NEW PALEONTOLOGIC EVIDENCE ON THE AGE OF THE METAMORPHIC SERIES OF NORTHEASTERN WASHINGTON

THE three northeastern counties of the state of Washington—Ferry, Stevens and Pend Oreille—are covered in the main by outcrops of metamorphosed sedimentary rocks. The outcrops are in isolated fault block hills, and stratigraphic relationships are obscure. Weaver, in his report on the mineral resources of Stevens County,[1] divides the sediments into twenty-one formations, all included in the Stevens series. This is a thick series of alternating argillites and quartzites with lenticular beds of limestone. Weaver states that "the several divisions or stratigraphic members which have been grouped under the Stevens series are entirely nonfossiliferous."[2] On the basis of possible lateral continuity with the Pend Oreille series of British Columbia he states that the upper members of the Stevens series are of the same age, possibly upper Paleozoic, and that the lower members of the Stevens series may represent the lower and middle Paleozoic.

Very little has been added since to this statement of age. Previously, Shedd had stated that the only locality in the limestones of eastern Washington where he knew of fossils being found was in the undifferentiated limestones north and east of Springdale.[3] The fossils appeared to be corals. Some crinoid stem segments have been found near Republic, Ferry County. From the coral and crinoid remains and from the apparent relationships of the Stevens series with beds in British Columbia, the age of the Stevens series has been given as Carboniferous, at least in part.

Dr. Culver and Dr. Jones, of the State College of Washington, have brought in some additional fossils from the Stevens series, and these give definite evidence of the age of the deposits. One collection was blasted from the undifferentiated limestone six miles north of Chewelah, Stevens County. The limestone is reddish in color, dense, sandy, and bears thin lenses of impure argillite. Specimens of *Kutorgina cingulata* (Billings) are abundant and a few fragments of free cheeks of trilobites occur. *K. cingulata* is confined to the Lower Cambrian in its numerous occurrences, so it is certain that this portion of the Stevens series is Lower Cambrian in age.

The Mission argillite occurs two miles east of Daisy, Stevens County. Two specimens of a pelecypod were found there. These appear to belong to the genus *Paleoneilo*, which is most common in Devonian rocks, but which ranges to Triassic. Some graptolites of the *Monograptus* type were found in the Mission argillite north of Colville, Stevens County. *Monograptus* is confined to Silurian and Devonian rocks, and this occurrence, together with the occurrence of *Paleoneilo*, indicates Devonian age of the Mission argillite. A coral from the undifferentiated limestone north of Colville appears to be a *Favosites*. Some *Fusulina*-like foraminifera were found in the same area.

It seems quite possible that the metamorphic series of northeastern Washington represents most of the Paleozoic periods, and that careful search in the area will disclose definitive fossils in most of the members of the Stevens series.

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[1] C. E. Weaver, Washington Geol. Surv., *Bull.* No. 20, 1920.

[2] *Idem*, p. 52.

[3] Solon Shedd, Washington Geol. Surv., *Bull.* No. 4, p. 123, 1914.

THE BASAL-METABOLIC RATES OF VEGETARIANS

THE work of Benedict and Roth[1] published in 1913 indicated that there is little, if any, difference between the basal-metabolic rates of vegetarians and non-vegetarians.

Consistent sub-normal results for the basal-metabolic rates of long-time vegetarians led the writers of this paper to present the following data:

The group chosen for intensive study consisted of girls—nurses in training at a vegetarian sanitarium—between the ages of eighteen and twenty-five, and living under uniform conditions of diet, work and general environment. No subjects who were more than 10 per cent. over or under weight, or who showed symptoms of poor health or other abnormality, were included in the group. The determinations were all made with the same apparatus and at the same time of day, before the girls left their beds in the morning. The Du Bois standards of normality were used as the basis of comparison.

Five girls were classed as life-long vegetarians, having never eaten meat of any kind in their lives. Their average basal-metabolic rate was 14 per cent. below the normal of Du Bois. Ten girls were classed as long-time vegetarians, having been non-meat-eaters for five years or more. Their average basal-metabolic rate was 12 per cent. below normal.

As a check on this work, the basal-metabolic rates of twenty-six non-vegetarian girls were determined, with the same apparatus and under conditions as nearly parallel as possible. Their average basal-metabolic rate was 4 per cent. below normal.

Comparison of these results with the basal-metabolic rates of short-time vegetarians seems to show that

[1] *Jour. Biol. Chem.*, 20: 231, 1913.