What Geology to See and Where

Geology

Prepared by U. S. Geological Survey, Department of Interior, Dr. George Otis Smith, director.

No matter where the traveler journeys, he can not avoid seeing geology. But some of the landscapes viewed from automobile or train window will be meaningless to untrained eyes. The purpose of the following brief guide to locations where interesting geological features can best be seen is to allow the scientifically-inclined explorer of modern America to benefit from the information and skill of the government geologists.

Glacial Features

Part of America was once covered with great ice sheets which have left their mark on the land as seen today. The geological features created by these glaciers include:

DRUMLIN—(1) There is a large area in Wayne, Cayuga and Onondaga counties, New York, in which every lenticular hill is a drumlin, made by the heaping together of glacial till underneath the ice sheet. This region has an area of about 1,100 square miles, extending from near Baldwinsville on the east to Palmyra on the west. The drumlins are well shown on the following contour maps of this Survey: Sodus Bay, Oswego, Fulton, Macedon, Palmyra, Clyde, Weedsport, Baldwinsville, Phelps, Geneva, and Auburn. (2) A large area lying northeast of Madison, mainly in the counties of Dodge and Jefferson, Wisconsin. This area has not been covered with contour mapping, but some of the drumlins are well shown on the Sun Prairie, Koshkoning, Waterloo, Watertown, and Hartford atlas sheets. These drumlins are also described and shown on a general map in Professional Paper 106, U. S. Geological Survey, which can be found in most large libraries. (3) Drumlins are also abundant in Massachusetts, but they are here more scattered than in the regions already mentioned. Their distribution in the State is shown in Bulletin 760, of the U. S. Geological Survey.

MORAINE—Ridges of clay, sand, and gravel that mark certain places where the ice sheet remained stationary for a great length of time are found in many places in the northern part of the country, but they are only typically developed at a few places, some of which are as follows: (1) A well marked moraine lies a few miles southeast of Whitewater, Walworth County, Wisconsin. This moraine trends northeastward from the point mentioned above, to the town of Palmyra, Jefferson County. The northwestern front of the moraine is abrupt and extremely irregular where it marked the contact with the great glacier that lay to the northwest. (2) There are many moraines excellently shown in the valley of the Arkansas River, between Buena Vista and Tennessee Pass, Colorado. These moraines are built by local glaciers that came down from the Wasatch Range on the west. The moraines are most pronounced at Clear Creek, Twin Lakes, and Lake Fork, the latter lying just west of Leadville. (3) There is a moraine excellently exposed at Pando in the valley of Eagle River just north of Tennessee Pass. The auto road crosses this moraine 5 miles south of Red Cliff.

ESKER—These long, narrow, and generally straight ridges are supposed to have resulted from the filling of stream channels under glaciers. (1) The most pronounced eskers are in Maine, but they are fairly common in the northern New England region. The longest eskers known are in the Passadumkeag region of Maine in the vicinity of Penobscot River. Some of these are 15 to 18 miles in length and can readily be seen, as the roads are built on their tops. These eskers are well shown on the Passadumkeag atlas of the U. S. Geological Survey. (2) A well marked esker may be seen in Oxford County, Maine, in the valley of Barkers Brook north of Bryant Pond. This is represented on the Bryant Pond Atlas sheet of the U. S. Geological Survey. As a road follows this esker it can easily be seen. (3) An esker of considerable length can be seen on the west side of Lake Champlain in the extreme northern part of New York. This esker has a length of about 10 miles and roads generally are located on its crest so that it can be readily seen. It is shown on the Rouses Point atlas sheet just west of Chazy.

GLACIAL CIRQUE—Glacial Cirques are developed only in mountainous regions and consequently they are to be found in their best development in such places as the Rocky Mountain National Park, Glacier National Park, and Yosemite National Park. Glacial cirques are most easily reached directly west of Denver. The best ones in this region are located at the base of Mount Evans and these may readily be seen in the summer time from the auto road which ends at Summit Lake. This lake and also Chicago Lakes occupy rock basins scooped out by the glaciers which originated in these cirques. The cirques are shown on the Geological Survey contour map of the Denver Mountain Parks.

Volcanic Features

VOLCANIC STOCK—Volcanic stocks, necks, or plugs, as they are variously named, are masses of volcanic material that cooled and hardened in the throat of volcanoes. After the softer rocks have been eroded, they stand up as towering masses of hard rocks or long fingers pointing upward. (1) One of the most prominent volcanic stocks is Mount Taylor, about 15 miles east of Bluewater on the Santa Fe Railroad, in Valencia County, New Mexico. (2) Many volcanic stocks occur in the region north of Holbrook, Arizona, in Navajo County. These are scattered widely over the desert region and can be reached only with considerable difficulty. (3) Many volcanic stocks are present in northwestern Colorado, the most prominent and most easily reached of which are those in the vicinity of the village of Yampa on the Moffat Railroad, 25 miles south of Steamboat Springs.

CINDER CONES—Cinder cones or volcanic cones built up of loose material, are common in many places in the West. (1) Some of the most easily accessible cones are those in the vicinity of Flagstaff, Arizona. The most perfect of these are Mt. Wing and Walker Lake, northwest of Flagstaff. These are shown on the map of the Flagstaff quadrangle. (2) About 25 miles south of Owens Lake in Inyo County, California, is a very perfect cinder cone that can easily be reached from the auto road from Mohave to Keeler.

RECENT LAVA FLOW—(1) A very recent lava flow can be seen on the road from Mohave to Keeler, California, just to the south of the cinder cone noted above. This is so easily accessible from the auto road that a traveler passing this way would have little difficulty in seeing the flow. It is in plain sight of the road for many miles. (2) A small but very interesting lava flow can be seen on Eagle River, Eagle County, Colorado, just above the junction of the Eagle River with the (*Turn to next page*)

What Geology to See—*Continued*

Colorado. This is about 5 miles below the town of Gypsum. It can be seen from the auto road and also from the trains of the Denver and Rio Grande Western Railroad.

DIKE—Dikes of hardened lava that has been forced up through some crack in the rocks are quite abundant, but few of them are large enough or hard enough to make much of a showing. (1) The largest dike in the country is one of a great system of dikes that ray out from the Spanish Peaks in Las Animas County, Colorado. The largest of these extends northward from West Spanish Peak along the west side of Guajaytoyan Creek to within 4 miles of the village of La Veta on the La Veta branch of the Denver and Rio Grande Western Railroad. This dike has the appearance of a great rock wall which in places is more than 100 feet high.

COLUMNAR LAVA—Some masses of molten rock on cooling develop a wonderful system of hexagonal prisms, perpendicular to the cooling surface. (1) Two notable examples of columnar structure may be seen in northeastern Wyoming. One of these is the Devil's Tower, 25 miles northeast of Moorcroft and the other is called Inyankara, 30 miles east of Moorcroft. (2) There are many features of this kind in the lava fields of Washington. One is at Cactus Siding, 5 miles south of Connell on the Northern Pacific Railway and another is in Yakima Canyon a few miles north of North Yakima.

Economic Materials

LARGE COAL BED—Coal beds are of such common occurrence that few stop to consider them, largely because they are rarely exposed in full thickness. A few localities will be given where the full thickness of the bed may be seen. (1) The full thickness and character of the celebrated Pocahontas No. 3 coal bed has been preserved at the type locality, Pocahontas, Tazewell County, Virginia, and can be readily seen without difficulty. The coal bed is nearly 11 feet thick and contains as fine steaming coal as any other coal bed in the world. (2) A coal bed 20 feet thick can be seen at Streator, about 12 miles northeast of Meeker, Rio Blanco County, Colorado, on the main road leading from Meeker to Craig. (3) Perhaps the most remarkable exposure of coal is to be seen in a strip pit which has recently been opened by the Northern Pacific Railroad Company in sec. 35, T. 2 N., R. 41 E., about 25 miles due south of Forsyth, Montana. This coal bed is 27 feet thick and the whole amount is mined or quarried with steam shovels.

SALT CRUST—The salt crust of Death Valley, Inyo County, California, is a very interesting feature, though it has not yet been used in a commercial way. This field of salt is 2 or 3 miles wide, 10 or 15 miles long and consists of a crust of salt several feet thick. The salt is very impure and it forms in pinnacles several feet high which make it difficult to cross, except where the pinnacles have been beaten down into a road. Any road leading to the Furnace Creek Ranch in the northern part of the valley will bring the visitor to this salt field.

OIL SHALE—Most persons are interested in the great reserves of oil shale which have been reported in several of the western states, but few have any idea of the appearance or character of these shales. The best place to see them is at Grand Valley, Garfield County, Colorado. Here the cliffs of oil shale are near the railroad and the auto highway and the shale can readily be examined. Most persons think of oil shale as containing oil, but on these shales he will see no signs of oil. In fact the oil can be obtained only by the distillation of the organic material that causes the shale to have a dark color.

Geologic Structures

ANTICLINE—Anticlines are great arches in the rock; these may be very elongate and are then called arches or may be as broad as they are long and when of such a shape are called domes. (1) Arches in the rocks are very common in the Appalachian region. One of the best of these and at the same time one that is easily accessible is just west of Cumberland, Maryland. This great anticline in massive sandstone has been cut by Willie Creek until the complete section of the arch is exposed. (2) Another anticline that is equally well known and accessible is the sandstone arch at the Iron Gate just east of Clifton Forge, Virginia. (3) The celebrated Teapot Dome oil field north of Casper, Wyoming, is a dome-shaped anticline, but the structure is not apparent at the surface as the rocks are too soft to preserve the dome. The adjacent oil field—Salt Creek field—is a slightly irregular dome outlined by the Rim Rock which once arched up and covered the entire structure. These fields are easily accessible and will well repay a visit.

Geological Guidebooks

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These publications are out of stock for free distribution, but can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Bulletin 611, Guidebook of the western United States, Part A, The Northern Pacific Route, with a side trip to Yellowstone Park, by M. R. Campbell and others, $1.00.

Bulletin 612, Guidebook of the western United States, Part B, The Overland Route, with a side trip to Yellowstone Park, by W. T. Lee, R. W. Stone, H. S. Gale, and others, 50 cents.

Bulletin 613, Guidebook of the western United States, Part C, The Santa Fe Route, with a side trip to the Grand Canyon of the Colorado, by N. H. Darton and others, $1.00.

Bulletin 614, Guidebook of the western United States, Part D, The Shasta Route and Coast Line, by J. S. Diller and others, 50 cents.

Bulletin 707, Guidebook of the western United States, Part E, The Denver & Rio Grande Western Route, by M. R. Campbell, $1.00

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Of Taming Dragons

Volcanology

In Sonoma County, California, near the town of Cloverdale, there is an industrial development, unique in this country and one of only two enterprises of its kind in the world, that will repay a brief visit by physicists, engineers and geologists. It is the effort to carry out the ancient and much-talked-of project to capture and utilize natural heat under the surface of the earth.

At "The Geysers" the effort is, to be sure, a fairly modest one. There is nothing here of the ten-mile-deep shaft talked about by Professors of Romantic Engineering, no effort at a Vernian or Wellsian tunnel through the earth. The promoters of this enterprise are contenting themselves with drilling into a place where the heat has accommodatingly come near to the surface, in the form of hot springs, and leading up the steam they find in casings not unlike those employed in oil or artesian wells. They declare their wells are working, and that they will pay. "The Geysers" is worth looking at, anyway.

The scientific aspects of the enterprise have been studied by Dr. E. T. Allen and Dr. A. L. Day, and are reported under the title Steam Wells and Other Thermal Activity at "The Geysers," California, published by the Carnegie Institution of Washington.

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