extent, *in situ*, at a depth of 1,500 fathoms, was quite unexpected in this part of the Atlantic.

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POSITION OF WOOD IN BEAVER DAMS

A TYPICAL beaver dam is a bank of earth reinforced with brush, in vertical sections approaching an equilateral triangle with a rounded apex. The reinforcing branches do not show on the upstream side of the dam; the slope in that direction is covered with a thick layer of solid earth. But on the downstream side the branches continue outward as a bed of brush a foot or so thick, covering the face of the dam from crest to foot, their very important function being to prevent erosion by the water flowing over the dam.

Every writer known to me who goes into details of beaver dam construction, says that these branches are placed with their butts upstream. Thus Morgan[1] writes in his monograph: "In general the large ends of the poles and of the limbs with their branches attached were upstream, which itself would tend to strengthen their hold on the bottom."

Mills[2] says: "The majority of dams are made of slender green poles. . . . With these are used occasionally small limby trees. The large end of the trees is placed upstream and the bushy end downstream."

Equally definite is Dugmore:[3] "As a matter of fact the building of an ordinary dam consists originally of a number of sticks and brush being laid (no stakes are driven) in the water with butts upstream."

Johnson[4] makes some qualifications: "Boughs are generally found with the butt end upstream, but numerous examples occur where they lie across the current, diagonally and in every intermediate position."

And lastly Warren,[5] in the best book yet written on the beaver: "Branches of willow, alder or whatever brush is most available . . . are cut and placed on the bottom with the butt ends upstream, and often forced into the bottom."

Now for twelve years I have been observing the work of a beaver family established on a small stream tributary to the Ottawa River near Arnprior, Ontario. There is nothing out of the ordinary in the situation. The stream rises in a group of springs, and with a moderate current flows a distance of two miles through a shallow thickly-wooded valley. Before the beavers came it had a fairly uniform width throughout its whole length of four to six feet, and a depth varying from six inches in its upper part to three or four feet in its lower reaches. The beavers occupy the last half-mile of the stream, where there is, or rather was a good supply of poplar and other favorite woods, and their dams have expanded this section of the stream into a pond four or five feet deep and about 300 feet wide.

At one time and another these beavers have built nine dams, and have rebuilt or repaired five or six dams that broke. In every case, both in new work and repairs, the great majority of the branches used in construction were laid with butts *downstream*, in direct opposition to the beaver practice unanimously alleged by the writers quoted. As mentioned by Johnson,[4] some of the branches were placed in every possible position, but at least 90 per cent. with butts downstream. To venture on an *a priori* argument, it may be said that this disposition of the branches is what might be expected. In general, beavers float their wood downstream: naturally it is towed butt-end first to prevent twigs and branches from catching, and it is likely to be laid in position without change of direction, that is, butts downstream.

Certainly such is the habitual and uniform procedure of my beavers, both in new construction and repairs. There is no reason to suppose that they differ in any way from other beavers, and there does not appear to be anything in their environment that might cause a reversal of habit.

I have had no opportunity of examining critically beaver dams elsewhere, but perhaps some field naturalist who is familiar with dams in different parts of the country will say if the wood in other dams really is laid with butts upstream.

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[1] Lewis H. Morgan, "The American Beaver and its Works," p. 103, 1868.

[2] Enos A. Mills, "In Beaver World," p. 66, 1913.

[3] A. R. Dugmore, "The Romance of the Beaver," p. 34, n. d. (ca. 1914).

[4] C. E. Johnson, "The Beaver in the Adirondacks," *Roosevelt Wild Life Bulletin*, p. 632, July, 1927.

[5] E. R. Warren, "The Beaver," p. 28, 1927.

VIRGINIA GEOLOGICAL SURVEY FIELD WORK

DURING 1931 the Virginia Geological Survey has conducted an extensive program of field work, under the supervision of the State Commission on Conservation and Development, Mr. William E. Carson, chairman, and Dr. Arthur Bevan, state geologist. The results of each of these projects will probably be published as survey bulletins.

This field work consists of the following projects:

The survey of the geology and mineral resources of the Hot Springs district in the central-western part of the state is being continued by the state geologist. He has been assisted at times by Mr. C. R. L. Oder, of the University of Illinois, Mr. Paul Averitt, of the University of Kentucky, and Mr. R. L. Laurence, of the University of Cincinnati. This area is also being topographically mapped, in cooperation with the

U. S. Geological Survey, in four 7½-minute quadrangles on a scale of 1:24,000 and a contour interval of 20 feet. The relief is about 3,000 feet. The formations range from Lower Ordovician (Upper Canadian) to Upper Devonian, inclusive.

Field work and a report on the Caverns of Virginia have been completed by Mr. William M. McGill, assistant state geologist. This report is of an educational character. A study of the geologic relations of the "natural wonders" in the state and a survey of the resources of certain counties are also being made by Mr. McGill.

Three projects are being surveyed in cooperation with the U. S. Geological Survey. Dr. Charles Butts is completing a study of the stratigraphy and structure of the Appalachian Valley in Virginia. He has been assisted this season by Mr. Benjamin Gildersleeve, of the University of Virginia. A geologic map is being prepared for publication on a scale of 1:250,000. This will be followed by a report on the Paleozoic formations of Virginia west of the Blue Ridge.

A field study of the lead and zinc district along New River in Smyth and Wythe counties has been completed by Dr. Louis W. Currier, assisted by Mr. H. E. Thomas. The mineralized zones occur in the Shady dolomite (Cambrian).

A study of the ground-water resources of northern Virginia has been begun by Mr. R. C. Cady. This will cover the northern tier of counties, thus including Paleozoic rocks of the northern Valley region, Cambrian and pre-Cambrian rocks of the Blue Ridge, pre-Cambrian and Triassic rocks of the Piedmont province, and Cretaceous sediments along the western edge of the Coastal Plain.

A study of the Lower Cambrian red hematite beds of the Blue Ridge northeast of Roanoke is being completed by Professor Roy J. Holden, of Virginia Polytechnic Institute, Blacksburg. These iron deposits were extensively mined until a few years ago, and large reserves still exist.

The geology and mineral resources of Brunswick County, in the southeastern part of the Piedmont province, have been mapped by Professor A. A. Pegau, assisted by Mr. J. S. Johnston, both of the University of Virginia.

A study of the lower part of the Williamsburg peninsula, between James and York rivers, has been made by Professor J. K. Roberts, of the University of Virginia, assisted by Mr. Henry Crenshaw, of Emory and Henry College. The geologic history of the Jamestown-Williamsburg-Yorktown region will be stressed in the report.

The commercial granites and allied rocks in the Piedmont and Blue Ridge provinces have been studied by Colonel Edward Steidtmann, of Virginia Military Institute, assisted by Mr. Chamberlain Ferry, of Washington and Lee University. Granite production in Virginia in 1929 had a value of more than one million dollars.

A survey of the belt of kyanite deposits, in the southwestern part of the Piedmont province, has been made by Dr. Anna I. Jonas.

The geology and mineral resources of Goochland County have been surveyed by Mr. Carl B. Brown, recently at the University of Cincinnati. This county is in the eastern Piedmont province, including parts of the gold belt and of the Richmond Triassic coal basin.

A survey of the slate resources of the Piedmont province has been made by Dr. J. D. Burfoot, of Cornell University. Commercial operations are now confined to two localities: (1) In the outlying Ordovician belt of the middle Piedmont region, and (2) in Lower Cambrian (?) slates near the western margin of the Piedmont province.

A study of the barite deposits is being made by Mr. Raymond Edmundson, of the graduate school of Cornell University, mainly as a thesis project under the supervision of Professor H. Ries. The barite occurs chiefly in the south-central and southwestern parts of the state, in pre-Cambrian rocks of the Piedmont province and early Paleozoic rocks of the Valley region.

The geology and mineral resources of the Warrenton quadrangle have been surveyed by Dr. A. S. Furcron, of Western Reserve University. This area includes parts of the mountainous belt of metamorphosed Cambrian rocks east of the Blue Ridge, pre-Cambrian rocks of the western Piedmont and the Triassic lowland.

An areal survey of the geology and mineral resources of Giles County, which includes the well-known Narrows area along New River, is being made by Dr. A. L. Mathews, formerly of Oberlin College. The formations are Cambrian to Mississippian, inclusive. Oberlin College has been giving for many years summer field courses in geology in this area under the direction of Professor G. D. Hubbard.

The survey of the geology and mineral resources of the Natural Bridge Special quadrangle has been partly completed by Dr. H. P. Woodward, of Dana College, Newark, N. J., assisted by Mr. Robert Laurence, of the University of Cincinnati. This area lies mainly in the Appalachian Valley and includes a small part of the Blue Ridge. It contains pre-Cambrian to Mississippian rocks, cut by great overthrusts.

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