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THE PAYETTE AND IDAHO FORMATIONS
A Review

By
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Introduction

Recent drilling[2] for oil and gas, together with extensive leasing, in Malheur County has caused considerable interest to be focused on the geology of southeastern Oregon.

The two sedimentary rock units most widely exposed in the Vale-Adrian, Oregon, area where exploration has been most active are the Payette and Idaho formations of late Cenozoic age. The terms "Payette formation" and "Idaho formation" have long been in use in geologic and paleontologic reports, but interpretations regarding age and distribution have often been conflicting. For this reason it was thought that a review of the literature would be of value to those interested in the geology of the area.

Most of the published information concerning geologic investigations of these formations has dealt with the Idaho portion of the Snake River plains. In the fall of 1954 Prof. E. M. Baldwin of the University of Oregon Geography and Geology Department in company with the writer visited many of the Idaho localities mentioned in the literature in conjunction with field studies in the Mitchell Butte quadrangle, Oregon. Some of the observations made at the time of this visit are included in this review.

General

Although the Payette and Idaho formations were first mapped as one unit, it has since been recognized that there are two mappable formations separated by a thick lava series. Early paleontological age determinations placed the Payette formation in the Eocene epoch of the geologic time scale. Later work, however, showed it to be late Miocene in age. The Idaho formation is Plio-Pleistocene in age.

Fossil remains of vertebrates, fresh-water mollusks, and leaves in both formations show that the sediments are continental lake and stream deposits. These sediments are widely distributed over the plains area of the Snake River from the general vicinity of Hagerman, Idaho, to Huntington, Oregon. Because the formations tend to dip toward the center of the Snake River plain, this region is sometimes referred to as the Snake River downwarp.

First fossil collections made

Clarence King (1878),[3] one of the early-day Federal Survey geologists, visited the lower part of the Snake River basin around 1869 and collected a number of fossils from the "white sands and marls" at Castle and Sinker creeks,[4] tributaries of the Snake River south of Boise, Idaho. Although the fossils were subsequently described by others, no lithologic description was given for the sediments from which they were obtained. Baldwin and the author found the beds in this vicinity grayish-white to cream, poorly sorted, loosely

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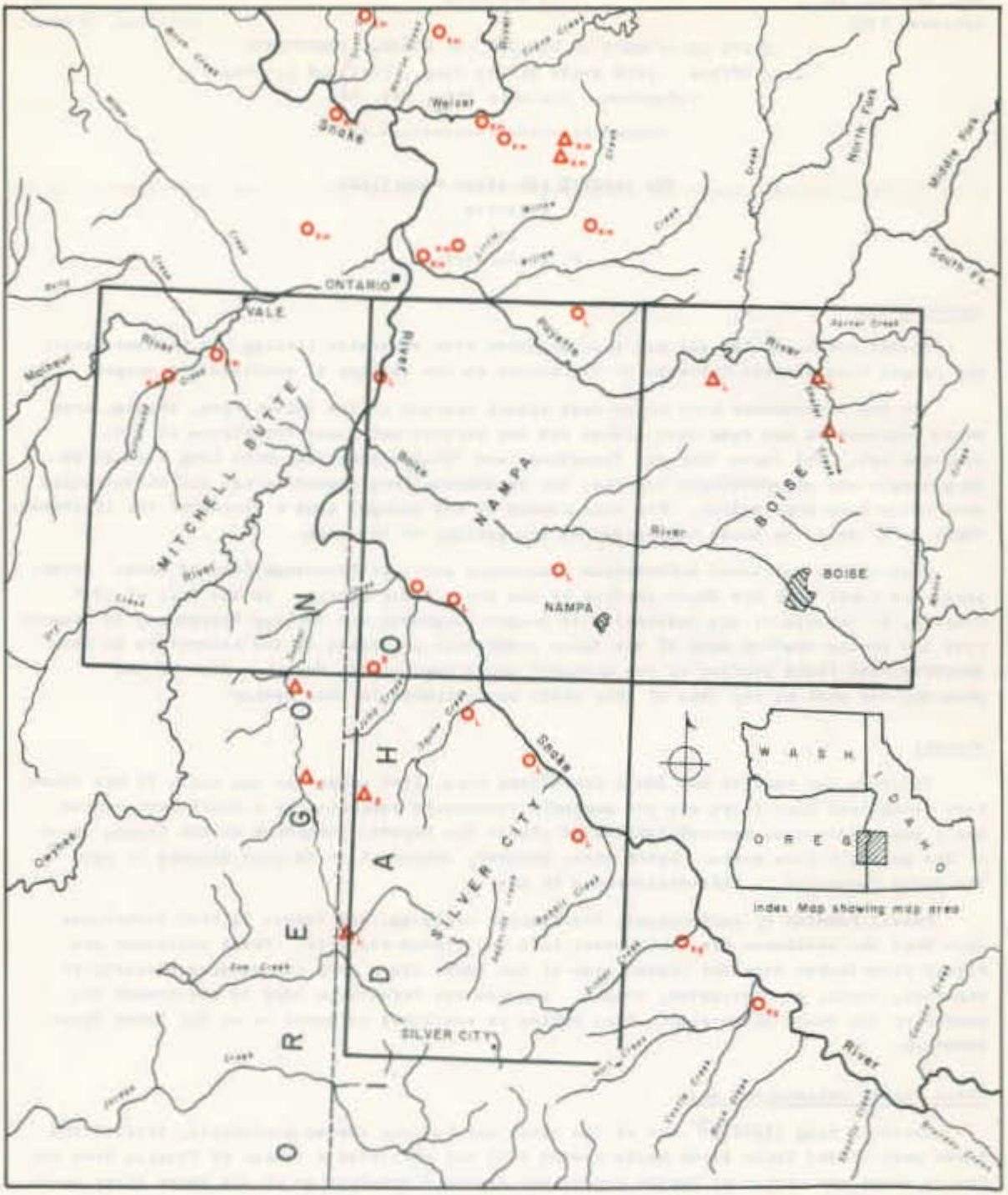
[1] Geologist, Oregon Department of Geology and Mineral Industries.

[2] El Paso Natural Gas Co.; NE¼ sec. 5, T. 20 S., R. 44 E., W.M., spudded in November 1954.
H. K. Riddle, Kiesel Estate No. 1; SW¼ sec. 8, T. 19 S., R. 47 E., W.M., spudded in September 1954.
R. W. Stamey; sec. 14, T. 19 S., R. 44 E., W.M., spudded in March 1954.

[3] References at end of report.

[4] See accompanying map.



Map showing region covered by this report

Fossil Localities

Payette formation ▲

Idaho formation ○

Fossil collections by:

King Kg
Lindgren L
Buwalda B
Chaney C
Kirkham Km
Scharf S

State of Oregon
Department of Geology & Mineral Industries

indurated, and somewhat massive. They are also often cross-bedded as well as sandy to clayey and occasionally tuffaceous. The beds are usually pedimented with the pediment dip nearly parallel to the bedding, that is, into the axis of the downwarp. An outstanding characteristic of the surface of these sediments is the presence of numerous fossil fish vertebrae.

Idaho formation named

Meek (1870) and White (1882) described fresh-water mollusks from the Sinker Creek area and assigned a Miocene age to them. Mammalian remains also from this locality were determined by Leidy (1872) to be of Pliocene age. Cope (1883) described an extensive fauna of fresh-water fishes from the fossil collections made by King and from a later collection by Wortman. On the basis of these determinations, Cope proposed the name "Idaho formation" for the sediments and assigned them a Pliocene age.

Payette formation named and type locality suggested

Lindgren (1898a, 1898b, 1904a, 1904b) was the first to do detailed mapping in the Snake River area of Idaho, the results of which were published by the U.S. Geological Survey as the Boise, Nampa, and Silver City folios and as a report on the mining districts.

Lindgren (1898a, 1898b) proposed that a large lake occupied the lower part of the Snake River valley during Miocene time and suggested the name "Payette formation" for the sediments. He stated that this formation was not the same as Cope's Idaho formation. A Miocene age for the Payette formation was given by Knowlton (1898) from determinations on fossil leaves obtained in the vicinity of Marsh post office and Horseshoe Bend on the Payette River, and from Cartwright's ranch on Shafer Creek, a tributary of the Payette River. When Knowlton dated the Payette formation, he correlated its flora with that of the Bridge Creek beds of the John Day formation in Oregon. A few years later the Bridge Creek flora was dated by Merriam (1901) as upper Eocene, and Knowlton (1902) then changed his interpretation of the age of the Payette formation from upper Miocene to upper Eocene.

Although no specific locality was designated by Lindgren as a type section for the Payette formation, the name apparently was suggested by exposures along the Payette River in western Idaho. Because the fossil leaves used by Knowlton for the original dating were found in the vicinity of Marsh post office it is proposed here that this locality be considered as the type section.

Distinction made between the two formations

On his published maps Lindgren does not show the Idaho and Payette formations as separate units. However, in the text of the Silver City folio the continental sediments were separated into two main groups: (1) the high lake beds on the western side of the quadrangle which are called the Payette formation, and (2) the beds below 3000 feet in the Snake River valley which are called the Idaho formation. A fossil flora from the "high lake beds" (the Payette formation) was determined by Knowlton to be identical with that found at Marsh post office. A large fresh-water molluscan fauna and some silicified mammalian remains were collected from the beds below 3000 feet (the Idaho formation) in the Snake River valley approximately 13 miles northwest of the Sinker Creek fossil locality, and these were stated to be of Miocene or Pliocene age by Lindgren (1904b). The distinction between the two formations was made not only on fossil evidence but also on the difference in petrographic character and topographic position. Lindgren, however, misinterpreted the stratigraphic position of the Payette formation, as he shows it on the cross sections in the Silver City folio to be overlying a lava series. Work done later by Buwalda (1924) and Kirkham (1931) showed the true position to be under the lavas which in turn are under the Idaho formation.

Russell (1902, 1903) and Washburne (1909) accepted Lindgren's definitions for the Payette and Idaho formations as he described them in Idaho but did not map the two separately.

Miocene age for the Payette formation established

Umpleby (1913) working in Lemhi County, Idaho, found lake beds at a relatively high elevation near Hailey that contained a fossil flora which Knowlton dated as Miocene. Because of similarity in topographic position and lithology to the Payette formation near Marsh post office, Umpleby inferred that the two could be correlated and suggested that the Payette formation might be of Miocene age rather than Eocene as Knowlton had previously indicated.

Merriam (1917), in discussing the problem, did not feel that the Idaho and Payette formations had been satisfactorily separated and stated that the upper part of the Idaho formation might be as young as latest Pliocene or earliest Pleistocene.

Buwalda (1921, 1924) made two mammalian fauna collections in the Silver City quadrangle from beds he called "Payette." One collection was below the lava series and the other above. According to him the lower fauna was of middle Miocene age, whereas the upper fauna was upper Miocene or lower Pliocene.

A fossil leaf collection made by Chaney (1922) from sediments beneath the lava series was determined by him to be of Miocene age.

Bryan (1929) working in the vicinity of the Owyhee reservoir in Malheur County, Oregon, followed the work of Lindgren and called most of the sediments overlying the lava series "Payette formation" but suggested that they might include the Idaho formation.

Lava series recognized as a separating unit

Kirkham (1931) found that the Payette and Idaho formations in Idaho, as well as in adjacent areas in eastern Oregon, are separated by great thicknesses of rhyolitic and basaltic lavas. In measuring the Payette formation he found a maximum thickness of approximately 1,200 feet in the vicinity of Lindgren's leaf locality near Marsh post office. For the Idaho formation, he found the maximum thickness on the south side of the downwarp along Little Squaw Creek to be 7,275 feet while on the north side along Little Willow Creek it was 18,633 feet. He reported fossil leaves of Miocene age from the Payette formation and a flora and fauna of Pliocene or later age from the Idaho formation.

Scharf (1935) collected a vertebrate fauna from sediments beneath the lava series in Sucker Creek a few miles west of the Idaho-Oregon boundary. On the basis of the fossil assemblage, a Miocene age was assigned and the beds were considered as part of the Payette formation.

In the spring of 1954, H. M. Dole of this Department and the writer (Dole and Corcoran, 1954) made a reconnaissance survey along U.S. Highway 20 from Vale to Buchanan, Oregon. It was shown that the lake beds in the Vale area dip gently to the northeast into the Snake River downwarp and that these sediments are separated from another underlying unit of terrestrial lake beds, which crop out farther to the west, by a series of lavas at least 5,000 feet thick. The upper lake beds were assigned to the Idaho formation and the lower to the Payette formation.

Summary

The field distinction between the Idaho and Payette formations of eastern Oregon and southern Idaho is made difficult by the similarity in environment of deposition, source rocks for the sediments, and tectonic setting.

The early-day field geologists in the area did not divide the formations into separate units on their maps, although they recognized that two ages of rocks were present. Failure to recognize the stratigraphic position of a lava series that occurs between the two formations has been responsible for some of the misunderstanding that accompanies the use of the terms both in the literature and in the field. Paleontological control for dating the formations has been good but due to an early misinterpretation some confusion has attended the

age of the Payette formation. It is now known that the Payette formation is middle to upper Miocene in age and the Idaho formation is Plio-Pleistocene in age.

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OIL AND GAS CONSERVATION WEEK PROCLAIMED BY GOVERNOR

The week of November 29 through December 4, 1954, was proclaimed as Oil and Gas Conservation Week by Paul L. Patterson, Governor of the State of Oregon. This State is one of many in which similar proclamations were issued. The need for conservation of natural resources is being recognized by progressive officials and agencies more than ever before. The State of Oregon is cognizant of this need. The 1953 Legislature passed a new oil and gas conservation law, even though the search for oil and gas in the State is in its infancy. In July, Oregon became an associate member of the Interstate Oil Compact Commission, a national organization whose sole purpose is to promote and encourage the conservation of oil and gas and to prevent physical waste.

Governor Patterson's proclamation was as follows:

WHEREAS, the conservation of oil and gas is of the utmost importance to the prosperity and well-being of all the citizens of the State of Oregon and of the United States and provides an effective guarantee of the security of our nation, and

WHEREAS, every citizen of the State of Oregon and of the United States should encourage and lend his support to the conservation of these great natural resources and the prevention of physical waste, and

WHEREAS, the Interstate Oil Compact Commission, consisting of 28 states, including the State of Oregon, will celebrate its 20th anniversary at a meeting to be held in Chicago, Illinois, on the 2nd, 3rd, and 4th of December 1954 at which time the cause of oil and gas conservation will be emphasized and accomplishments of the Compact reviewed,

THEREFORE, I, Paul L. Patterson, Governor of the State of Oregon, do hereby designate the week of November 29, 1954, through December 4, 1954, to be OIL AND GAS CONSERVATION WEEK, and call to the attention of all citizens the importance of this program of conservation that has led to great development of gas and oil and petroleum products.

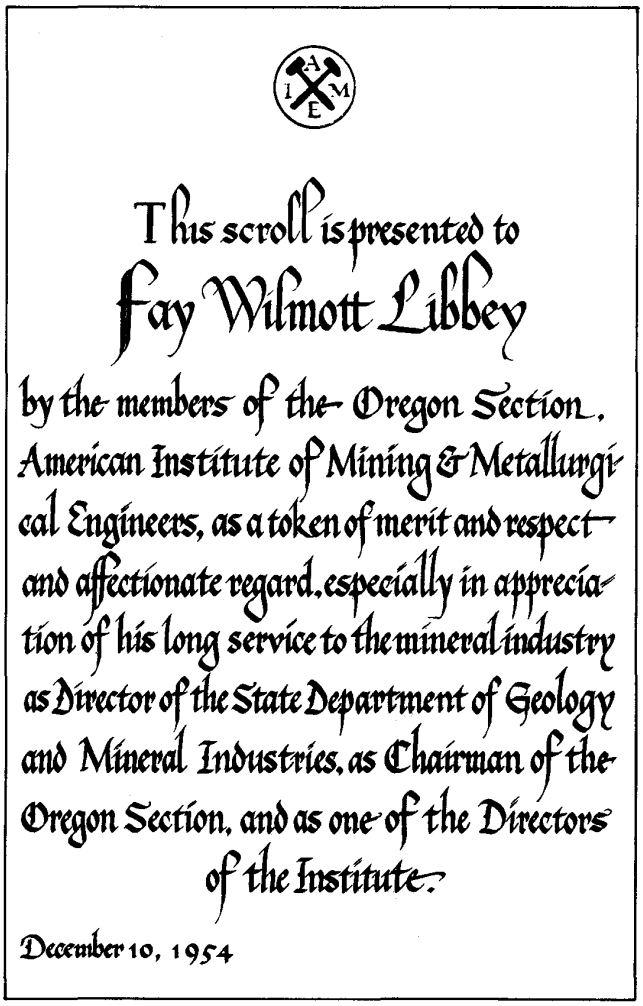
Paul L. Patterson, Governor of Oregon

November 18, 1954

LIBBEY HONORED BY AIME

The December meeting of the Oregon Section, American Institute of Mining and Metallurgical Engineers, was held in honor of Mr. Fay W. Libbey who retired as Director of the Oregon Department of Geology and Mineral Industries on November 1. Alex Leipper, Vice-Chairman of the Section, acted as master of ceremonies and presented to Mr. Libbey on behalf of the group, a scroll, a copy of which is shown below.

Honored guests present at the ceremony were the members of the Governing Board of the Oregon Department of Geology and Mineral Industries. Niel Allen, speaking for the Board, highlighted some of Mr. Libbey's accomplishments while with the Department, first as a mining engineer and for the past ten years as Director. Mr. Allen stated that it was Mr. Libbey's recognition of the possibilities of the laterite of northwest Oregon that culminated in extensive exploration by a major aluminum company, with the result that large areas of high-iron bauxite were determined to be present in Washington and Columbia counties. At the time of his retirement Mr. Libbey was directing the exploration of similar material in Marion County. It was while he was Director that the $25 million Hanna Nickel Smelter was built at Riddle in southwest Oregon to process the ore found at Nickel Mountain. Under his direction the Department has issued forty-one bulletins and maps. The monthly publication, The Ore.-Bin, has been almost entirely his work. Its popularity was demonstrated in a recent issue which showed that the circulation has been climbing steadily and passed the 1,000 mark in 1954.



Fay Bristol, President of the Oregon Mining Association, expressed the appreciation of his group for the assistance which Mr. Libbey has so frequently given, and stated that the chrome stockpile at Grants Pass and the Government purchase plan for domestic chromite is in great part due to the efforts of Mr. Libbey.

Governor Patterson could not attend the meeting but sent the following telegram:

"Mr. Mason L. Bingham, Chairman of the Governing Board

"I WISH MY SCHEDULE PERMITTED ME TO JOIN IN PAYING TRIBUTE TONIGHT TO MR. LIBBEY FOR HIS OUTSTANDING SERVICE AS DIRECTOR OF GEOLOGY AND MINERAL INDUSTRIES. NOT ONLY DID HE RENDER A LOYAL AND FAITHFUL SERVICE BUT HE CONTRIBUTED SO MUCH TO THE GROWTH AND DEVELOPMENT OF THE INDUSTRY. I KNOW THE PEOPLE OF OREGON ARE GRATEFUL TO HIM FOR HIS UNTIRING EFFORTS. PLEASE CONVEY MY PERSONAL GREETINGS TO MR. LIBBEY AND EXPRESS MY BEST WISHES TO ALL FOR A MOST ENJOYABLE EVENING.

Paul L. Patterson
Governor of Oregon"

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OIL LAND LEASING IN OREGON INCREASES

Total amount of land leased in Oregon for oil and gas exploration is well over a million acres. Most of this has been leased since July 1954. This indicates that the next few years may show a real effort on the part of the major oil companies to determine if oil and gas occur in the State in commercial quantities.

The amount of Federal land leased in Oregon for oil and gas prospecting has increased nearly 500 percent since July. Records on file in the Portland office of the U.S. Bureau of Land Management show that in the 5-month period from July 1, 1954, to December 1, 1954, 246 new applications for leases were made. Total area involved was estimated to be around 582,000 acres. In the 12-month period from July 1, 1953, to June 30, 1954, 128 new applications for leases were filed involving an estimated 109,000 acres. These figures are impressive when compared with the 33,000 acres of Federal land leased in the 28-year period beginning in February 1920, when the Mineral Lease Act became effective, and ending July 1949. These figures do not include leases made either on Federally acquired lands or on Indian lands but they are thought to represent the bulk of the land leased.

The amount of State-owned land currently leased for oil and gas investigations totals 68,579 acres. Seven counties are represented, of which Lake County has the largest amount. Others are Malheur, Crook, Deschutes, Benton, Lincoln, and Coos counties in that order.

County-owned land under lease may equal that held by Federal leases. Information from 24 of the 36 counties in the State shows 367,000 acres leased. Coos and Douglas counties have the largest acreage while only three other counties, Deschutes, Linn, and Clatsop, make up the remainder. No information was received on County-owned lands in southeastern Oregon where considerable State and Federal land was leased.

Activity by the oil companies in Oregon is definitely a contributing factor to the economy of the State. This is especially noticeable to the counties in which the leasing and drilling are taking place. Besides the supplies purchased for drilling and the money paid in salaries to the geologists, drillers, and leasing agents of the companies, a fee is paid to hold the land under lease. This is in the form of a direct payment on State and County lands, and in the case of most Federal lands 37½ percent of the fee is returned to the State for distribution to the counties in which leases were made. The office of the Secretary of State reported that for the first six months of 1954 this amounted to $26,458. The last half of the year should return several times this amount. However, of much greater importance to the State would be the discovery of oil or gas in commercial quantities. At this time when Oregon is working toward developing new industries, the interest that is being shown in prospecting by the major oil companies is a notable development.

H.M.D.

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AREA IN MALHEUR COUNTY TO BE GEOLOGICALLY MAPPED

At a meeting of the Governing Board of the State of Oregon Department of Geology and Mineral Industries, held in the State Office Building, December 11, 1954, a program was authorized to map the Mitchell Butte quadrangle, Malheur County, Oregon. The area to be mapped embraces approximately 850 square miles. Vale is located near the northern margin of the map area, the Oregon-Idaho line forms part of the eastern margin, and the Owyhee Reservoir is in the south-central part.

The Governing Board, in making the announcement, noted that the geologic mapping of the Mitchell Butte quadrangle would be a component part of the State Geologic Map. They also stated that this was a basic step in providing assistance in exploration of the oil and mineral development of that part of the State.

R. E. Corcoran, geologist with the Department, will be in charge of the mapping project. Field work will commence early in the spring of 1955. The Board action authorizes completion of the field work and the publication of a geologic map and report.

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