally acquainted with the operators. Furthermore, the operators are not confused and annoyed by similar requests from different sources.

The same advantages are to be derived from national and state association in the co-operative survey of the agricultural soils with the U. S. Bureau of Soils, the forestry with the U. S. Forest Service, the terrestrial magnetism with the U. S. Coast and Geodetic Survey and the climate with the U. S. Weather Bureau.

W. B. CLARK.

HYPOTHESIS TO ACCOUNT FOR THE TRANSFORMATION OF VEGETABLE MATTER INTO THE DIFFERENT GRADES OF COAL.

DISCUSSION OF PAPER BY MARIUS R. CAMPBELL.

Sir:—The recent interesting article by M. R. Campbell¹ on the origin of coal suggests certain comments to me. Mr. Campbell is certainly right in saying that time by itself does nothing. It merely offers opportunity for other factors to work. His suggestion that the ease of escape of the by-products of alteration is one of the dominant factors in determining the rate and extent of alteration of vegetable matter into coal is therefore very plausible. One is tempted to enquire whether the mantling of the great ice sheet should not have checked that action, and whether therefore, according to his hypothesis, the coals north of the Ohio

¹ This Journal Vol. I., No. 1, p. 26.

should not be in an average way less developed than those farther south, where the gases have been less confined and the temperature probably on the whole higher.

Is this really the case?

It occurs to me that there are other factors which may not be negligible. The composition of the vegetable matter of which the coal is made must have varied with the evolution of plant life.

The lack of coal beds in the lowest part of the geological column may be due to the fact that plants then existing decomposed almost entirely into bituminous products.

Again the composition of the water in which the vegetable deposits were laid down must have had some influence on the form and rate of decomposition, even as it does on olives and pickles to-day. May not the effect of the joints to which Campbell refers have been in letting down surface oxidizing waters, as well as in letting the gaseous products of decomposition escape, and may it not have been the access of such waters, rather than heat, which has determined the rate and extent of the development of the coal toward anthracite.

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