GEOLOGICAL SURVEY CIRCULAR 208

STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION IN IDAHO, 1947–48, PART I

By V. E. McKelvey, D. F. Davidson, F. W. O'Malley, and L. E. Smith

UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

GEOLOGICAL SURVEY CIRCULAR 208

STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION IN IDAHO, 1947–48, PART I

By V. E. McKelvey, D. F. Davidson, F. W. O'Malley, and L. E. Smith

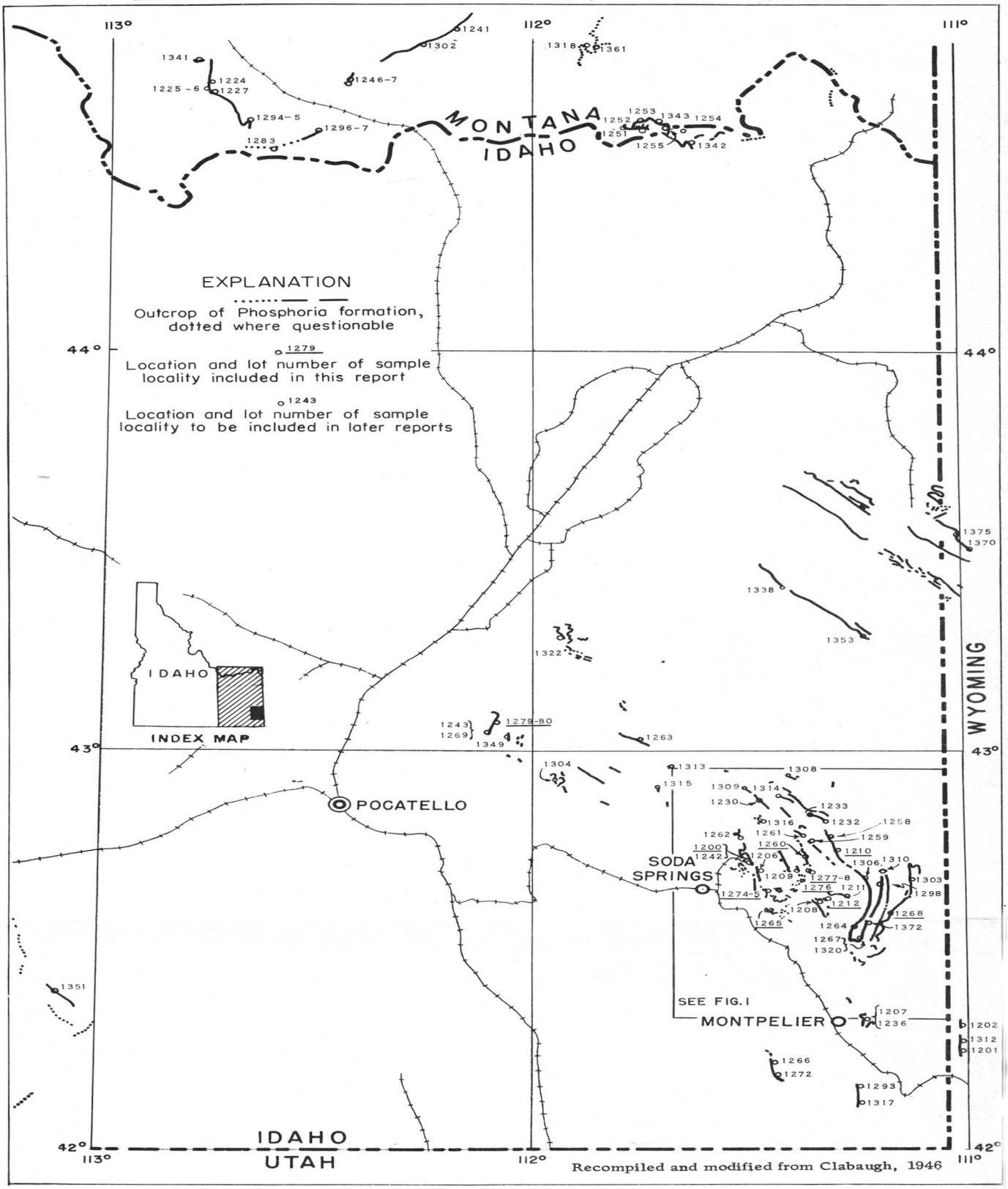
This report concerns work done partly on behalf of the
U. S. Atomic Energy Commission
and is published with the permission of the Commission.

Washington, D. C., 1953

Free on application to the Geological Survey, Washington 25, D. C.

CONTENTS

ILLUSTRATIONS



PHOSPHORIA FORMATION OUTCROPS IN IDAHO AND LOCALITIES SAMPLED FOR PHOSPHATE

10 0 10 20 30 40 Miles

STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION IN IDAHO, 1947–48, PART I

INTRODUCTION

The Permian Phosphoria formation of the western states contains one of the world's largest reserves of phosphate. Although previous investigations (see especially Mansfield, 1927), including reconnaissance geologic mapping and sampling, established the location of most of the important deposits and their quality at scattered localities, they were not sufficiently detailed to permit a comparison of the merits of individual deposits or an appraisal of the reserves of phosphate rock that might be available under present economic conditions. Because the growing importance of the western phosphate deposits requires a better, more detailed understanding of their distribution and quality, the Geological Survey began in 1947 a comprehensive investigation, including (1) reconnaissance geologic mapping, mostly in Montana, of areas in which the Phosphoria formation could occur but where it had not previously been looked for or found; (2) geologic mapping, mostly in Montana, at a scale no smaller than 1:62,500, of several areas known to contain the Phosphoria formation but not previously mapped except in reconnaissance fashion; (3) Geologic and topographic mapping, at a scale of 1:12,000, of some of the richest, thickest, and most accessible deposits; (4) measuring, describing, and sampling all beds of the phosphatic and shaly parts, and in some places the full thickness, of the Phosphoria formation and its stratigraphic equivalents at one or two localities per township over the entire field; (5) chemical and spectrographic analysis of the samples for phosphate, fluorine, minor metals, oil, and rock-forming constituents; and (6) petrologic and geochemical studies of the rocks and minerals of the formation.

These studies are designed to define the regional and local geologic structures in which the phosphate beds lie, to provide a basis for the estimation of reserves of the inferred class over the entire region, and to determine the origin of the rocks and the elements contained in them. The data collected are not of the detail required to plan actual mining operations, but it is hoped they will guide industry in the selection of individual deposits worthy of further exploration.

Most of the field work contemplated as a part of this investigation is now completed. Although the data will not be compiled or published in final form for some years to come, segments of the data, accompanied by little or no interpretation, will be published as preliminary maps or reports as they are assembled. The present report is the first of a series presenting in abbreviated form the descriptions and analyses of the beds measured and sampled at various localities in southeastern Idaho (pl. 1). Companion reports presenting segments of the data from Montana, Wyoming, and Utah (Swanson and others, 1953, McKelvey, and others, 1953, and Smith and others, 1953) are being released at the same time as this report, and others are in preparation.

A large number of people have taken part in this investigation. In addition to the authors, F. C. Armstrong, R. P. Sheldon, R. M. Campbell, R. A. Gulbrandsen, R. A. Hoppin, D. M. Larrabee, O. A. Payne, R. S. Sears, R. A. Smart, R. G. Waring, and R. A. Weeks participated in the description of the strata and collection of the samples referred to in this report. D. B. Dimick, Jack George, W. S. Hunziker, J. E. Jones, H. A. Larsen, and T. K. Rigby assisted in the preparation of trenches and collection, crushing, and splitting of samples in the field. The diamond drilling described in this report was undertaken for the Geological Survey as a cooperative project by the U. S. Bureau of Mines. This drilling was under the supervision of A. E. Long (1949).

The laboratory preparation of samples for chemical analysis was done under the direction of W. P. Huleatt (1950), who also designed a crushing and splitting apparatus for field use. The analyses for P_2O_5 and acid insoluble and most of those for Al_2O_3, Fe_2O_3, and loss on ignition were made for the Survey by the Bureau of Mines at the Northwest Electrodevelopment Laboratory, Albany, Oreg., under the direction of S. M. Shelton and M. L. Wright. The spectrographic analyses in the Bureau of Mines laboratory were prepared by D. M. Mortimer. Analytical work by the Geochemistry and Petrology Branch of the Geological Survey has been done under the direction of J. C. Rabbitt by chemists I. Barlow, A. Caemmerer, J. Greene, N. Guttag, and E. H. Humphrey.

Compilation of the data has been largely by R. P. Sheldon and F. D. Frieske under the supervision of R. W. Swanson. Organization of the tabular data has been largely by Anita Cozzetto.

Acknowledgments

Special thanks are due W. W. Rubey, J. Steele Williams, and A. E. Weissenborn who have given much advice in planning and organizing the field program.

The cost of both the field and laboratory investigations has been partly borne by the Division of Raw Materials of the Atomic Energy Commission. This support is gratefully acknowledged.

It is a pleasure to acknowledge the fine cooperation extended to the field party by the local residents, property owners, and operating phosphate companies, who furnished information and services and gave access to property. A. J. Winters, Superintendent of the Montpelier schools; E. M. Norris, C. T. Russell, and L. E. Traeger of the Anaconda Copper Mining Company; D. L. King of the San Francisco Chemical Company; and G. A. McHugh and H. B. Fowler of the Simplot Fertilizer Company have been especially helpful in this connection.

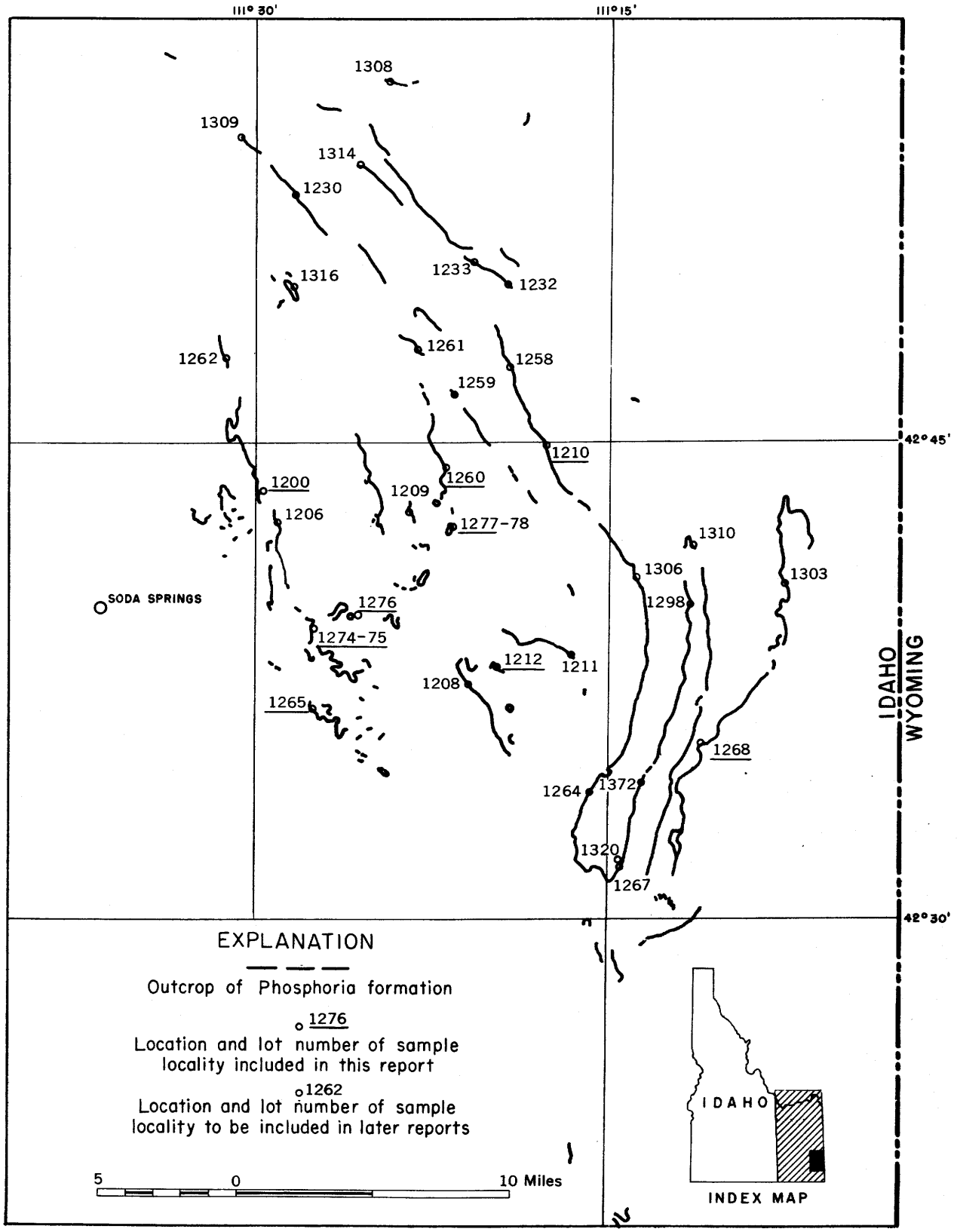


Figure 1.-- Phosphoria outcrops and sample localities of inset area on plate 1

FIELD AND LABORATORY PROCEDURES

The field and laboratory procedures followed in these investigations and the definitions of the lithologic terms adopted throughout the work, particularly insofar as they bear upon the interpretation of the data presented, are described in some detail in this report but will be omitted or only summarized in subsequent ones.

Preparation of Sections for Description and Sampling

Natural exposures of the phosphatic shale member of the Phosphoria formation are rare. Most of the sections measured, therefore, have been exposed artificially, generally by bulldozer but in some places by hand-trenching. The trenches, which range from 5 to as much as 30 feet in depth and from 200 to 500 feet in length, have been located mostly on steep slopes containing a minimum of foreign talus and abundant fragments of phosphate rock and in areas where the regularity of outcrops of adjacent formations and the covered interval between them indicated little or no structural complication. Despite these precautions, part if not much of the phosphatic shale proved too deeply buried to expose at several localities; the rocks exposed at most localities are weathered and in some places physically distorted or displaced by creep; and at some localities parts of the section are repeated or omitted by faults not recognizable at the surface. For these reasons the thicknesses measured do not everywhere represent the true thickness of the rocks, and the samples collected and analyzed are not wholly representative of the rocks at depth.

A few sections were obtained by diamond drilling undertaken by the Bureau of Mines in cooperation with the Geological Survey in an effort to develop a means of coring the Phosphoria formation. The engineering results of this experimental drilling have been described in another report (Long, 1949).

Measurement and Description of Strata

The full thickness, or such of it as could be exposed, of the phosphatic member of the Phosphoria formation has been described and sampled at each locality. In addition the entire formation has been described, and in some places sampled as well, at selected localities to provide information on other constituents besides the phosphate and to provide stratigraphic information for correlation purposes.

Each lithologic unit greater than 0.5 foot in thickness has been described and sampled separately (a few thinner units have been described and sampled as well), and units greater than 5 feet in thickness have been divided into two or more parts, except in nonphosphatic parts of the formation where some thicker units have not been subdivided. For identification purposes, each locality has been assigned a lot number, each bed described a bed number, and each bed sampled a sample number.

Because many people have participated in the measurement and description of the beds, it has been necessary to standardize the terminology used in the work in order to achieve uniform results. This has been achieved mainly through the use of prepared forms or tables with spaces in which to record for each unit its bed number, sample number, field name, thickness, texture, grain size, hardness, thickness of bedding, presence of fossils, mineralogy, reaction to hydrochloric acid, color, jointing, and nature of contact with the underlying unit. In order that field descriptions could be augmented by laboratory petrographic studies, one or more chip samples have been collected from each unit. Only a brief abstract of this field description—bed and sample numbers, rock name, and bed thickness—is presented here, but most of the remaining data will be presented later.

Collection of Samples

Channel or bench samples have been collected from each unit over the full thickness of the phosphatic member of the Phosphoria formation and, in a few places, over the entire formation. The minimum weight of the samples is 12 pounds, but the average weight of those collected from the sections described in this report is about 35 pounds.

Treatment and Analysis of Samples

All samples have been crushed to minus $\frac{1}{2}$-inch mesh and reduced to 10 pounds in a field laboratory established at Montpelier, Idaho, using a combination jaw crusher and Vezin-type splitter designed by W. P. Huleatt (1950). The crushed samples have been split into two parts at the Geological Survey sample-preparation laboratory in Denver—one stored with no further treatment and the other ground to minus 20-mesh. From the latter, two 4-ounce splits have been cut and ground to minus 80-mesh for chemical analysis. Powders for spectrographic analysis also have been prepared in the Survey's Denver laboratory.

All samples have been analyzed for P_2O_5 and acid insoluble by methods essentially the same as those described by Hoffman and Lundell (1938). In addition all samples from a few localities have been analyzed for Al_2O_3, Fe_2O_3, V_2O_5, and loss on ignition, and semiquantitatively spectrographed for Al, Ba, B, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Si, Ag, Na, Sr, Ti, V, Zn, and Zr and, in a large percentage of the samples, for nearly 20 additional elements including Sb, As, Be, Bi, Cd, Cb, Ga, Ge, Au, In, Li, Hg, Pt, Ta, Sn, and W. Most samples representing a thickness of more than 3 feet and a P_2O_5 content in excess of 30 percent or a thickness of more than 10 feet and a P_2O_5 content in excess of 20 percent have been analyzed for Al_2O_3, Fe_2O_3, and loss on ignition, and most of these same samples have been spectrographed for the constituents listed above. Some of these samples have also been analyzed for F or V_2O_5.

A small percentage of the analyses of the samples reported here are not yet available. They will be presented in later reports.

INTERPRETATION OF CHEMICAL DATA

Nearly all the phosphate is in carbonate-fluorapatite, which has a composition of about $9CaO.3P_2O_5.CaF_2.CO_2.H_2O$. The percentage of P_2O_5 multiplied by 2.56, therefore, gives the approximate percentage of the phosphate mineral. The percentage of tricalcium phosphate, $3CaO.P_2O_5$, or bone phosphate of lime (B.P.L.) as it is called in the phosphate industry, may be calculated by multiplying the percentage of P_2O_5 by 2.18.

Acid-insoluble content may be determined by a variety of procedures that yield widely different results. In the analyses reported here, the acid-insoluble content represents that portion of the rock not soluble in aqua regia and not ignitable or volatile at about 1000° C. The acid-insoluble fraction consists principally of silica, but it generally also includes 10-30 percent of the total iron oxide, alumina, and titania and a generally negligible percentage of phosphate, magnesia, lime, and several minor metals such as zirconium. Mineralogically it may be taken as an approximate index of the total amount of detrital minerals in the rock; the fact that some of the detritals may have been partially dissolved by the acid treatment is counterbalanced by the fact that many rocks contain some secondary chert. Attention is called to

the fact that the acid-insoluble residue determined in this fashion includes little if any carbonaceous matter.

That portion of the rock not in carbonate-fluorapatite or acid insoluble, that is, A. I. +(P_2O_5 x 2.56), includes the CaO and CO_2 not in fluorapatite as well as nearly all the MgO, Na_2O, K_2O, SO_3, organic matter, and minor metals such as vanadium, chromium, nickel, zinc, etc. (even some of the zirconium is in acid-soluble form); it also includes all the Fe_2O_3, Al_2O_3, and TiO_2 that would be reported in separate analyses for these constituents (only soluble iron, alumina, and titania are generally reported). Mineralogically this portion of the rock consits mainly of calcite and dolomite; pyrite, marcasite, and other iron sulfides; limonite, hematite, and other iron oxides; iron sulfates and gypsum; and organic matter. The minerals containing the soluble alumina, alkalis, and minor metals are as yet poorly defined, but they seem to be mainly of the hydromica type.

Loss on ignition includes chiefly carbonate CO_2, organic matter, and water. It may also include some sulfur, depending upon the minerals present in the rock and the temperature reached during ignition. Loss on ignition may be taken as a rough measure of the organic-matter content if the rock contains no carbonates and little or no clay or if CO_2 and water have been determined and can be subtracted from the loss on ignition.

An accurate total of all constituents is extremely difficult to obtain, even when all the constituents present, and this may include 30 or 40, are determined. This partly because the accurate determination of many constituents in phosphate rock is extremely difficult and partly because the state of oxidation of many of the elements is not known. Thus, iron is generally reported as Fe_2O_3 but it may actually be present as FeO, FeS_2, etc.; vanadium is reported as V_2O_5 but may be present as V_2O_3; and sulfur is reported as SO_3 but is known to be present as organic, sulfide, and sulfate compounds. The same uncertainty applies to several other elements, particularly metals.

Because nearly all stratigraphic sections were measured and sampled at or near the surface, the analyses reported here are of partly weathered rocks. Aside from physical disintegration, the principal effects of weathering of Phosphoria formation rocks are progressive oxidation of organic matter and leaching of more soluble constituents.

In advanced stages of weathering, such as are found where the rocks immediately underlie the weathering surface developed prior to the deposition of the Tertiary Wasatch formation, the organic matter is so completely oxidized and removed that the rocks are white, light gray, or pink in color. Relatively soluble constituents, including calcium carbonate and minor metals like vanadium, are leached out, so that only the more insoluble constituents remain.

In less-advanced stages of weathering, such as those characteristic of the present weathering cycle and of most of the rocks described here, the rocks are medium to dark shades of brown or gray and some of the more soluble materials mentioned above have been leached out. Judging from the rocks exposed on various levels in the Anaconda Copper Mining Company mine at Conda, the P_2O_5 content of such moderately weathered rocks may be one or two percentage points higher than in unweathered rocks at depth.

CLASSIFICATION AND NOMENCLATURE OF ROCKS OF THE PHOSPHORIA FORMATION

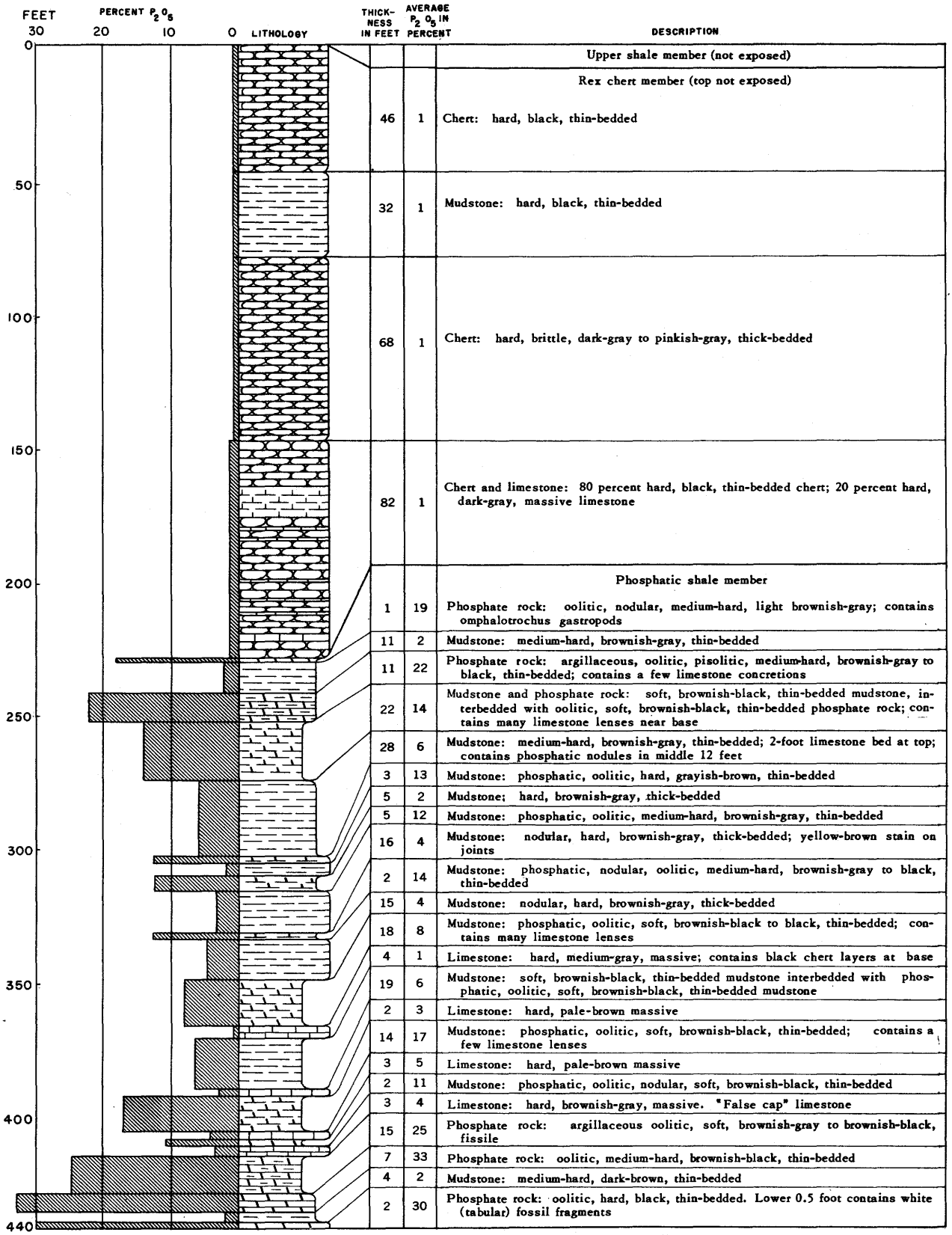
Rocks of the Phosphoria and adjacent formations consist of mixtures of three types of materials: (1) detrital silicates—principally quartz, clay, mica, and feldspar; (2) chemical precipitates—dominantly the isotropic carbonate-fluorapatite (collophane), calcite, dolomite, and chert but locally including minor amounts of pyrite or marcasite, gypsum, and glauconite; and (3) carbonaceous matter. Most of the detrital materials are silt or clay size in southeastern Idaho, but sand-size particles occur in other parts of the field. Many of the chemical precipitates, particularly the phosphates, are aggregated into pellets or nodules which give a coarse-textured appearance. Because the rocks are mixtures and because they were deposited under similar physical conditions, they are remarkably uniform in appearance and they are difficult to differentiate, especially in the field. For this reason, the majority of the names applied to the rocks in the field have been revised or modified on receipt of chemical or petrographic analyses.

The most significant property of the rocks is their composition, and this has been used as the principal basis in naming them. As the rocks are mixtures, their composition seldom can be described by the use of a noun alone. The rock names reported here, therefore, generally consist of a noun, chosen to represent the dominant constituent, supplemented by adjectives representing each constituent that makes up more than 20 percent of the rock, listed in order of decreasing abundance.

Nouns describing nonsilicate rocks include phosphate rock, limestone, and dolomite. The choice of these names is not influenced by texture, whether colloform, crystalline, or fragmental. Silicate rocks, that is, those rocks that contain a predominance, either individually or collectively, of silicate minerals such as chert, quartz, clay, mica, and feldspar, are subdivided into sandstone or mudstone, depending upon whether the larger percentage of these materials is sand size (1/16-2mm) or is finer-grained, or into chert. Because it is seldom possible to differentiate silt-size from clay-size particles in the field, and frequently not possible to do it in thin sections, in carbonaceous rocks such as these, the term mudstone has been used to include all detrital rocks containing particles smaller than sand size. Quartzite has been used to describe a sandstone so well cemented that the rock breaks through, rather than around, most of the grains.

Derivatives of all these nouns are used as adjectives—phosphatic, calcareous, dolomitic, cherty, sandy, argillaceous (silt and clay not differentiated)—if the respective constituents make up 20 percent or more of the rock. Other constituents that generally do not make up 20 percent or more of the rocks, such as gypsum, glauconite, limonite, and fluorite, are mentioned, if they seem unusually abundant, by preceding the constituent name with "contains". Because nearly all rocks of the phosphatic shale member contain carbonaceous matter, though rarely in excess of or even approaching 20 percent, this constituent is generally not recognized in the rock name.

Attention should be called to the fact that certain rock names—shale (which, where rigorously defined, is a fine-grained fissile detrital rock), oolite, and pisolite—are not applied here to rocks of the Phosphoria formation. These names, which are based upon structural features, have been abandoned with some misgivings, for they are easy to use in the field.



THICKNESS IN FEET	AVERAGE P_2O_5 IN PERCENT	DESCRIPTION
		Upper shale member (not exposed)
		Rex chert member (top not exposed)
46	1	Chert: hard, black, thin-bedded
32	1	Mudstone: hard, black, thin-bedded
68	1	Chert: hard, brittle, dark-gray to pinkish-gray, thick-bedded
82	1	Chert and limestone: 80 percent hard, black, thin-bedded chert; 20 percent hard, dark-gray, massive limestone
		Phosphatic shale member
1	19	Phosphate rock: oolitic, nodular, medium-hard, light brownish-gray; contains omphalotrochus gastropods
11	2	Mudstone: medium-hard, brownish-gray, thin-bedded
11	22	Phosphate rock: argillaceous, oolitic, pisolitic, medium-hard, brownish-gray to black, thin-bedded; contains a few limestone concretions
22	14	Mudstone and phosphate rock: soft, brownish-black, thin-bedded mudstone, interbedded with oolitic, soft, brownish-black, thin-bedded phosphate rock; contains many limestone lenses near base
28	6	Mudstone: medium-hard, brownish-gray, thin-bedded; 2-foot limestone bed at top; contains phosphatic nodules in middle 12 feet
3	13	Mudstone: phosphatic, oolitic, hard, grayish-brown, thin-bedded
5	2	Mudstone; hard, brownish-gray, thick-bedded
5	12	Mudstone: phosphatic, oolitic, medium-hard, brownish-gray, thin-bedded
16	4	Mudstone: nodular, hard, brownish-gray, thick-bedded; yellow-brown stain on joints
2	14	Mudstone: phosphatic, nodular, oolitic, medium-hard, brownish-gray to black, thin-bedded
15	4	Mudstone: nodular, hard, brownish-gray, thick-bedded
18	8	Mudstone: phosphatic, oolitic, soft, brownish-black to black, thin-bedded; contains many limestone lenses
4	1	Limestone: hard, medium-gray, massive; contains black chert layers at base
19	6	Mudstone: soft, brownish-black, thin-bedded mudstone interbedded with phosphatic, oolitic, soft, brownish-black, thin-bedded mudstone
2	3	Limestone: hard, pale-brown massive
14	17	Mudstone: phosphatic, oolitic, soft, brownish-black, thin-bedded; contains a few limestone lenses
3	5	Limestone: hard, pale-brown massive
2	11	Mudstone: phosphatic, oolitic, nodular, soft, brownish-black, thin-bedded
3	4	Limestone: hard, brownish-gray, massive. "False cap" limestone
15	25	Phosphate rock: argillaceous oolitic, soft, brownish-gray to brownish-black, fissile
7	33	Phosphate rock: oolitic, medium-hard, brownish-black, thin-bedded
4	2	Mudstone: medium-hard, dark-brown, thin-bedded
2	30	Phosphate rock: oolitic, hard, black, thin-bedded. Lower 0.5 foot contains white (tabular) fossil fragments

Wells formation

Figure 2.--Generalized typical section of Phosphoria formation in southeastern Idaho

Though the term shale is discarded as a rock name, it will continue to be used as a formation name, as the "phosphatic shale member". The usage of the term in this sense for a group of fine-grained thin-bedded, but not necessarily fissile, detrital rocks is so firmly entrenched in stratigraphic nomenclature that it would be useless to try to displace it, even if it were desirable to do so.

STRATIGRAPHY OF THE PHOSPHORIA FORMATION IN SOUTHEASTERN IDAHO

At its type locality in southeastern Idaho (Richards and Mansfield, 1912), the Phosphoria formation consists of a lower member, the phosphatic shale, about 180 feet thick and an upper member, the Rex chert, about 240 feet thick; another member, a thin-bedded cherty mudstone 15 to 75 feet thick, overlies the Rex chert in most of southeastern Idaho and western Wyoming, though it is not well defined at the type locality.

The Phosphoria formation overlies the Pennsylvanian Wells formation and underlies the Triassic Dinwoody formation. The upper 50 to 75 feet of the Wells formation consists of gray fossiliferous cherty limestone that contains some thin phosphatic layers. It may be the correlative of the lowermost member (A member) of the Phosphoria formation in Montana and the lower limestone member of the Park City formation in Utah (McKelvey, 1949).

In southeastern Idaho most of the phosphatic beds are in the phosphatic shale member, and it is on this member that most of our studies have been focused. It consists of many thin layers, some of which persist over the whole area. They may be grouped into several broad units, as yet unnamed, as shown in figure 2.

STRATIGRAPHIC SECTIONS

Abstracts of stratigraphic sections measured at 12 localities, and the available analytical data, are presented in the following pages. Their locations, as well as the locations of others to be reported later, are shown in plate 1.

The semiquantitative spectrographic analyses are based upon comparisons with a standard plate representing known quantities of the elements tested for and made at the same exposure. Greater sensitivities for many elements can be obtained by additional exposures. The standard sensitivities for the elements noted in this report are as follows:

Element	Percent	Element	Percent
Al	0.005	Li	0.2
Sb	.05	Mg	.001
As	.1	Mn	.004
Ba	.08	Hg	.10
Be	.001	Mo	.004
Bi	.002	Ni	.01
B	.001	P	.8
Cd	.1	Pt	.01
Ca	.01	Si	.002
Cr	.02	Ag	.001
Co	.01	Na	.05
Cb	.01	Sr	.1
Cu	.001	Ta	1.0
Ga	.05	Sn	.01
Ge	.01	Ti	.002
Au	.01	W	.1
In	.05	V	.01
Fe	.005	Zn	.05
Pb	.1	Zr	.003

REFERENCES

Clabaugh, P. S., 1946, Permian phosphate deposits of Montana, Idaho, Wyoming, and Utah: U. S. Geol. Survey, Strategic Minerals Investigations Preliminary Map 3-198.

Deiss, Charles, 1947, Phosphate deposits of the Deer Creek-Wells Canyon area, Caribou County, Idaho: U. S. Geol. Survey Bull. 955-C.

Hoffman, James J., and Lundell, G. E., 1938, Analysis of phosphate rock: U. S. Bur. Standards Research Paper 1095.

Huleatt, William P., 1950, Automatic sample preparation saves time, money for U.S.G.S.: Eng. and Min. Jour., vol. 151, pp. 62-67.

Long, A. E., 1949, Experimental diamond core-drilling in the Phosphoria formation in southeastern Idaho: U. S. Bur. Mines Rept. Inv. 4597.

Mansfield, G. R., 1927, Geography, Geology, and mineral resources of part of southeastern Idaho: U. S. Geol. Survey Prof. Paper 152. References to other areas are listed by Clabaugh, 1946.

McKelvey, V. E., 1949, Geological studies of the western phosphate field: Am. Inst. Min. Met. Eng. Mining Trans., vol. 184, pp. 270-279.

McKelvey, V. E., Smith, L. E., Hoppin, R. A., and Armstrong, F. C., 1953; Stratigraphic sections of the Phosphoria formation in Wyoming, 1947-48: U. S. Geol. Survey Circular 210.

Richards, R. W., and Mansfield, G. R., 1912, The Bannock overthrust: a major fault in southeastern Idaho and northeastern Utah: Jour. Geology, vol. 20, p. 684

Smith, L. E., Hosford, G. F., Sears, R. S., Sprouse, D. P., and Stewart, M. D., 1953; Stratigraphic sections of the Phosphoria and Park City formations in Utah, 1947-48: U. S. Geol. Survey Circular 211.

Swanson, R. W., Lowell, W. R., Cressman, E. R., and Bostwick, D. A., 1953; Stratigraphic sections of the Phosphoria formation in Montana, 1947-48: U. S. Geol. Survey Circular 209.

DIAMOND DRILL HOLE 8, FORT HALL MINE, IDAHO. LOT NO. 1279.

Part of phosphatic shale member of Phosphoria formation cored in diamond drill hole 8, near diamond drill hole 237 at Fort Hall Mine of J. R. Simplot Company, sec. 14, T. 4 S., R. 37 E., Bingham County, Idaho. Hole drilled in October 1948 by U. S. Bureau of Mines, A. E. Long in charge, and core measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—lower beds only						
P -35	Mudstone and phosphate rock	DFD-1144	2.5	16.1	40.2	2.5	40.25
P -34	Mudstone and phosphate rock	DFD-1145	0.9	15.8	41.5	3.4	54.47
P -33	Limestone, argillaceous	DFD-1146	1.6	5.2	23.2	5.0	62.79
P -32	Phosphate rock, argillaceous, calcareous	DFD-1147	0.7	15.4	33.8	5.7	73.57
P -31	Mudstone, phosphatic, calcareous	DFD-1148	1.8	9.5	51.6	7.5	90.67
P -30	Limestone	DFD-1149	0.8	2.3	10.2	8.3	92.51
P -29	Core missing	--	1.4	--	--	9.7	--
P -28	Mudstone, phosphatic	DFD-1150	0.3	13.8	40.5	10.0	4.14*
P -27	Mudstone, phosphatic	DFD-1206	3.2	13.3	49.4	13.2	46.70
P -26	Phosphate rock, calcareous, argillaceous	DFD-1207	1.5	18.4	24.4	14.7	74.30
P -25	Phosphate rock, calcareous, argillaceous	DFD-1208	1.2	14.8	25.8	15.9	92.06
P -24	Phosphate rock, calcareous	DFD-1209	1.0	22.9	19.6	16.9	114.96
P -23	Limestone, phosphatic	DFD-3336	1.2	15.6	11.6	18.1	133.68
P -22	Phosphate rock	DFD-1248	1.8	26.7	19.6	19.9	181.74
P -21	Phosphate rock, argillaceous	DFD-1249	1.6	16.2	39.1	21.5	207.66
P -20	Mudstone, phosphatic	DFD-1250	1.2	15.6	43.4	22.7	226.38
P -19	Phosphate rock, argillaceous, calcareous	DFD-1251	1.7	17.9	32.3	24.4	256.81
P -18	Phosphate rock, argillaceous	DFD-1252	0.6	25.8	21.9	25.0	272.29
P -17	Phosphate rock, argillaceous	DFD-1253	1.5	27.0	21.0	26.5	312.79
P -16	Phosphate rock, argillaceous	DFD-1254	1.8	26.3	22.8	28.3	360.13
P -15	Core missing	--	2.8	--	--	31.1	--
P -14	Mudstone, phosphatic	DFD-1255	0.5	16.6	45.6	31.6	8.30*
P -13	Mudstone, phosphatic	DFD-1256	0.6	15.7	46.5	32.2	17.72
P -12	Phosphate rock	DFD-1257	1.3	30.7	13.8	33.5	57.63
P -11	Phosphate rock, argillaceous	DFD-1258	2.8	22.2	33.1	36.3	119.79
P -10	Phosphate rock and mudstone	DFD-1259	2.0	18.5	28.1	38.3	156.79
P - 9	Phosphate rock and mudstone	DFD-1827	2.0	30.8	12.6	40.3	218.39
P - 8	Phosphate rock and mudstone	DFD-1828	1.0	24.6	20.2	41.3	242.99
P - 7	Limestone	DFD-1976	1.0	4.9	17.4	42.3	247.89

* Cumulative data incomplete due to missing information. Computations start from zero after interruption.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
P - 6	Phosphate rock	DFD-1977	1.1	28.0	15.9	43.4	278.69
P - 5	Limestone, phosphatic	DFD-1978	1.8	11.8	13.1	45.2	299.93
P - 4	Phosphate rock, argillaceous	DFD-1979	2.0	24.0	23.9	47.2	347.93
P - 3	Phosphate rock	DFD-1980	2.6	34.7	3.1	49.8	438.15
P - 2	Limestone, argillaceous, phosphatic	DFD-2170	0.5	11.8	29.4	50.3	444.05
P - 1	Limestone, argillaceous	DFD-2295	0.8	5.4	33.3	51.1	448.37**
			Wells formation				
Cw- 1	Limestone, argillaceous	DFD-2296	0.2	2.5	23.0	0.2	0.50

** Note incompleteness of cumulative data.

DIAMOND DRILL HOLE 9, FORT HALL MINE, IDAHO. LOT NO. 1280.

Part of phosphatic shale member of Phosphoria formation sampled from diamond drill hole 9 near diamond drill hole 237 at Fort Hall Mine of J. R. Simplot Company, sec. 14, T. 4 S., R. 37 E., Bingham County, Idaho. Hole drilled in October 1948 by U. S. Bureau of Mines, A. E. Long in charge, and measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—lower beds only						
P -34	Mudstone, calcareous	DFD-2297	0.5	7.7	43.8	0.5	3.85
P -33	Mudstone, phosphatic	DFD-2298	2.0	13.5	44.0	2.5	30.85
P -32	Mudstone, phosphatic, calcareous	DFD-2299	0.6	13.7	36.5	3.1	39.07
P -31	Limestone	DFD-2300	0.7	1.9	8.0	3.8	40.40
P -30	Mudstone, phosphatic, calcareous	DFD-3035	3.4	11.5	46.2	7.2	79.50
P -29	Core missing	--	1.0	--	--	8.2	--
P -28	Limestone	DFD-2468	0.8	0.7	8.6	9.0	0.56*
P -27	Mudstone, phosphatic	DFD-2469	2.2	12.1	49.4	11.2	27.18
P -26	Phosphate rock, argillaceous	DFD-2470	1.1	16.0	39.7	12.3	44.78
P -25	Phosphate rock, calcareous, argillaceous	DFD-2471	1.0	14.6	30.6	13.3	59.38
P -24	Phosphate rock and calcareous mudstone	DFD-2472	0.9	19.3	21.7	14.2	76.75
P -23	Phosphate rock and mudstone	DFD-2473	1.0	18.2	22.9	15.2	94.95
P -22	Phosphate rock, calcareous, argillaceous	DFD-2474	1.5	17.0	23.5	16.7	120.45
P -21	Phosphate rock, calcareous	DFD-2475	1.2	24.4	16.9	17.9	149.73
P -20	Phosphate rock, argillaceous	DFD-2531	1.7	26.1	20.4	19.6	194.10
P -19	Phosphate rock, argillaceous	DFD-2532	1.6	17.2	38.6	21.2	221.62
P -18	Limestone	DFD-2533	0.9	3.2	4.5	22.1	224.50
P -17	Mudstone, phosphatic, calcareous	DFD-2534	2.9	13.4	36.5	25.0	263.36
P -16	Phosphate rock and mudstone	DFD-2535	1.6	29.1	13.1	26.6	309.92
P -15	Phosphate rock and mudstone	DFD-2536	1.9	22.7	29.6	28.5	353.05
P -14	Phosphate rock and mudstone	DFD-2537	1.3	22.6	27.3	29.8	382.43
P -13	Limestone	DFD-2538	0.5	2.6	14.5	30.3	383.73
P -12	Core missing	--	0.4	--	--	30.7	--
P -11	Mudstone, phosphatic, calcareous	DFD-2539	2.5	13.9	40.7	33.2	34.75*
P -10	Phosphate rock and mudstone	DFD-2540	2.7	27.6	19.8	35.9	109.27
P - 9	Phosphate rock and mudstone	DFD-2541	2.0	22.8	31.6	37.9	154.87
P - 8	Phosphate rock	DFD-2542	2.0	31.7	9.4	39.9	218.27
P - 7	Phosphate rock and mudstone	DFD-2543	2.2	27.6	16.3	42.1	278.99
P - 6	Limestone, argillaceous	DFD-2544	0.6	0.9	22.4	42.7	279.53
P - 5	Phosphate rock, calcareous	DFD-2545	1.6	22.0	19.0	44.3	314.73

* Cumulative data incomplete due to missing information. Computations start from zero after interruption.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
P - 4	Limestone	DFD-2546	0.8	6.4	8.6	45.1	319.85
P - 3	Core missing	--	2.9	--	--	48.1	--
P - 2	Phosphate rock	DFD-2547	1.4	27.5	11.2	49.4	35.75*
P - 1	Limestone, argillaceous	DFD-2548	1.4	0.8	36.0	50.8	36.87**
	Wells formation						
Cw- 3	Limestone, argillaceous	DFD-2549	0.7	2.7	21.2	0.7	1.89
Cw- 2	Core missing	--	3.0	--	--	3.7	--
Cw- 1	Limestone, argillaceous	DFD-2550	1.4	2.1	31.7	5.1	4.83*

* Cumulative data incomplete due to missing information. Computations start from zero after interruption.
** Note incompleteness of cumulative data.

CALDWELL CANYON, IDAHO. LOT NO. 1260.

Phosphatic shale member of Phosphoria formation sampled in bulldozer trench on north side of Caldwell Canyon, sec. 1, T. 8 S., R. 43 E., Caribou County, Idaho, on east limb of Slug Creek syncline. Beds strike N. 10° W. and dip 40° E. Section measured by R. A. Hoppin, D. F. Davidson, and F. W. O' Malley and sampled by R. A. Smart, R. P. Sheldon, R. G. Waring and T. K. Rigby in August 1948. Samples analyzed for P_2O_5 and acid insoluble by U. S. Bureau of Mines Laboratory, Albany, Oregon, and for other constituents by Trace Elements Section Laboratory, U. S. Geological Survey, Washington, D. C.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble		
	Rex member of Phosphoria formation—basal bed only									
R- 1	Chert	WOM-1750	3.5	0.4	--	--	--	75.8	--	--
	Phosphatic shale member of Phosphoria formation[1]									
P-84	Mudstone	WOM-1749	1.1	5.2	--	--	--	57.7	1.1	5.70
P-83	Mudstone	WOM-1748	1.2	0.7	--	--	--	70.0	2.3	6.56
P-82	Mudstone	WOM-1747	1.4	4.9	--	--	--	59.0	3.7	13.42
P-81	Mudstone; fos. col. no. 48-JES-189[2]	WOM-1746	2.7	0.5	--	--	--	64.4	6.4	14.77
P-80	Mudstone, calcareous	WOM-1745	0.6	2.4	--	--	--	63.1	7.0	16.21
P-79	Limestone, argillaceous; fos. col. no. 48-JES-188	WOM-1744	1.1	0.6	--	--	--	38.0	8.1	16.87
P-78	Mudstone, calcareous; fos. col. no. 48-JES-187	WOM-1743	3.3	2.7	--	--	--	68.3	11.4	25.78
P-77	Mudstone, phosphatic	WOM-1742	0.3	14.8	--	--	--	49.0	11.7	30.22
P-76	Mudstone	WOM-1741	1.3	2.3	--	--	--	78.5	13.0	33.21
P-75	Phosphate rock, argillaceous	WOM-1740	0.5	24.1	--	--	--	21.2	13.5	45.26
P-74	Mudstone; fos. col. no. 48-JES-186	WOM-1780	1.9	2.5	--	--	--	69.5	15.4	50.01
P-73	Mudstone, calcareous; fos. col. no. 48-JES-185	WOM-1779	1.3	0.2	--	--	--	52.0	16.7	50.27
P-72	Phosphate rock	WOM 1778	1.9	32.9	--	--	--	11.3	18.6	112.78
P-71	Phosphate rock; fos. col. no. 48-JES-184	WOM-1777	0.7	29.1	--	--	--	17.7	19.3	133.15
P-70	Mudstone	WOM-1776	0.6	7.5	--	--	--	58.2	19.9	137.65
P-69	Phosphate rock, calcareous	WOM-1775	0.9	24.9	--	--	--	9.5	20.8	160.06
P-68	Phosphate rock	WOM-1774	0.8	33.3	--	--	--	5.5	21.6	186.70
--	Limestone concretion; fos. col. no. 48-JES-183	WOM-1773	(0.9)	5.3	--	--	--	2.2	--	--
P-67	Phosphate rock, calcareous and phosphatic calcareous mudstone; fos. col. no. 48-JES-182	WOM-1772	3.0	19.7	--	--	--	25.0	24.6	245.80
P-66	Mudstone, phosphatic	WOM-1771	1.0	12.7	--	--	--	45.0	25.6	258.50
P-65	Phosphate rock, argillaceous	DFD- 1790	1.3	18.0	--	--	--	37.3	26.9	281.90
P-64	Mudstone; fos. col. no. 48-JES-181	DFD- 1789	1.3	7.6	--	--	--	63.3	28.2	291.78

[1] The thinness of the Phosphatic shale member is probably due to faulting.
[2] Fossil collection by J. E. Smedley, Paleontology and Stratigraphy Branch, U. S. Geological Survey.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble		
--	Limestone lens?, argillaceous	DFD- 1788	(0.9)	0.5	--	--	--	29.8	--	--
P-63	Mudstone, phosphatic, fos. col. no. 48-JES-180	DFD- 1787	3.2	8.5	--	--	--	61.7	31.40	318.98
P-62	Mudstone, phosphatic	DFD- 1786	0.7	10.6	--	--	--	59.8	32.10	326.40
P-61	Phosphate rock, argillaceous; fos. col. no. 48-JES-179	DFD- 1785	2.7	19.4	--	--	--	44.0	34.80	378.78
P-60	Mudstone, phosphatic	DFD- 1784	0.5	8.9	--	--	--	67.3	35.30	383.23
P-59	Mudstone, phosphatic; fos. col. no. 48-JES-178	DFD- 1783	0.9	8.7	--	--	--	66.3	36.20	391.06
P-58	Mudstone, phosphatic,	DFD- 1782	0.4	9.6	--	--	--	59.7	36.60	394.90
P-57	Mudstone; fos. col. no. 48-JES-177	DFD- 1781	3.6	6.4	--	--	--	70.6	40.20	417.94
P-56	Mudstone	DFD- 1760	0.8	1.6	--	--	--	83.0	41.00	419.22
P-55	Mudstone	DFD- 1759	0.5	6.4	--	--	--	74.2	41.50	422.42
P-54	Mudstone, phosphatic	DFD- 1758	1.2	9.1	--	--	--	64.0	42.70	433.34
P-53	Phosphate rock, argillaceous	DFD- 1757	0.6	17.5	--	--	--	43.2	43.30	443.84
P-52	Mudstone, phosphatic	DFD- 1756	0.8	15.4	--	--	--	45.8	44.10	456.16
P-51	Mudstone, phosphatic	DFD- 1755	0.6	9.8	--	--	--	57.8	44.70	462.04
P-50	Mudstone	DFD- 1754	0.7	6.4	--	--	--	62.5	45.40	466.52
P-49	Mudstone, phosphatic	DFD- 1753	1.0	7.9	--	--	--	64.5	46.40	474.42
P-48	Mudstone	DFD- 1752	1.1	5.1	--	--	--	74.8	47.50	480.03
P-47	Mudstone; fos. col. no. 48-JES-176	DFD- 1751	0.7	5.5	--	--	--	72.8	48.20	483.88
P-46	Phosphate rock and phosphatic mudstone	WOM-1810	0.7	24.6	--	--	--	26.0	48.90	501.10
P-45	Mudstone, phosphatic	WOM-1809	0.7	8.4	--	--	--	55.6	49.60	506.98
P-44	Mudstone	WOM-1808	0.7	5.1	--	--	--	71.1	50.30	510.55
	Many of the beds from P-27 to P-43 show prominent shearing that probably represents faulting and accounts for the abnormally small thickness of the phosphatic shale member at this locality.									
P-43	Phosphate rock	WOM-1807	0.4	25.8	--	--	--	19.5	50.70	520.87
P-42	Mudstone, phosphatic	WOM-1806	0.7	13.7	--	--	--	53.1	51.40	530.46
P-41	Mudstone	WOM-1805	0.8	1.2	--	--	--	84.3	52.20	531.42
P-40	Mudstone	WOM-1804	2.2	1.6	--	--	--	83.8	54.40	534.94
P-39	Mudstone	WOM-1803	0.6	0.9	--	--	--	83.3	55.00	535.48
P-38	Mudstone, phosphatic	WOM-1802	1.5	11.1	--	--	--	60.3	56.50	552.13
P-37	Mudstone	WOM-1801	2.8?	4.7	--	--	--	73.0	59.30	565.29
P-36	Mudstone, calcareous	WOM-1800	0.7	7.3	--	--	--	58.2	60.00	570.40
P-35	Phosphate rock	WOM-1799	0.5	27.4	--	--	--	19.8	60.50	584.10
P-34	Mudstone, phosphatic	WOM-1798	1.0	9.5	--	--	--	61.3	61.50	593.60
P-33	Phosphate rock, argillaceous	WOM-1797	0.6	18.1	--	--	--	37.7	62.10	604.46
P-32	Mudstone, calcareous	WOM-1796	1.0	2.8	--	--	--	58.5	63.10	607.26
P-31	Mudstone, phosphatic	WOM-1795	0.5	11.1	--	--	--	51.9	63.60	612.81
P-30	Mudstone, phosphatic; fos. col. no. 48-JES-175?	WOM-1794	1.3	10.4	--	--	--	49.7	64.90	626.33

P-29	Mudstone	WOM-1793	0.4	3.3	--	--	--	72.2	65.30	627.65
P-28	Mudstone	WOM-1792	0.7	2.9	--	--	--	74.5	66.00	629.68
P-27	Mudstone	WOM-1791	1.9	4.9	--	--	--	66.3	67.90	638.99
P-26	Mudstone, phosphatic, calcareous	WOM-1820	1.2	10.4	--	--	--	50.6	69.10	651.47
P-25	Mudstone, phosphatic	WOM-1819	1.1	9.7	--	--	--	59.0	70.20	662.14
P-24	Mudstone, phosphatic	WOM-1818	1.2	13.2	--	--	--	47.3	71.40	677.98
P-23	Phosphate rock, argillaceous	WOM-1817	2.2	22.7	--	--	--	21.2	74.60	727.92
P-22	Phosphate rock, argillaceous	WOM-1816	1.2	15.7	--	--	--	34.1	73.80	746.76
P-21	Limestone	WOM-1815	4.5	1.2	--	--	--	5.9	79.30	752.16
P-20	Limestone; fos. col. no. 48-JES-174	WOM-1814	5.0	1.4	--	--	--	14.0	84.30	759.16
P-19	Phosphate rock, argillaceous	WOM-1813	1.4	23.2	--	--	--	29.8	85.70	791.64
P-18	Mudstone, phosphatic, calcareous	WOM-1812	1.2	11.7	--	--	--	48.7	86.90	805.68
P-17	Mudstone, phosphatic; fos. col. no. 48-JES-173	WOM-1811	0.8	10.2	--	--	--	53.4	87.70	813.84
P-16	Limestone; fos. col. no. 48-JES-172	RAH- 1826	3.7	5.6	--	--	--	12.7	91.40	834.56
P-15	Phosphate rock, argillaceous	RAH- 1825	0.6	23.7	4.1	1.52	6.92	26.8	92.00	848.78
P-14	Phosphate rock	RAH- 1824	1.8	31.6	1.3	0.73	6.98	10.0	93.80	905.66
P-13	Phosphate rock, argillaceous	RAH- 1823	1.9	26.7	3.3	1.32	6.66	20.5	95.70	956.39
P-12	Limestone, argillaceous; fos. col. no. 48-JES-171	RAH- 1822	0.8	3.4	4.5	1.50	28.58	29.7	96.50	959.11
P-11	Phosphate rock	RAH- 1821	1.2	34.2	0.67	0.46	6.52	4.3	97.70	1,000.15
P-10	Phosphate rock	RAH- 1770	1.3	29.1	2.5	1.03	8.34	12.3	99.00	1,037.98
P- 9	Phosphate rock	RAH- 1769	2.0	32.8	0.67	0.42	6.76	4.8	101.00	1,103.58
P- 8	Phosphate rock	RAH- 1768	1.5	32.0	1.5	0.71	6.88	7.0	102.50	1,151.58
P- 7	Limestone, phosphatic, argillaceous; fos. col. no. 48-JES-170	RAH- 1767	1.3	9.7	3.4	1.06	25.18	20.2	103.80	1,164.19
P- 6	Phosphate rock	RAH- 1766	1.0	26.9	2.1	0.85	10.18	10.9	104.80	1,191.09
P- 5	Limestone	RAH- 1765	1.0	4.9	2.3	0.52	35.92	7.9	105.80	1,195.99
P- 4	Phosphate rock; fos. col. no. 48-JES-169	RAH- 1764	3.3?	25.3	3.5	1.07	8.14	18.8	109.10	1,279.48
P- 3	Limestone; fos. col. no. 48-JES-168	RAH- 1763	2.5	2.3	0.46	0.50	38.42	12.4	111.60	1,285.23
P- 2	Limestone and phosphate rock; fos. col. no. 48-JES-167	RAH- 1762	0.8	19.9	1.8	2.56	15.96	14.3	112.40	1,301.15
P- 1	Phosphate rock	RAH- 1761	3.5	38.6	1.1	0.67	9.20	14.0	115.90	1,436.25
					Wells formation					
Cw-1	Limestone; fos. col. no. 48-JES-166	RAH- 1739	4.0	2.8	--	--	--	4.5	--	--

MABIE CANYON, IDAHO. LOT NO. 1210.

Phosphatic shale member of Phosphoria formation sampled in bulldozer trench in Mabie Canyon, NW¼NE¼ sec. 10, T. 8 S., R. 44 E., Caribou County, Idaho, on east limb of Dry Valley anticline. Section measured by R. M. Campbell, V. E. McKelvey, and R. A. Weeks and sampled by Campbell and Weeks in September and October 1947. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	F	Loss on ignition	Acid insoluble		
	Rex member of Phosphoria formation—basal beds only										
R - 5	Chert	VEM-470-47	3.8	0.5	1.1	3.5	--	9.6	73.3	3.8	1.90
R - 4	Limestone, argillaceous	VEM-469-47	1.2	0.3	0.7	1.8	--	32.0	25.9	5.0	2.26
R - 3	Chert	VEM-468-47	1.7	0.6	0.79	3.8	--	6.7	78.6	6.7	3.28
R - 2	Mudstone, calcareous; fos. col. no. 47-HW-259[1]	VEM-467-47	0.35	0.5	1.3	1.5	--	21.2	51.1	7.05	3.46
R - 1	Mudstone, calcareous and chert	VEM-466-47[2]	1.0	--	--	--	--	--	--	8.05	--
	Phosphatic shale member of Phosphoria formation										
P -170	Mudstone, calcareous	VEM-465-47	0.7	5.1	4.0	1.5	0.53	13.8	60.1	0.7	3.57
P -169	Phosphate rock, argillaceous, calcareous; fos. col. no. 47-HW-258	VEM-464-47	0.6	20.1	4.0	1.3	--	12.2	26.6	1.3	15.63
P -168	Mudstone, calcareous; fos. col. no. 47-HW-257	VEM-463-47	1.9	2.9	9.9	3.0	--	9.9	69.4	3.2	21.14
P -167	Mudstone, calcareous	VEM-462-47	2.1	4.7	9.7	3.2	--	12.7	61.7	5.3	31.01
P -166	Mudstone	VEM-461-47	1.3	0.6	11.1	3.1	--	8.1	76.6	6.6	31.79
--	Limestone lens, argillaceous, in top of bed P-165	VEM-460-47	(0.0-0.5)	0.7	3.6	1.3	--	34.5	22.5	--	--
P -165	Mudstone	VEM-459-47	1.2	2.6	11.6	3.7	--	8.7	69.0	7.8	34.91
P -164	Mudstone, calcareous	VEM-458-47	2.4	0.4	7.4	2.4	--	19.8	52.5	10.2	35.87
P -163	Mudstone, calcareous	VEM-457-47	1.9	0.4	9.4	3.1	--	12.0	67.5	12.1	36.63
P -162	Mudstone, calcareous	VEM-456-47	2.4	1.3	11.0	3.6	--	11.0	66.0	14.5	39.75
P -161	Limestone; fos. col. no. 47-HW-255	VEM-455-47	0.7	0.6	2.2	0.8	--	37.7	14.0	15.2	40.17
P -160	Mudstone, calcareous; fos. col. no. 47-HW-254	VEM-454-47	1.8	4.0	10.6	3.0	--	10.7	62.4	17.0	47.37
P -159	Mudstone, calcareous; fos. col. no. 47-HW-254	VEM-453-47	1.8	1.5	9.2	2.7	--	12.7	64.8	18.8	50.07
P -158	Limestone, argillaceous, contains phosphatic nodules	VEM-452-47	0.9	6.3	1.3	3.3	--	27.5	24.3	19.7	55.73
P -157	Mudstone, calcareous	VEM-451-47	0.7	3.0	9.2	3.2	--	8.3	68.7	20.4	57.84
P -156	Phosphate rock, argillaceous,	VEM-450-47	0.5	19.9	3.1	1.8	--	9.0	28.5	20.9	67.79
P -155	Mudstone; fos. col. no. 47-HW-253	VEM-449-47	2.4	3.1	10.7	3.1	--	8.9	69.9	23.3	75.23

P -154	Limestone, argillaceous; fos. col. no. 47-HW-252	VEM-448-47	1.1	0.2	5.7	1.8	--	25.8	42.1	24.4	75.45
P -153	Mudstone	VEM-447-47	2.4	1.9	11.7	3.6	--	8.2	72.1	26.8	80.01
P -152	Phosphate rock	VEM-446-47	0.5	37.7	0.7	0.5	--	3.2	1.8	27.3	98.86
P -151	Phosphate rock	VEM-445-47	0.5	36.7	0.8	0.4	3.90	4.4	3.5	27.8	117.21
P -150	Phosphate rock	VEM-444-47	0.7	37.1	0.8	0.5	3.72	3.5	5.0	28.5	143.18
P -149	Mudstone, calcareous; fos. col. no. 47-HW-251	VEM-443-47	1.3	4.1	8.6	2.8	0.47	11.8	60.7	29.8	148.51
P -148	Phosphate rock, argillaceous	VEM-442-47	1.1	25.5	4.4	1.9	2.35	5.4	25.1	30.9	176.56
P -147	Phosphate rock	VEM-441-47	1.0	21.8	2.4	0.9	3.17	6.1	11.5	31.9	208.36
P -146	Phosphate rock	VEM-440-47	0.8	32.7	1.8	0.7	3.27	5.8	9.8	32.7	234.52
P -145	Mudstone, phosphatic; fos. col. no. 47-HW-250	VEM-439-47	1.0	14.2	6.2	2.3	1.50	7.4	48.1	33.7	248.72
P -144	Phosphate rock	VEM-438-47	0.6	31.5	2.1	0.9	3.17	6.6	11.9	34.3	267.62
P -143	Phosphate rock and mudstone	VEM-437-47	0.8	16.8	6.4	2.4	1.45	9.1	40.5	35.1	281.06
P -142	Phosphate rock and mudstone	VEM-436-47	0.5	12.9	8.1	2.5	1.40	9.3	49.4	35.6	287.51
P -141	Mudstone, calcareous	VEM-435-47	0.3	6.8	9.8	2.4	0.66	16.5	50.6	35.9	289.55
P -140	Phosphate rock and calcareous mudstone	VEM-434-47	0.3	9.1	7.6	2.6	1.15	14.0	47.8	36.2	292.28
P -139	Phosphate rock	VEM-433-47	0.9	35.1	0.6	0.3	3.54	5.5	3.5	37.1	323.87
P -138	Phosphate rock	VEM-432-47	1.4	34.0	1.6	0.5	3.54	8.0	4.5	38.5	371.47
P -137	Phosphate rock	VEM-431-47	0.9	26.5	3.1	1.2	2.83	11.8	14.4	39.4	395.32
--	Limestone lens 0.2 foot below top of bed P-136	VEM-430-47	(0.0-0.5)	2.2	1.0	0.1	--	42.5	1.6	--	--
P -136	Phosphate rock	VEM-429-47	1.8	23.8	3.8	1.1	--	15.8	17.8	41.2	438.16
P -135	Phosphate rock	VEM-428-47	1.0	25.9	2.3	0.9	--	18.7	11.2	42.2	464.06
P -134	Phosphate rock	VEM-427-47	1.3	28.4	2.4	0.8	--	14.9	9.8	43.5	500.98
P -133	Phosphate rock and mudstone	VEM-426-47	0.4	20.9	4.8	1.7	--	18.5	22.6	43.9	509.34
P -132	Phosphate rock, argillaceous	VEM-425-47	1.2	20.9	4.9	1.6	--	15.5	25.6	45.1	534.42
P -131	Phosphate rock	VEM-424-47	0.7	26.8	2.7	1.1	--	14.8	14.0	45.8	553.18
P -130	Phosphate rock	VEM-423-47	0.7	23.9	3.8	1.2	--	15.5	18.5	46.5	569.91
P -129	Phosphate rock, argillaceous	VEM-422-47	0.9	20.1	4.9	1.6	--	17.7	25.6	47.4	588.00
P -128	Phosphate rock, argillaceous	VEM-421-47	1.0	21.2	4.2	1.6	--	16.5	24.2	48.4	609.20
P -127	Phosphate rock, argillaceous	VEM-420-47	0.8	18.5	4.9	1.7	--	17.3	30.5	49.2	624.00
P -126	Mudstone, phosphatic	VEM-419-47	1.0	9.2	7.5	2.6	--	16.3	52.4	50.2	633.20
P -125	Mudstone, phosphatic	VEM-418-47	1.3	9.0	7.6	2.7	--	17.4	51.3	51.5	644.90
P -124	Mudstone, phosphatic	VEM-417-47	1.2	13.0	7.4	2.3	--	15.8	45.0	52.7	660.50
P -123	Mudstone	VEM-416-47	1.3	6.5	9.4	3.1	--	11.7	62.5	54.0	668.95
P -122	Limestone, argillaceous; fos. col. no. 47-HW-249	VEM-415-47	2.0	0.6	4.1	1.8	--	32.7	28.4	56.0	670.15
P -121	Mudstone, phosphatic	VEM-414-47	1.7	12.4	7.6	2.5	--	16.2	44.4	57.7	691.23

[1] Fossil collection by H. Wedow, Paleontology and Stratigraphy Branch, U. S. Geological Survey.
[2] Sample lost.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	F	Loss on ignition	Acid insoluble		
P -120	Mudstone, phosphatic	VEM-413-47	0.3	10.2	8.0	2.5	--	16.6	49.4	58.00	694.29
P -119	Phosphate rock, argillaceous	VEM-412-47	0.8	16.8	6.1	2.2	--	15.5	35.6	58.80	707.73
P -118	Mudstone, phosphatic	VEM-411-47	0.6	15.6	4.9	2.2	--	10.7	44.7	59.40	717.09
P -117	Mudstone, phosphatic	VEM-410-47	1.2	8.6	8.5	2.6	--	14.9	54.0	60.60	727.41
P -116	Mudstone	VEM-409-47	1.3	7.4	9.8	3.2	--	11.4	63.9	61.90	737.03
P -115	Mudstone, phosphatic	VEM-408-47	2.0	10.9	7.8	2.8	--	10.4	56.1	63.90	758.83
P -114	Mudstone, phosphatic	VEM-407-47	0.5	15.7	7.2	2.8	--	10.6	44.1	64.40	766.68
P -113	Mudstone, phosphatic, contains phosphatic nodules	VEM-406-47	0.8	13.6	6.1	3.0	--	4.5	56.9	65.20	777.56
P -112	Phosphate rock, argillaceous	VEM-405-47	0.8	24.3	4.0	2.5	--	5.1	30.1	66.00	797.00
P -111	Mudstone, contains phosphatic nodules	VEM-404-47	1.6	3.7	8.9	2.9	--	6.5	77.4	67.60	802.92
P -110	Mudstone, phosphatic	VEM-403-47	1.1	11.4	7.3	2.7	--	6.5	59.9	68.70	815.46
P -109	Mudstone, phosphatic	VEM-402-47	0.8	15.4	5.9	1.9	--	11.4	44.0	69.50	827.78
P -108	Mudstone, phosphatic	VEM-401-47	1.2	10.0	7.4	2.0	--	9.1	60.8	70.70	839.78
P -107	Mudstone; fos. col. no. 47-HW-248	VEM-400-47	2.6	6.9	7.9	2.7	--	7.4	69.7	73.30	857.72
P -106	Limestone; fos. col. no. 47-HW-243	VEM-399-47	1.6	0.7	1.9	0.9	--	38.1	16.1	74.90	858.84
P -105	Mudstone	VEM-398-47	0.7	5.4	8.1	2.8	--	8.4	70.8	75.60	862.62
P -104	Phosphate rock and mudstone	VEM-397-47	1.2	13.1	6.4	2.6	--	10.9	47.4	76.80	878.34
P -103	Phosphate rock, argillaceous	VEM-396-47	1.1	16.3	8.4	2.5	--	11.3	23.6	77.90	896.27
P -102	Mudstone	VEM-395-47	1.5	2.1	9.9	2.7	--	8.9	78.2	79.40	899.42
P -101	Mudstone	VEM-394-47	1.0	1.3	9.9	2.8	--	10.7	76.2	80.40	900.72
P -100	Mudstone, calcareous	VEM-393-47	1.2	2.7	8.2	2.5	--	16.4	60.7	81.60	903.96
P - 99	Mudstone, phosphatic	VEM-392-47	1.2	10.1	7.4	2.4	--	14.1	53.2	82.80	916.08
P - 98	Mudstone	VEM-391-47	0.8	3.0	9.9	2.8	--	13.9	71.5	83.60	918.48
P - 97	Mudstone	VEM-390-47	1.4	4.6	9.6	3.0	--	10.4	72.1	85.00	924.92
P - 96	Mudstone	VEM-389-47	0.9	4.6	10.7	3.2	--	8.6	75.0	85.90	929.06
P - 95	Mudstone	VEM-388-47	0.5	3.4	11.8	3.7	--	15.8	65.4	86.40	930.76
P - 94	Phosphate rock	VEM-387-47	0.3	27.9	2.5	1.4	--	8.2	16.9	86.70	939.13
P - 93	Mudstone	VEM-386-47	1.0	7.1	9.0	3.4	--	9.0	66.2	87.70	946.23
P - 92	Mudstone, calcareous, phosphatic	VEM-385-47	1.1	11.4	7.5	2.8	--	16.9	45.6	88.80	958.77
P - 91	Mudstone and phosphate rock	VEM-384-47	1.0	8.8	8.5	3.2	--	16.0	51.7	89.80	967.57
P - 90	Phosphate rock, argillaceous	VEM-383-47	0.8	19.1	4.5	1.6	--	18.0	27.8	90.60	982.85
P - 89	Mudstone	VEM-382-47	1.1	4.6	10.2	2.9	--	12.9	68.3	91.70	987.91
P - 88	Mudstone and phosphate rock; fos. col. no. 47-HW-242	VEM-381-47	1.3	12.8	8.4	3.4	--	7.8	54.4	93.00	1,004.55
P - 87	Mudstone	VEM-380-47	2.3	3.9	10.5	4.4	--	5.0	79.4	95.30	1,013.52
P - 86	Limestone, argillaceous	VEM-379-47	2.0	0.4	4.9	1.9	--	29.7	35.0	97.30	1,014.32
P - 85	Mudstone and phosphate rock	VEM-378-47	2.4	7.4	9.8	4.2	--	5.3	69.6	99.70	1,032.08
P - 84	Mudstone	VEM-377-47	0.4	1.0	7.2	5.2	--	8.1	82.0	100.10	1,032.48

P - 83	Mudstone and calcareous mudstone	VEM-376-47	2.8	0.4	6.8	2.5	--	24.2	47.4	102.90	1,033.60
P - 82	Mudstone and phosphate rock	VEM-375-47	0.5	14.7	7.9	3.3	--	5.5	50.9	103.40	1,040.95
P - 81	Mudstone and phosphate rock	VEM-374-47	2.9	9.8	9.9	4.7	--	5.3	63.9	106.30	1,069.37
P - 80	Mudstone	VEM-373-47	1.0	1.7	12.0	3.8	--	5.4	84.7	107.30	1,071.07
P - 79	Phosphate rock	VEM-372-47	1.0	32.2	2.4	2.4	--	3.3	12.0	108.30	1,103.27
P - 78	Phosphate rock and mudstone	VEM-371-47	0.7	21.4	5.4	4.9	--	5.2	33.3	109.00	1,118.25
P - 77	Mudstone	VEM-370-47	1.4	1.6	11.5	5.2	--	6.7	81.8	110.40	1,120.49
P - 76	Phosphate rock and mudstone	VEM-369-47	0.9	22.5	5.5	3.5	--	6.4	32.0	111.30	1,140.74
P - 75	Mudstone, phosphatic	VEM-368-47	0.4	9.6	10.5	3.6	--	10.0	59.6	111.70	1,144.58
P - 74	Mudstone	VEM-367-47	1.1	3.5	11.7	3.5	--	6.7	78.7	112.80	1,148.43
P - 73	Mudstone, phosphatic	VEM-366-47	0.9	14.0	8.0	3.0	--	11.8	45.9	113.70	1,161.03
P - 72	Mudstone	VEM-365-47	1.3	0.9	4.0	3.6	--	8.6	84.1	115.00	1,162.20
P - 71	Mudstone	VEM-364-47	0.8	4.8	11.0	3.5	--	8.2	74.6	115.80	1,166.04
P - 70	Phosphate rock, argillaceous	VEM-363-47	0.4	17.1	5.3	2.4	--	19.7	26.7	116.20	1,172.88
P - 69	Phosphate rock	VEM-362-47	0.7	24.3	3.3	1.4	--	17.9	14.9	116.90	1,189.89
P - 68	Mudstone, phosphatic	VEM-361-47	0.8	11.1	8.7	2.7	--	14.0	50.7	117.70	1,198.77
P - 67	Mudstone, phosphatic	VEM-360-47	1.0	13.3	7.9	2.7	--	17.2	40.7	118.70	1,212.07
P - 66	Mudstone, phosphatic	VEM-359-47	0.8	8.2	10.6	3.5	--	14.5	55.0	119.50	1,218.63
P - 65	Mudstone, phosphatic	VEM-344-47	0.4	9.1	9.6	3.3	--	25.2	36.8	119.90	1,222.27
P - 64	Mudstone, calcareous, phosphatic	VEM-343-47	1.8	10.1	7.7	2.9	--	21.5	36.7	121.70	1,240.45
P - 63	Phosphate rock, calcareous, argillaceous	VEM-342-47	1.2	13.7	5.3	2.2	--	19.2	27.6	122.90	1,256.89
P - 62	Mudstone, calcareous, phosphatic	VEM-341-47	1.6	7.9	8.0	2.7	--	18.9	40.7	124.50	1,269.53
P - 61	Mudstone, calcareous; fos. col. no. 47-HW-241	VEM-340-47	0.4	5.7	10.6	3.3	--	15.2	52.3	124.90	1,271.81
P - 60	Limestone; fos. col. no. 47-HW-240	VEM-339-47	0.5	0.3	2.0	0.8	--	40.6	11.9	125.40	1,271.96
P - 59	Limestone; fos. col. no. 47-HW-239	VEM-338-47	1.5	0.3	1.4	0.4	--	40.8	11.3	126.90	1,272.41
P - 58	Mudstone, calcareous; fos. col. no. 47-HW-238	VEM-337-47	1.1	1.8	11.9	3.4	--	13.7	65.6	128.00	1,274.39
P - 57	Limestone; fos. col. no. 47-HW-237	VEM-336-47	3.6	0.3	1.9	0.5	--	38.5	17.4	131.60	1,275.47
P - 56	Chert; fos. col. no. 47-HW-236	VEM-335-47	0.3	1.0	2.4	3.5	--	5.0	85.1	131.90	1,275.77
P - 55	Mudstone; fos. col. no. 47-HW-235	VEM-334-47	1.0	1.8	7.6	2.6	--	6.9	81.1	132.90	1,277.57
P - 54	Mudstone, calcareous	VEM-333-47	1.5	2.9	11.7	3.3	--	12.1	68.9	134.40	1,281.92
P - 53	Mudstone	VEM-332-47	1.7	1.7	11.7	3.5	--	10.0	76.6	136.10	1,284.81
P - 52	Mudstone, calcareous	VEM-331-47	1.6	4.1	9.2	2.9	--	19.0	48.6	137.70	1,291.37
P - 51	Mudstone; fos. col. no. 47-HW-234	VEM-330-47	1.2	3.7	10.3	3.1	--	9.1	72.6	138.90	1,295.81
P - 50	Mudstone	VEM-329-47	1.6	6.8	11.1	3.4	--	9.2	64.3	140.50	1,306.69
P - 49	Mudstone	VEM-328-47	1.7	1.6	11.4	3.6	--	8.5	81.0	142.20	1,309.41

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	F	Loss on ignition	Acid insoluble		
P - 48	Mudstone, phosphatic	RMC-104-47	2.0	10.7	11.0	3.7	--	11.5	52.6	144.2	1,330.81
P - 47	Mudstone	RMC-103-47	0.9	4.0	11.5	3.5	--	8.9	73.7	145.1	1,334.41
P - 46	Mudstone and calcareous mudstone	RMC-102-47	1.4	5.1	11.6	3.9	--	10.8	64.0	146.5	1,341.55
P - 45	Limestone; fos. col. no. 47-HW-233	RMC-101-47	1.1	0.6	2.3	1.1	--	38.6	14.3	147.6	1,342.21
P - 44	Mudstone, calcareous and phosphatic, calcareous mudstone	RMC-100-47	1.8	14.6	9.2	3.2	--	12.1	41.9	149.4	1,368.49
P - 43	Phosphate rock, argillaceous	RMC- 99-47	0.6	21.7	5.1	1.8	--	14.3	24.4	150.0	1,381.51
P - 42	Phosphate rock, argillaceous, calcareous	RMC- 98-47	0.5	14.7	7.9	2.5	--	17.0	33.4	150.5	1,388.86
P - 41	Mudstone, calcareous, phosphatic	RMC- 97-47	1.5	8.0	7.5	2.7	--	18.5	44.0	152.0	1,400.86
P - 40	Mudstone, phosphatic	VEM-327-47	0.8	12.2	8.9	3.2	--	11.8	49.8	152.8	1,410.62
P - 39	Phosphate rock, argillaceous	VEM-326-47	0.8	16.3	9.4	2.5	--	11.7	38.9	153.6	1,423.66
P - 38	Phosphate rock, argillaceous, contains limestone lens at top	VEM-325-47	1.2	15.5	7.8	2.5	--	15.2	34.4	154.8	1,442.26
--	Limestone lens between bed P-38 and bed P-37	VEM-324-47	(0.0-1.1)	0.7	0.6	0.2	--	42.7	3.1	--	1,442.26
P - 37	Mudstone, phosphatic, calcareous	VEM-323-47	1.5	11.1	10.1	3.2	--	13.5	49.4	156.3	1,458.91
P - 36	Mudstone, phosphatic, calcareous	VEM-322-47	1.5	10.6	10.5	3.2	--	15.1	47.4	157.80	1,474.81
P - 35	Phosphate rock, argillaceous, calcareous	VEM-321-47	0.7	15.2	6.3	2.7	--	16.1	36.2	158.5	1,485.45
P - 34	Phosphate rock; fos. col. no. 47-HW-232	VEM-320-47	1.6	27.1	2.8	1.2	--	14.1	11.3	160.1	1,528.81
P - 33	Phosphate rock, argillaceous	VEM-319-47	0.8	16.5	4.3	2.5	--	25.5	23.1	160.9	1,542.01
P - 32	Phosphate rock	VEM-318-47	0.8	30.8	1.4	1.6	--	10.7	6.8	161.7	1,566.65
P - 31	Phosphate rock	VEM-317-47	1.2	26.1	2.8	1.5	--	11.1	17.8	162.9	1,597.97
P - 30	Limestone	VEM-316-47	1.6	2.7	1.8	0.7	--	38.6	11.9	164.5	1,602.29
--	Limestone lens, argillaceous, phosphatic, in bed P-29	VEM-315-47	(0.0-0.8)	10.2	4.6	1.3	--	22.4	31.0	--	--
P - 29	Limestone, argillaceous, phosphatic	VEM-314-47	0.8	10.1	4.9	1.3	--	22.1	31.3	165.3	1,610.37
P - 28	Mudstone, calcareous, phosphatic	VEM-313-47	2.7	9.6	7.6	2.3	--	16.3	42.4	168.0	1,636.29
P - 27	Limestone	VEM-312-47	1.8	1.1	3.1	1.3	--	36.9	19.8	169.8	1,638.27
P - 26	Phosphate rock, calcareous, argillaceous	VEM-311-47	0.9	16.8	3.2	1.1	1.49	18.6	21.0	170.7	1,653.39
P - 25	Phosphate rock	RAW- 60-47	0.8	28.6	2.2	1.0	2.86	10.3	14.7	171.5	1,676.27
P - 24	Phosphate rock	RAW- 59-47	0.8	29.2	1.8	0.6	2.82	11.5	10.7	172.3	1,699.63
P - 23	Phosphate rock	RAW- 58-47	1.4	27.7	2.4	1.1	2.48	10.8	15.2	173.7	1,738.41
P - 22	Phosphate rock, argillaceous	RAW- 49-47	1.3	18.6	5.4	2.0	1.94	9.4	37.6	175.0	1,762.59
P - 21	Limestone, argillaceous; fos. col. no. 47-HW-224	RAW- 48-47	1.2	3.0	2.9	1.6	0.31	29.9	25.6	176.2	1,766.19

P - 20	Phosphate rock	RAW- 47-47	0.9	32.5	1.3	0.8	3.30	8.8	6.8	177.1	1,795.44
P - 19	Phosphate rock	RAW- 46-47	2.1	28.7	2.5	0.9	2.47	9.4	14.1	179.2	1,855.71
--	Limestone lens in bed P-18	RAW- 45-47	(0.5)	1.3	0.4	0.2	--	41.0	3.8	--	--
P - 18	Phosphate rock	RAW- 44-47	2.0	26.2	2.5	1.3	2.50	10.0	19.8	181.2	1,908.11
P - 17	Phosphate rock, argillaceuus	RAW- 43-47	1.7	23.1	4.1	1.3	2.16	11.0	23.4	182.9	1,947.38
P - 16	Limestone, phosphatic	RAW- 42-47	0.9	8.9	1.3	0.7	0.86	32.6	7.8	183.8	1,955.39
P - 15	Limestone	RAW- 41-47	0.8	2.0	2.5	0.7	--	40.6	8.2	184.6	1,956.99
P - 14	Phosphate rock	RAW- 40-47	1.5	26.9	3.2	0.7	2.55	9.9	16.7	186.1	1,997.34
P - 13	Phosphate rock, calcareous, fos. col. no. 47-HW-223	RAW- 39-47	1.4	20.2	2.8	1.0	2.04	15.5	18.2	187.5	2,025.62
P - 12	Limestone, phosphatic, fos. col. no. 47-HW-222	RAW- 38-47	1.5	10.5	0.8	1.2	1.06	31.1	8.4	189.0	2,041.37
P - 11	Phosphate rock	RAW- 37-47	1.0	32.6	1.24	0.4	2.67	8.5	4.0	190.0	2,073.97
P - 10	Phosphate rock	RAW- 36-37	1.1	32.4	0.94	0.5	3.21	9.8	3.8	191.1	2,109.61
P - 9	Phosphate rock	RAW- 35-47	1.2	32.0	1.1	0.8	3.17	10.7	3.7	192.3	2,148.01
P - 8	Phosphate rock	RAW- 34-47	1.1	32.4	0.98	0.6	3.24	9.9	3.3	193.4	2,183.65
P - 7	Phosphate rock	RAW- 33-47	0.6	30.1	1.4	0.9	3.07	13.0	5.2	194.0	2,201.71
P - 6	Phosphate rock	RAW- 32-47	1.4	31.0	1.4	0.8	3.17	8.3	8.9	195.4	2,245.11
P - 5	Mudstone, calcareous	RAW- 31-47	1.2	3.8	9.8	3.5	--	13.2	64.0	196.6	2,249.67
P - 4	Limestone, argillaceous	RAW- 30-47	2.6	0.4	4.2	2.0	--	29.5	34.5	199.2	2,250.71
P - 3	Mudstone, calcareous	RAW- 29-47	2.3	0.7	8.0	2.3	--	15.5	61.4	201.5	2,252.32
P - 2	Phosphate rock, argillaceous	RAW- 28-47	0.2	20.8	5.6	1.8	--	6.1	30.9	201.7	2.256.48
P - 1	Phosphate rock, fos. col. no. 47-HW-221	RAW- 61-47	0.4	29.6	1.1	0.6	2.90	8.0	7.8	202.1	2,268.32
					Wells formation						
Cw- 1	Limestone, fos. col. no. 47-HW-220	--	4.6	--	--	--	--	--	--	--	--
Cw- 2	Phosphate rock	--	0.2	--	--	--	--	--	--	--	--

SPECTROGRAPHIC ANALYSES—MABIE CANYON, IDAHO. LOT NO. 1210.

Semi-quantitative analyses of samples of the Phosphoria formation, Mabie Canyon, Idaho (see immediately preceding pages for location of section, thickness and description of strata, and chemical analyses of samples), made by U. S. Bureau of Mines Laboratory, Albany, Oregon. In addition to the elements listed in the table below, Sb, As, Ba, Be, Bi, Cd, Cb, Ga, Ge, Au, In, Pb, Li, Hg, Pt, Ta, Sn, and W were looked for in all samples but were not detected.

Explanation of symbols

A = more than 10 percent
B = 5-10 percent
C = 1-5 percent
D = 0.1-1 percent
E = 0.01-0.1 percent
F = 0.001-0.01 percent
G = less than 0.001 percent
ND = not detected

Bed no.	Sample no.	Al	B	Ca	Cr	Co	Cu	Fe	Mg	Mn	Mo	Ni	Si	Ag	Na	Sr	Ti	V	Zn	Zr
R - 5	VEM-470-47	C	F	C	E	ND	G	C	C	E	F	E	A	G	E	F	E	E	ND	E
R - 4	VEM-469-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	E	F	E	E	ND	E
R - 3	VEM-468-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	E	F	E	E	ND	E
R - 2	VEM-467-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	E	F	E	E	E	E
R - 1	VEM-466-47	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P -170	VEM-465-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	E	F	E	E	E	E
P -169	VEM-464-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	E	E	E	E	E	E
P -168	VEM-463-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	E	F	E	E	E	E
P -167	VEM-462-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	D	E	E
P -166	VEM-461-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	E	E
--	VEM-460-47	C	F	A	E	ND	G	C	C	E	F	E	B	G	E	F	E	E	E	E
P -165	VEM-459-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	E	F	E	E	E	E
P -164	VEM-458-47	C	F	C	E	ND	G	C	C	E	F	E	A	G	E	F	E	E	ND	E
P -163	VEM-457-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P -162	VEM-456-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P -161	VEM-455-47	C	F	A	E	ND	G	C	C	E	F	E	C	G	E	F	E	E	ND	E
P -160	VEM-454-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P -159	VEM-453-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P -158	VEM-452-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	E	F	E	E	ND	E
P -157	VEM-451-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P -156	VEM-450-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	E	E	E	E	E	E
P -155	VEM-449-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	E	E
P -154	VEM-448-47	D	F	C	E	ND	G	C	D	E	F	E	C	ND	ND	F	E	E	N	E
P -153	VEM-447-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	E	E
P -152	VEM-446-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	E	E
P -151	VEM-445-47	D	F	A	E	ND	G	C	D	F	F	E	C	G	E	E	E	E	E	E
P -150	VEM-444-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	E	E	E	E	E	E
P -149	VEM-443-47	C	F	C	E	ND	G	C	D	F	F	E	A	G	E	F	E	E	E	E
P -148	VEM-442-47	C	F	A	E	ND	G	C	D	E	F	E	B	G	E	E	E	D	E	E

P -147	VEM-441-47	C	F	A	E	ND	G	C	D	E	F	E	B	G	E	E	E	D	E	E
P -146	VEM-440-47	C	F	A	E	ND	G	C	D	E	F	E	C	G	E	E	E	D	E	E
P -145	VEM-439-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -144	VEM-438-47	C	F	A	E	ND	G	C	D	E	F	E	C	G	E	E	E	D	E	E
P -143	VEM-437-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -142	VEM-436-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -141	VEM-435-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	E	E	E	D	E	E
P -140	VEM-434-47	C	F	B	E	ND	G	C	D	E	F	E	A	G	E	E	E	E	E	E
P -139	VEM-433-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	E	E	E	D	E	E
P -138	VEM-432-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	E	E	E	D	E	E
P -137	VEM-431-47	C	F	A	E	ND	G	C	D	F	F	E	A	F	E	E	E	D	E	E
--	VEM-430-47	C	F	A	E	ND	G	D	C	F	F	E	C	G	E	E	E	D	E	E
P -136	VEM-429-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -135	VEM-428-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -134	VEM-427-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -133	VEM-426-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -132	VEM-425-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	D	D	E	D	E	E
P -131	VEM-424-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -130	VEM-423-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -129	VEM-422-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	E	D	E	D	E	E
P -128	VEM-421-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P -127	VEM-420-47	C	F	A	E	ND	G	C	D	E	F	F	A	F	D	E	E	D	E	E
P -126	VEM-419-47	C	F	A	D	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P -125	VEM-418-47	C	F	A	D	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P -124	VEM-417-47	C	F	A	D	ND	G	C	D	E	F	E	A	F	D	D	E	D	E	E
P -123	VEM-416-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -122	VEM-415-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	D	E	E	D	E	E
P -121	VEM-414-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	D	E	E
P -120	VEM-413-47	C	F	A	D	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -119	VEM-412-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	D	E	E
P -118	VEM-411-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	D	E	E
P -117	VEM-410-47	C	F	B	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -116	VEM-409-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -115	VEM-408-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -114	VEM-407-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -113	VEM-406-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -112	VEM-405-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	E	E	E
P -111	VEM-404-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -110	VEM-403-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -109	VEM-402-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -108	VEM-401-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -107	VEM-400-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	ND	E
P -106	VEM-399-47	C	F	A	E	ND	G	C	B	E	F	E	B	G	D	E	E	E	E	E
P -105	VEM-398-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P -104	VEM-397-47	C	F	A	D	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E

Bed no.	Sample no.	Al	B	Ca	Cr	Co	Cu	Fe	Mg	Mn	Mo	Ni	Si	Ag	Na	Sr	Ti	V	Zn	Zr
P -103	VEM-396-47	C	F	B	D	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P -102	VEM-395-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	N	E
P -101	VEM-394-47	C	F	C	E	E	G	C	D	E	F	E	A	G	D	F	E	E	N	E
P -100	VEM-393-47	C	F	B	E	ND	G	C	C	E	F	E	A	G	D	F	E	D	E	E
P - 99	VEM-392-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P - 98	VEM-391-47	C	F	C	E	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P - 97	VEM-390-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	D	E	E
P - 96	VEM-389-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P - 95	VEM-388-47	C	F	C	D	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P - 94	VEM-387-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	D	E	E
P - 93	VEM-386-47	C	F	B	E	ND	G	C	D	E	F	E	A	G	D	E	E	D	E	E
P - 92	VEM-385-47	C	F	A	D	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P - 91	VEM-384-47	C	F	B	D	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P - 90	VEM-383-47	C	F	A	E	ND	G	C	D	E	F	E	A	F	D	D	E	D	E	E
P - 89	VEM-382-47	C	F	C	E	ND	G	C	D	E	F	E	A	F	D	E	E	D	E	E
P - 88	VEM-381-47	C	F	B	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	ND	E
P - 87	VEM-380-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P - 86	VEM-379-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	D	F	E	E	ND	E
P - 85	VEM-378-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	ND	E
P - 84	VEM-377-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 83	VEM-376-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	D	F	E	E	ND	E
P - 82	VEM-375-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	ND	E
P - 81	VEM-374-47	C	F	B	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	ND	E
P - 80	VEM-373-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 79	VEM-372-47	C	F	A	E	ND	G	C	D	E	F	E	B	G	D	D	E	E	ND	E
P - 78	VEM-371-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	D	E	E	ND	E
P - 77	VEM-370-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 76	VEM-369-47	C	F	A	E	ND	G	C	D	F	E	E	A	G	D	E	E	E	ND	E
P - 75	VEM-368-47	C	F	C	E	ND	G	C	D	F	F	E	A	G	D	F	E	E	ND	E
P - 74	VEM-367-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	D	ND	E
P - 73	VEM-366-47	C	F	A	D	ND	G	C	D	F	F	E	A	G	D	E	E	E	ND	E
P - 72	VEM-365-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 71	VEM-364-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 70	VEM-363-47	C	F	A	D	ND	G	C	D	F	F	E	A	G	E	E	E	E	E	E
P - 69	VEM-362-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	E	E	E	E	E	E
P - 68	VEM-361-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P - 67	VEM-360-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	E	E	E	E
P - 66	VEM-359-47	C	F	B	E	ND	G	C	D	E	F	E	A	F	D	D	E	E	E	E
P - 65	VEM-344-47	C	F	B	D	ND	G	C	D	E	F	E	A	F	E	E	E	D	E	E
P - 64	VEM-343-47	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P - 63	VEM-342-47	C	F	A	D	ND	G	C	C	E	E	E	A	G	D	E	E	D	E	E

P - 62	VEM-341-47	C	F	A	E	ND	G	C	C	E	E	E	A	G	D	E	E	D	E	E
P - 61	VEM-340-47	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P - 60	VEM-339-47	C	F	A	E	ND	G	D	B	E	F	E	C	G	E	F	E	E	ND	E
P - 59	VEM-338-47	C	F	A	E	ND	G	D	B	E	F	E	C	G	E	F	E	E	ND	E
P - 58	VEM-337-47	C	F	C	E	ND	G	C	C	E	F	E	A	G	D	F	E	E	E	E
P - 57	VEM-336-47	C	F	A	E	ND	G	C	B	E	F	E	B	G	E	F	E	E	ND	E
P - 56	VEM-335-47	C	F	C	E	ND	G	D	D	E	F	E	A	G	E	F	E	E	E	E
P - 55	VEM-334-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	E	E	E	E
P - 54	VEM-333-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	D	E	E
P - 53	VEM-332-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	D	E	E
P - 52	VEM-331-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	D	E	E	E
P - 51	VEM-330-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	E	D	E	E	E
P - 50	VEM-329-47	C	F	A	E	ND	G	C	D	E	E	E	A	G	D	E	D	E	E	E
P - 49	VEM-328-47	C	F	C	E	ND	G	C	D	E	F	E	A	G	D	F	D	E	ND	E
P - 48	RMC-104-47	C	F	B	E	ND	G	C	D	F	F	E	A	G	D	E	E	E	E	E
P - 47	RMC-103-47	C	F	C	E	ND	G	C	D	F	F	E	A	G	D	F	E	E	E	E
P - 46	RMC-102-47	C	F	C	E	ND	G	C	D	F	F	E	A	G	D	F	E	E	E	E
P - 45	RMC-101-47	C	F	A	E	ND	G	C	C	F	F	E	C	G	D	E	E	E	E	E
P - 44	RMC-100-47	C	F	A	E	ND	G	C	D	F	F	E	A	G	D	E	E	E	E	E
P - 43	RMC- 99-47	C	F	A	D	ND	G	C	D	F	F	E	A	G	D	E	E	E	E	E
P - 42	RMC- 98-47	C	F	A	E	ND	G	C	D	F	F	E	A	G	D	E	E	E	E	E
P - 41	RMC- 97-47	C	F	A	E	ND	G	C	C	F	F	E	A	G	D	E	E	E	E	E
P - 40	VEM-327-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	E	D	E	E	E
P - 39	VEM-326-47	C	F	A	E	ND	G	C	D	F	F	E	A	G	D	E	E	E	E	E
P - 38	VEM-325-47	C	F	A	E	ND	G	C	D	E	E	E	A	G	D	E	E	D	E	E
--	VEM-324-47	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P - 37	VEM-323-47	C	F	A	E	ND	G	C	D	E	E	E	A	G	D	E	D	D	E	E
P - 36	VEM-322-47	C	F	A	E	ND	F	C	D	E	E	E	A	G	D	E	D	D	E	E
P - 35	VEM-321-47	C	F	A	E	ND	F	C	D	E	E	E	A	G	D	E	E	D	E	E
P - 34	VEM-320-47	C	F	A	D	ND	F	C	D	F	F	E	B	F	D	E	E	D	E	E
P - 33	VEM-319-47	C	F	A	D	ND	E	C	D	F	E	E	A	F	E	E	D	C	E	E
P - 32	VEM-318-47	C	F	A	E	ND	G	C	D	F	E	E	C	G	E	E	E	D	E	E
P - 31	VEM-317-47	C	F	A	E	ND	G	C	D	F	E	E	C	G	E	E	E	D	E	E
P - 30	VEM-316-47	C	F	A	E	ND	G	C	B	E	F	E	B	G	E	F	E	D	E	E
--	VEM-315-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	D	F	E	D	E	E
P - 29	VEM-314-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	D	F	E	D	E	E
P - 28	VEM-313-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	E	F	E	D	E	E
P - 27	VEM-312-47	C	F	A	F	ND	G	D	B	E	F	E	A	G	D	F	E	D	ND	E
P - 26	VEM-311-47	C	F	A	E	ND	G	C	C	F	F	E	A	G	D	E	E	D	E	E
P - 25	RAW- 60-47	C	F	A	E	ND	G	C	D	F	F	E	B	F	D	E	E	D	E	E
P - 24	RAW- 59-47	C	F	A	E	ND	G	C	D	F	F	E	B	G	E	E	E	D	E	E
P - 23	RAW- 58-47	C	F	A	E	ND	G	C	D	F	F	E	B	G	E	E	E	D	E	E
P - 22	RAW- 49-47	C	F	A	E	ND	G	C	D	F	F	E	A	G	D	E	E	D	E	E
P - 21	RAW- 48-47	C	F	A	E	ND	G	C	C	F	F	E	A	G	D	F	E	D	ND	E
P - 20	RAW- 47-47	C	F	A	E	ND	G	C	D	F	F	E	B	G	D	E	E	D	E	E

Bed no.	Sample no.	Al	B	Ca	Cr	Co	Cu	Fe	Mg	Mn	Mo	Ni	Si	Ag	Na	Sr	Ti	V	Zn	Zr
P - 19	RAW- 46-47	C	F	A	E	ND	G	C	D	F	F	E	A	F	D	E	E	D	E	E
--	RAW- 45-47	C	F	A	E	ND	G	D	D	F	F	E	C	G	E	F	E	E	ND	E
P - 18	RAW- 44-47	C	F	A	E	ND	G	C	D	F	F	E	A	F	D	E	E	D	E	E
P - 17	RAW- 43-47	C	F	A	E	ND	G	C	D	F	F	E	A	F	D	E	E	D	E	E
P - 16	RAW- 42-47	C	F	A	E	ND	G	D	C	F	F	E	C	G	E	F	E	D	E	E
P - 15	RAW- 41-47	C	F	A	E	ND	G	D	C	F	F	E	C	G	E	F	E	D	E	E
P - 14	RAW- 40-47	C	F	A	E	ND	G	C	D	F	F	E	A	F	D	E	E	D	E	E
P - 13	RAW- 39-47	C	F	A	E	ND	G	C	C	F	F	E	B	F	D	F	E	E	E	E
P - 12	RAW- 38-47	C	F	A	E	ND	G	C	C	F	F	E	C	G	D	F	E	D	E	E
P - 11	RAW- 37-47	C	F	A	E	ND	G	D	D	F	F	E	C	G	D	E	E	D	E	E
P - 10	RAW- 36-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	D	E	E
P - 9	RAW- 35-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	D	E	E
P - 8	RAW- 34-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	D	E	E
P - 7	RAW- 33-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	D	E	E
P - 6	RAW- 32-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	D	E	E
P - 5	RAW- 31-47	C	F	C	E	ND	G	C	D	F	F	E	A	G	E	F	E	D	E	E
P - 4	RAW- 30-47	C	F	A	E	ND	G	C	C	E	F	E	A	G	E	F	E	D	E	E
P - 3	RAW- 29-47	C	F	C	E	ND	G	C	C	E	F	E	A	G	E	F	E	D	E	E
P - 2	RAW- 28-47	C	F	A	E	ND	G	C	D	E	F	E	A	G	D	F	E	D	E	E
P - 1	RAW- 61-47	C	F	A	E	ND	G	C	D	F	F	E	C	G	D	E	E	E	E	E

CONDA, IDAHO. LOT NO. 1200.

Phosphatic shale member of Phosphoria formation sampled in 300 level east crosscut of Conda mine, sec. 13, T. 8 S., R. 42 E., Caribou County, Idaho, on west limb of Trail syncline. Beds strike N. 10° W., and dip 55° E. Section measured by F. C. Armstrong, R. A. Hoppin, and L. E. Smith and sampled by R. A. Gulbrandsen, O. A. Payne, R. S. Sears, and R. P. Sheldon in July 1947. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	V_2O_5	Loss on ignition	Acid insoluble		
Rex member of Phosphoria formation—basal beds only											
R - 4	Chert and mudstone	--	2.7	--	--	--	--	--	--	2.70	--
R - 3	Limestone, cherty	--	1.75	--	--	--	--	--	--	4.45	--
R - 2	Chert, calcareous	--	3.0	--	--	--	--	--	--	7.45	--
R - 1	Mudstone, calcareous	FCA-141-47	0.3	1.3	5.5	2.4	.045	8.6	56.3	7.75	0.39
Phosphatic shale member of Phosphoria formation											
P -142	Phosphate rock, calcareous; fos. col. no. 47-HW-12[1]	FCA-140-47	0.8	24.0	1.8	1.3	.025	16.2	15.1	0.80	19.20
P -141	Mudstone, calcareous	FCA-139-47	0.35	4.2	9.4	3.2	.095	13.2	54.4	1.15	20.67
P -140	Mudstone, calcareous; fos. col. no. 47-HW-11	FCA-138-47	1.7	1.7	8.9	3.9	.095	13.2	60.3	2.85	23.56
P -139	Mudstone, calcareous	FCA-137-47	0.75	5.6	9.6	3.1	.03	15.8	51.5	3.60	27.76
P -138	Mudstone, calcareous; fos. col. no. 47-HW-10	FCA-144-47	4.9	1.2	8.6	4.0	.025	24.8	58.6	8.50	33.64
P -137	Limestone, argillaceous; fos. col. 47-HW-9	FCA-143-47	2.8	4.1	4.1	1.9	.015	13.5	31.6	11.30	45.12
P -136	Phosphate rock, argillaceous	FCA-142-47	0.25	24.6	5.1	2.3	.035	24.8	20.3	11.55	51.27
P -135	Phosphate rock	FCA-136-47	1.35	28.8	2.1	1.3	.08	8.4	12.3	12.90	90.15
P -134	Mudstone, calcareous	FCA-135-47	0.35	4.6	8.6	3.2	.17	15.8	54.0	13.25	91.76
P -133	Phosphate rock, calcareous; fos. col. no. 47-HW-8	FCA-134-47	0.65	25.0	0.7	0.8	.035	15.3	5.1	13.90	108.01
P -132	Phosphate rock	FCA-133-37	0.35	34.2	0.4	0.6	.06	8.5	2.3	14.25	119.98
P -131	Phosphate rock	FCA-132-47	0.55	26.9	2.2	1.1	.14	13.5	9.9	14.80	134.78
P -130	Phosphate rock	FCA-131-47	0.85	33.4	0.5	0.6	.065	8.8	2.6	15.65	163.17
P -129	Phosphate rock	FCA-130-47	0.3	30.1	1.9	1.4	.06	7.7	11.3	15.95	172.20
P -128	Phosphate rock, calcareous	FCA-129-47	0.8	22.3	1.8	1.2	.04	13.8	14.3	16.75	190.04
P -127	Phosphate rock	FCA-128-47	0.75	32.4	1.0	1.0	.09	7.4	5.2	17.50	214.34
P -126	Phosphate rock, calcareous near base	FCA-127-47	0.75	26.9	2.4	1.5	.09	8.7	15.0	18.25	234.52
P -125	Phosphate rock	FCA-126-47	0.35	26.5	2.5	1.6	.13	9.6	15.3	18.60	243.80
P -124	Limestone, phosphatic	FCA-125-47	0.65	7.8	1.5	0.7	.03	31.0	11.7	19.25	248.87
P -123	Phosphate rock, calcareous	FCA-124-47	0.8	24.2	1.4	0.8	.08	15.8	6.9	20.05	268.23

[1] Fossil collection by H. Wedow, Paleontology and Stratigraphy Branch, U. S. Geological Survey.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	V_2O_5	Loss on ignition	Acid insoluble		
P -122	Mudstone and phosphate rock	FCA-123-47	0.6	17.5	4.8	2.0	.24	14.0	28.1	20.65	278.73
P -121	Phosphate rock, calcareous	FCA-122-47	0.7	20.0	2.6	1.5	.19	16.2	16.0	21.35	292.73
P -120	Limestone, phosphatic	FCA-121-47	1.1	15.6	0.9	0.8	.08	25.0	6.7	22.45	309.87
P -119	Limestone, argillaceous	FCA-120-47	0.9	6.7	4.8	2.0	.25	23.0	31.0	23.35	315.92
P -118	Mudstone, calcareous	FCA-119-47	0.7	3.0	7.3	2.9	.36	22.0	44.6	24.05	318.02
P -117	Mudstone, calcareous	FCA-118-47	0.25	1.0	7.4	3.7	.49	23.5	44.9	24.30	318.27
P -116	Mudstone	FCA-117-47	0.4	1.1	7.9	4.1	.42	21.0	50.4	24.70	318.71
P -115	Limestone, argillaceous	FCA-116-47	0.4	1.9	7.0	3.0	.36	22.8	46.0	25.10	319.47
P -114	Mudstone	FCA-115-47	0.65	4.7	7.5	3.4	.33	18.7	49.4	25.75	322.53
P -113	Mudstone	FCA-114-47	0.3	1.8	8.9	3.2	.41	21.7	51.3	26.05	323.07
P -112	Limestone, phosphatic, argillaceous	FCA-111-47	0.75	14.1	3.9	1.7	.38	24.1	21.6	26.80	333.65
P -111	Mudstone, phosphatic, calcareous	FCA-110-47	0.6	12.5	6.2	2.4	.30	14.8	41.4	27.40	341.15
P -110	Limestone, phosphatic	RAH-146-47	0.6	18.4	0.4	0.4	0.95	9.6	4.3	28.00	352.19
P -109	Limestone, phosphatic	RAH-145-47	2.2	8.9	1.6	1.0	.12	24.4	11.1	30.20	371.77
P -108	Limestone, phosphatic	RAH-144-47	3.5	12.8	2.9	1.4	.22	36.6	15.7	33.70	416.57
P -107	Limestone, phosphatic	RAH-143-47	2.1	13.8	3.5	1.5	.31	28.7	19.1	35.80	445.55
P -106	Phosphate rock, argillaceous, calcareous	RAH-142-47	1.6	14.5	5.4	2.2	.09	24.6	33.1	37.40	468.75
P -105	Limestone, argillaceous	RAH-141-47	2.1	2.6	4.6	2.2	.04	18.6	35.0	39.50	474.21
P -104	Mudstone, calcareous, phosphatic	RAH-140-47	1.3	10.8	6.7	2.4	.015	26.7	37.6	40.80	488.25
P -103	Mudstone, phosphatic, calcareous	LES-243-47	1.8	11.6	6.5	2.5	.055	18.9	40.6	42.60	509.13
P -102	Mudstone, calcareous	LES-242-47	4.2	4.5	7.3	3.3	.02	11.5	59.1	46.80	528.03
P -101	Mudstone	LES-241-47	1.9	2.4	7.3	3.3	.015	11.1	75.1	38.70	532.59
P -100	Phosphate rock, argillaceous, calcareous	LES-240-47	0.6	16.2	5.2	3.2	.024	12.5	35.6	49.30	542.31
P - 99	Mudstone, calcareous	LES-239-47	2.4	1.4	7.6	3.0	.018	15.3	64.0	51.79	545.67
P - 98	Mudstone, calcareous	FCA-109-47	0.9	2.7	8.5	2.8	.02	12.6	70.8	52.60	548.10
P - 97	Mudstone, calcareous, phosphatic	FCA-108-47	1.4	8.0	7.1	3.0	.025	12.8	55.9	54.00	559.30
P - 96	Mudstone, calcareous	FCA-107-47	2.0	6.5	5.9	2.4	.03	15.2	55.9	56.00	572.30
P - 95	Mudstone, calcareous	FCA-106-47	3.0	4.3	8.1	3.2	.03	13.0	65.8	59.00	585.20
P - 94	Limestone	FCA-105-47	1.8	0.5	2.2	1.2	.015	35.9	19.1	60.80	586.10
P - 93	Mudstone, calcareous	FCA-104-47	1.1	5.5	7.6	2.8	.025	18.2	60.8	61.90	592.15
P - 92	Mudstone, calcareous, phosphatic	FCA-103-47	0.8	7.8	5.1	2.4	.025	14.6	53.4	62.70	598.39
P - 91	Mudstone, phosphatic, calcareous	FCA-102-47	0.7	11.3	5.9	2.4	.03	15.8	43.2	63.40	606.30
P - 90	Mudstone, calcareous	FCA-101-47	2.7	3.8	8.2	3.1	.025	14.6	61.1	66.10	616.56
P - 89	Mudstone, calcareous	FCA-100-47	2.5	3.8	7.3	2.7	.03	18.8	51.9	68.60	626.06
P - 88	Phosphate rock, argillaceous, calcareous	FCA- 99-47	1.15	14.0	5.3	3.5	.03	14.3	39.2	69.75	642.16
P - 87	Mudstone	FCA- 98-47	1.3	5.7	5.5	2.7	.04	18.1	50.9	71.05	649.57
P - 86	Phosphate rock, argillaceous, calcareous	FCA- 97-47	1.1	14.1	4.0	1.9	.04	17.0	36.6	72.15	665.08

P - 85	Mudstone, calcareous	FCA- 96-47	0.8	4.4	8.6	3.2	.04	15.8	60.4	72.95	668.60
P - 84	Phosphate rock, argillaceous, calcareous	LES-238-47	0.35	20.9	4.5	3.0	.036	13.3	23.9	73.30	675.92
P - 83	Mudstone, calcareous	LES-237-47	0.9	3.2	8.2	3.9	.03	13.2	61.4	74.20	678.80
P - 82	Mudstone	LES-236-47	0.75	2.2	8.3	4.2	.03	12.6	65.9	74.95	680.45
P - 81	Limestone, argillaceous	LES-235-47	3.4	1.1	4.8	2.1	.018	26.0	34.5	78.35	684.19
P - 80	Mudstone, calcareous and phosphate rock; fos. col. no. 47-HW-7	LES-234-47	0.45	19.4	4.1	2.8	.018	11.3	26.6	78.80	692.92
P - 79	Mudstone, calcareous	LES-233-47	0.9	7.4	7.8	4.2	.018	9.9	59.9	79.70	699.58
P - 78	Mudstone	LES-232-47	2.5	1.2	9.7	4.4	.018	9.5	76.2	82.20	702.58
P - 77	Phosphate rock, argillaceous; fos. col. no. 47-HW-6	LES-231-47	0.35	18.5	4.4	4.0	.018	10.8	29.2	82.55	709.06
P - 76	Mudstone	LES-230-47	1.0	7.3	8.3	5.5	.018	9.7	60.7	83.55	716.36
P - 75	Mudstone	LES-229-47	1.3	2.3	9.0	5.1	.03	8.4	75.0	84.85	719.35
P - 74	Mudstone	LES-228-47	2.3	5.6	8.2	4.5	.018	8.9	65.9	87.15	732.23
P - 73	Limestone, argillaceous	LES-227-47	1.9	3.2	7.1	3.3	.018	21.7	43.6	89.05	738.31
P - 72	Phosphate rock, argillaceous, calcareous	LES-226-47	0.65	16.2	3.5	4.1	.024	12.3	35.6	89.70	748.84
P - 71	Phosphate rock and mudstone	LES-225-47	0.5	18.6	5.2	2.8	.03	16.0	27.3	90.20	758.14
P - 70	Mudstone, calcareous	LES-224-47	1.0	1.3	6.7	3.8	.018	12.1	54.3	91.20	759.44
P - 69	Mudstone, phosphatic, calcareous	LES-223-47	0.35	14.5	5.9	3.3	.03	12.0	41.4	91.55	764.52
P - 68	Mudstone, calcareous	LES-222-47	1.8	1.2	9.1	4.2	.043	10.3	74.9	93.35	766.68
P - 67	Limestone, phosphatic, argillaceous	LES-221-47	1.0	13.4	3.2	2.3	.018	20.0	22.0	94.35	780.08
P - 66	Mudstone, contains calcareous concretions near top	LES-220-47	3.9	0.6	10.1	4.0	.015	8.8	77.6	98.25	782.42
P - 65	Mudstone	LES-219-47	3.9	0.4	10.6	4.4	.015	8.9	78.4	102.15	783.98
P - 64	Mudstone, phosphatic, calcareous	LES-218-47	0.9	9.3	9.0	4.1	.018	11.9	53.2	103.05	792.35
P - 63	Mudstone, calcareous	LES-217-47	5.4	5.8	8.4	3.6	.015	8.7	60.3	108.45	823.67
P - 62	Limestone, phosphatic, argillaceous	LES-216-47	1.05	11.8	3.8	2.2	.03	21.3	20.6	109.50	836.06
P - 61	Mudstone, dolomitic	FCA- 95-47	2.15	5.4	7.0	2.7	.03	19.8	46.2	111.65	847.67
P - 60	Limestone, argillaceous, phosphatic	FCA- 94-47	1.2	7.7	5.8	2.4	.03	21.3	35.3	112.85	856.91
P - 59	Limestone, argillaceous	FCA- 93-47	2.8	2.8	4.4	1.8	.015	28.7	29.2	115.65	864.75
P - 58	Limestone, argillaceous	FCA- 92-47	1.6	5.3	3.0	2.0	.035	28.3	27.8	117.25	873.23
P - 57	Limestone, argillaceous	FCA- 91-47	2.2	6.4	3.5	1.7	.045	30.0	28.8	119.45	887.31
P - 56	Limestone, argillaceous	FCA- 90-47	2.6	4.5	4.9	2.1	.03	26.8	33.7	122.05	899.01
P - 55	Limestone, argillaceous	FCA- 89-47	3.5	5.5	4.8	2.4	.025	28.2	27.2	125.55	918.26
P - 54	Limestone, argillaceous	FCA- 88-47	2.9	5.2	3.2	2.9	.03	21.4	40.9	128.45	933.34
P - 53	Dolomite, calcareous; fos. col. no. 47-HW-5	FCA- 87-47	3.2	0.9	2.6	1.3	.03	37.5	17.6	131.65	936.22
P - 52	Mudstone, calcareous	FCA- 86-47	0.9	2.2	7.8	4.2	.04	12.0	69.8	132.55	938.20
P - 51	Mudstone, calcareous	FCA- 85-47	2.3	2.3	9.9	3.9	.055	15.5	63.7	134.85	943.49

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)						Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	V_2O_5	Loss on ignition	Acid insoluble		
P - 50	Mudstone, calcareous	FCA- 84-47	4.2	3.1	9.5	4.0	.01	14.0	64.1	139.05	956.51
P - 49	Mudstone, calcareous, phosphatic	LES-215-47	3.2	8.9	8.0	2.9	.024	13.8	45.8	142.25	984.99
P - 48	Limestone, argillaceous; fos. col. no. 47-HW-4	LES-214-47	1.6	2.7	5.2	2.1	.015	27.2	33.0	143.85	989.31
P - 47	Mudstone, phosphatic, calcareous	LES-213-47	1.1	11.8	8.2	3.0	.03	17.4	39.3	144.95	1,002.29
P - 46	Mudstone, phosphatic	LES-212-47	2.0	12.3	7.2	2.4	.03	18.8	33.4	146.95	1,026.89
P - 45	Limestone	LES-211-47	1.6	0.3	2.9	1.2	.015	36.5	16.7	148.55	1,027.37
P - 44	Limestone, argillaceous	LES-210-47	0.8	4.5	5.6	2.1	.015	24.5	34.0	149.35	1,030.97
P - 43	Mudstone, phosphatic, calcareous	LES-209-47	0.7	11.6	8.4	3.0	.03	15.1	44.2	150.05	1,039.09
P - 42	Mudstone, phosphatic, contains gypsum	LES-208-47	0.45	13.7	8.5	2.6	.03	17.0	37.0	150.50	1,045.26
P - 41	Phosphate rock	LES-207-47	0.35	31.8	7.1	2.5	.03	17.9	3.5	150.85	1,056.39
P - 40	Phosphate rock	LES-206-47	1.1	31.0	7.3	2.9	.03	18.4	3.8	151.95	1,090.49
P - 39	Mudstone, phosphatic	LES-189-47	0.7	12.8	8.3	2.9	.015	17.7	43.8	152.65	1,099.45
	Possible shear zone, beds P-31 to P-38: rock structure largely destroyed; stratigraphic relations and thicknesses uncertain.										
P - 38	Mudstone, phosphatic	LES-188-47	0.8	13.5	8.1	3.1	.015	19.0	39.3	153.45	1,110.25
P - 37	Limestone, dolomitic, argillaceous	LES-187-47	0.5	1.5	4.9	1.2	.01	35.0	24.0	153.95	1,111.00
P - 36	Limestone, argillaceous, phosphatic	LES-186-47	1.4	8.1	6.6	2.1	.01	24.7	31.8	155.35	1,122.34
P - 35	Mudstone, phosphatic	LES-185-47	0.8	12.1	7.8	2.9	.015	17.8	40.6	156.15	1,132.02
P - 34	Mudstone, calcareous	LES-184-47	0.6	6.9	7.0	2.5	.015	16.4	47.6	156.75	1,136.16
P - 33	Limestone, argillaceous, phosphatic	LES-183-47	1.6	10.1	7.5	2.4	.010	20.5	36.0	158.35	1,152.32
P - 32	Mudstone, phosphatic, calcareous	LES-182-47	1.3	11.9	7.2	2.5	.015	18.3	36.7	159.65	1,167.79
P - 31	Phosphate rock, calcareous	LES-181-47	1.2	18.2	4.2	1.6	.040	20.2	18.0	160.85	1,189.63
P - 30	Phosphate rock, calcareous	LES-180-47	0.4	15.7	4.4	1.7	.050	17.0	27.0	161.25	1,195.91
P - 29	Phosphate rock, argillaceous	FCA- 83-47	0.4	17.4	5.8	2.8	.065	12.7	33.9	161.65	1,202.87
P - 28	Phosphate rock, calcareous	FCA- 82-47	1.9	26.0	1.5	1.5	.03	14.1	8.8	163.55	1,252.27
P - 27	Limestone	FCA- 81-47	2.1	3.5	1.5	0.7	.025	28.0	10.0	165.65	1,259.62
P - 26	Mudstone, phosphatic	FCA- 80-47	0.9	12.2	8.2	2.9	.03	12.6	43.0	166.55	1,270.60
P - 25	Limestone, dolomitic	FCA- 79-47	2.4	6.4	3.6	1.5	.03	29.4	21.0	168.95	1,285.96
P - 24	Phosphate rock	FCA- 78-47	2.5	26.3	2.7	1.4	.12	10.0	17.3	171.45	1,351.71
P - 23	Phosphate rock	FCA- 77-47	1.8	29.3	2.0	1.2	.26	10.4	12.2	173.25	1,404.45
P - 22	Phosphate rock, argillaceous, calcareous	FCA- 76-47	2.5	17.1	3.8	1.7	.13	15.5	25.4	175.75	1,447.20
P - 21	Phosphate rock	FCA- 75-47	1.4	29.6	1.8	1.0	.19	10.7	11.1	177.15	1,488.64
P - 20	Phosphate rock	FCA- 74-47	1.45	26.5	2.4	1.5	.25	11.8	14.7	178.60	1,527.06
P - 19	Phosphate rock; fos. col. no. 47-HW-3	FCA- 73-47	1.6	27.7	2.4	1.2	.25	12.6	14.2	180.20	1,571.38
P - 18	Limestone, phosphatic	FCA- 72-47	2.3	9.3	3.2	1.4	.1	27.2	20.6	182.50	1,592.77
P - 17	Phosphate rock, calcareous	FCA- 71-47	2.65	18.5	2.2	1.4	.04	17.4	19.2	185.15	1,641.80
P - 16	Dolomite, phosphatic	FCA- 70-47	1.6	8.7	1.2	0.7	.03	33.3	8.0	186.75	1,655.72

P - 15	Phosphate rock	LES-205-47	1.35	31.6	1.1	0.9	.12	10.5	4.6	188.10	1,698.38
P - 14	Phosphate rock	LES-204-47	0.9	30.4	0.9	0.6	.18	10.6	4.6	189.00	1,725.74
P - 13	Phosphate rock	LES-203-47	0.65	30.9	0.9	0.5	.28	10.2	4.3	189.65	1,745.82
P - 12	Phosphate rock, argillaceous	LES-202-47	1.4	16.0	0.9	0.6	.51	9.3	32.0	191.05	1,768.22
P - 11	Phosphate rock, argillaceous	LES-201-47	0.55	14.4	0.9	0.6	.54	10.2	36.8	191.60	1,776.14
P - 10	Phosphate rock	LES-200-47	0.5	31.6	0.8	0.5	.54	9.8	2.7	192.10	1,791.94
P - 9	Phosphate rock	LES-199-47	1.25	31.2	1.2	0.6	.26	8.7	5.3	193.35	1,830.94
P - 8	Limestone	LES-198-47	0.5	0.1	1.5	0.7	.16	26.3	7.7	193.85	1,830.99
P - 7	Phosphate rock	LES-197-47	0.55	27.5	2.1	1.1	.21	9.3	12.4	194.40	1,846.12
P - 6	Mudstone, calcareous	LES-196-47	1.0	5.7	8.2	2.9	.45	13.9	57.3	195.40	1,851.82
P - 5	Limestone, argillaceous	LES-195-47	1.65	0.6	5.3	2.1	.07	25.0	44.6	197.05	1,852.81
P - 4	Mudstone, calcareous	LES-194-47	0.65	1.0	10.5	3.6	.22	9.5	77.5	197.70	1,853.46
P - 3	Mudstone, calcareous	LES-193-47	0.85	0.3	7.0	2.1	.08	16.4	61.5	198.55	1,853.71
P - 2	Mudstone, calcareous	LES-192-47	0.35	7.5	10.1	3.3	.25	9.0	55.6	198.90	1,856.34
P - 1	Phosphate rock; fos. col. no. 47-HW-2	LES-191-47	0.25	34.0	0.9	0.6	.025	4.8	4.5	199.15	1,864.84
					Wells formation						
Cw- 1	Limestone; fos. col. no. 47-HW-1	LES-190-47	1.2	0.7	0.8	0.4	.02	44.4	2.7	1.2	--

SPECTROGRAPHIC ANALYSES—CONDA, IDAHO. LOT NO. 1200.

Semi-quantitative analyses of samples of the Phosphoria formation, Conda, Idaho (see immediately preceeding pages for location of section, thickness and description of strata, and chemical analyses of samples), made by U. S. Bureau of Mines Laboratory, Albany, Oregon. In addition to the elements listed in the table below, Sb, As, Be, Bi, Cd, Co, Ga, Au, Li, Pt, Ta, Sn, and W were looked for in all samples but were not detected.

Explanation of symbols

A = more than 10 percent
B = 5-10 percent
C = 1-5 percent
D = 0.1-1 percent
E = 0.01-0.1 percent
F = 0.001-0.01 percent
G = less than 0.001 percent
ND = not detected

Bed no.	Sample no.	Al	Ba	B	Ca	Cr	Cb	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Si	Ag	Na	Sr	Ti	V	Zn	Zr
R - 1	FCA-141-47	C	ND	E	C	E	ND	G	C	ND	D	E	F	E	A	ND	E	ND	E	E	ND	F
P -142	FCA-140-47	C	ND	F	A	E	ND	G	D	ND	D	E	F	E	C	ND	E	E	E	D	E	F
P -141	FCA-139-47	C	ND	E	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	D	E
P -140	FCA-139-47	C	ND	E	C	E	ND	G	C	ND	D	E	F	E	A	ND	D	ND	E	D	ND	F
P -139	FCA-137-47	C	ND	E	C	E	ND	G	C	ND	D	E	F	E	A	ND	E	ND	E	E	E	F
	Beds P-138 through P-136 not analyzed.																					
P -135	FCA-136-47	C	ND	F	A	E	ND	G	D	ND	D	E	F	E	C	G	D	E	E	D	E	F
P -134	FCA-135-47	C	ND	E	C	E	ND	G	C	ND	D	E	E	E	A	G	D	E	D	D	D	F
P -133	FCA-134-47	D	ND	F	A	E	ND	G	D	ND	D	F	F	F	D	G	E	E	F	E	E	F
P -132	FCA-133-47	D	ND	F	A	E	ND	G	D	ND	D	F	F	F	D	G	E	E	F	E	E	F
P -131	FCA-132-47	C	E	F	A	D	ND	G	C	ND	D	F	E	E	B	G	E	E	E	D	D	F
P -130	FCA-131-47	D	E	F	A	E	ND	G	C	ND	D	F	F	F	C	G	E	E	E	E	E	F
P -129	FCA-130-47	C	E	F	A	E	ND	G	C	ND	D	F	F	E	B	G	E	E	E	E	E	F
P -128	FCA-129-47	C	E	F	A	E	ND	G	C	ND	D	F	F	F	C	G	E	F	E	E	ND	F
P -127	FCA-128-47	C	E	F	A	E	ND	G	C	ND	D	F	F	E	C	G	E	E	E	D	E	F
P -126	FCA-127-47	C	E	F	A	E	ND	G	C	ND	D	F	F	E	C	G	E	E	E	D	E	F
P -125	FCA-126-47	C	E	F	A	E	ND	G	C	ND	D	F	F	E	C	G	E	E	E	D	E	F
P -124	FCA-125-47	C	E	F	A	E	ND	G	D	ND	C	F	F	F	C	G	E	F	E	E	ND	F
P -123	FCA-124-47	C	E	F	A	E	ND	G	D	ND	D	F	F	E	C	G	E	E	E	E	E	F
P -122	FCA-123-47	C	E	E	A	E	E	G	C	ND	D	F	E	E	A	G	E	E	E	D	D	E
P -121	FCA-122-47	C	E	F	A	E	E	G	D	ND	D	F	E	E	B	G	E	E	E	D	E	F
P -120	FCA-121-47	D	E	F	A	E	ND	G	D	ND	C	F	F	F	C	G	E	E	E	E	ND	F
P -119	FCA-120-47	C	E	F	A	E	E	G	C	ND	C	E	E	E	A	G	D	E	E	D	E	F
P -118	FCA-119-47	C	E	E	B	E	E	G	C	ND	D	F	E	E	A	G	D	F	E	D	E	F
P -117	FCA-118-47	C	E	E	C	E	E	G	C	ND	D	F	E	E	A	G	D	F	E	D	D	F
P -116	FCA-117-47	C	E	E	C	E	E	G	C	ND	D	F	E	E	A	G	D	F	E	D	E	F
P -115	FCA-116-47	C	E	E	C	E	E	G	C	ND	D	E	E	E	A	G	D	F	E	D	E	E

P -114	FCA-115-47	C	E	E	C	E	E	G	C	ND	C	E	E	E	A	G	D	F	E	D	E	E
P -113	FCA-114-47	C	E	E	C	E	E	G	C	ND	C	E	E	E	A	G	D	F	E	D	E	E
P -112	FCA-111-47	C	E	F	A	E	E	G	C	E	C	E	E	E	B	G	D	E	E	D	E	F
P -111	FCA-110-47	C	E	F	B	E	E	G	C	ND	D	E	E	E	A	G	D	E	E	D	E	F
P -110	RAH-146-47	C	ND	F	A	E	ND	G	D	ND	D	E	F	F	C	ND	E	E	F	D	ND	F
P -109	RAH-145-47	C	ND	F	A	E	ND	G	D	ND	D	E	E	E	B	ND	E	E	E	D	E	F
P -108	RAH-144-47	C	ND	F	A	E	ND	G	D	ND	D	E	E	E	B	G	E	E	E	D	E	F
P -107	RAH-143-47	C	ND	F	A	E	ND	G	D	ND	D	E	F	E	B	G	E	E	E	D	E	F
P -106	RAH-142-47	C	ND	E	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P -105	RAH-141-47	C	ND	F	A	E	ND	G	C	ND	C	E	F	E	A	G	D	E	E	E	ND	F
P -104	RAH-140-47	C	ND	E	A	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
	Beds P-103 through P-99 not analyzed.																					
P - 98	FCA-109-47	C	E	F	C	E	ND	G	C	E	D	E	F	E	A	G	D	F	E	E	ND	E
P - 97	FCA-108-47	C	E	F	C	E	ND	G	D	ND	D	F	F	E	B	G	D	E	E	E	E	F
P - 96	FCA-107-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 95	FCA-106-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 94	FCA-105-47	C	E	F	B	E	ND	G	D	ND	C	F	F	E	C	G	D	F	E	E	ND	F
P - 93	FCA-104-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	ND	F
P - 92	FCA-103-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 91	FCA-102-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 90	FCA-101-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	ND	F
P - 89	FCA-100-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 88	FCA- 99-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 87	FCA- 98-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	E	E	E	E	E	F
P - 86	FCA- 97-47	C	E	F	C	E	ND	G	D	ND	D	E	F	E	B	G	E	E	E	D	E	F
P - 85	FCA- 96-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 84	LES-238-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	B	G	E	E	E	E	E	F
P - 83	LES-237-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	ND	F
P - 82	LES-236-47	C	E	F	C	E	ND	G	C	ND	C	E	F	E	A	G	D	F	E	E	ND	E
P - 81	LES-235-47	C	E	F	C	E	ND	G	C	ND	C	E	F	E	B	G	E	F	E	E	ND	F
P - 80	LES-234-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	B	G	E	E	E	E	ND	F
P - 79	LES-233-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	ND	E
P - 78	LES-232-47	C	E	F	D	ND	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	ND	F
P - 77	LES-231-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	B	A	E	E	E	D	ND	F
P - 76	LES-230-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	E	F	E	E	ND	E
P - 75	LES-229-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	D	E	ND	E
P - 74	LES-228-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	D	E	ND	E
P - 73	LES-227-47	C	E	F	B	E	ND	G	C	ND	C	E	F	E	A	G	D	F	E	E	ND	E
P - 72	LES-226-47	C	E	F	B	E	ND	G	C	ND	D	F	F	E	B	G	D	F	E	E	ND	F
P - 71	LES-225-47	C	E	F	B	E	ND	G	C	ND	D	F	F	E	B	G	E	F	E	E	ND	F
P - 70	LES-224-47	C	E	F	C	F	ND	G	C	ND	D	E	F	E	B	G	D	F	E	E	ND	E
P - 69	LES-223-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	B	G	D	E	E	D	ND	E

Bed no.	Sample no.	Al	Ba	B	Ca	Cr	Cb	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Si	Ag	Na	Sr	Ti	V	Zn	Zr
P - 68	LES-222-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	D	E	ND	E
P - 67	LES-221-47	C	E	F	C	E	ND	G	D	ND	D	E	F	E	C	ND	D	F	E	E	ND	F
P - 66	LES-220-47	C	E	F	D	F	ND	G	C	ND	D	E	F	E	A	ND	D	ND	E	E	ND	E
P - 65	LES-219-47	C	E	F	D	F	ND	G	C	ND	D	E	F	E	A	ND	D	ND	E	E	ND	E
P - 64	LES-218-47	C	E	F	C	E	ND	G	D	ND	D	F	F	E	B	ND	D	ND	E	E	ND	F
P - 63	LES-217-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	E	E
P - 62	LES-216-47	C	E	F	B	E	ND	G	D	ND	D	E	F	E	C	G	D	F	E	E	E	F
P - 61	FCA- 95-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 60	FCA- 94-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	E	F
P - 59	FCA- 93-47	C	E	F	B	E	ND	G	D	ND	D	E	F	E	B	G	D	E	E	E	ND	F
P - 58	FCA- 92-47	C	E	F	C	D	ND	G	C	ND	D	E	F	E	A	G	E	E	E	E	E	F
P - 57	FCA- 91-47	C	E	F	C	D	ND	G	C	ND	D	E	E	E	A	G	E	E	E	D	E	F
P - 56	FCA- 90-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	B	G	D	E	E	E	ND	F
P - 55	FCA- 89-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	C	G	E	E	E	E	E	F
P - 54	FCA- 88-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	E	E	E	ND	F
P - 53	FCA- 87-47	C	E	F	B	E	ND	G	D	ND	C	E	F	E	C	G	E	F	E	E	ND	F
P - 52	FCA- 86-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	ND	F
P - 51	FCA- 85-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	ND	F
P - 50	FCA- 84-47	C	E	F	C	E	ND	G	D	ND	D	E	F	E	A	G	E	F	E	E	ND	E
P - 49	LES-215-47	C	E	F	C	E	ND	G	C	ND	D	E	F	E	A	G	D	F	E	E	E	F
P - 48	LES-214-47	C	E	F	C	E	ND	G	D	ND	C	E	F	E	B	ND	E	ND	E	E	ND	F
P - 47	LES-213-47	C	E	F	C	E	ND	G	C	ND	D	F	F	E	A	G	E	F	E	E	E	F
P - 46	LES-212-47	C	E	F	C	E	ND	G	C	ND	D	F	F	E	A	G	D	F	E	E	E	F
P - 45	LES-211-47	C	ND	F	B	F	ND	G	D	ND	C	E	F	F	C	ND	D	F	E	E	ND	F
P - 44	LES-210-47	C	ND	F	C	F	ND	G	D	ND	C	F	F	F	C	ND	D	ND	E	E	ND	F
P - 43	LES-209-47	C	E	F	C	E	ND	G	C	ND	D	F	F	E	A	G	E	F	E	E	E	F
P - 42	LES-208-47	C	E	F	B	E	ND	G	C	ND	D	F	F	E	C	G	E	F	E	E	E	F
P - 41	LES-207-47	C	E	F	A	E	ND	G	C	ND	D	F	F	E	B	G	E	E	E	D	E	F
P - 40	LES-206-47	C	E	F	C	E	ND	G	C	ND	D	F	F	E	B	G	E	F	E	E	ND	F
P - 39	LES-189-47	C	ND	F	A	E	ND	G	D	ND	D	F	F	E	C	G	D	E	E	F	E	F
P - 38	LES-188-47	C	ND	F	C	D	ND	G	D	ND	D	F	F	E	A	G	D	ND	E	F	F	F
P - 37	LES-187-47	C	ND	F	B	E	ND	G	D	ND	C	E	F	E	C	G	E	ND	E	F	E	F
P - 36	LES-186-47	C	ND	F	C	E	ND	G	D	ND	C	F	F	E	B	G	E	ND	E	F	E	F
P - 35	LES-185-47	C	ND	F	C	E	ND	G	D	ND	D	F	F	E	C	G	E	ND	E	F	F	F
P - 34	LES-184-47	C	ND	F	B	E	ND	G	D	ND	D	F	F	E	B	G	D	ND	E	F	E	F
P - 33	LES-183-47	C	ND	F	B	E	ND	G	D	ND	D	F	F	E	B	G	E	ND	E	F	E	F
P - 32	LES-182-47	C	ND	E	A	E	ND	G	C	ND	D	E	F	E	A	G	D	ND	D	F	E	F
P - 31	LES-181-47	C	ND	F	A	E	ND	G	D	ND	D	F	F	E	C	G	E	ND	E	F	E	F
P - 30	LES-180-47	C	E	F	A	D	ND	G	C	ND	D	F	F	E	B	G	D	E	D	E	E	F
P - 29	FCA- 83-47	C	E	F	B	E	ND	G	C	ND	D	F	F	E	B	G	E	E	E	D	E	F
P - 28	FCA- 82-47	D	E	F	A	E	ND	G	C	ND	D	E	F	E	C	G	E	E	E	D	E	F

P - 27	FCA- 81-47	D	E	F	B	E	ND	G	D	ND	C	F	F	E	C	G	E	F	E	E	ND	F
P - 26	FCA- 80-47	C	E	F	B	E	ND	G	C	ND	D	E	F	E	A	G	E	E	E	E	E	E
P - 25	FCA- 79-47	C	E	F	B	E	ND	G	C	ND	C	E	F	E	B	G	E	F	E	E	E	F
P - 24	FCA- 78-47	D	E	F	B	E	ND	G	C	ND	D	F	F	E	B	G	E	E	E	D	E	F
P - 23	FCA- 77-47	D	E	F	B	E	ND	G	C	ND	D	F	F	E	B	G	E	E	E	D	E	F
P - 22	FCA- 76-47	C	E	F	B	E	ND	G	C	ND	C	E	F	E	B	G	D	F	E	D	E	F
P - 21	FCA- 75-47	E	E	F	C	E	ND	G	D	ND	D	F	F	E	D	G	D	E	E	E	E	F
P - 20	FCA- 74-47	D	E	F	A	E	ND	G	C	ND	D	E	F	E	B	G	D	E	E	D	E	F
P - 19	FCA- 73-47	D	E	F	B	E	ND	G	D	ND	D	F	F	E	C	G	E	F	E	D	E	F
P - 18	FCA- 72-47	C	E	F	B	E	ND	G	D	ND	C	E	F	E	B	G	E	F	E	D	E	F
P - 17	FCA- 71-47	C	E	F	B	E	ND	G	D	ND	D	F	F	E	C	G	E	F	E	D	E	F
P - 16	FCA- 70-47	D	E	F	B	E	ND	G	D	ND	C	F	F	E	C	G	E	F	E	E	ND	F
P - 15	LES -205-47	D	ND	F	A	E	ND	G	D	ND	D	F	F	E	C	G	D	E	E	E	F	E
P - 14	LES -204-47	D	ND	F	A	E	ND	G	D	ND	D	ND	F	E	C	G	D	E	E	D	F	F
P - 13	LES -203-47	D	ND	F	B	E	ND	G	D	ND	D	ND	F	E	C	G	D	E	E	D	F	F
P - 12	LES -202-47	D	ND	F	A	E	ND	G	D	ND	D	ND	F	E	C	G	D	E	E	D	E	F
P - 11	LES -201-47	D	ND	F	B	E	ND	G	D	ND	D	ND	F	E	C	G	D	E	E	D	E	F
P - 10	LES -200-47	D	ND	F	B	E	ND	G	E	ND	D	ND	F	E	C	G	D	E	E	D	E	F
P - 9	LES -199-47	D	ND	F	A	E	ND	G	D	ND	D	ND	F	E	C	G	D	E	E	D	E	F
P - 8	LES -198-47	D	ND	F	B	E	ND	G	D	ND	C	F	F	E	C	G	E	ND	E	E	F	F
P - 7	LES -197-47	C	ND	F	A	E	ND	G	D	ND	D	F	F	E	C	G	D	E	E	D	E	F
P - 6	LES -196-47	C	ND	E	C	E	ND	G	C	ND	D	F	E	E	A	G	D	ND	D	D	D	E
P - 5	LES -195-47	C	ND	E	C	F	ND	G	C	ND	C	F	F	E	A	G	E	ND	E	E	F	E
P - 4	LES -194-47	C	ND	E	D	E	ND	G	C	ND	D	F	F	E	A	G	E	ND	D	D	E	E
P - 3	LES -193-47	C	ND	E	C	F	ND	G	D	ND	C	F	F	E	A	G	E	ND	D	E	F	E
P - 2	LES -192-47	C	ND	E	C	E	ND	G	C	ND	D	E	F	E	A	G	D	ND	D	E	E	E
P - 1	LES -191-47	C	ND	F	A	F	ND	G	D	ND	D	F	F	E	C	G	D	E	F	F	F	F

DIAMOND DRILL HOLE 6, SLUG CREEK VALLEY, IDAHO. LOT NO. 1277.

Part of phosphatic shale member of Phosphoria formation cored in diamond drill hole 6 on west slope of hill above Slug Creek Valley, sec. 30, T. 8 S., R. 44 E., Caribou County, Idaho, on west limb of Schmid syncline. Beds strike north and dip 8° E. Hole drilled in September 1948 by U. S. Bureau of Mines, A. E. Long in charge, and core measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—lower beds only						
P-32	Phosphate rock, argillaceous	DFD-1111	2.5	16.8	41.9	2.5	42.00
P-31	Phosphate rock, argillaceous	DFD-1112	2.0	16.3	39.0	4.5	74.60
P-30	Phosphate rock, argillaceous	DFD-1113	0.5	21.2	25.4	5.0	85.20
P-29	Phosphate rock	DFD-1114	2.2	28.0	14.5	7.2	146.80
P-28	Mudstone, phosphatic, calcareous	DFD-1115	0.7	13.0	29.8	7.9	155.90
P-27	Limestone	DFD-1116	2.1	2.4	9.9	10.0	160.94
P-26	Limestone	DFD-1117	1.4	7.6	17.9	11.4	171.58
P-25	Phosphate rock, argillaceous	DFD-1118	0.5	22.3	26.0	11.9	182.73
P-24	Limestone	DFD-1119	0.8	3.7	15.8	12.7	185.69
P-23	Limestone, argillaceous, phosphatic	DFD-1120	1.3	9.1	27.5	14.0	197.52
P-22	Mudstone, phosphatic	DFD-1121	1.5	11.3	53.9	15.5	214.47
P-21	Limestone, argillaceous	DFD-1122	1.6	4.1	28.4	17.1	221.03
P-20	Limestone, argillaceous	DFD-1123	0.7	0.4	30.8	17.8	221.31
P-19	Limestone	DFD-1124	0.7	6.7	16.2	18.5	226.00
P-18	Phosphate rock	DFD-1125	1.3	28.9	14.7	19.8	263.57
P-17	Phosphate rock	DFD-1126	1.1	30.9	10.9	20.9	297.56
P-16	Phosphate rock	DFD-1127	0.8	28.8	14.5	21.7	320.60
P-15	Phosphate rock, argillaceous	DFD-1128	1.5	22.4	30.2	23.2	354.20
P-14	Limestone, argillaceous	DFD-1129	1.4	3.6	27.7	24.6	359.24
P-13	Phosphate rock, calcareous	DFD-1130	4.2	24.2	11.0	28.8	460.88
P-12	Phosphate rock	DFD-1131	1.5	22.8	16.5	30.3	495.08
P-11	Phosphate rock, argillaceous	DFD-1132	1.1	22.7	23.7	31.4	520.05
P-10	Limestone, phosphatic	DFD-1133	1.1	13.9	13.4	32.5	535.34
P- 9	Limestone, phosphatic	DFD-1134	0.9	9.8	8.6	33.4	544.16
P- 8	Phosphate rock	DFD-1135	1.0	31.4	7.3	34.4	575.56
P- 7	Phosphate rock	DFD-1136	1.3	33.7	2.8	35.7	619.37
P- 6	Phosphate rock	DFD-1137	2.5	33.6	2.3	38.2	703.37
P- 5	Phosphate rock	DFD-1138	2.3	31.8	6.1	40.5	776.51
P- 4	Mudstone	DFD-1139	1.0	6.1	64.6	41.5	782.61
P- 3	Limestone, argillaceous	DFD-1140	1.1	2.0	42.6	42.6	784.81
P- 2	Mudstone, calcareous	DFD-1141	2.1	1.1	56.2	44.7	787.12
P- 1	Phosphate rock	DFD-1142	0.4	30.7	7.4	45.1	799.40

Wells formation

Cw-1	Limestone	DFD-1143	0.6	0.8	3.9	0.6	0.48

DIAMOND DRILL HOLE 3, MIDDLE SULPHUR CANYON, IDAHO. LOT NO. 1274.

Part of phosphatic shale member of Phosphoria formation cored in diamond drill hole 3 on south slope of Middle Sulphur Canyon, sec. 8, T. 9 S., R. 43 E., Caribou County, Idaho, on west limb of Trail Creek syncline. Beds strike north-northwest and dip 15° E. Hole drilled in September 1948 by U. S. Bureau of Mines, A. E. Long in charge, and core measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—partial section						
P-25	Mudstone	DFD-961	1.2	4.4	73.4	1.2	5.28
P-24	Mudstone	DFD-962	0.8	2.2	84.9	2.0	7.04
P-23	Mudstone	DFD-963	3.8	3.4	78.9	5.8	19.96
P-22	Mudstone	DFD-964	2.0	6.4	66.6	7.8	32.76
P-21	Mudstone	DFD-965	2.3	7.8	65.9	10.1	50.70
P-20	Mudstone, phosphatic	DFD-966	4.7	12.8	50.6	14.8	110.86
P-19	Mudstone, phosphatic	DFD-967	2.2	13.5	50.3	17.0	140.56
P-18	Phosphate rock, argillaceous	DFD-968	3.5	19.1	37.7	20.5	207.41
P-17	Phosphate rock, argillaceous	DFD-969	1.1	24.4	20.6	21.6	234.25
P-16	Phosphate rock, calcareous	DFD-970	2.1	25.0	13.1	23.7	286.75
P-15	Phosphate rock	DFD-971	0.7	25.3	17.3	24.4	304.46
P-14	Phosphate rock and mudstone	DFD-972	0.4	21.4	28.0	24.8	313.02
P-13	Phosphate rock and mudstone	DFD-973	3.0	24.5	16.6	27.8	386.52
P-12	Phosphate rock, argillaceous	DFD-974	0.7	18.8	35.1	28.5	399.67
P-11	Mudstone, phosphatic	DFD-975	1.9	12.8	52.4	30.4	424.00
P-10	Phosphate rock, argillaceous	DFD-976	2.6	19.8	39.3	33.0	475.48
P- 9	Phosphate rock	DFD-977	1.3	27.9	17.2	34.3	511.75
P- 8	Phosphate rock, argillaceous	DFD-978	1.9	20.8	36.0	36.2	551.27
P- 7	Mudstone, phosphatic	DFD-979	0.9	14.5	51.0	37.1	564.32
--	Core missing	--	0.3	--	--	37.4	--
P- 6	Phosphate rock, argillaceous	DFD-980	2.4	27.5	21.2	39.8	66.00*
P- 5	Phosphate rock	DFD-981	2.7	28.8	19.7	42.5	143.76
P- 4	Phosphate rock, argillaceous	DFD-982	1.3	19.9	36.7	43.8	169.63
P- 3	Phosphate rock, argillaceous	DFD-983	1.3	23.8	27.5	45.1	200.57
P- 2	Phosphate rock, argillaceous	DFD-984	0.7	28.8	24.1	45.8	220.73**
--	Core missing	--	22.4	--	--	68.2	--
P- 1	Phosphate rock	DFD-985	1.2	32.4	9.1	69.4	38.88*

* Cumulative data incomplete due to missing information. Computations start from zero after interruption.
** Note incompleteness of cumulative data.

DIAMOND DRILL HOLE 4, MIDDLE SULPHUR CANYON, IDAHO. LOT NO. 1275.

Phosphatic shale member of Phosphoria formation cored in diamond drill hole 4 on north slope of Middle Sulphur Canyon, sec. 8, T. 9 S., R. 43 E., Caribou County, Idaho, on west limb of Trail Creek syncline. Beds strike north-northwest and dip 22° E. Hole drilled in September 1948 by U. S. Bureau of Mines, A. E. Long in charge. Partial section measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—basal beds only						
P- 8	Phosphate rock	DFD-986	1.2	29.1	15.6	1.2	34.92
P- 7	Phosphate rock	DFD-987	0.9	27.6	19.4	2.1	59.76
P- 6	Phosphate rock, argillaceous	DFD-988	2.5	27.2	21.8	4.6	127.76
P- 5	Phosphate rock, argillaceous	DFD-989	4.4	26.6	21.5	9.0	244.80
P- 4	Phosphate rock	DFD-990	4.1	32.8	5.9	13.1	379.28
P- 3	Mudstone	DFD-991	3.0	2.4	78.5	16.1	386.48
P- 2	Mudstone	DFD-992	0.4	1.2	80.9	16.5	386.96
P- 1	Mudstone, phosphatic	DFD-993	0.6	9.9	59.7	17.1	392.90
	Wells formation						
Cw-1	Limestone	DFD-994	1.0	0.2	2.8	1.0	0.20

DIAMOND DRILL HOLE 5, SOUTH FORK OF JOHNSON CREEK, IDAHO. LOT NO. 1276.

Part of phosphatic shale member of Phosphoria formation cored in diamond drill hole 5 in valley bottom of south fork of Johnson Creek, sec. 9, T. 9 S., R. 43 E., Caribou County, Idaho, on east limb of Trail Creek syncline. Beds strike northwest and dip 30° SW. Hole drilled in September 1948 by U. S. Bureau of Mines, A. E. Long in charge, and core measured and sampled by D. F. Davidson. Samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation—partial section						
P-7	Mudstone	DFD- 995	0.5	1.8	83.0	0.5	0.90
P-6	Mudstone, phosphatic	DFD- 996	1.0	12.8	51.4	1.5	13.70
P-5	Mudstone	DFD- 997	1.2	2.7	76.1	2.7	16.94
P-4	Mudstone	DFD- 998	2.3	6.6	64.0	5.0	32.12
P-3	Mudstone	DFD-1098	0.9	3.9	71.0	5.9	35.63
P-2	Mudstone	DFD-1099	2.8	6.2	67.4	8.7	52.99
--	Core missing	--	1.1	--	--	9.8	--
P-1	Mudstone and phosphatic mudstone	DFD-1110	2.1	11.5	44.6	11.9	24.15**

** Note incompleteness of cumulative data.

NORTH DAIRY, IDAHO. LOT NO. 1212.

Upper part of phosphatic shale member of Phosphoria formation sampled in bulldozer trench near north end of Dairy syncline, NE¼NE¼ sec. 20, T. 9 S., R. 44 E., Caribou County, Idaho. The stratigraphic sequence of the units is questionable for, because of a large number of faults, some beds may be omitted or repeated. No cumulative totals are given for this reason. Section measured by R. M. Campbell and L. E. Smith and sampled by R. S. Sears, R. P. Sheldon, and R. A. Smart in August and September 1947. Samples analyzed for P_2O_5 and acid insoluble by U. S. Bureau of Mines Laboratory, Albany, Oregon, and for other constituents by Trace Elements Section Laboratory, U. S. Geological Survey, Washington, D. C.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)				
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble
	Rex member of Phosphoria formation—basal bed only							
R- 1	Chert	LES-400-47	0.8	6.2	--	--	--	79.6
	Phosphatic shale member of Phosphoria formation—upper part only							
P-61	Phosphate rock	LES-399-47	0.6	30.8	--	--	--	12.9
P-60	Mudstone	LES-398-47	0.8	--	--	--	--	--
P-59	Mudstone	LES-397-47	0.5	6.9	--	--	--	60.1
P-58	Mudstone	LES-396-47	2.0	1.5	--	--	--	79.3
P-57	Mudstone	LES-395-47	1.2	1.2	--	--	--	78.6
P-56	Mudstone	LES-394-47	0.3	3.9	--	--	--	67.7
P-55	Mudstone	LES-393-47	1.1	4.7	--	--	--	73.9
P-54	Mudstone	LES-392-47	1.5	6.2	--	--	--	67.3
P-53	Mudstone	LES-391-47	3.4	2.2	--	--	--	78.0
P-52	Phosphate rock, argillaceous	LES-390-47	1.0	26.6	--	--	--	23.3
P-51	Mudstone	LES-389-47	1.3	3.9	--	--	--	69.0
P-50	Mudstone	LES-388-47	1.8	1.0	--	--	--	83.3
	Several beds may be missing in fault zone between LES-388-47 and RMC-50-47.							
P-49	Phosphate rock	RMC- 50-47	1.3	34.2	1.60	0.94	4.26	7.1
P-48	Mudstone and phosphatic mudstone	RMC- 49-47	1.1	11.7	7.60	3.0	5.10	59.2
P-47	Phosphate rock and mudstone	RMC- 48-47	0.9	27.2	3.4	1.61	5.98	22.8
P-46	Mudstone	RMC- 47-47	0.3	5.8	11.0	4.3	5.48	69.2
P-45	Phosphate rock	RMC- 46-47	0.6	31.3	1.6	0.89	4.24	12.8
P-44	Phosphate rock, argillaceous	RMC- 45-47	1.4	18.8	5.0	1.86	5.92	40.1
P-43	Phosphate rock	RMC- 44-47	1.0	28.7	2.1	0.92	6.40	16.1
P-42	Mudstone, phosphatic	RMC- 43-47	1.2	12.5	8.6	2.56	6.20	54.5
P-41	Phosphate rock	RMC- 42-47	1.4	32.7	1.1	1.45	6.36	7.3
P-40	Phosphate rock, argillaceous	RMC- 41-47	0.7	24.4	3.3	1.29	7.30	25.6
P-39	Phosphate rock	RMC- 40-47	0.7	26.2	2.0	1.32	9.92	18.2

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)				
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble
P-38	Phosphate rock and phosphatic mudstone	RMC-39-47	0.7	20.8	4.1	1.42	7.02	35.9
P-37	Mudstone	RMC-38-47	0.6	5.6	9.20	3.10	5.84	73.2
P-36	Mudstone, phosphatic	RMC-37-47	0.5	13.4	7.40	2.50	5.82	55.2
P-35	Phosphate rock, argillaceous	RMC-36-47	0.9	21.7	4.90	1.70	8.64	30.0
P-34	Mudstone, phosphatic	RMC-35-47	1.0	10.4	8.40	2.90	9.72	55.3
P-33	Mudstone, calcareous and phosphate rock	RMC-34-47	0.3	17.3	7.10	2.4	9.60	38.8
P-32	Mudstone	RMC-33-47	0.2	3.5	12.00	4.10	14.84	63.3
P-31	Mudstone, phosphatic, calcareous	RMC-32-47	0.4	9.2	8.90	2.10	1.10	56.3
P-30	Phosphate rock and phosphatic mudstone	RMC-31-47	0.4	29.1	1.9	0.77	8.62	13.4
P-29	Phosphate rock and phosphatic mudstone	RMC-30-47	0.4	21.5	5.1	1.70	7.62	32.6
P-28	Phosphate rock	RMC-29-47	0.4	32.3	0.93	0.46	6.02	10.3
P-27	Phosphate rock, contains chert lens	RMC-28-47	0.37	30.1	0.55	0.70	4.29	16.6
P-26	Phosphate rock and argillaceous phosphate rock	RMC-27-47	0.43	31.3	1.6	0.70	8.04	10.2
P-25	Phosphate rock and argillaceous phosphate rock	RMC-26-47	0.5	29.6	1.3	0.63	9.52	12.1
P-24	Phosphate rock and argillaceous phosphate rock	RMC-25-47	0.8	31.4	1.4	0.68	9.34	13.6
P-23	Phosphate rock	RMC-24-47	0.57	26.8	2.4	0.97	12.54	14.3
P-22	Phosphate rock	RMC-23-47	0.5	27.6	2.3	0.86	11.78	8.0
	Fault zone, correlation not positive.							
P-21	Mudstone	LES-387-47	0.85	1.1	--	--	--	83.9
P-20	Phosphate rock and mudstone	Sample lost	0.35	--	--	--	--	--
P-19	Mudstone, phosphatic	LES-385-47	0.55	12.4	--	--	--	45.2
P-18	Mudstone, phosphatic	LES-384-47	0.7	10.4	--	--	--	53.1
P-17	Mudstone, phosphatic	LES-383-47	0.5	13.4	--	--	--	46.6
P-16	Mudstone, phosphatic	LES-382-47	0.55	15.8	--	--	--	40.9
P-15	Phosphate rock, argillaceous	LES-381-47	0.45	20.1	--	--	--	35.3
P-14	Mudstone, phosphatic	LES-380-47	0.3	8.8	--	--	--	58.0
P-13	Mudstone and phosphate rock	LES-379-47	0.55	6.9	--	--	--	60.2
P-12	Mudstone, phosphatic	LES-378-47	0.5	8.1	--	--	--	62.1
P-11	Mudstone	LES-377-47	0.6	5.9	--	--	--	73.2
P-10	Mudstone, phosphatic	LES-376-47	0.7	7.8	--	--	--	63.9
P- 9	Mudstone, phosphatic	LES-375-47	0.5	8.5	--	--	--	63.4
P- 8	Mudstone	LES-374-47	0.5	6.5	--	--	--	70.7
P- 7	Mudstone	LES-373-47	0.5	6.1	--	--	--	69.6
P- 6	Mudstone	LES-372-47	0.6	1.9	--	--	--	76.2
P- 5	Mudstone	LES-371-47	0.4	6.9	--	--	--	67.1
P- 4	Mudstone, phosphatic	LES-370-47	0.6	11.3	--	--	--	55.8

P- 3	Mudstone, chert, and phosphate rock	Sample lost	0.3	--	--	--	--	--
P- 2	Mudstone, contains chert nodules	LES-368-47	0.35	3.0	--	--	--	80.3
P- 1	Mudstone, contains chert nodules	LES-367-47	2.4	2.4	--	--	--	85.1

SWAN LAKE GULCH, IDAHO. LOT NO. 1265.

Phosphatic shale member and part of Rex member of Phosphoria formation sampled in bulldozer trench in Swan Lake gulch, NE¼SW¼ sec. 29, T. 9 S., R. 43 E., Caribou County, Idaho, on west limb of faulted and contorted syncline. Beds of Rex member strike N. 46° W. and dip 54° E. Section measured by F. W. O'Malley, R. P. Sheldon, and R. G. Waring and sampled by Waring and H. A. Larsen in September 1948. Samples analyzed for P_2O_5 and acid insoluble by U. S. Bureau of Mines Laboratory, Albany, Oregon, and for other constituents by Trace Elements Section Laboratory, U. S. Geological Survey, Washington, D. C.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble		
	Rex member of Phosphoria formation—basal beds only									
R- 8	Chert	WOM-3011	2.7	0.2	--	--	--	79.4	2.7	0.54
R- 7	Limestone, argillaceous	WOM-3020	3.5	0.3	--	--	--	35.4	6.2	1.59
R- 6	Chert, calcareous	WOM-3019	3.5	0.4	--	--	--	77.4	9.7	2.99
R- 5	Chert, calcareous and limestone	WOM-3018	2.5	0.6	--	--	--	65.9	12.2	4.49
R- 4	Limestone, argillaceous	WOM-3017	1.5	0.4	--	--	--	24.6	13.7	5.09
R- 3	Chert	WOM-3016	0.9	0.5	--	--	--	77.8	14.6	5.54
R- 2	Chert, calcareous	WOM-3015	5.9	0.5	--	--	--	70.3	20.5	8.49
R- 1	Chert, calcareous	WOM-3014	2.9	0.7	--	--	--	60.7	23.4	10.52
	Phosphatic shale member of Phosphoria formation									
P-97	Phosphate rock, argillaceous, calcareous; fos. col. no. 48-JES-243[1]	WOM-3013	0.9	19.5	--	--	--	28.9	0.9	17.55
P-96	Mudstone, calcareous	WOM-3012	1.2	1.5	--	--	--	74.8	2.1	19.35
P-95	Mudstone, calcareous	RGW-3010	1.1	6.4	--	--	--	54.5	3.2	26.39
P-94	Mudstone; fos. col. no. 48-JES-242	RGW-3009	2.0	1.8	--	--	--	76.4	5.2	29.99
P-93	Mudstone, calcareous; fos. col. no. 48-JES-241	RGW-3008	3.5	0.6	--	--	--	68.4	8.7	32.09
P-92	Mudstone, calcareous; fos. col. no. 48-JES-240	RGW-3007	1.5	0.9	--	--	--	73.9	10.2	33.44
P-91	Limestone	RGW-3006	0.6	0.7	--	--	--	19.7	10.8	33.86
P-90	Mudstone, calcareous; fos. col. no. 48-JES-239	RGW-3005	1.0	3.5	--	--	--	59.3	11.8	37.36
P-89	Mudstone, calcareous; fos. col. no. 48-JES-238	RGW-3004	2.2	3.2	--	--	--	66.1	14.0	44.40
P-88	Mudstone	RGW-3003	1.7	3.5	--	--	--	72.1	15.7	50.35
P-87	Mudstone, phosphatic	RGW-3002	0.3	12.3	--	--	--	43.3	16.0	54.04
P-86	Limestone, phosphatic	RGW-3001	0.5	15.8	--	--	--	18.9	16.5	61.94
P-85	Limestone, argillaceous	RPS- 2850	1.0	0.8	--	--	--	47.1	17.5	62.74
P-84	Phosphate rock	RPS- 2849	1.4	32.8	--	--	--	6.9	18.9	108.66
P-83	Phosphate rock, argillaceous, calcareous	RPS- 2848	0.4	20.9	--	--	--	23.0	19.3	117.02
P-82	Mudstone, phosphatic; fos. col. no. 48-JES-237	WOM-3000	2.7	15.8	--	--	--	39.4	22.0	159.68

P-81	Mudstone, calcareous, phosphatic; fos. col. no. 48-JES-236	WOM-2999	2.4	10.3	--	--	--	38.9	24.4	184.40
P-80	Phosphate rock, calcareous	WOM-2998	0.8	25.2	--	--	--	13.2	25.2	204.56
--	Limestone concretion	WOM-2973	(0.4)	0.9	--	--	--	0.7	--	--
P-79	Phosphate rock, calcareous	WOM-2997	4.0	18.2	--	--	--	19.2	29.2	277.36
P-78	Limestone, phosphatic; fos. col. no. 48-JES-235	WOM-2996	1.5	12.6	--	--	--	18.6	30.7	296.26
P-77	Limestone, phosphatic; fos. col. no. 48-JES-234	WOM-2995	1.7	15.2	--	--	--	18.9	32.4	322.10
P-76	Phosphate rock, calcareous, argillaceous; fos. col. no. 48-JES-233	RPS- 2847	4.2	15.8	--	--	--	25.7	36.6	388.46
--	Limestone concretion	RPS- 2846	(0.5)	1.3	--	--	--	1.5	--	--
P-75	Mudstone, phosphatic; fos. col. no. 48-JES-232	RPS- 2845	2.5	11.1	--	--	--	48.3	39.1	416.21
P-74	Mudstone	RPS- 2844	0.9	0.9	--	--	--	85.5	40.0	417.02
P-73	Mudstone and argillaceous phosphate rock	RPS- 2843	3.3	10.7	--	--	--	52.2	43.3	452.33
P-72	Mudstone; fos. col. no. 48-JES-231	RPS- 2842	3.4	5.2	--	--	--	71.6	46.7	470.01
P-71	Mudstone, phosphatic	RPS- 2841	0.5	14.4	--	--	--	51.7	47.2	477.21
P-70	Mudstone	RPS- 2840	1.3	2.2	--	--	--	85.2	48.5	480.07
P-69	Phosphate rock, argillaceous	RPS- 2839	1.0	18.4	--	--	--	45.2	49.5	498.47
P-68	Mudstone	RPS- 2838	1.7	1.4	--	--	--	87.2	51.2	500.85
P-67	Mudstone, phosphatic	WOM-2994	4.0	10.2	--	--	--	61.7	55.2	541.65
P-66	Mudstone	WOM-2993	4.8	4.9	--	--	--	75.9	60.0	565.17
P-65	Mudstone	WOM-2992	2.5	5.5	--	--	--	66.6	62.5	578.92
P-64	Phosphate rock	WOM-2991	0.3	28.3	--	--	--	18.1	62.8	587.41
P-63	Mudstone; fos. col. no. 48-JES-230	WOM-2990	0.8	5.2	--	--	--	71.7	63.6	591.57
P-62	Phosphate rock, argillaceous	WOM-2989	0.4	17.4	--	--	--	40.9	64.0	598.53
P-61	Mudstone	WOM-2988	1.0	6.2	--	--	--	62.6	65.0	604.73
P-60	Phosphate rock, argillaceous and mudstone	WOM-2987	1.4	15.6	--	--	--	39.4	66.4	626.57
P-59	Mudstone	WOM-2986	1.4	5.9	--	--	--	63.2	67.8	634.83
P-58	Mudstone, phosphatic	WOM-2985	1.1	13.6	--	--	--	47.2	68.9	649.79
P-57	Mudstone	WOM-2984	1.8	1.6	--	--	--	85.7	70.7	652.67
P-56	Mudstone, phosphatic	WOM-2983	0.8	14.3	--	--	--	48.4	71.5	664.11
P-55	Mudstone	WOM-2982	2.5	1.1	--	--	--	85.6	74.0	666.86
P-54	Mudstone; fos. col. no. 48-JES-229	WOM-2981	4.0	1.3	--	--	--	85.3	78.0	672.06
P-53	Phosphate rock, argillaceous	WOM-2980	0.6	21.6	--	--	--	33.0	78.6	685.02
P-52	Mudstone	WOM-2979	0.6	5.5	--	--	--	71.7	79.2	688.32
P-51	Mudstone	WOM-2978	1.4	3.7	--	--	--	80.8	80.6	693.50
P-50	Mudstone	WOM-2977	0.8	0.3	--	--	--	88.3	81.4	693.74
P-49	Mudstone; fos. col. no. 48-JES-228	WOM-2976	1.6	1.4	--	--	--	83.1	83.0	695.98
P-48	Mudstone	WOM-2975	1.0	0.4	--	--	--	84.6	84.0	696.38

[1] Fossil collection made by J. E. Smedley, Paleontology and Stratigraphy Branch, U. S. Geological Survey.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Al_2O_3	Fe_2O_3	Loss on ignition	Acid insoluble		
P-47	Mudstone	WOM-2974	1.4	0.4	--	--	--	85.7	85.4	696.94
P-46	Phosphate rock, argillaceous	WOM-2972	1.7	20.3	--	--	--	34.9	87.1	731.45
P-45	Mudstone; fos. col. no. 48-JES-227	WOM-2971	5.0	1.4	--	--	--	85.5	92.1	738.45
P-44	Mudstone, phosphatic	WOM-2970	1.1	8.1	--	--	--	71.0	93.2	747.36
P-43	Mudstone; fos. col. no. 48-JES-226	WOM-2969	2.0	3.0	--	--	--	76.2	95.2	753.36
P-42	Phosphate rock, argillaceous	WOM-2968	0.7	18.8	--	--	--	37.3	95.9	766.52
P-41	Phosphate rock	WOM-2967	0.9	27.7	--	--	--	19.1	96.8	791.45
P-40	Mudstone	WOM-2966	3.5	1.2	--	--	--	88.1	100.3	795.65
P-39	Mudstone	WOM-2965	1.3	1.0	--	--	--	87.1	101.6	796.95
P-38	Mudstone; fos. col. no. 48-JES-225	WOM-2964	3.0	4.2	--	--	--	77.0	104.6	809.55
P-37	Mudstone	WOM-2963	4.4	2.1	--	--	--	87.8	109.0	818.79
P-36	Phosphate rock, argillaceous	WOM-2962	0.5	22.1	--	--	--	37.8	109.5	829.84
P-35	Mudstone	WOM-2961	4.7	4.2	--	--	--	74.1	114.2	849.58
P-34	Phosphate rock, argillaceous	WOM-2960	0.5	25.3	--	--	--	24.9	114.7	862.23
P-33	Mudstone; fos. col. no. 48-JES-224	WOM-2959	1.7	1.2	--	--	--	86.5	116.4	864.27
P-32	Phosphate rock and mudstone	WOM-2958	0.7	21.3	--	--	--	35.5	117.1	879.18
P-31	Mudstone; fos. col. no. 48-JES-223	WOM-2957	0.8	2.6	--	--	--	82.7	117.9	881.26
P-30	Mudstone, phosphatic, calcareous	WOM-2956	2.4	14.5	--	--	--	38.7	120.3	916.06
P-29	Mudstone	WOM-2955	1.8	3.2	--	--	--	75.9	122.1	921.82
P-28	Mudstone	WOM-2954	0.7	3.3	--	--	--	75.7	122.8	924.13
P-27	Mudstone	WOM-2953	0.8	1.5	--	--	--	83.3	123.6	925.33
P-26	Mudstone	WOM-2952	1.0	4.9	--	--	--	68.9	124.6	930.23
P-25	Phosphate rock, argillaceous, calcareous	WOM-2951	0.4	16.4	--	--	--	31.7	125.0	936.79
P-24	Mudstone, calcareous	WOM-2950	1.1	6.7	--	--	--	53.7	126.1	944.16
P-23	Mudstone, phosphatic, calcareous	WOM-2949	3.0	13.4	--	--	--	42.0	129.1	984.36
P-22	Phosphate rock, calcareous, argillaceous	WOM-2948	2.5	21.4	--	--	--	21.3	131.6	1,037.86
P-21	Mudstone, phosphatic	WOM-2947	0.6	13.3	--	--	--	42.3	132.2	1,045.84
P-20	Phosphate rock	WOM-2946	2.6	26.7	--	--	--	14.8	134.8	1,115.26
P-19	Phosphate rock, argillaceous	WOM-2945	1.0	17.4	--	--	--	35.2	135.8	1,132.66
P-18	Limestone	WOM-2944	2.0	2.8	--	--	--	13.3	137.8	1,138.26
P-17	Mudstone, phosphatic, calcareous	WOM-2943	2.3	12.0	--	--	--	48.7	140.1	1,165.86
P-16	Limestone, argillaceous	WOM-2942	2.1	1.5	--	--	--	21.6	142.2	1,169.01
P-15	Limestone, phosphatic, argillaceous	WOM-2941	0.4	11.7	--	--	--	20.0	142.6	1,173.69
P-14	Phosphate rock, argillaceous	WOM-2940	2.9	25.6	2.1	0.80	8.74	21.7	145.5	1,247.93
P-13	Phosphate rock, argillaceous	WOM-2939	1.0	19.0	5.1	1.7	7.20	37.8	146.5	1,266.93
P-12	Phosphate rock, argillaceous	WOM-2938	0.7	21.35	2.6	1.3	5.92	34.6	147.2	1,281.87
P-11	Phosphate rock	WOM-2937	1.3	27.6	2.7	1.1	6.76	19.7	148.5	1,317.75
P-10	Phosphate rock, argillaceous	WOM-2936	1.0	25.6	2.5	0.79	9.02	20.8	149.5	1,343.35
P- 9	Mudstone; fos. col. no. 48-JES-222	WOM-2935	0.3	3.0	8.9	2.8	7.60	77.8	149.8	1,344.25
P- 8	Phosphate rock, argillaceous; fos. col. no. 48-JES-221	WOM-2934	1.3	22.3	4.0	3.9	6.54	28.5	151.1	1.373.24

P- 7	Phosphate rock, argillaceous; fos. col. no. 48-JES-220	WOM-2933	1.0	25.1	2.8	1.7	7.90	23.2	152.1	1,398.34
P- 6	Phosphate rock	WOM-2932	1.9	33.0	1.2	0.63	7.38	5.8	154.0	1,461.04
P- 5	Phosphate rock	WOM-2931	3.6	33.7	0.81	0.48	7.92	4.7	157.6	1,582.36
P- 4	Phosphate rock; fos. col. no. 48-JES-219	WOM-2890	1.4	26.5	3.1	1.2	8.10	18.1	159.0	1,619.46
P- 3	Mudstone, calcareous, phosphatic	WOM-2889	1.5	8.5	--	--	--	53.5	160.5	1,632.21
P- 2	Mudstone	WOM-2874	0.9	3.9	--	--	--	66.7	161.4	1,635.72
P- 1	Phosphate rock	WOM-2873	0.2	32.8	--	--	--	5.3	161.6	1,642.28
	Wells formation									
Cw-1	Limestone; fos. col. no. 48-JES-218	WOM-2872	1.5	1.6	--	--	--	3.7	1.5	2.40

DEER CREEK, IDAHO. LOT NO. 1268.

Phosphatic shale member of Phosphoria formation sampled in Trench I (hand trench) on north side of Deer Creek, S½SW¼ sec. 34, T. 9 S., R. 45 E., Caribou County, Idaho. Section measured and partially sampled by C. F. Deiss in 1944.[1] Unsampled part of section remeasured by R. P. Sheldon and sampled by R. G. Waring in 1948. All I series samples analyzed by Tennessee Valley Authority. All RPS series samples analyzed by U. S. Bureau of Mines Laboratory, Albany, Oregon.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
	Phosphatic shale member of Phosphoria formation						
P-82	Phosphate rock, calcareous	57-I	0.3	24.1	14.9	0.3	7.23
P-81	Mudstone, calcareous	RPS-2837	0.8	2.1	64.8	1.1	8.91
P-80	Mudstone, phosphatic	RPS-2836	1.0	5.2	--	2.1	14.11
P-79	Mudstone, calcareous	RPS-2835	2.0	1.6	69.7	4.1	17.31
P-78	Mudstone, calcareous	RPS-2834	6.0	0.3	57.1	10.1	19.11
P-77	Mudstone, calcareous	RPS-2833	0.4	0.4	74.4	10.5	19.27
P-76	Mudstone, calcareous	RPS-2832	4.5	2.3	67.9	15.0	29.62
P-75	Limestone	RPS-2831	2.3	0.9	13.4	17.3	31.69
P-74	Mudstone and phosphate rock	RPS-2830	0.7	11.4	62.2	18.0	39.67
P-73	Mudstone	RPS-2829	1.8	1.9	78.9	19.8	43.09
P-72	Phosphate rock	RPS-2828	0.5	27.4	11.2	20.3	56.79
P-71	Mudstone, calcareous	RPS-2827	3.4	1.4	74.4	23.7	61.55
	RPS-2827 through RPS-2837 equivalent to Deiss' unit nos. 69 through 73.						
P-70	Phosphate rock	56-I	0.8	35.5	4.4	24.5	89.95
P-69	Phosphate rock	55-I	1.3	33.8	6.8	25.8	133.89
P-68	Mudstone, phosphatic	54-I	0.8	9.0	61.8	26.6	134.61
P-67	Limestone	--	0.9	--	--	27.5	--
P-66	Phosphate rock and mudstone	53-I	2.3	21.8	30.5	29.8	50.14*
P-65	Phosphate rock	52-I	1.7	32.0	6.4	31.5	104.54
P-64	Phosphate rock and mudstone	51-I	1.8	17.0	40.7	33.3	135.14
P-63	Phosphate rock	50-I	1.0	34.4	4.7	34.3	169.54
P-62	Phosphate rock	49-I	2.0	34.3	4.6	36.3	238.14
P-61	Phosphate rock, contains limestone nodules	48-I	2.5	20.1	11.1	38.8	288.39
P-60	Phosphate rock	47-I	3.5	25.4	12.5	42.3	377.29
P-59	Phosphate rock, contains limestone nodules	46-I	3.8	18.1	29.6	46.1	446.07
P-58	Limestone, argillaceous	45-I	2.5	2.3	35.1	48.6	451.82
P-57	Phosphate rock and mudstone	44-I	1.7	16.7	32.2	50.3	480.21
P-56	Mudstone, phosphatic	43-I	4.2	13.0	47.1	54.5	534.81
P-55	Phosphate rock	42-I	0.9	28.0	18.7	55.4	560.01
P-54	Mudstone	41-I	1.4	6.0	69.8	56.8	568.41
P-53	Phosphate rock, argillaceous	40-I	0.5	24.2	22.8	57.3	580.51

P-52	Mudstone, phosphatic	39-I	2.4	10.7	59.5	59.7	606.19
P-51	Limestone	RPS-2826	1.0	1.3	12.0	60.7	607.49
	RPS-2826 equivalent to Deiss' unit no. 49.						
P-50	Mudstone, calcareous	38-I	1.3	3.2	59.3	62.0	611.65
P-49	Mudstone, phosphate rock, and limestone	37-I	1.8	14.6	39.9	63.8	637.93
P-48	Mudstone	36-I	2.2	2.2	78.7	66.0	642.77
P-47	Mudstone	35-I	1.5	4.7	64.5	67.5	649.82
P-46	Mudstone	34-I	2.7	2.6	76.3	70.2	656.84
P-45	Phosphate rock and mudstone	33-I	1.5	13.4	43.8	71.7	676.94
P-44	Phosphate rock and mudstone	32-I	1.2	22.6	25.8	72.9	704.06
P-43	Mudstone	31-I	7.3	2.4	66.5	80.2	721.58
P-42	Phosphate rock and mudstone	30-I	1.2	17.5	42.9	81.4	742.58
P-41	Mudstone and phosphate rock	29-I	0.7	9.6	58.2	82.1	749.30
P-40	Limestone and mudstone, phosphatic	28-I	1.4	12.6	27.4	83.5	766.94
P-39	Limestone	--	0.3	--	--	83.8	--
P-38	Mudstone, limestone, and phosphate rock	27-I	3.3	9.6	39.7	87.1	31.68
P-37	Mudstone, phosphate rock, and limestone	26-I	2.0	7.9	30.4	89.1	47.48
P-36	Mudstone, phosphatic and limestone	25-I	3.6	9.4	35.6	92.7	81.32
P-35	Limestone	RPS-2825	2.7	0.1	12.4	95.4	81.59
	RPS-2825 equivalent to Deiss' unit no. 33.						
P-34	Mudstone, calcareous	24-I	1.8	2.0	65.1	97.2	85.19
P-33	Mudstone, phosphatic	23-I	2.0	9.2	53.3	99.2	103.59
P-32	Limestone	RPS-2824	2.5	0.2	11.8	101.7	104.09
	RPS-2824 equivalent to Deiss' unit no. 30.						
P-31	Mudstone	22-I	1.2	2.0	76.5	102.9	106.49
P-30	Limestone	21-I	4.3	0.3	17.2	107.2	107.78
P-29	Mudstone	20-I	4.2	2.5	74.0	111.4	118.28
--	Limestone concretion	RPS-2823	(0.6)	0.6	3.2	--	--
	RPS-2823 equivalent to Deiss' unit no. 26. Concretion occurs between Deiss-25 and Deiss-27.						
--	Limestone concretion	RPS-2822	(1.1)	0.7	4.4	--	--
	RPS-2822 occurs within Deiss' unit no. 25.						

[1] The full section was measured but only part of the section was sampled by Deiss. The I series sample data here listed are taken from table 9, p. 91 of Deiss' report. The beds not sampled by Deiss are included in the columnar section for Trench I (as shown on plates 6 and 7 of Deiss' report) and are there identified by unit numbers which do not correspond to the sample numbers of table 9. The beds sampled by Sheldon (RPS series) are correlated with the unit numbers of Deiss.

* Cumulative data incomplete due to missing information. Computations start from zero after interruption.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P_2O_5 (cumulative)
				P_2O_5	Acid insoluble		
P-28	Mudstone	19-I	5.2	2.4	74.0	116.6	130.76
P-27	Mudstone, phosphatic and limestone	18-I	4.5	7.3	53.7	121.1	163.61
P-26	Limestone	RPS-2821	1.1	1.7	18.8	122.2	165.48
	RPS-2821 equivalent to Deiss' unit no. 23.						
P-25	Phosphate rock, argillaceous and limestone	17-I	3.4	13.6	29.2	125.6	211.72
--	Limestone concretion?	RPS-2819	(1.2)	1.4	2.3	--	--
	RPS-2819 eqivalent to Deiss' unit no. 21 and occurs between RPS-2820 and Deiss-22.						
P-24	Phosphate rock and calcareous mudstone	RPS-2820	0.5	15.9	31.0	126.1	219.67
P-23	Mudstone, phosphatic and limestone	16-I	4.3	12.0	37.9	130.4	271.27
P-22	Limestone	RPS-2818	1.2	0.9	3.0	131.6	272.35
	RPS-2818 equivalent to Deiss' unit no. 19.						
P-21	Mudstone, phosphatic	15-I	2.4	10.2	47.0	134.0	296.83
P-20	Phosphate rock, calcareous, argillaceous	14-I	1.2	20.4	22.2	135.2	321.31
P-19	Phosphate rock, calcareous	13-I	1.5	23.3	14.5	136.7	356.26
P-18	Phosphate rock and mudstone	12-I	2.8	23.9	17.0	139.5	423.18
P-17	Phosphate rock and mudstone	11-I	1.9	23.9	17.6	141.4	468.59
P-16	Limestone, argillaceous	10-I	3.0	5.1	20.9	144.4	483.89
P-15	Mudstone, calcareous, phosphatic	9-I	2.7	9.2	45.8	147.1	508.73
P-14	Limestone, argillaceous	RPS-2812	2.5	0.6	20.9	149.6	510.23
	RPS-2812 equivalent to Deiss' unit no. 11.						
P-13	Phosphate rock and mudstone	8-I	2.7	25.2	18.4	152.3	578.27
P-12	Phosphate rock, mudstone, and limestone	7-I	3.5	18.7	34.9	155.8	643.72
P-11	Phosphate rock and mudstone	6-I	7.6	25.4	17.6	163.4	836.76
--	Limestone concretion	RPS-2811	(0.6)	9.8	12.8	--	--
	RPS-2811 concretion occurs within RPS-2810.						
P-10	Phosphate rock and calcareous mudstone	RPS-2810	1.7	24.9	15.7	165.1	879.09
P- 9	Limestone	RPS-2809	1.1	2.3	6.5	166.2	904.39
	RPS-2809 and RPS-2810 equivalent to Deiss' unit no. 7.						
P- 8	Phosphate rock, argillaceous	5-I	3.0	21.9	34.6	169.2	970.09
P- 7	Limestone	RPS-2808	1.6	6.6	6.9	170.8	980.65
	RPS-2808 equivalent to Deiss' unit no. 5.						
P- 6	Phosphate rock	4-I	0.8	28.0	8.1	171.6	1,003.05

P- 5	Phosphate rock	3-I	3.2	32.1	4.1	174.8	1,105.77
P- 4	Phosphate rock	2-I	1.5	33.0	3.9	176.3	1,155.27
P- 3	Mudstone	1-I	0.9	2.9	71.8	177.2	1,157.88
P- 2	Limestone, argillaceous	RPS-2807	3.5	0.3	38.8	180.7	1,158.93
P- 1	Phosphate rock	RPS-2806	0.5	31.2	6.8	181.2	1,174.53**
			Wells formation				
Cw-5	Limestone	RPS-2817	7.0	1.2	5.6	7.0	8.40
Cw-4	Phosphate rock	RPS-2816	0.1	33.4	4.2	7.1	11.74
Cw-3	Limestone	RPS-2815	3.0	1.9	3.8	10.1	17.44
Cw-2	Phosphate rock	RPS-2814	0.1	34.6	5.9	10.2	20.90
Cw-1	Limestone	RPS-2813	1.8	0.7	6.1	12.0	22.16

** Note incompleteness of cumulative data.

GPO 83-51428