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UNITED STATES
DEPARTMENT OF THE INTERIOR
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GEOLOGY OF THE DRY VALLEY QUADRANGLE, IDAHO

A preliminary report by E. R. Cressman

MINERAL DEPOSITS BRANCH
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GEOLOGY OF THE DRY VALLEY QUADRANGLE, IDAHO

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INTRODUCTION

The Dry Valley quadrangle is one of seven $7\frac{1}{2}$-minute quadrangles in southeastern Idaho being mapped by the U. S. Geological Survey as part of an investigation of the western phosphate field. This work was done on behalf of the Division of Raw Materials of the Atomic Energy Commission. Most of the quadrangle was mapped on a new 1:12,000 topographic base during the summer and fall of 1950 by E. R. Cressman and R. A. Gulbrandsen with the assistance of K. B. Krauskopf, K. Lutz, and J. W. Hill. The field work was completed in the fall of 1951 by Cressman and assisted by R. G. Waring and M. A. Warner. This quadrangle is the NE$\frac{1}{4}$ of the Slug Creek 15-minute quadrangle, which was mapped by Mansfield (1927) at a scale of 1:62,500.

GEOGRAPHY

The Dry Valley quadrangle is about 25 miles north of Montpelier and 15 miles east of Soda Springs in southeastern Idaho. It includes most of Tps. 8 and 9 S., R. 44 E., and the eastern half and the southwestern corner of the quadrangle are within Caribou National Forest. The area is accessible by gravel roads from Montpelier, Georgetown, and Soda Springs, which are connected by a paved highway, U. S. Route 30 N., and is traversed by a few secondary roads and dry-weather trails. The main line of the Union Pacific Railroad between Chicago and Portland passes through these same towns. A spur into the Dry Valley area from Conda, near Soda Springs, via the Blackfoot River valley, the shortest practicable route, would be about 25 miles in length.

The area is mountainous and the winters are fairly severe, with the deep snowfall making it almost inaccessible during the winter months The population is sparse, being limited to a few ranches that are occupied during the summer.

Maximum relief in the area is more than 2,500 feet and local relief is nearly that much in the northeast corner where the highest point is 8,925 feet above sea level, though elsewhere the relief does not exceed 1,500 feet. Schmid Ridge, bearing N. 25° W., is 2 to 3 miles wide and passes through the middle of the quadrangle. It is flanked by Slug Creek valley on the west and Dry Valley on the east. Dry Ridge crosses the northeast corner and the east edge of Aspen Range makes up the southwest corner of the quadrangle.

North and east slopes are generally forested with both mixed and pure stands of aspen and conifers. South and west slopes and valley floors are covered with grasses and sagebrush. Part of Slug Creek valley is cultivated.

STRATIGRAPHY

Carboniferous System

Brazer limestone

The Brazer limestone (Cb) of Mississippian age is the oldest formation exposed within the quadrangle. Mansfield (1927) reported the Brazer thickness as greater than 1,130 feet at Wells Canyon, a few miles southeast of the Dry Valley quadrangle, and recent measurement by T. M. Cheney indicates a thickness in excess of 1,700 feet. Only the upper 800 feet of the formation are exposed within the quadrangle.

The upper 400 feet consist mostly of thick-bedded to massive light- to dark-gray dense limestone and medium-grained crinoidal(?) limestone. Underlying strata include interbedded dense limestone, medium- to coarse-grained crinoidal limestone, poorly sorted oolitic limestone, calcareous quartz siltstone, and well-sorted medium-grained quartz sandstone. Large horn corals, the most conspicuous fossils, are especially common in the uppermost massive limestone.

Wells formation

The Wells formation is described as Pennsylvanian in age but may overlap into both the Mississippian and Permian. It has been mapped as two units, a lower member (Cwa) that corresponds approximately to the "lower sandy and cherty facies" and an upper member (Cwb) that includes both the "middle sandy facies" and the "upper siliceous limestone" of Mansfield (1927, p. 72).

The lower member (Cwa) consists of interbedded limestone, sandy limestone, and calcareous quartz sandstone. Some of the limestones are composed largely of flattened oolites and are diagnostic of the member. Chert nodules and stringers are common in the limestone, especially in the upper half of the member. Horn corals are present but not in abundance. The thickness of the member in this quadrangle is about 600 feet.

The upper member (Cwb), which is 1,300 to 1,500 feet thick, consists of calcareous quartz sandstone with subordinate limestone and chert. The sandstone, which ranges from very fine-grained to fine-grained, is commonly cross-bedded and brecciated. The color ranges from light-gray to weak yellowish-orange, but many beds in the uppermost several hundred feet are reddish-brown. A distinctive light-gray limestone 50 to 100 feet thick that contains silicified Squamularia (brachiopod) shells and bluish-gray chert bands occurs at the top of the member and is extremely useful as a guide to the overlying phosphate.

Permian System

Phosphoria formation

The Phosphoria formation is mapped as two distinctive members, a lower phosphatic shale member and an upper Rex chert member. This follows the usage of Mansfield (1927).

The phosphatic shale member (Pps) is composed of 180 to 200 feet of interbedded black mudstone, oolitic phosphate rock, and limestone. The member is seldom exposed in outcrop, usually forming a swale between the underlying Wells formation and the overlying Rex chert member.

The Rex chert member (Ppr) consists of approximately 300 feet of bedded chert and cherty mudstone, the cherty mudstone usually occurring in the upper half of the member.

A thin bed of nodular phosphate rock is present locally at the top of the member. In places the bedded chert crops out in massive cliffs, but in others it is marked only by float.

Triassic System

Dinwoody formation

Though the Triassic strata overlying the Phosphoria formation were mapped as the Woodside shale by Mansfield (1927), the same strata are here referred to as Dinwoody formation. This change in nomenclature is based in large part on unpublished studies by B. Kummel, who has made a fairly thorough examination of Triassic strata in this region as part of the current program.

Two members were mapped. The lower member (Ŧrda) consists of 850 to 1,000 feet of fissile and thin-bedded olive-gray to dusky yellowish-green calcareous siltstone with a few thin interbeds of gray limestone. At the top of the lower member are 100 to 150 feet of thick-bedded olive-gray silty limestone and calcareous siltstone that weather moderate brown to shiny black. The upper member (Ŧrdb) consists of gray limestone interbedded with thin-bedded olive-gray siltstone and thick-bedded black-weathering siltstone similar to those in the lower member. The average thickness is approximately 900 feet, but the range is from 700 to 1,100 feet.

Thaynes formation

The Thaynes formation of Early Triassic age, not completely represented here, has been mapped as two members. The base of the A member is marked by gray limestone beds about 30 feet thick that contains the Meekoceras ammonite fauna. Overlying the Meekoceras beds are 650 to 850 feet of poorly exposed black and gray shale containing two units of thin-bedded limestone, each probably not more than 100 feet thick. The B member consists of 500 feet of platy brownish-gray silty limestone and calcareous siltstone overlain by about 150 feet of medium-bedded calcareous siltstone. Beds that occur higher in the formation crop out at one locality on Schmid Ridge, but because of poor exposures they are included in the B member of the Thaynes formation.

Tertiary System

Sedimentary deposits of Tertiary (and Quaternary?) age

All deposits of Cenozoic age other than Quaternary alluvium have been mapped as a single unit (QTs). These deposits occur chiefly within Dry Valley and Slug Creek valley and include chiefly oolitic limestone, calcareous and tuffaceous limestone- and siltstone-cobble conglomerate, and gravel deposits derived mainly from the Wells, Dinwoody, and Phosphoria—Rex chert member—formations. The oolitic limestone and the calcareous and tuffaceous conglomerates that crop out on the west side of the upper part of Slug Creek valley dip steeply east and are evidently faulted against older rocks, but elsewhere neither bedding nor structure is apparent. Some of the unconsolidated deposits, especially those on the east side of Dry Valley, probably include Quaternary hill wash and alluvial fan deposits that are indistinguishable from the older deposits.

Quaternary System

Alluvium

Alluvial deposits on the flood plains of the present stream system have been mapped as Qal. Included are minor amounts of hill wash and alluvial fan deposits.

STRUCTURE

The area is characterized by generally moderate folding striking north-northwest and by a few large faults of similar trend and many short faults of small displacement commonly transverse to the major structures. Many of the structures are very poorly defined or may even be concealed completely, a condition due chiefly to the infrequency of outcrops and the fairly deep weathering of intervening areas. This is particularly true in the area of complex structures composing the southwest corner of the quadrangle. Because of the poor exposures, dips of most faults shown on the map and in the cross sections are quite interpretive.

This area was shown by Mansfield (1927) to belong to the upper plate of the Bannock overthrust. Inasmuch as there is little evidence for the Bannock thrust exposed in this quadrangle, it is not indicated on the cross sections shown on plate 2.

The most prominent structural feature of the quadrangle is Schmid Ridge syncline, a relatively simple, open fold with both the north and south ends plunging toward the center. The beds that turn around the south end are broken by numerous small transverse faults, and the west side is complicated by several west-dipping high-angle normal and reverse longitudinal faults.

A fault, probably west-dipping and normal, occurs along the east side of Dry Valley nearly coincident with the Dry Valley anticlinal axis. There are several minor folds on the west flank of the anticline. Both the fault and the minor folds apparently die out to the north.

Most of that part of Dry Ridge included within the quadrangle is underlain by the moderately dipping strata forming the east limb of the Dry Valley anticline. These beds are interpreted as being thrust east onto a tightly folded, slightly overturned syncline. In the extreme north east corner of the quadrangle, beds dipping gently west are thrust west onto the syncline. This structure is interpretive and must be checked by mapping in adjacent quadrangles. Unusually large thicknesses of the lower member of the Wells formation (Cwa) and the upper member of the Dinwoody formation (Ћdb) indicate the presence of more structure on Dry Ridge than is shown on the map and structure sections.

The only readily apparent major structure to the west of Slug Creek valley is a tightly folded anticline, in part overturned and in part fan-shaped, that exposes the Brazer limestone along the axis. Although the anticline is much faulted in the southwest corner of the quadrangle, mapping in the Johnson Creek quadrangle to the west indicated that the structure was originally a continuous arcuate anticline convex to the west.

In the extreme southwest corner of the quadrangle, the faulted east flank of an anticline is bordered on the east by a syncline, in part overturned, with a gently dipping east limb. To the east of the syncline the structure has been interpreted as consisting of tear faults and west-dipping arcuate thrusts, in places intersected by high-angle normal faults.

These structures are too complex to project under the alluvium in Slug Creek valley. It should be noted, however, that beds of Tertiary age dipping steeply east on the west side of the upper part of the valley indicate that the west side has been displaced downward by relatively late faulting.

PHOSPHATE DEPOSITS

No mineral deposits other than phosphate rock are known to occur in the quadrangle. The phosphate deposits are found in the phosphatic shale member of the Phosphoria formation, which contains two zones of phosphate rock suitable for mining and processing. The higher grade zone is near the base of the member and the other zone is about 20 feet below the upper contact. The phosphatic shale member has been sampled by the U. S. Geological Survey at seven localities within the quadrangle (lot nos. 1208, 1210, 1211, 1212, 1260, 1277, and 1278). The basic stratigraphic and analytical data for these lots are now on open file (McKelvey, and others, July 1951 and August 1951, and O' Malley, and others, February 1952), and will be published in Circular by the U. S. Geological Survey in the near future. Part of the data are summarized in table I.

Table I

THICKNESS OF MINABLE a/ PHOSPHATE AT DRY VALLEY SAMPLE LOCALITIES b/

		Thickness (feet)					
		Upper Phosphatic Zone			Lower Phosphatic Zone		
Lot no.	Name and Location	31.0% P_2O_5	25.0% P_2O_5	20.0% P_2O_5	31.5% P_2O_5	25.0% P_2O_5	20.0% P_2O_5
1208	West Dairy sec. 19, T. 9 S., R. 44 E.	--	18.7	29.5	9.0	21.7	55.0
1210	Mabie Canyon NW¼NE¼ sec. 10, T. 8 S., R. 44 E.	--	17.1	29.2	6.4	19.2	39.1
1211	South Dry Valley W½SE¼ sec. 14, T. 9 S., R. 44 E.	3.6	22.6	39.8	8.1	30.9	49.8
1260	Caldwell Canyon c/ sec. 1, T. 8 S., R. 43 E.	--	4.9	12.2	6.0	17.7	31.6
1277	Drill Hole 6 sec. 30, T. 8 S., R. 44 E.	--	Not sampled	--	7.1	22.0	28.0

a/ A minimum mining thickness of three feet is assumed.
b/ Lot 1212 (North Dairy) is not included because the section is complicated by faulting. Lot 1278 (Drill Hole 7) is not included because of poor core recovery.
c/ Although at least parts of both phosphatic zones are present, faulting has reduced the total thickness of the phosphatic shale member from nearly 200 feet to 116 feet.

Probably the most favorable deposit for strip mining is the belt of Phosphoria turning around the south end of Schmid syncline. It has been thoroughly trenched by private companies, but there has been no production to date. The low-dipping middle belt of phosphatic shale on the west side of the upper part of Slug Creek valley might appear suitable for stripping; however, the belt shown on the map is largely interpretive and the surrounding region is much faulted. The large knoll underlain by Phosphoria strata in southern Dry Valley might offer possibilities for stripping; however, interpretation of the structure is somewhat uncertain and less favorable interpretations are possible.

The belt of phosphatic shale on Dry Ridge is probably the only deposit in the quadrangle that is suitable for underground mining. Most of the favorable ground has been leased by the Western Fertilizer Association, and in the summer of 1951 a short exploratory adit was driven into the north side of Mabie Canyon.

The remaining phosphatic shale outcrops in the quadrangle are probably too complicated by structure to warrant mining consideration at this time. The belt of phosphatic shale on the northwest flank of Schmid Ridge might offer possibilities, but faulting in adjacent strata and at the Caldwell Canyon trench (lot 1260) show the need for caution. The structure west of Slug Creek valley is so complicated that any attempt at mining would be hazardous.

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