

mitted for publication on February 1st, and it comes to hand early in April. This is in great contrast with the delay which formerly used to occur.

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*Marine Fossils from the Coal Measures of Arkansas.* By JAMES PERRIN SMITH. (Preface by JOHN C. BRANNER, late State Geologist of Arkansas.) Pp. 72. Plates xvi.-xxiv.

This memoir, reprinted January 7, 1897, from the *Proceedings of the American Philosophical Society*, Vol. XXXV., No. 152, is also "the ninth of a series designed to illustrate the investigations and explorations of the Hopkins Seaside Laboratory, an adjunct of the biological laboratories of the Leland Stanford Junior University." It was prepared at the request of Dr. Branner and deals with the rarer, and therefore more interesting, fossils of the Coal Measures. In these strata marine species furnish the most valuable data for the purposes of correlation. Heretofore they had been announced from but one locality: now, after a careful study of the material brought together by the last (Branner) survey, Professor Smith is able to announce them from twenty-one additional localities, extending from Independence county, on the east, to the Indian Territory, on the west. Forty-eight genera are represented by ninety species, of which forty-eight are found in the Lower Coal Measures and fifty-two in the Upper, ten species being common to both. The author characterizes the fauna as poor, such as would wander in whenever, by subsidence, the shallow waters became more habitable, and he also points out that, under the conditions then prevailing, it could not become well established, as it was frequently forced to migrate. In consequence of this, a gradual transition from the fauna of the Lower Carboniferous Limestone does not exist in this region. No attempt is made to classify the beds more minutely than into Upper and Lower Coal Measures, and even this is at times uncertain, especially when their marked similarity, folding and faulting are taken into consideration. Then follows a list of localities in which marine fossils were found,

seventeen in the Lower Coal Measures and four in the Upper (one of which, Poteau mountain, is two miles west of the Scott county, Arkansas, line, in Indian Territory), together with the names of the fossils, character of the deposits, and the names of the collectors. A comparison is made with the Permo-Carboniferous of Kansas and Nebraska and the strong faunal resemblance of the Upper Coal Measures of Arkansas to the youngest Paleozoic rocks of Nebraska shown. The relations of the Arkansas deposits to those of Texas are also noted: "None of the characteristic ammonite genera [of the Permian] were found in the Arkansas region, but nearly every fossil found in these Coal Measures was also found in Texas. And in the Texas Permian nearly all the species excepting the ammonites were found in the underlying Upper Coal Measures. This makes the analogy between the Upper Coal Measures of the two regions very strong."

In view of this Professor Smith concludes "that while some of the beds in western Arkansas are very high up in the Coal Measures, none that belong above them are as yet certainly known, and the Poteau mountain syncline, across the line in Indian Territory, is the only place where there is any likelihood of finding Permian deposits." Some very interesting comparisons are also made with foreign faunas: for instance, of the Lo-ping fauna in China "nearly all of the species are either found in America, or they have their nearest relatives there." In this connection another point of unusual interest is brought out, viz., that many of the species which are "very common in America and Asia are unknown or rare in Europe, which fact would tend to prove a connection with Asia by water, and the separation of the European and the American Upper Coal Measure deposits by a land barrier." In short, our author regards the two regions, America and Asia, as belonging to the "same zoological province, the Pacific Carboniferous sea." Moreover, "many of the American species that are found at Lo-ping are also found in the Salt Range beds," thus extending the close relationship to India. Of the Upper Carboniferous fauna, at Itaituba, Brazil, described by Derby, twelve out of twenty-seven species of brachiopods are shown to be "iden-

tical with American forms, although most of these are cosmopolitan." The *Strophalosia* of this locality by its close relation to Australian forms would indicate "a closer connection with the Australian, or Southern, Carboniferous region than with the Pacific Province."

But the classification and age of the Arkansas Coal Measures is the most difficult problem the author has to deal with and the most unsatisfactory, being at best provisional. He says: "The Coal Measures of Arkansas have been temporarily classified by the Survey, for the sake of convenience, as Upper, or Productive, and Lower, or Barren Coal Measures. The division is not based on any paleontologic or stratigraphic break, but merely on the occurrence or non-occurrence of coal.

"The divisions that are recognized in Pennsylvania could not be recognized in Arkansas, but the strata of the two sections are correlated, as far as possible, with the scanty data now at hand.

"Of the age of the Lower Coal Measures we have only stratigraphic evidence, their position above the limestone of the Lower Carboniferous and below the coal-bearing beds of the Upper Coal Measure being unmistakable. But their known fauna and flora have been too limited and indecisive to enable us to correlate the stages with those of other Carboniferous areas, since collections have been made in but few places, and these chiefly in sandstones, where the preservation of fossils is usually unsatisfactory and the determination uncertain.

"But the Lower Coal Measures correspond in a general way to the Strawn and the lower part of the canyon division of Texas, to the Pottsville Conglomerate series, the Lower Productive Coal Measures, and part of the Lower Barren Coal Measures of Pennsylvania. The series corresponds, in the main, to the Middle Carboniferous limestone of eastern Russia."

Concerning the Upper Coal Measures of Arkansas, Professor Smith expresses the opinion that they "correspond to the upper part of the Canyon and the whole of the Cisco division of Texas." He infers, from the presence of certain fossils, that the beds of Poteau Mountain, I. T., are probably of the age of those in the Lo-ping district, and that the yellow shales of

Scott county, Arkansas, are probably of the age of the Carboniferous Limestone at Moscow and the west slope of the Urals.

Under the heading, 'Paleobotanic Evidence,' reference is made to an unpublished report by Messrs. H. L. Fairchild and David White on the *Fossil Flora of the Coal Measures of Arkansas*, which "throws much new light on the stratigraphic and regional distribution of species, and has been of material aid in correlating the Arkansas strata with those of other regions." It may not be out of place here to express the hope that this monograph may soon be printed "They prove that all the Coal Measure plants \* published from Arkansas belong to the horizon of the Upper or Productive Coal Measures." The position of the Van Buren plant bed is found to be below the marine beds of Poteau Mountain and above those occurring in the vicinity of Fort Smith, the last named horizon being above that from which most of the coal is obtained. While not entirely devoid of plant remains, the rocks of the Lower Coal Measures furnish but little evidence of a paleobotanical kind suitable for correlation purposes.

The Pacific Carboniferous sea is next discussed, including the following topics: Revolution in Devonian Time; The Carboniferous Sea; Upper Carboniferous in the West; The Pawhuski Limestone; The Interchange of Life between East and West (the most striking topic); Replacement of Limestone by Coal-bearing Formations in Western Europe; and Land Areas in the West. The Permian Pacific Ocean and the Triassic Pacific Ocean are also touched upon.

As to the time of the Ouachita Uplift Professor Smith writes: "The youngest rocks known to take part in the Ouachita Mountain system belong to the Upper Coal Measures, and the disturbance must have taken place at the border between the Carboniferous and the Permian. Still it is not unlikely that deposits of Permo-Carboniferous age may yet be found at some places in that region. \* \* \*

"This uplift may be of the same age as that movement in the Appalachians which cut off the Upper Barren Coal Measures of Pennsyl-

\* Exclusive of those described from Washington county.

vania and West Virginia entirely from the western sea; in these deposits no marine fossils are found, but only land plants and fresh-water Crustaceans and a few fresh-water mollusks."

A table showing the correlation of the Coal Measures of Arkansas and similar deposits in Indian Territory, Texas, the Mississippi Valley, Pennsylvania, China and other parts of Asia, Russia and the Ural Mountains, India and South America, closes what may be termed the first part of this contribution. The remainder, pages 25-72, consists of an annotated list of the Marine Fossils of the Arkansas Coal Measures, together with a check list showing their stratigraphic distribution and the localities of their occurrence in Arkansas and elsewhere. Nine excellent plates accompany the text. A new species of *Gastrioceras*, *G. branneri*, and a variety of *Pronorites cyclobolus*, Phillips, called *arkansiensis*, are described. A description of the trilobite *Phillipsia (griffithides) ornatea*, by Capt. A. W. Vogdes, U. S. A., quoted from the Proceedings of the California Academy of Science,\* is also inserted.

By those interested in the organic side of geology Professor Smith's paper will be read with much satisfaction. The comparative study of faunas, their relations and distribution, is a line of investigation which promises much in the near future.

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*Clay Deposits of Missouri.* By H. A. WHEELER.

Missouri Geological Survey, Vol. XI., 622 pp., 39 pl. Jefferson City, 1896.

The recent report upon the Missouri clays, while essentially economic in character, discusses a number of problems of wide scientific interest. Among these the nature of plasticity as exemplified in clays is perhaps the most important. Professor Wheeler finds, as a result of physical tests and the microscopic examinations of Haworth, that the fine plate theory of Johnson and Blake† is the only one which satisfactorily explains the facts, and that fineness in itself has no real bearing on the plasticity.

It is found that the fusibility of a clay is a

\* Second Series, Vol. IV., p. 589 *et seq.*

† *Am. Jour. Sci.* (2), XLIII., p. 357. 1867.

function not only of the chemical composition, but of the fineness of grain and the density. The following formula is developed and thought to be satisfactory for approximate results, but it is held that absolute results can only be obtained by testing.

$$FF = \frac{N}{D + D' + C}$$

In this  $FF$  represents the numerical value of refractoriness.  $N$  represents the sum of the non-detrimental constituents, or the total silica, alumina, titanica acid, water, moisture and carbonic acid.  $D$  represents the sum of the fluxing impurities or the alkalies, oxide of iron, lime and magnesia.  $D'$  represents the sum of the alkalies, which are estimated to have double the fluxing value of the other detrimental, and hence are added twice.  $C$  has the following values:

$C=1$ ,	clay coarse grained sp. gr. over	2.00
$C=2$ ,	" " " " "	2.00 — 2.25
$C=3$ ,	" " " " "	1.75 — 2.00
$C=2$ ,	" fine " " "	over 2.25
$C=3$ ,	" " " " "	2.00 — 2.25
$C=4$ ,	" " " " "	1.75 — 2.25

There are a large number of physical tests, chemical analyses and detailed descriptions of processes, and the work is one of wide interest and considerable value.

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#### SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, MAY.

*On Urethanes:* By O. FOLIN. When sodium methylate is treated with acetbromamide the yield is not, as might be expected, a hydroxylamine derivative, but a urethane which is formed by a molecular rearrangement during the course of the reaction. The purpose of the author was to test this reaction, to find out if it was general and also the effect of different negative and positive groups substituted in the bromamide. As a result of a number of experiments with different radicals, it was found that the difference in the nature of the radical did not affect the reaction, which is a general one that can be used in the preparation of urethanes. The urethanes when treated with phosphorus penta-