



STRATIGRAPHIC SECTIONS OF THE  
PHOSPHORIA FORMATION IN  
IDAHO, 1949, PART 1

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UNITED STATES DEPARTMENT OF THE INTERIOR  
Douglas McKay, Secretary

GEOLOGICAL SURVEY  
W. E. Wrather, Director

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By R. P. Sheldon, M. A. Warner, M. E. Thompson, and H. W. Peirce

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

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## INTRODUCTION

The U. S. Geological Survey has recently measured and sampled the Phosphoria formation at many localities in Idaho and other western states. These data will not be fully synthesized and analyzed for several years, but segments of the data, accompanied by little or no interpretation, are published as preliminary reports as they are assembled. This report, which contains abstracts of many of the sections measured in southeastern Idaho (fig. 1), is one of this series and is the fourth report on Idaho; it includes about half the data gathered in Idaho in 1949. The field and laboratory procedures adopted in these investigations are described rather fully in a previous report (McKelvey and others, 1953a).

Many people have taken part in this investigation, which was organized and supervised by V. E. McKelvey. F. J. Anderson, D. F. Davidson, R. S. Jones, R. A. Smart, R. G. Waring, and J. D. Weiser participated in the description of strata and the collection of samples referred to in this report. T. K. Rigby assisted in the preparation of trenches and the collection, crushing, and splitting of samples in the field. The laboratory preparation of samples for chemical analyses was done in Denver, Colo., under the direction of W. P. Huleatt.

The  $P_2O_5$  and acid-insoluble analyses were made for the Survey by the U. S. Bureau of Mines at the Northwest Electrodevelopment Laboratory, Albany, Oreg., under the direction of S. M. Shelton

and M. L. Wright. The  $Al_2O_3$ ,  $Fe_2O_3$ , and loss-on-ignition analyses were made in the Trace Elements Section laboratory of the Survey in Washington, D. C., under the direction of J. C. Rabbitt, by chemists H. Alberty, I. Barlow, A. Caemmerer, F. J. Flanagan, F. S. Grimaldi, N. Gutttag, C. Hoy, J. J. Rowe, and W. P. Tucker, and the spectrographic analyses were made in this laboratory by K. Valentine and C. L. Waring.

The data were compiled largely by K. S. Bergman under the supervision of R. W. Swanson. Organization of the tabular data was by Anita Wise.

## 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.

It is a pleasure to acknowledge the fine cooperation extended to the field parties 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 Co.; D. L. King of the San Francisco Chemical Co.; and G. A. McHugh and H. B. Fowler of the Simplot Fertilizer Co. have been especially helpful in this connection.



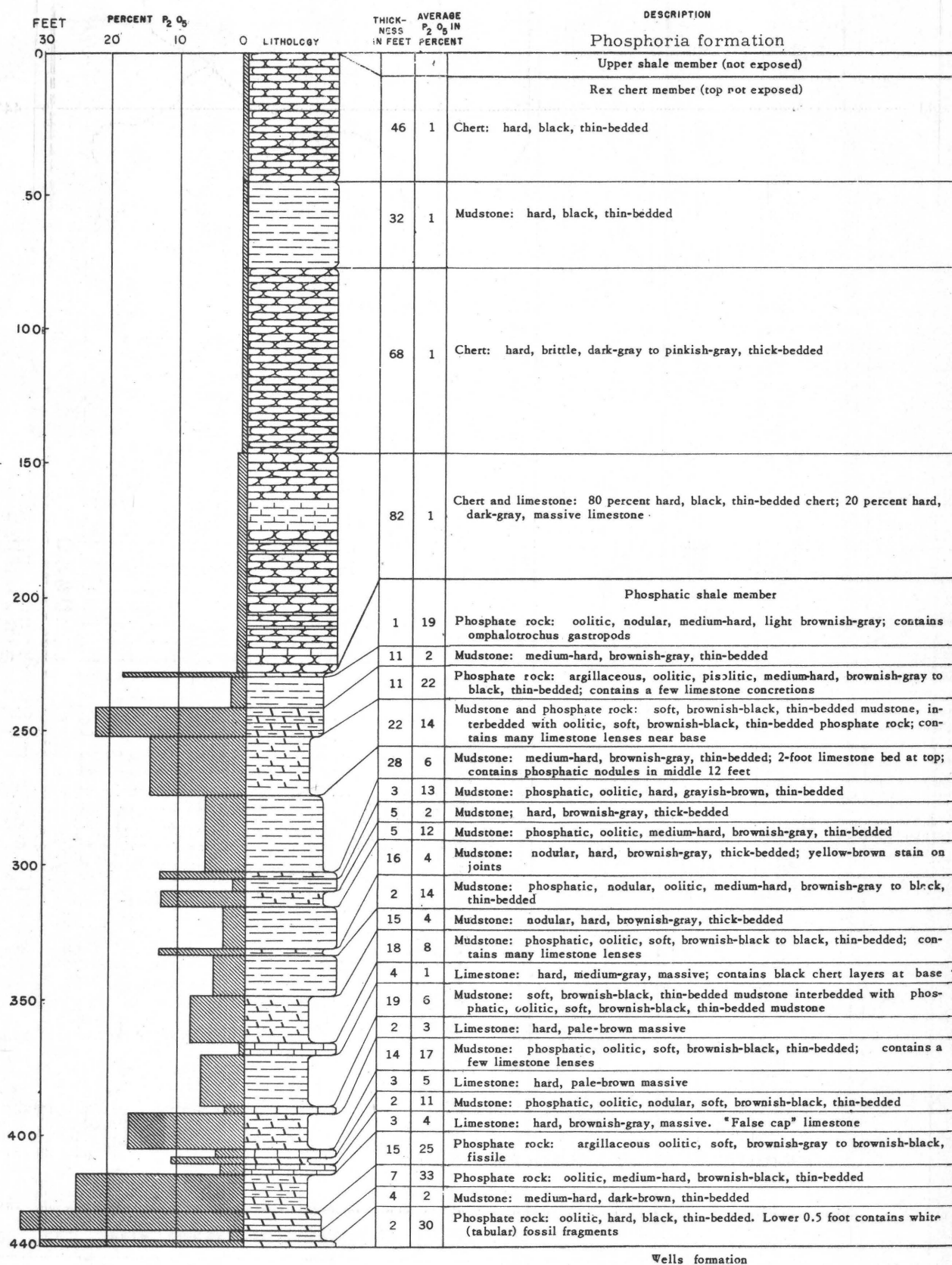


Figure 2. —Generalized section of the Phosphoria formation at Trail Canyon, Idaho, lot no. 1206.

## 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 member in most of southeastern Idaho and western Wyoming, although 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 a 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 seven localities, and the available analytical data, are presented in the following pages. Their locations, as well as the locations of sections reported previously (McKelvey and others, 1953a and b, and O'Malley and others, 1953) and of others to be reported later, are shown in figure 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 listed below:

### Spectrographic sensitivities

Percent	Percent	Percent	Percent
Al----- 0.0001	Gd----- 0.01	Nd----- 0.01	Na----- *0.1
Sb----- .01	Ga----- .01	Ni----- .01	Sr----- .01
As----- .1	Ge----- .001	Nb----- .01	Ta----- .1
Ba----- .0001	Au----- .01	Os----- .1	Te----- .1
Be----- .0001	Hf----- .1	Pd----- .01	Tb----- .01
Bi----- .001	Ho----- .01	P----- .1	Tl----- .1
B----- .001	In----- .001	Pt----- .01	Th----- .1
Cd----- .01	Ir----- .1	K----- *1.0	Tm----- .01
Ca----- .001	Fe----- .001	Pr----- .01	Sn----- .01
Ce----- .1	La----- .01	Re----- .1	Ti----- .001
Cs----- *1.0	Pb----- .01	Rh----- .01	W----- .1
Cr----- .001	Li----- *.1	Rb----- *10.0	V----- .01
Co----- .01	Lu----- .01	Ru----- .01	Yb----- .0001
Cu----- .0001	Mg----- .0001	Sm----- .1	Y----- .001
Dy----- .01	Mn----- .001	Sc----- .001	Zn----- .01
Er----- .01	Hg----- .1	Si----- .0001	Zr----- .001
Eu----- .01	Mo----- .001	Ag----- .0001	

\*A greater sensitivity may be obtained by additional exposures.

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Timber Creek, Idaho, lot 1310

Phosphatic shale member of the Phosphoria formation sampled in bulldozer trench on east limb of Snowdrift anticline, S $\frac{1}{2}$  sec. 21, T. 8 S., R. 45 E., Caribou County, Idaho. Section measured by M. A. Warner, R. G. Waring, R. A. Smart, J. D. Weiser, and M. E. Thompson and sampled by Smart, Waring, H. W. Peirce, and Warner in August 1949. Samples analyzed for P<sub>2</sub>O<sub>5</sub> and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)	
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble			
Rex chert member of Phosphoria formation—basal bed only											
R- 11	Chert-----	4235-MAW	2.2	0.5	--	--	--	94.0	2.2	--	
Phosphatic shale member of Phosphoria formation											
P-115	Mudstone -----	4234-MAW	1.5	1.7	--	--	--	91.0	1.5	2.55	
P-114	Mudstone and phosphate rock-----	4233-MAW	1.2	10.4	--	--	--	60.6	2.7	15.03	
P-113	Mudstone -----	4232-MAW	2.7	4.7	--	--	--	71.5	5.4	27.72	
P-112	Mudstone -----	4031-MAW	1.5	5.1	--	--	--	65.7	6.9	35.37	
P-111	Mudstone -----	4030-MAW	1.8	1.8	--	--	--	78.6	8.7	38.61	
P-110	Mudstone -----	4029-MAW	2.5	2.0	--	--	--	79.1	11.2	43.61	
P-109	Mudstone, carbonatic -----	4228-MAW	2.7	.6	--	--	--	68.8	13.9	45.23	
P-108	Mudstone -----	4227-MAW	1.3	.6	--	--	--	82.9	15.2	46.01	
P-107	Mudstone -----	4226-MAW	2.0	1.6	--	--	--	78.0	17.2	49.21	
P-106	Mudstone -----	4459- RGW	.9	1.1	--	--	--	80.5	18.1	50.20	
P-105	Mudstone -----	4458- RGW	.6	3.0	--	--	--	65.6	18.7	52.00	
P-104	Mudstone -----	4457- RGW	3.3	3.0	--	--	--	73.6	22.0	61.90	
P-103	Phosphate rock, argillaceous -----	4456- RGW	.7	28.2	--	--	--	20.2	22.7	81.64	
P-102	Mudstone -----	4455- RGW	3.0	3.8	--	--	--	71.9	25.7	93.04	
P-101	Phosphate rock-----	4454- RGW	1.7	35.7	0.86	0.35	4.75	3.4	27.4	153.73	
P-100	Phosphate rock-----	4453- RGW	1.3	36.0	.85	.33	5.55	3.2	28.7	200.53	
P- 99	Phosphate rock and mudstone -----	4452- RGW	1.2	29.6	2.98	1.05	4.50	17.5	29.9	236.05	
P- 98	Mudstone -----	4451- RGW	1.0	6.2	9.05	2.78	5.65	71.3	31.5	245.97	
P- 97	Phosphate rock, argillaceous, and phosphatic mudstone-----	4450- RGW	1.0	21.1	6.98	2.10	4.80	36.7	32.5	267.07	
P- 96	Phosphate rock-----	5209- RGW	1.0	34.4	1.34	.60	2.75	8.2	33.5	301.47	
P- 95	Phosphate rock-----	5208- RGW	1.9	32.5	1.84	.80	2.80	12.7	35.4	363.22	
P- 94	Phosphate rock, argillaceous -----	5207- RGW	.7	25.1	3.90	1.13	3.70	28.5	36.1	380.79	
P- 93	Phosphate rock, argillaceous -----	5206- RGW	.6	24.1	4.06	1.38	4.90	30.6	36.7	395.25	
P- 92	Phosphate rock; argillaceous and mudstone-----	5205- RGW	.8	15.4	6.08	1.98	6.93	46.9	37.5	407.57	
P- 91	Phosphate rock, argillaceous -----	4445- RAS	1.1	18.6	5.68	2.00	5.50	43.0	38.6	428.03	
P- 90	Phosphate rock-----	4444- RAS	1.1	30.8	2.46	.75	3.45	14.5	39.7	461.91	
P- 89	Phosphate rock-----	4443- RAS	.9	37.1	1.34	.33	3.15	3.6	40.6	495.30	
P- 88	Phosphate rock-----	4442- RAS	2.2	35.5	1.18	.55	4.88	4.0	42.8	573.40	

Timber Creek—Continued

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
P-87	Phosphate rock, argillaceous -----	4441- RAS	2.3	23.6	4.15	1.80	11.50	18.4	45.1	627.68
P-86	Phosphate rock -----	4440- RAS	1.9	29.1	1.94	1.33	10.95	10.3	47.0	682.97
P-85	Phosphate rock, argillaceous -----	4439- RAS	1.9	24.9	3.35	1.78	15.00	17.6	48.9	730.28
P-84	Phosphate rock, argillaceous -----	4438- RAS	1.2	24.5	3.60	1.23	15.70	18.7	50.1	759.68
P-83	Phosphate rock, argillaceous -----	4437- RAS	2.3	23.7	4.10	1.35	13.50	22.3	52.4	814.19
P-82	Mudstone, phosphatic -----	4436- RAS	1.8	12.5	--	--	--	46.8	54.2	836.69
P-81	Mudstone, phosphatic -----	4435- RAS	1.4	8.7	--	--	--	61.6	55.6	848.87
P-80	Carbonate rock -----	5756- JDW	.5	5.3	--	--	--	6.5	56.1	851.52
P-79	Mudstone -----	5755- JDW	.9	2.2	--	--	--	76.7	57.0	853.50
P-78	Mudstone, phosphatic -----	5754- JDW	.8	15.6	--	--	--	39.7	57.8	865.98
P-77	Mudstone, phosphatic -----	5753- JDW	4.3	14.4	--	--	--	42.2	62.1	927.90
P-76	Phosphate rock, argillaceous, and mudstone -----	5752- JDW	2.0	17.8	--	--	--	38.2	64.1	963.50
--	Mudstone lens -----	5751- JDW	(.7)	6.15	--	--	--	67.8	--	--
P-75	Phosphate rock, argillaceous -----	5750- JDW	.7	19.7	--	--	--	35.5	64.8	977.29
P-74	Mudstone, phosphatic -----	5749- JDW	.7	8.0	--	--	--	63.5	65.5	982.89
P-73	Mudstone, phosphatic -----	5748- JDW	.7	15.3	--	--	--	48.3	66.2	993.60
P-72	Mudstone, phosphatic -----	5747- JDW	.8	13.2	--	--	--	52.2	67.0	1,004.16
P-71	Phosphate rock, argillaceous -----	5746- DFD	1.3	28.4	--	--	--	20.5	68.3	1,041.08
P-70	Mudstone, phosphatic -----	5765-MET	.8	9.3	--	--	--	67.3	69.1	1,048.52
P-69	Mudstone, phosphatic -----	5764-MET	1.2	15.3	--	--	--	52.8	70.3	1,066.88
P-68	Mudstone, phosphatic -----	5763-MET	2.4	13.5	--	--	--	55.0	72.7	1,099.28
P-67	Mudstone, phosphatic -----	5762-MET	2.0	8.2	--	--	--	69.0	74.7	1,115.68
P-66	Mudstone, phosphatic -----	5761-MET	2.1	8.5	--	--	--	66.7	76.8	1,133.53
P-65	Phosphate rock, argillaceous -----	5760-MET	1.2	23.0	--	--	--	29.5	78.0	1,161.13
P-64	Phosphate rock, argillaceous and mudstone -----	5745-MET	2.4	9.2	--	--	--	61.6	80.4	1,183.21
P-63	Mudstone -----	5744-MET	1.1	3.0	--	--	--	77.0	81.5	1,186.51
P-62	Mudstone -----	5743-MET	.9	2.2	--	--	--	80.9	82.4	1,188.49
P-61	Mudstone -----	5742-MET	1.2	2.8	--	--	--	78.9	83.6	1,191.85
P-60	Mudstone -----	5741-MET	2.9	4.9	--	--	--	69.7	86.5	1,206.06
P-59	Mudstone -----	5740-MET	.6	2.4	--	--	--	80.0	87.1	1,207.50
P-58	Mudstone -----	5739-MET	1.1	5.5	--	--	--	72.3	88.2	1,213.55
P-57	Phosphate rock and mudstone -----	5738-MET	1.7	8.7	--	--	--	51.2	89.9	1,228.34
P-56	Mudstone, phosphatic -----	5737-MET	.7	9.9	--	--	--	59.5	90.6	1,235.27
P-55	Mudstone -----	5736-MET	1.0	7.7	--	--	--	59.2	91.6	1,242.97
P-54	Chert, phosphatic -----	5735-MET	2.4	11.0	--	--	--	62.9	94.0	1,269.37
P-53	Mudstone -----	5734-MET	2.0	.7	--	--	--	86.7	96.0	1,270.77
P-52	Mudstone -----	5733-MET	1.5	2.3	--	--	--	83.8	97.5	1,274.22
P-51	Chert, phosphatic -----	5732-MET	2.4	8.9	--	--	--	68.7	99.9	1,295.58

P-50	Mudstone -----	5731-MET	3.3	.7	--	--	--	86.2	103.2	1,297.89
P-49	Mudstone -----	5730-MET	1.2	1.0	--	--	--	86.6	104.4	1,299.09
P-48	Chert, phosphatic -----	5729-MET	4.9	15.5	--	--	--	50.1	109.3	1,375.04
P-47	Mudstone, phosphatic -----	5728-MET	.9	9.7	--	--	--	59.6	110.2	1,383.77
P-46	Mudstone -----	5727-MET	2.1	6.1	--	--	--	68.8	112.3	1,396.58
P-45	Mudstone -----	5726-MET	2.4	6.4	--	--	--	65.6	114.7	1,411.94
P-44	Phosphate rock, argillaceous -----	5779-JDW	1.7	23.2	--	--	--	15.2	116.4	1,451.38
P-43	Mudstone and phosphatic mudstone -----	5778-JDW	1.9	10.4	--	--	--	51.5	118.3	1,471.14
P-42	Mudstone, phosphatic -----	5777-JDW	4.2	14.1	--	--	--	36.6	122.5	1,530.36
P-41	Mudstone, phosphatic -----	5776-JDW	1.9	8.4	--	--	--	60.7	124.4	1,546.32
P-40	Carbonate rock, argillaceous -----	5759-JDW	1.7	1.0	--	--	--	29.1	126.1	1,548.02
P-39	Carbonate rock, argillaceous -----	5758-JDW	1.2	1.1	--	--	--	43.6	127.3	1,549.34
P-38	Mudstone -----	5757-JDW	1.2	2.5	--	--	--	78.0	128.5	1,552.34
P-37	Mudstone, carbonatic -----	5773-MET	2.3	1.2	--	--	--	54.3	130.8	1,555.10
P-36	Mudstone -----	5772-MET	1.3	2.7	--	--	--	64.3	132.1	1,558.61
P-35	Mudstone -----	5771-MET	1.5	2.0	--	--	--	74.3	133.6	1,561.61
P-34	Mudstone, cherty -----	5770-MET	.9	2.0	--	--	--	85.3	134.5	1,563.41
P-33	Mudstone -----	5769-MET	2.0	3.5	--	--	--	72.3	136.5	1,570.41
P-32	Mudstone -----	5768-MET	4.6	5.0	--	--	--	66.7	141.1	1,593.41
P-31	Mudstone, phosphatic -----	5767-MET	3.2	8.7	--	--	--	57.7	144.3	1,621.25
P-30	Mudstone, carbonatic -----	5766-MET	.7	5.7	--	--	--	52.7	145.0	1,625.24
P-29	Phosphate rock, argillaceous -----	5725-JDW	3.5	18.2	--	--	--	31.9	148.5	1,688.94
P-28	Mudstone, phosphatic -----	5724-JDW	1.3	10.4	--	--	--	56.1	149.8	1,702.46
P-27	Mudstone, phosphatic -----	5723-JDW	2.7	14.8	--	--	--	42.2	152.5	1,742.42
P-26	Mudstone, phosphatic -----	5722-JDW	3.2	14.2	--	--	--	40.1	155.7	1,787.86
Bed P-26 is highly crumpled and weathered.										
P-25	Mudstone, phosphatic -----	5721-JDW	1.5	15.4	--	--	--	45.4	157.2	1,810.96
P-24	Phosphate rock, argillaceous -----	5720-JDW	1.7	25.3	--	--	--	17.6	158.9	1,853.97
P-23	Phosphate rock, argillaceous -----	5719-JDW	1.2	25.4	--	--	--	22.5	160.1	1,884.45
P-22	Mudstone, phosphatic -----	5718-JDW	3.0	15.8	--	--	--	47.5	163.1	1,931.85
P-21	Mudstone, phosphatic -----	5717-JDW	3.4	12.7	--	--	--	51.3	166.5	1,975.03
P-20	Mudstone, phosphatic -----	5716-JDW	1.5	8.8	--	--	--	61.5	168.0	1,988.23
P-19	Phosphate rock, argillaceous -----	5715-JDW	3.0	25.4	--	--	--	19.3	171.0	2,064.43
P-18	Phosphate rock, argillaceous -----	5714-JDW	2.1	21.0	--	--	--	31.9	173.1	2,108.53
P-17	Mudstone, phosphatic -----	5713-JDW	1.3	8.4	--	--	--	64.7	174.4	2,119.45
P-16	Phosphate rock -----	5712-JDW	5.0	31.5	1.53	.70	7.30	8.9	179.4	2,276.95
P-15	Phosphate rock -----	5711-JDW	1.4	29.4	2.04	.85	7.15	14.9	180.8	2,318.11
P-14	Mudstone, phosphatic -----	5710-JDW	1.0	16.3	6.20	2.05	9.35	40.5	181.8	2,334.41
P-13	Phosphate rock -----	5709-JDW	.9	30.4	2.30	.95	7.00	11.5	182.7	2,361.77
P-12	Phosphate rock, argillaceous -----	5708-MAW	.7	15.9	7.32	1.95	9.20	38.7	183.4	2,372.90
P-11	Phosphate rock, argillaceous -----	5707-MAW	2.4	27.4	3.30	1.18	6.75	16.2	185.8	2,438.66

Timber Creek—Continued

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-10	Phosphate rock, argillaceous -----	5706-MAW	1.2	25.0	2.76	1.48	5.67	24.8	187.0	2,468.66
P- 9	Phosphate rock, argillaceous -----	5705-MAW	2.1	22.5	4.65	2.00	7.50	24.3	189.1	2,515.91
P- 8	Phosphate rock-----	5704-MAW	1.9	32.1	1.47	2.88	6.40	3.5	191.0	2,576.90
P- 7	Phosphate rock-----	5239-MAW	2.9	33.1	.70	.53	7.55	2.3	193.9	2,672.89
P- 6	Phosphate rock-----	5703-MAW	1.2	31.6	1.17	.68	6.20	6.0	195.1	2,710.81
P- 5	Mudstone -----	5702-MAW	1.2	.3	--	--	--	75.3	196.3	2,711.17
P- 4	Mudstone -----	5701-MAW	2.4	.4	--	--	--	71.9	198.7	2,712.13
P- 3	Mudstone -----	4238-MAW	1.2	.7	--	--	--	70.3	199.9	2,712.97
P- 2	Mudstone -----	4237-MAW	.7	7.6	--	--	--	57.0	200.6	2,718.29
P- 1	Phosphate rock, argillaceous -----	4236-MAW	.5	26.4	--	--	--	15.5	201.1	2,731.49

South Stewart Canyon, Idaho, lot 1306

Phosphatic shale member of Phosphoria formation sampled in two hand trenches on overturned east limb of the Dry Valley anticline in South Stewart Canyon, SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 31, T. 8 S., R. 45 E., Caribou County, Idaho. Because of limitations of hand trenches and complicated local structure, the total thickness of the phosphatic shale member is probably in error. Section measured by R. P. Sheldon, R. G. Waring, M. A. Warner, D. F. Davidson, M. E. Thompson, J. D. Weiser, and H. W. Peirce and sampled by Waring, Warner, Peirce, and R. A. Smart in August 1949. Samples analyzed for P<sub>2</sub>O<sub>5</sub> and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Rex chert member of Phosphoria formation—basal beds only										
R- 3	Chert -----	4193-MET	--	0.4	--	--	--	92.4	--	--
R- 2	Mudstone -----	4192-MET	0.9	1.4	--	--	--	88.3	0.9	--
R- 1	Chert -----	4191-MET	.8	1.6	--	--	--	87.8	1.7	--
Phosphatic shale member of Phosphoria formation										
P-164	Mudstone -----	4190-MET	1.8	2.8	--	--	--	81.6	1.8	5.04
P-163	Phosphate rock, argillaceous -----	4189-MET	.8	17.8	--	--	--	37.6	2.6	19.28
P-162	Mudstone -----	4188-MET	1.2	2.2	--	--	--	72.2	3.8	21.92
P-161	Mudstone -----	4187-MET	2.2	3.6	--	--	--	66.3	6.0	29.84
--	Limestone concretion in bed P-160 -----	--	(.4)	--	--	--	--	--	--	--
P-160	Mudstone -----	4186-MET	2.9	1.2	--	--	--	77.5	8.9	33.32
P-159	Mudstone -----	4185-MET	3.7	.5	--	--	--	68.8	12.6	35.17
P-158	Mudstone -----	4184-MET	1.7	2.6	--	--	--	72.3	14.3	39.59
--	Limestone concretion in bed P-157 -----	--	(.3)	--	--	--	--	--	--	--
P-157	Mudstone -----	4183-MET	2.5	2.8	--	--	--	71.8	16.8	46.59
P-156	Mudstone, cherty -----	4182-MET	1.9	4.6	--	--	--	68.3	18.7	55.33
P-155	Mudstone, phosphatic -----	4181-MET	1.5	13.7	--	--	--	56.5	20.2	75.88
P-154	Chert -----	4180-MET	.6	2.2	--	--	--	90.7	20.8	77.20
P-153	Phosphate rock, argillaceous -----	4179-MET	.7	19.9	--	--	--	40.2	21.5	91.13
P-152	Mudstone -----	4178-MET	1.2	1.9	--	--	--	75.7	22.7	93.41
P-151	Mudstone, carbonatic -----	4177-MET	1.1	.3	--	--	--	47.1	23.8	93.74
P-150	Mudstone -----	4176-MET	1.5	2.5	--	--	--	64.6	25.3	97.49
P-149	Phosphate rock -----	4175-MET	.7	36.4	0.93	0.52	3.99	3.2	26.0	122.97
P-148	Phosphate rock -----	4174-MET	1.3	33.8	1.7	.79	5.19	6.9	27.3	166.91
P-147	Phosphate rock -----	4173-MET	1.0	36.9	.76	.47	2.55	4.0	28.3	203.81
P-146	Mudstone and argillaceous phosphate rock -----	4172-MET	1.1	6.3	--	--	--	67.9	29.4	210.74
P-145	Mudstone -----	4171-MET	1.1	3.2	--	--	--	71.8	30.5	214.26
P-144	Phosphate rock, argillaceous, and phosphatic mudstone -----	4138-JDW	.8	18.6	--	--	--	41.6	31.3	229.14

South Stewart Canyon—Continued

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-143	Phosphate rock -----	4137- JDW	0.8	34.4	1.3	0.72	2.88	8.6	32.1	256.66
P-142	Phosphate rock, argillaceous-----	4136- JDW	.5	27.8	3.0	1.15	4.22	22.1	32.6	270.56
P-141	Mudstone, phosphatic-----	4135- JDW	.5	10.9	7.9	3.97	5.40	56.9	33.1	276.01
P-140	Phosphate rock -----	4134- JDW	.65	35.6	1.0	.62	3.97	4.0	33.75	299.15
P-139	Mudstone, phosphatic-----	4133- JDW	.6	14.2	6.6	2.63	5.77	50.2	34.35	307.67
P-138	Phosphate rock -----	4132- JDW	1.9	31.2	2.1	.79	5.67	12.2	36.25	366.95
P-137	Mudstone, phosphatic-----	4131- JDW	1.2	9.5	3.2	2.94	6.21	63.0	37.45	378.35
P-136	Mudstone and phosphate rock -----	4130- JDW	1.1	12.0	6.8	2.62	6.15	56.7	38.55	391.55
P-135	Phosphate rock -----	4129- JDW	.9	33.2	1.5	.67	5.12	9.1	39.45	421.43
P-134	Phosphate rock, argillaceous-----	4128- JDW	.65	26.9	4.3	1.80	5.75	20.7	40.10	438.92
P-133	Phosphate rock -----	4127- JDW	2.1	36.6	.85	.45	5.13	2.3	42.20	515.78
P-132	Phosphate rock -----	4126- JDW	4.0	26.1	2.9	1.22	13.70	14.2	46.20	620.18
P-131	Phosphate rock, argillaceous-----	4125- JDW	5.0	24.1	3.5	1.66	14.66	18.2	51.20	740.68
P-130	Mudstone, phosphatic and mudstone -----	4124- JDW	3.7	13.9	--	--	--	39.8	54.90	792.10
P-129	Mudstone-----	4123- JDW	1.45	7.3	--	--	--	64.6	56.35	802.69
P-128	Mudstone-----	4538-MET	1.1	2.8	--	--	--	76.5	57.45	805.77
P-127	Mudstone, phosphatic-----	4537-MET	1.7	14.6	--	--	--	40.0	59.15	830.59
P-126	Mudstone, phosphatic-----	4536-MET	1.1	14.1	--	--	--	41.2	60.25	846.10
P-125	Mudstone, phosphatic-----	4535-MET	2.2	12.0	--	--	--	49.0	62.45	872.50
P-124	Mudstone, phosphatic-----	4534-MET	2.3	11.3	--	--	--	56.0	64.75	898.49
P-123	Phosphate rock and mudstone-----	4533-MET	2.3	20.9	--	--	--	37.5	67.05	946.56
P-122	Mudstone-----	4532-MET	1.4	6.0	--	--	--	71.4	68.45	954.96
P-121	Mudstone-----	4531-MET	1.2	5.5	--	--	--	75.0	69.65	961.56
P-120	Mudstone, phosphatic-----	4530-MET	2.2	14.5	--	--	--	50.9	71.85	993.46
P-119	Mudstone, phosphatic-----	4529-MET	4.2	8.0	--	--	--	68.5	76.05	1,027.06
P-118	Mudstone-----	4528-MET	1.6	6.4	--	--	--	72.6	77.65	1,037.30
P-117	Mudstone and phosphate rock -----	4527-MET	2.4	11.8	--	--	--	57.6	80.05	1,065.62
P-116	Mudstone, phosphatic-----	4526-MET	2.2	9.2	--	--	--	57.1	82.25	1,085.86
P-115	Mudstone-----	4160- RPS	1.4	4.1	--	--	--	72.9	83.65	1,091.60
P-114	Mudstone-----	4159- RPS	.7	2.6	--	--	--	76.1	84.35	1,093.42
P-113	Mudstone-----	4158- RPS	1.5	5.8	--	--	--	64.7	85.85	1,102.11
P-112	Mudstone-----	4157- RPS	3.5	3.5	--	--	--	75.1	89.35	1,114.36
P-111	Mudstone, carbonatic-----	4156- RPS	1.2	2.0	--	--	--	59.2	90.55	1,116.76
P-110	Mudstone, phosphatic and phosphate rock -----	4155- RPS	1.0	19.9	--	--	--	29.4	91.55	1,136.66
P-109	Mudstone, phosphatic-----	4154- RPS	1.7	8.5	--	--	--	60.5	93.25	1,151.11

P-108	Mudstone and phosphate rock -----	4153- RPS	2.4	8.0	--	--	--	51.2	95.65	1,170.31
P-107	Mudstone, phosphatic and mudstone -----	4152- RPS	1.8	8.1	--	--	--	56.8	97.45	1,184.89
P-106	Phosphate rock, argillaceous, and phosphatic mudstone -----	4151- RPS	1.2	18.2	--	--	--	31.1	98.65	1,206.73
P-105	Mudstone, phosphatic -----	4150- RPS	1.3	12.0	--	--	--	47.7	99.95	1,222.33
P-104	Mudstone -----	4149- RPS	2.4	5.9	--	--	--	63.5	102.35	1,236.49
P-103	Mudstone -----	4148- RPS	2.6	4.2	--	--	--	72.2	104.95	1,247.41
P-102	Mudstone -----	4147- RPS	.6	.6	--	--	--	83.5	105.55	1,247.77
P-101	Mudstone -----	4146- RPS	1.8	5.0	--	--	--	73.6	107.35	1,256.77
P-100	Mudstone, phosphatic and phosphate rock -----	4145- RPS	1.6	11.5	--	--	--	45.2	108.95	1,275.17
P- 99	Mudstone, phosphatic and phosphate rock -----	4144- RPS	1.9	21.8	--	--	--	28.4	110.85	1,316.59
P- 98	Mudstone -----	4143- RPS	1.6	2.7	--	--	--	76.4	112.45	1,320.91
P- 97	Mudstone and argillaceous phosphate rock -----	4142- RPS	1.4	13.5	--	--	--	41.6	113.85	1,339.81
P- 96	Mudstone, phosphatic -----	4141- RPS	1.5	8.8	--	--	--	51.2	115.35	1,353.01
P- 95	Phosphate rock, argillaceous, and phosphatic mudstone -----	4140- RPS	1.4	16.6	--	--	--	30.7	116.75	1,376.25
P- 94	Mudstone -----	4120- RPS	1.2	4.2	--	--	--	69.5	117.95	1,381.29
P- 93	Mudstone -----	5555- DFD	.9	6.5	--	--	--	60.7	118.85	1,387.14
P- 92	Mudstone -----	5554- DFD	.7	2.4	--	--	--	78.3	119.55	1,388.82
P- 91	Mudstone, phosphatic -----	5553- DFD	.4	13.2	--	--	--	55.2	119.95	1,394.10
P- 90	Mudstone -----	5552- DFD	1.7	1.6	--	--	--	79.9	121.65	1,396.82
P- 89	Mudstone -----	5551- DFD	.8	7.4	--	--	--	70.5	122.45	1,402.74
P- 88	Mudstone -----	5550- HWP	1.4	5.3	--	--	--	76.6	123.85	1,410.16
P- 87	Mudstone -----	5549- HWP	1.4	.5	--	--	--	87.7	125.25	1,410.86
P- 86	Mudstone -----	5548- HWP	.5	.4	--	--	--	88.3	125.75	1,411.06
P- 85	Phosphate rock -----	5547- HWP	1.5	29.1	--	--	--	17.3	127.25	1,454.71
P- 84	Mudstone -----	5546- HWP	1.3	2.9	--	--	--	81.1	128.55	1,458.48
P- 83	Mudstone -----	5545- HWP	2.5	1.1	--	--	--	84.6	131.05	1,461.23
P- 82	Mudstone -----	5544- HWP	.8	.5	--	--	--	87.8	131.85	1,461.63
P- 81	Mudstone -----	5543- HWP	1.6	.3	--	--	--	87.8	133.45	1,462.11
P- 80	Mudstone -----	5542- HWP	.5	1.4	--	--	--	84.3	133.95	1,462.81
P- 79	Phosphate rock, argillaceous -----	5541- HWP	1.5	18.6	--	--	--	41.4	135.45	1,490.71
P- 78	Chert -----	3050- MET	3.3	.7	--	--	--	86.1	138.75	1,493.02
P- 77	Chert -----	3049- MET	3.4	2.6	--	--	--	81.6	142.15	1,501.86
P- 76	Mudstone -----	3048- MET	1.6	.7	--	--	--	87.1	143.75	1,502.98
P- 75	Phosphate rock, argillaceous -----	3047- MET	.8	17.8	--	--	--	40.1	144.55	1,517.22
P- 74	Chert, phosphatic, argillaceous -----	3046- MET	2.2	24.4	--	--	--	28.1	146.75	1,570.90
P- 73	Mudstone, phosphatic -----	3045- MET	1.0	9.1	--	--	--	58.4	149.75	1,580.00
P- 72	Mudstone -----	3044- MET	.8	1.2	--	--	--	84.9	148.55	1,580.96
P- 71	Mudstone, phosphatic -----	3043- MET	2.3	9.5	--	--	--	61.8	150.85	1,602.81
P- 70	Mudstone, phosphatic -----	3042- MET	1.1	12.6	--	--	--	53.1	151.95	1,616.67

South Stewart Canyon—Continued

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-69	Mudstone -----	3041- MET	1.5	6.7	--	--	--	64.7	153.45	1,626.72
P-68	Mudstone, phosphatic, carbonatic -----	3040- MET	1.2	8.2	--	--	--	44.9	154.65	1,636.56
P-67	Phosphate rock, argillaceous -----	3039- MET	.9	20.4	--	--	--	26.4	155.55	1,654.92
P-66	Mudstone and argillaceous phosphate rock -	3038- MET	.8	7.8	--	--	--	59.6	156.35	1,661.16
P-65	Mudstone, phosphatic -----	3037- MET	2.3	9.8	--	--	--	48.6	158.65	1,683.70
P-64	Phosphate rock, argillaceous -----	3338- MET	1.3	14.6	--	--	--	34.3	159.95	1,702.68
P-63	Mudstone, phosphatic -----	3337- MET	1.1	13.3	--	--	--	39.9	161.05	1,717.31
P-62	Mudstone, phosphatic, carbonatic -----	4210- MET	3.3	8.0	--	--	--	44.2	164.35	1,743.72
P-61	Carbonate rock, cherty -----	4209- MET	2.7	.7	--	--	--	26.1	167.05	1,745.61
P-60	Carbonate rock -----	4208- MET	3.0	.3	--	--	--	16.3	170.05	1,746.51
P-59	Mudstone -----	4207- MET	1.7	.9	--	--	--	85.9	171.75	1,748.04
P-58	Chert, argillaceous -----	4206- MET	.9	1.3	--	--	--	87.8	172.65	1,749.21
P-57	Mudstone -----	4205- MET	2.9	2.3	--	--	--	77.4	175.55	1,755.88
P-56	Mudstone -----	4204- MET	4.9	2.4	--	--	--	80.9	180.45	1,767.64
P-55	Mudstone -----	4203- MET	5.0	6.7	--	--	--	69.3	185.45	1,801.14
P-54	Mudstone -----	4202- MET	1.7	.6	--	--	--	85.0	187.15	1,802.16
P-53	Mudstone -----	4201- MET	1.4	2.7	--	--	--	80.0	188.55	1,805.94
P-52	Mudstone -----	4200- MET	.9	1.5	--	--	--	83.7	189.45	1,807.29
P-51	Mudstone -----	4199- MET	2.0	4.2	--	--	--	72.9	191.45	1,815.69
P-50	Mudstone, phosphatic -----	4198- MET	2.1	14.6	--	--	--	46.7	193.55	1,846.35
P-49	Mudstone -----	4197- MET	1.9	6.3	--	--	--	67.7	195.45	1,858.32
P-48	Mudstone -----	4196- MET	.9	4.0	--	--	--	76.4	196.35	1,861.92
P-47	Mudstone, phosphatic -----	4195- MET	1.3	8.4	--	--	--	54.2	197.65	1,872.84
P-46	Mudstone, phosphatic -----	4194- MET	5.0	14.1	--	--	--	38.5	202.65	1,943.34
P-45	Mudstone -----	4240- MET	.7	2.4	--	--	--	77.7	203.35	1,945.02
P-44	Mudstone -----	5515- JDW	1.1	6.7	--	--	--	68.2	204.45	1,952.39
P-43	Mudstone, phosphatic -----	5514- JDW	.8	11.8	--	--	--	53.9	205.25	1,961.83
P-42	Phosphate rock, argillaceous -----	5513- JDW	1.5	17.0	--	--	--	33.5	206.75	1,987.33
P-41	Phosphate rock, argillaceous -----	5512- JDW	.85	17.2	--	--	--	35.8	207.60	2,001.95
P-40	Phosphate rock, argillaceous -----	5511- JDW	1.0	16.5	--	--	--	35.3	208.60	2,018.45
P-39	Mudstone, phosphatic -----	5510- JDW	1.2	15.4	--	--	--	42.0	209.80	2,036.93
P-38	Mudstone, phosphatic -----	5509- JDW	.6	12.4	--	--	--	51.1	210.40	2,044.37
P-37	Phosphate rock, argillaceous -----	5508- JDW	2.1	18.2	--	--	--	31.5	212.50	2,082.59
P-36	Mudstone, phosphatic -----	5507- JDW	4.8	14.4	--	--	--	43.8	217.30	2,151.71
P-35	Phosphate rock, argillaceous -----	5506- JDW	4.5	17.1	--	--	--	32.8	221.80	2,228.66
P-34	Mudstone, phosphatic -----	5505- JDW	.7	14.8	--	--	--	41.8	222.50	2,239.02
P-33	Mudstone, phosphatic -----	5504- JDW	.6	14.4	--	--	--	44.0	223.10	2,247.66
P-32	Mudstone, phosphatic -----	5503- JDW	.5	14.4	--	--	--	42.7	223.60	2,254.86
P-31	Mudstone, phosphatic -----	5502- JDW	.9	14.4	--	--	--	43.3	224.50	2,267.82

P-30	Phosphate rock, argillaceous-----	5501- JDW	1.4	17.6	--	--	--	34.7	225.90	2,292.46
P-29	Phosphate rock, argillaceous-----	5500- JDW	3.5	17.6	--	--	--	36.8	229.40	2,354.06
P-28	Phosphate rock, argillaceous-----	5525- JDW	3.8	20.6	4.8	2.09	14.34	22.8	233.20	2,432.34
P-27	Mudstone, phosphatic-----	5524- JDW	1.5	13.2	7.4	3.13	9.59	44.9	234.70	2,452.14
P-26	Mudstone, phosphatic-----	5523- JDW	1.5	11.2	7.2	3.22	10.11	49.9	236.20	2,468.94
P-25	Phosphate rock-----	4122- JDW	1.5	32.9	1.3	1.19	9.10	3.4	237.70	2,518.29
P-24	Phosphate rock-----	4121- JDW	1.0	27.4	1.7	1.17	12.04	7.3	238.70	2,545.69
P-23	Carbonate rock, argillaceous-----	4107-MAW	.9	2.4	.91	1.18	8.24	33.6	239.60	2,547.85
P-22	Carbonate rock, argillaceous, phosphatic--	4106-MAW	1.1	8.6	4.5	1.89	25.93	23.0	240.70	2,557.31
P-21	Phosphate rock, argillaceous-----	4105-MAW	.6	21.2	4.4	1.98	10.19	24.4	241.30	2,570.03
P-20	Carbonate rock, argillaceous-----	4104-MAW	.7	3.7	3.7	1.45	33.61	19.1	242.00	2,572.62
P-19	Phosphate rock, argillaceous-----	4103-MAW	.6	26.8	2.5	1.10	8.29	16.4	242.60	2,588.70
P-18	Phosphate rock-----	4102-MAW	2.8	28.1	2.6	1.22	7.81	12.5	245.40	2,667.38
P-17	Phosphate rock, argillaceous-----	4101-MAW	3.3	20.0	4.3	1.91	9.75	30.2	248.70	2,733.38
P-16	Carbonate rock-----	4100-MAW	1.8	2.4	1.7	.67	37.57	13.5	250.50	2,737.70
P-15	Mudstone, phosphatic-----	5522- JDW	2.5	11.8	6.6	.24	9.79	45.3	253.00	2,767.20
P-14	Carbonate rock, argillaceous-----	5521- JDW	1.0	2.1	2.8	1.05	34.54	21.2	254.00	2,769.30
P-13	Phosphate rock, argillaceous-----	5520- JDW	(?)	24.6	2.5	1.04	10.26	18.0	--	--
P-12	Interval, probably small, between beds P-13 and P-12.									
P-12	Phosphate rock, argillaceous-----	4525- RGW	.8	18.5	4.3	3.34	10.29	32.7	*.8	*14.80
P-11	Mudstone, phosphatic-----	4524- RGW	.9	14.6	6.2	1.85	10.65	41.9	1.7	27.94
P-10	Phosphate rock-----	4523- RGW	1.6	29.6	2.2	.68	7.82	12.5	3.3	75.30
P-9	Phosphate rock-----	4522- RGW	1.7	30.3	1.9	.67	7.56	11.8	5.0	126.81
P-8	Phosphate rock, argillaceous-----	4521- RGW	.7	27.4	2.7	.78	7.15	18.0	5.7	145.99
P-7	Phosphate rock-----	4511- RGW	1.2	31.1	.92	.53	8.04	5.0	6.9	183.31
P-6	Phosphate rock, argillaceous-----	4244-MAW	.7	24.3	2.7	1.30	8.93	19.7	7.6	200.32
P-5	Mudstone-----	4243-MAW	.6	1.5	7.7	3.95	6.24	75.7	8.2	201.22
P-4	Mudstone, phosphatic, carbonatic-----	4242-MAW	1.0	9.6	6.2	2.37	11.12	44.5	9.2	210.82
P-3	Mudstone, carbonatic-----	4241-MAW	.7	2.4	5.7	2.05	19.29	45.2	9.9	212.50
P-2										
P-2	Limestone-----	4433- DFD	3.8	3.25	--	--	--	4.0	13.7	224.85
P-1	Phosphate rock-----	4434- DFD	1.6	35.5	--	--	--	3.3	**15.3	**281.65

Wells formation—top bed only

Cw-1	Limestone, siliceous-----	--	(?)	--	--	--	--	--	--	--
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\* Cumulative data incomplete because of missing information. Computations start from zero after interruption.

\*\* Note incompleteness of cumulative data.

Pole Canyon, Idaho, lot 1303

Phosphatic shale member of the Phosphoria formation sampled in bulldozer trench on the west limb of the Boulder Creek anticline, in Pole Canyon, SW $\frac{1}{4}$  sec. 31, T. 8 S., R. 46 E., Caribou County, Idaho. Beds strike N. 10° W. and dip 20° W. Section measured and sampled by M. A. Warner, R. A. Smart, F. J. Anderson, R. S. Jones, and R. G. Waring in August 1949. Samples analyzed for P<sub>2</sub>O<sub>5</sub> and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Rex chert member of Phosphoria formation—basal bed only										
R- 1	Chert -----	--	4.0	--	--	--	--	--	4.0	--
Phosphatic shale member of Phosphoria formation										
P-86	Phosphate rock -----	--	0.2	--	--	--	--	0.2	0.2	--
P-85	Mudstone -----	4225-MAW	1.8	1.9	--	--	--	77.7	2.0	3.42
P-84	Mudstone -----	4224-MAW	3.4	5.0	--	--	--	68.8	5.4	20.42
	Beds P-84, P-85, and P-86 highly weathered.									
P-83	Phosphate rock, argillaceous -----	4223-MAW	.7	21.9	--	--	--	32.8	6.1	35.75
P-82	Phosphate rock, argillaceous -----	4222-MAW	1.4	24.2	--	--	--	27.7	7.5	69.63
P-81	Mudstone -----	4221-MAW	1.5	5.0	--	--	--	69.2	9.0	77.13
P-80	Mudstone -----	4432- RAS	.9	2.0	--	--	--	78.1	9.9	78.93
P-79	Mudstone -----	4431- RAS	.8	6.1	--	--	--	67.6	10.7	83.81
P-78	Phosphate rock -----	4430- RAS	1.2	35.3	1.1	0.44	5.06	4.0	11.9	126.17
P-77	Phosphate rock -----	4429- RAS	.5	37.8	.44	.16	3.60	2.3	12.4	145.07
P-76	Phosphate rock -----	4428- RAS	.9	34.6	1.4	.67	7.04	4.4	13.3	176.21
P-75	Phosphate rock -----	4427- RAS	1.3	33.2	1.2	.63	2.12	13.5	14.6	219.37
P-74	Mudstone -----	4426- RAS	1.1	6.7	9.7	3.69	5.26	66.6	15.7	226.74
P-73	Phosphate rock, argillaceous -----	4425- RAS	1.1	21.7	5.1	1.93	3.72	34.8	16.8	250.61
P-72	Phosphate rock -----	4424- RAS	2.0	34.6	1.3	.56	2.44	9.0	18.8	319.81
P-71	Phosphate rock -----	4423- RAS	1.0	35.9	1.1	.50	3.80	4.7	19.8	355.71
P-70	Mudstone, phosphatic -----	4422- RAS	1.3	17.2	5.6	2.37	5.44	43.6	21.1	378.07
P-69	Phosphate rock -----	4421- RAS	1.7	35.3	1.4	.54	7.22	5.8	22.8	438.08
P-68	Phosphate rock -----	4420- RAS	1.9	35.4	1.3	.45	5.42	4.5	24.7	505.34
P-67	Phosphate rock, argillaceous -----	4419- RAS	1.2	26.5	3.4	1.43	13.86	15.8	25.9	537.14
P-66	Phosphate rock -----	4418- RAS	2.0	30.3	2.0	.88	11.64	8.5	27.9	597.74
P-65	Phosphate rock, argillaceous -----	4417- RAS	1.4	27.0	3.3	1.34	9.94	16.5	29.3	635.54
P-64	Phosphate rock, argillaceous -----	4416- RAS	2.6	24.0	3.4	1.61	13.62	21.0	31.9	697.94
P-63	Phosphate rock, argillaceous -----	4415- RAS	2.2	18.2	--	--	--	32.5	34.1	737.98

P-62	Mudstone, phosphatic -----	4220-MAW	1.3	8.4	--	--	--	58.9	35.4	748.90
P-61	Mudstone -----	4219-MAW	1.4	3.0	--	--	--	63.4	36.8	753.10
P-60	Phosphate rock, argillaceous -----	4218-MAW	3.2	17.4	--	--	--	33.7	40.0	808.78
P-59	Mudstone, phosphatic -----	4217-MAW	2.6	13.4	--	--	--	49.2	42.6	843.62
P-58	Mudstone, phosphatic -----	4216-MAW	.9	15.8	--	--	--	42.7	43.5	857.84
P-57	Phosphate rock, argillaceous -----	4215-MAW	2.3	18.8	--	--	--	42.7	45.8	901.08
P-56	Mudstone, phosphatic -----	4214-MAW	1.5	16.5	--	--	--	46.0	47.3	925.83
P-55	Mudstone, phosphatic -----	4213-MAW	3.9	9.5	--	--	--	62.8	51.2	962.88
P-54	Phosphate rock, argillaceous -----	4212-MAW	1.8	21.8	--	--	--	29.8	53.0	1,002.12
P-53	Mudstone -----	4211-MAW	2.1	5.1	--	--	--	69.7	55.1	1,012.83
P-52	Mudstone -----	4079-MAW	1.2	7.4	--	--	--	55.2	56.3	1,021.71
P-51	Carbonate rock, argillaceous -----	4078-MAW	1.8	7.1	--	--	--	27.8	58.1	1,034.49
P-50	Mudstone -----	4077-MAW	2.8	1.9	--	--	--	79.0	60.9	1,039.81
P-49	Phosphate rock, argillaceous -----	4076-MAW	1.9	19.2	--	--	--	33.0	62.8	1,076.29
P-48	Mudstone, phosphatic -----	4075-MAW	2.0	9.1	--	--	--	66.4	64.8	1,094.49
P-47	Mudstone -----	5199- FJA	1.9	1.8	--	--	--	79.6	66.7	1,097.91
P-46	Phosphate rock, argillaceous -----	5198- FJA	3.0	18.8	--	--	--	41.7	69.7	1,154.31
P-45	Mudstone, phosphatic -----	5197- FJA	1.0	9.7	--	--	--	63.4	70.7	1,164.01
P-44	Mudstone -----	5196- FJA	2.7	5.8	--	--	--	69.7	73.4	1,179.67
P-43	Mudstone, phosphatic -----	5195- FJA	1.1	14.2	--	--	--	33.0	74.5	1,195.29
P-42	Mudstone, phosphatic -----	5194- FJA	.7	10.0	--	--	--	56.6	75.2	1,202.29
P-41	Mudstone, phosphatic -----	5193- FJA	2.6	13.4	--	--	--	38.4	77.8	1,237.13
P-40	Mudstone, phosphatic -----	5192- FJA	3.6	12.1	--	--	--	50.1	81.4	1,280.69
P-39	Mudstone -----	5191- FJA	1.2	5.4	--	--	--	59.9	82.6	1,287.17
P-38	Mudstone -----	5190- FJA	2.1	2.6	--	--	--	74.0	84.7	1,292.63
P-37	Mudstone -----	5189- FJA	2.4	2.6	--	--	--	70.8	87.1	1,298.87
P-36	Mudstone -----	5188- FJA	1.1	2.4	--	--	--	78.3	88.2	1,301.51
P-35	Mudstone -----	5187- FJA	1.6	.4	--	--	--	84.7	89.8	1,302.15
P-34	Phosphate rock, argillaceous and mudstone -----	5186- FJA	2.2	10.5	--	--	--	56.3	92.0	1,325.25
P-33	Mudstone -----	5185- FJA	1.4	1.6	--	--	--	82.9	93.4	1,327.49
P-32	Mudstone, phosphatic -----	5184- FJA	3.6	9.9	--	--	--	54.4	97.0	1,363.13
P-31	Mudstone, phosphatic -----	5183- FJA	1.8	11.9	--	--	--	51.1	98.8	1,384.55
P-30	Mudstone, phosphatic -----	5182- FJA	3.9	14.8	--	--	--	38.7	102.7	1,442.27
P-29	Mudstone, phosphatic and phosphate rock -----	5181- FJA	3.7	17.9	--	--	--	33.3	106.4	1,508.50
P-28	Phosphate rock -----	5180- FJA	2.5	28.6	--	--	--	12.1	108.9	1,580.00
P-27	Carbonate rock -----	4414- RAS	3.0	2.4	--	--	--	12.2	111.9	1,587.20
P-26	Mudstone, phosphatic -----	4413- RAS	1.8	13.9	--	--	--	45.3	113.7	1,612.22
P-25	Mudstone, phosphatic -----	4412- RAS	2.2	13.4	--	--	--	46.3	115.9	1,641.70
P-24	Mudstone, phosphatic -----	4411- RAS	1.8	11.1	--	--	--	50.3	117.7	1,661.68
P-23	Mudstone, phosphatic -----	4410- RAS	1.9	10.1	--	--	--	55.0	119.6	1,680.87
P-22	Carbonate rock, argillaceous -----	4409- RAS	2.0	3.1	--	--	--	28.3	121.6	1,687.07

Pole Canyon—Continued

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-21	Phosphate rock, argillaceous -----	4408- RAS	1.9	27.0	2.7	1.19	8.96	16.7	123.5	1,738.37
P-20	Phosphate rock, argillaceous -----	5166- RSJ	2.1	22.5	4.0	1.44	7.56	29.1	125.6	1,785.62
P-19	Carbonate rock, argillaceous -----	5164- RSJ	.9	1.1	2.7	.99	32.78	21.9	126.5	1,786.61
P-18	Phosphate rock -----	5163- RSJ	.9	29.0	2.1	.86	8.00	12.1	127.4	1,812.71
P-17	Phosphate rock -----	5162- RSJ	1.3	29.6	2.3	1.01	6.52	14.3	128.7	1,851.19
P-16	Phosphate rock -----	5161- RSJ	2.6	31.4	1.7	.73	6.87	10.2	131.3	1,932.83
P-15	Phosphate rock, argillaceous -----	5204- RGW	1.0	22.1	4.2	1.33	8.02	27.8	132.3	1,954.93
P-14	Phosphate rock, contains carbonate rock lens	5203- RGW	1.0	26.2	3.2	1.7	7.70	17.1	133.3	1,981.13
P-13	Carbonate rock, phosphatic -----	5202- RGW	.8	8.4	1.3	.58	31.06	10.4	134.1	1,987.85
P-12	Phosphate rock, argillaceous, carbonatic --	5201- RGW	.7	16.7	4.7	1.14	16.56	21.0	134.8	1,999.54
P-11	Phosphate rock, argillaceous -----	5200- RGW	1.8	26.3	3.3	1.17	6.48	20.3	136.6	2,046.88
P-10	Phosphate rock, argillaceous -----	5160- RGW	.6	24.4	3.5	1.77	6.32	24.5	137.2	2,061.52
P- 9	Phosphate rock -----	5159- RGW	.9	33.3	1.0	.43	5.74	4.9	138.1	2,091.49
P- 8	Phosphate rock -----	5158- RGW	.7	34.2	.67	.34	6.66	3.3	138.8	2,115.43
P- 7	Phosphate rock -----	5157- RGW	.8	32.7	1.1	.50	7.04	4.5	139.6	2,141.59
P- 6	Phosphate rock -----	5156- RGW	.9	34.3	.68	.41	5.68	2.5	140.5	2,172.46
P- 5	Phosphate rock -----	5155- RGW	.9	35.6	.55	.31	4.42	2.5	141.4	2,204.50
P- 4	Mudstone -----	5154- RGW	.7	4.2	--	--	--	66.7	142.1	2,207.44
P- 3	Mudstone, carbonatic and limestone -----	5153- RGW	2.0	.5	--	--	--	31.7	144.1	2,208.44
P- 2	Carbonate rock, argillaceous -----	5152- RGW	1.1	1.2	--	--	--	39.8	145.2	2,209.76
P- 1	Phosphate rock -----	5151- RGW	.3	32.0	--	--	--	5.2	145.5	2,219.36
Wells formation—top bed only										
Cw-1	Carbonate rock -----	5150- RGW	0.8	2.1	--	--	--	4.2	0.8	--

## Spectrographic Analyses—Pole Canyon, Idaho, lot 1303

Semiquantitative analyses of samples of the phosphatic shale member of the Phosphoria formation, Pole Canyon, Idaho (see immediately preceding pages for location of section, thickness and description of strata, and chemical analyses of samples), made by U. S. Geological Survey, Geochemistry and Petrology Branch, Washington, D. C. In addition to the elements listed in the table below, Sb, As, Bi, Cd, Ce, Cs, Cr, Co, Dy, Er, Eu, Gd, Ge, Au, Hf, In, Ir, Li, Lu, Hg, Nd, Os, Pd, Pt, Pr, Re, Rh, Rb, Ru, Sm, Ta, Te, Tb, Tl, Th, and W were looked for in all samples but were not detected.

## Explanation of Symbols

A = more than 10 percent  
 B' = 1-10 percent<sup>1</sup>  
 D = 0.1-1 percent  
 E = 0.01-0.1 percent  
 F = 0.001-0.001 percent  
 G = less than 0.001 percent  
 ND = not detected  
 V = vanadium<sup>2</sup>

Bed no.	Sample no.	Al	Ba	Be	B	Ca	Cr	Cu	Ga	Ho	Fe	La	Pb	Mg	Mn	Mo	Ni	Nb	P	K	Sc	Si	Ag	Na	Sr	Tm	Sn	Ti	V	Yb	Y	Zn	Zr
P-86	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P-85	4225-MAW	A	E	ND	E	B'	E	E	F	F	B'	E	F	D	E	F	E	E	D	B'	F	A	G	B'	F	E	F	D	0.03	G	E	E	E
P-84	4224-MAW	A	E	ND	E	B'	D	E	F	F	B'	E	F	D	E	F	E	E	B'	B'	F	A	G	B'	F	E	F	E	0.03	G	E	E	E
P-83	4223-MAW	B'	E	G	E	A	E	E	F	F	B'	E	F	D	E	F	E	ND	B'	B'	F	A	G	B'	E	E	F	E	0.03	F	E	E	E
P-82	4222-MAW	B'	E	G	E	A	E	E	F	F	B'	E	F	D	E	F	E	ND	B'	B'	F	A	G	B'	E	E	F	E	0.04	F	E	E	E
P-81	4221-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	D	B'	F	A	G	B'	E	E	F	E	0.06	G	E	E	E
P-80	4432- RAS	B'	E	G	E	B'	E	E	F	F	B'	E	F	D	E	F	E	E	D	B'	F	A	G	B'	F	E	F	D	0.07	G	E	E	E
P-79	4431- RAS	B'	E	ND	E	B'	D	E	F	F	B'	E	ND	D	E	F	E	E	D	B'	F	A	G	B'	F	E	F	D	0.06	G	E	E	F
P-78	4430- RAS	B'	E	ND	F	A	D	E	F	F	D	E	F	D	F	F	E	E	B'	B'	F	B'	G	B'	F	E	F	E	0.06	G	E	E	E
P-77	4429- RAS	B'	E	ND	F	A	E	E	F	F	D	E	F	E	F	F	E	E	B'	D	F	D	G	B'	F	E	F	E	0.06	G	E	E	F
P-76	4428- RAS	B'	E	ND	F	A	D	E	F	F	B'	E	F	D	E	F	E	E	B'	B'	F	B'	G	B'	F	E	F	E	0.08	G	E	E	E
P-75	4427- RAS	B'	E	ND	F	A	E	E	F	F	B'	E	F	E	F	F	E	E	B'	D	F	B'	G	B'	F	E	F	E	0.04	G	E	E	E
P-74	4426- RAS	B'	E	G	E	B'	E	E	F	F	P'	E	F	D	E	F	E	E	D	B'	F	A	G	B'	F	E	F	D	0.07	G	E	E	E
P-73	4425- RAS	B'	E	G	E	A	E	E	F	F	B'	E	F	D	E	F	E	E	B'	B'	F	B'	G	B'	F	E	F	D	0.08	G	E	E	E
P-72	4424- RAS	B'	E	ND	F	A	E	E	F	F	D	E	E	E	F	F	E	E	B'	B'	F	B'	G	B'	F	E	F	E	0.04	G	E	E	E
P-71	4423- RAS	B'	E	ND	F	A	E	E	F	F	D	E	F	E	F	F	E	E	B'	B'	F	D	G	B'	F	E	F	E	0.07	G	E	E	E
P-70	4422- RAS	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	E	E	B'	B'	F	B'	G	B'	F	E	F	D	0.06	G	E	E	E
P-69	4421- RAS	B'	E	ND	F	A	E	E	F	F	D	F	F	D	F	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	0.09	G	E	E	E
P-68	4420- RAS	B'	E	G	F	A	D	E	F	F	D	F	F	D	F	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	0.08	G	E	E	E
P-67	4419- RAS	B'	E	ND	F	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	F	D	F	E	0.10	G	E	E	E
P-66	4418- RAS	B'	E	ND	F	A	D	E	F	F	B'	F	F	D	F	F	D	E	B'	B'	F	B'	G	B'	F	D	F	E	0.20	G	E	E	E
P-65	4417- RAS	B'	E	ND	F	A	D	E	F	F	B'	F	F	D	F	F	D	E	B'	B'	F	B'	G	B'	F	D	F	E	0.1	G	E	E	E
P-64	4416- RAS	B'	E	ND	F	A	D	E	F	F	B'	F	F	D	F	F	D	E	B'	B'	F	B'	G	B'	F	E	F	E	0.08	G	E	E	E
P-63	4415- RAS	B'	E	G	E	A	D	E	F	F	B'	F	F	D	F	F	D	E	B'	B'	F	B'	G	B'	F	E	F	E	0.09	G	E	E	F
P-62	4220-MAW	B'	E	G	E	B'	E	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	E	E	F	E	0.08	G	ND	E	E
P-61	4219-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	D	B'	F	A	G	B'	E	E	F	E	0.09	G	E	E	E
P-60	4218-MAW	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	0.09	F	E	E	E
P-59	4217-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	E	E	F	E	0.07	G	E	E	E
P-58	4216-MAW	B'	E	G	E	B'	E	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	0.06	G	E	E	E
P-57	4215-MAW	B'	E	G	E	B'	E	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	E	E	F	E	0.05	G	E	E	E
P-56	4214-MAW	A	E	ND	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	F	E	F	E	0.05	F	E	E	E

<sup>1</sup> B' is equivalent to B and C of Bureau of Mines analyses as recorded in other reports.

<sup>2</sup> Vanadium determined by a "quickie" quantitative method, accuracy estimated at  $\pm$  10-15 percent of vanadium present.

## Spectrographic Analyses—Pole Canyon—Continued

Bed no.	Sample no.	Al	Ba	Be	B	Ca	Cr	Cu	Ga	Ho	Fe	La	Pb	Mg	Mn	Mo	Ni	Nb	P	K	Sc	Si	Ag	Na	Sr	Tm	Sn	Ti	V	Yb	Y	Zn	Zr
P-55	4213-MAW	B'	E	G	E	B'	E	E	F	F	B'	E	F	D	E	F	E	ND	B'	B'	F	A	G	B'	E	E	F	E	0.05	G	E	E	E
P-54	4212-MAW	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	E	E	F	E	.05	F	E	E	E
P-53	4211-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	E	E	F	E	.06	G	ND	E	E
P-52	4079-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.08	F	E	E	E
P-51	4078-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	E	E	F	E	.09	F	E	E	E
P-50	4077-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	D	B'	F	A	G	B'	E	E	F	E	.08	G	E	E	E
P-49	4076-MAW	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	E	E	F	E	.07	F	E	E	E
P-48	4075-MAW	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.06	F	E	E	E
P-47	5199- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	F	E	F	D	.08	G	E	E	E
P-46	5198- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	F	E	F	D	.06	G	E	E	E
P-45	5197- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	F	E	F	D	.04	G	E	E	E
P-44	5196- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	F	E	F	D	.07	G	E	E	E
P-43	5195- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	F	E	F	D	.06	G	E	E	E
P-42	5194- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	ND	B'	B'	F	A	G	B'	F	E	F	D	.05	G	E	E	E
P-41	5193- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.05	G	E	E	E
P-40	5192- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.05	G	E	E	E
P-39	5191- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.07	G	E	E	E
P-38	5190- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	D	B'	F	A	G	B'	E	E	F	E	.07	G	E	ND	E
P-37	5189- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	D	B'	F	A	G	B'	E	E	F	E	.07	G	E	E	E
P-36	5188- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	D	B'	F	A	G	B'	E	E	F	E	.08	G	E	E	E
P-35	5187- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	D	B'	F	A	G	B'	E	E	F	E	.07	G	E	E	E
P-34	5186- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.04	G	E	E	E
P-33	5185- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	D	B'	F	A	G	B'	E	E	F	D	.06	G	E	E	E
P-32	5184- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.05	G	E	E	E
P-31	5183- FJA	B'	E	G	E	B'	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	A	G	B'	E	E	F	E	.05	G	E	E	E
P-30	5182- FJA	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	E	E	F	E	.06	G	E	E	E
P-29	5181- FJA	B'	E	G	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	E	E	F	E	.07	G	E	E	E
P-28	5180- FJA	B'	E	G	F	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	E	E	F	E	.06	G	E	E	E
P-27	4414- RAS	B'	F	ND	F	A	D	E	F	F	D	F	F	B'	E	F	D	ND	D	D	F	D	G	B'	F	E	F	E	.01	G	E	F	E
P-26	4413- RAS	B'	E	G	E	A	D	E	F	F	B'	F	F	D	E	F	D	E	B'	B'	F	B'	G	B'	F	E	F	D	.02	G	E	E	ND
P-25	4412- RAS	B'	E	ND	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	F	E	F	E	.02	G	E	E	E
P-24	4411- RAS	A	E	ND	F	B'	D	E	F	F	B'	E	ND	D	E	F	D	E	B'	B'	F	A	G	B'	F	E	ND	D	.02	G	E	E	E
P-23	4410- RAS	B'	E	ND	E	A	D	E	F	F	B'	E	F	D	E	F	D	E	B'	B'	F	B'	G	B'	F	E	F	E	.04	G	E	E	E
P-22	4409- RAS	B'	E	ND	F	A	D	E	F	F	B'	F	F	B'	E	F	D	E	D	B'	F	B'	G	B'	F	E	F	E	.01	G	E	E	F
P-21	4408- RAS	B'	E	G	F	A	D	E	F	F	D	F	F	D	F	F	E	E	B'	B'	F	B'	G	B'	F	D	F	E	.23	G	E	E	F
P-20	5166- RSJ	B'	E	ND	F	A	E	E	F	F	B'	E	F	D	E	F	D	ND	D	B'	F	B'	G	B'	F	E	ND	D	.09	G	E	E	E
P-19	5164- RSJ	B'	E	ND	F	A	F	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	ND	D	.01	G	F	E	E
P-18	5163- RSJ	B'	E	ND	F	A	E	E	F	F	D	E	F	D	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	F	E	.09	G	E	E	E
P-17	5162- RSJ	B'	E	ND	F	A	E	E	F	F	D	E	F	D	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	F	E	.08	G	E	E	E
P-16	5161- RSJ	B'	E	ND	F	A	E	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	ND	E	.08	G	E	E	E
P-15	5204- RGW	B'	E	G	F	A	D	E	F	F	B'	E	F	D	E	ND	E	ND	B'	B'	F	B'	G	B'	F	E	F	D	.09	G	E	E	E
P-14	5203- RGW	B'	E	G	F	A	D	E	F	F	B'	E	F	D	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	F	E	.07	G	E	E	E

P-13	5202-RGW	B'	E	G	F	A	E	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	.04	G	E	E	E
P-12	5201-RGW	B'	E	G	F	A	D	E	F	F	D	E	F	B'	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	F	E	.07	G	E	E	E
P-11	5200-RGW	B'	E	G	F	A	D	E	F	F	D	E	F	D	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	F	E	.05	G	E	E	E
P-10	5160-RGW	B'	E	ND	F	A	E	E	F	F	D	E	F	D	E	F	D	ND	B'	B'	F	B'	G	B'	F	E	ND	D	.04	G	E	E	E
P- 9	5159-RGW	B'	E	ND	F	A	E	E	F	F	D	E	ND	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	ND	E	.06	G	E	E	E
P- 8	5158-RGW	B'	E	ND	F	A	E	E	F	F	D	E	ND	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	ND	E	.07	G	E	E	E
P- 7	5157-RGW	B'	E	ND	F	A	D	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	.09	G	E	E	E
P- 6	5156-RGW	B'	E	ND	F	A	F	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	.09	G	E	E	E
P- 5	5155-RGW	B'	E	ND	F	A	F	E	F	F	D	E	F	D	E	F	E	ND	B'	D	F	B'	G	B'	F	E	F	E	.06	G	E	E	E
P- 4	5154-RGW	B'	E	ND	F	B'	E	E	F	F	D	E	F	D	E	F	D	ND	D	B'	F	A	G	B'	F	E	ND	D	.09	G	E	E	E
P- 3	5153-RGW	B'	E	ND	F	A	F	E	F	F	D	E	F	B'	E	F	E	ND	B'	B'	F	B'	G	B'	F	E	ND	E	.03	F	E	E	E
P- 2	5152-RGW	B'	E	ND	E	A	E	E	F	F	B'	E	F	B'	E	F	E	E	D	B'	F	B'	G	D	F	E	F	D	.05	G	E	E	E
P- 1	5151-RGW	B'	E	ND	F	A	E	E	F	F	D	E	F	D	F	F	E	E	B'	D	F	B'	ND	B'	F	E	F	E	.03	G	E	E	F
Cw-1	5150-RGW	D	E	G	F	A	E	E	ND	F	B'	E	F	B'	F	F	F	E	D	D	F	D	ND	D	F	E	F	E	0.01	G	E	E	E

Lone Pine Springs, Idaho, lot 1298

Phosphatic shale member of the Phosphoria formation sampled in bulldozer trench on the west limb of the Snowdrift anticline near Lone Pine Springs, NE $\frac{1}{4}$  sec. 4, T. 9 S., R. 45 E., Caribou County, Idaho. Section measured and sampled by M. A. Warner, R. A. Smart, R. G. Waring, R. S. Jones, and R. P. Sheldon in July 1949. Samples analyzed for P<sub>2</sub>O<sub>5</sub> and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Rex chert member of Phosphoria formation—basal bed only										
R- 11	Chert -----	--	1.8	--	--	--	--	--	1.8	--
Phosphatic shale member of Phosphoria formation										
P-115	Mudstone -----	5080-MAW	0.9	2.1	--	--	--	84.4	0.9	1.89
P-114	Phosphate rock, argillaceous -----	5006-MAW	.5	29.6	--	--	--	17.1	1.4	16.69
P-113	Mudstone -----	5007-MAW	.7	3.6	--	--	--	73.8	2.1	19.21
P-112	Mudstone -----	5008-MAW	.9	2.8	--	--	--	69.7	3.0	21.73
P-111	Mudstone -----	5009-MAW	2.0	2.0	--	--	--	75.0	5.0	25.73
P-110	Mudstone -----	5010-MAW	2.3	.9	--	--	--	79.0	7.3	27.80
P-109	Mudstone -----	5011-MAW	3.2	1.0	--	--	--	79.2	10.5	31.00
P-108	Mudstone -----	5012-MAW	1.1	.9	--	--	--	77.7	11.6	31.99
P-107	Mudstone -----	5013-MAW	3.3	3.7	--	--	--	70.3	14.9	44.20
P-106	Phosphate rock, argillaceous -----	5014-MAW	1.0	27.8	2.8	1.24	4.08	21.1	15.9	72.00
P-105	Mudstone -----	5015-MAW	2.2	3.8	9.5	3.34	5.88	71.7	18.1	80.36
P-104	Phosphate rock -----	5016-MAW	1.5	36.9	1.2	.82	4.08	2.8	19.6	135.71
P-103	Phosphate rock -----	5017-MAW	.9	35.7	1.5	.67	5.96	2.8	20.5	167.84
P-102	Phosphate rock -----	5018-MAW	1.0	36.5	1.2	.50	2.56	4.9	21.5	204.34
P-101	Mudstone -----	5019-MAW	1.5	6.6	8.8	3.23	4.94	66.7	23.0	214.24
P-100	Phosphate rock and argillaceous phosphate rock -----	5081-MAW	.7	29.6	3.2	1.32	3.56	18.0	23.7	234.96
P- 99	Phosphate rock, argillaceous -----	5082-MAW	.4	18.3	6.0	2.10	4.84	41.8	24.1	242.28
P- 98	Phosphate rock -----	5083-MAW	.9	31.7	2.5	1.07	3.36	13.4	25.0	270.81
P- 97	Phosphate rock -----	5084-MAW	1.0	34.1	1.5	.59	3.22	9.6	26.0	304.91
P- 96	Mudstone -----	5085-MAW	.6	7.1	8.5	3.29	8.32	63.7	26.6	309.17
P- 95	Phosphate rock -----	5086-MAW	1.2	36.2	.78	.23	3.08	6.4	27.8	352.61
P- 94	Mudstone, phosphatic -----	5087-MAW	.7	14.3	6.7	2.80	8.20	47.9	28.5	362.62
P- 93	Phosphate rock -----	5088-MAW	.6	34.6	1.4	.38	4.26	8.0	29.1	383.38
P- 92	Phosphate rock, argillaceous -----	5089-MAW	.5	20.3	5.6	1.30	10.06	30.3	29.6	393.53
P- 91	Phosphate rock -----	5090-MAW	1.2	35.8	1.1	.72	2.76	6.0	30.8	436.49
P- 90	Mudstone, phosphatic -----	5091-MAW	1.3	11.7	6.8	2.84	5.34	55.7	32.1	451.70
P- 89	Phosphate rock -----	5020- RAS	1.0	31.9	2.0	.76	1.84	13.5	33.1	483.60
P- 88	Phosphate rock -----	5021- RAS	.9	38.5	.77	.44	2.70	1.2	34.0	518.25

P- 87	Phosphate rock -----	5022- RAS	1.5	33.5	2.3	1.11	3.92	8.7	35.5	568.50
P- 86	Phosphate rock -----	5023- RAS	1.2	27.4	2.9	1.96	9.82	14.8	36.7	601.38
P- 85	Phosphate rock -----	5024- RAS	1.5	32.5	1.7	.51	8.54	6.3	38.2	650.13
P- 84	Phosphate rock, argillaceous -----	5025- RAS	2.0	25.8	3.4	1.24	13.56	16.1	40.2	701.73
P- 83	Phosphate rock, argillaceous -----	5026- RAS	2.2	22.6	4.0	1.34	14.36	22.2	42.4	751.45
P- 82	Mudstone -----	5027- RAS	2.3	6.5	--	--	--	61.9	44.7	766.40
P- 81	Mudstone, phosphatic -----	5028- RAS	2.5	15.4	--	--	--	38.0	47.2	804.90
P- 80	Mudstone, phosphatic, carbonatic -----	5029- RAS	2.0	10.7	--	--	--	37.9	49.2	826.30
P- 79	Mudstone, phosphatic -----	5030- RAS	2.2	12.8	--	--	--	51.0	51.4	854.46
P- 78	Phosphate rock, argillaceous -----	5031- RAS	1.3	24.2	--	--	--	29.5	52.7	885.92
P- 77	Mudstone -----	5032- RAS	.5	4.5	--	--	--	73.0	53.2	888.17
P- 76	Mudstone, phosphatic -----	5033- RAS	1.0	10.1	--	--	--	61.7	54.2	898.27
P- 75	Phosphate rock, argillaceous -----	5034- RAS	.8	20.7	--	--	--	34.1	55.0	914.83
P- 74	Mudstone, phosphatic -----	5035- RAS	.8	12.2	--	--	--	54.2	55.8	924.59
P- 73	Mudstone -----	5036- RAS	1.6	7.5	--	--	--	66.8	57.4	936.59
P- 72	Mudstone -----	5037- RAS	1.4	6.4	--	--	--	67.3	58.8	945.55
P- 71	Mudstone, phosphatic -----	5038- RAS	1.4	8.6	--	--	--	64.2	60.2	957.59
P- 70	Phosphate rock, argillaceous -----	5039- RAS	1.5	18.4	--	--	--	40.2	61.7	985.19
P- 69	Mudstone -----	5092- RAS	1.4	5.6	--	--	--	67.3	63.1	993.03
P- 68	Mudstone -----	5093- RAS	1.2	2.7	--	--	--	76.5	64.3	996.27
P- 67	Mudstone -----	5094- RAS	2.0	3.0	--	--	--	67.1	66.3	1,002.27
P- 66	Mudstone -----	5095- RAS	1.3	4.2	--	--	--	70.4	67.6	1,007.73
P- 65	Mudstone -----	5040- RSJ	2.0	2.8	--	--	--	75.0	69.6	1,013.33
P- 64	Mudstone -----	5041- RSJ	1.2	3.5	--	--	--	72.3	70.8	1,017.53
P- 63	Phosphate rock, argillaceous -----	5042- RSJ	.2	24.5	--	--	--	23.5	71.0	1,022.43
P- 62	Mudstone, phosphatic -----	5043- RSJ	.7	14.3	--	--	--	61.0	71.7	1,032.44
P- 61	Mudstone -----	5044- RSJ	2.6	7.5	--	--	--	66.0	74.3	1,051.94
P- 60	Mudstone, phosphatic -----	5045- RSJ	2.8	14.4	--	--	--	38.0	77.1	1,092.26
P- 59	Mudstone, phosphatic -----	5046- RSJ	2.5	10.5	--	--	--	58.5	79.6	1,118.51
P- 58	Mudstone -----	5047- RSJ	.7	3.1	--	--	--	76.5	80.3	1,120.68
P- 57	Mudstone, phosphatic and mudstone -----	5048- RSJ	1.7	3.0	--	--	--	83.0	82.0	1,125.78
P- 56	Mudstone -----	5049- RSJ	1.6	.7	--	--	--	83.6	83.6	1,126.90
P- 55	Mudstone -----	5050- RSJ	1.8	7.5	--	--	--	69.8	85.4	1,140.40
P- 54	Mudstone -----	5051- RSJ	1.2	1.2	--	--	--	87.2	86.6	1,141.84
P- 53	Mudstone -----	5052- RSJ	3.0	.6	--	--	--	85.9	89.6	1,143.64
P- 52	Mudstone, phosphatic -----	5053- RSJ	.6	10.1	--	--	--	64.7	90.2	1,149.70
P- 51	Mudstone -----	5054- RSJ	1.5	.4	--	--	--	90.2	91.7	1,150.30
P- 50	Mudstone, phosphatic -----	5055- RSJ	2.0	18.2	--	--	--	45.8	93.7	1,186.70
P- 49	Mudstone, phosphatic and mudstone -----	5056- RSJ	1.5	8.6	--	--	--	64.2	95.2	1,199.60
P- 48	Mudstone -----	5057- RSJ	2.4	4.4	--	--	--	72.8	97.6	1,210.16
P- 47	Mudstone, phosphatic -----	5058- RSJ	2.4	14.4	--	--	--	38.3	100.0	1,244.72
P- 46	Mudstone, phosphatic -----	5059- RSJ	2.3	13.0	--	--	--	42.8	102.3	1,274.62
P- 45	Mudstone and phosphate rock -----	5060- RPS	1.7	15.9	--	--	--	40.4	104.0	1,301.65

Lone Pine Springs—Continued

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P <sub>2</sub> O <sub>5</sub> (cumulative) <sup>5</sup>
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
P-44	Mudstone-----	5061- RPS	3.3	3.1	--	--	--	73.7	107.3	1,311.88
P-43	Mudstone-----	5062- RPS	1.1	1.4	--	--	--	81.4	108.4	1,313.42
P-42	Chert and mudstone-----	5063- RPS	1.7	1.4	--	--	--	88.9	110.1	1,315.80
P-41	Mudstone-----	5064- RPS	2.8	4.5	--	--	--	73.7	112.9	1,328.40
P-40	Mudstone-----	5065- RPS	2.0	1.8	--	--	--	84.0	114.9	1,332.00
P-39	Mudstone-----	5066- RPS	3.1	5.8	--	--	--	72.1	118.0	1,349.98
P-38	Mudstone-----	5067- RPS	2.8	4.4	--	--	--	75.2	120.8	1,362.30
P-37	Mudstone-----	5068- RPS	2.3	1.7	--	--	--	83.0	123.1	1,366.21
P-36	Mudstone and phosphatic mudstone-----	5069- RPS	1.2	10.0	--	--	--	56.7	124.3	1,378.21
P-35	Mudstone, phosphatic-----	5070- RPS	3.0	11.5	--	--	--	55.7	127.3	1,412.71
P-34	Mudstone-----	5071- RPS	1.1	5.7	--	--	--	68.2	128.4	1,418.98
P-33	Mudstone and phosphate rock-----	5072- RPS	2.7	20.4	7.0	2.82	7.24	33.3	131.1	1,474.06
P-32	Mudstone and argillaceous phosphate rock--	5073- RPS	3.2	16.3	8.2	3.19	7.76	43.7	134.3	1,526.22
P-31	Mudstone and phosphate rock-----	5074- RPS	2.7	20.5	7.1	2.57	7.72	32.7	137.0	1,581.57
P-30	Mudstone, phosphatic and phosphate rock--	5075- RPS	3.5	24.3	5.6	2.16	8.74	22.5	140.5	1,666.62
P-29	Mudstone, phosphatic-----	5076- RPS	.5	13.8	8.6	3.36	7.56	47.3	141.0	1,673.52
P-28	Phosphate rock-----	5077- RPS	2.0	29.5	2.9	1.79	6.16	14.0	143.0	1,732.52
P-27	Phosphate rock, argillaceous-----	5078- RPS	1.0	26.3	3.9	1.63	6.30	22.0	144.0	1,758.82
P-26	Phosphate rock, argillaceous-----	5096- RAS	1.3	23.0	5.1	1.86	6.48	30.8	145.3	1,788.72
P-25	Mudstone, phosphatic-----	5097- RAS	1.1	13.2	--	--	--	52.2	146.4	1,803.24
P-24	Mudstone, phosphatic-----	5098- RAS	1.5	15.6	--	--	--	46.0	147.9	1,826.64
P-23	Mudstone, phosphatic-----	5099- RAS	1.6	14.6	--	--	--	48.3	149.5	1,850.00
P-22	Mudstone, phosphatic-----	5100- RAS	1.4	11.9	--	--	--	53.7	150.9	1,866.66
P-21	Mudstone-----	5101- RAS	.9	3.1	--	--	--	74.0	151.8	1,869.45
P-20	Phosphate rock, argillaceous-----	5102- RAS	1.4	28.4	--	--	--	20.5	153.2	1,909.21
P-19	Phosphate rock, argillaceous-----	5103- RAS	1.7	19.0	--	--	--	40.0	154.9	1,941.51
P-18	Mudstone, phosphatic-----	5104- RAS	.8	8.3	--	--	--	62.6	155.7	1,948.15
P-17	Phosphate rock-----	5105- RAS	2.0	31.6	2.3	1.11	5.76	13.0	157.7	2,011.35
	Samples 4501-4509-RGW and 4512-4520-RGW collected in second trench 400 feet up gulley. Beds P-4 through P-18 much crumpled and weathered. Samples 4512-RGW and 4513-RGW are equivalent to 5104-RAS and 5105-RAS, respectively.									
--	Mudstone-----	4512-RGW	(.9)	6.3	--	--	--	70.7	--	--
--	Phosphate rock-----	4513-RGW	(2.6)	29.7	--	--	--	13.5	--	--
P-16	Phosphate rock-----	4514-RGW	3.3	29.2	2.1	.89	6.86	15.7	161.0	2,107.71

P-15	Phosphate rock -----	4515-RGW	2.8	31.5	1.7	.80	7.06	10.1	163.8	2,195.91
P-14	Phosphate rock -----	4516-RGW	1.6	32.5	2.0	.83	7.84	6.7	165.4	2,247.91
P-13	Mudstone, phosphatic -----	4517-RGW	.7	14.1	8.2	3.01	8.18	44.1	166.1	2,257.78
P-12	Phosphate rock -----	4518-RGW	.8	31.6	1.8	1.10	6.82	9.6	166.9	2,283.06
P-11	Phosphate rock, argillaceous -----	4519-RGW	.9	24.6	4.8	2.26	6.80	23.4	167.8	2,305.20
P-10	Phosphate rock -----	4520-RGW	2.0	35.6	.94	.40	6.20	1.5	169.8	2,376.40
P- 9	Phosphate rock -----	4501-RGW	2.0	35.3	.77	.37	6.94	1.0	171.8	2,447.00
P- 8	Phosphate rock -----	4502-RGW	1.0	31.6	1.3	.58	8.60	5.9	172.8	2,478.60
P- 7	Phosphate rock -----	4503-RGW	1.2	33.6	.74	.44	6.50	3.0	174.0	2,518.92
P- 6	Phosphate rock -----	4504-RGW	.9	31.7	1.1	.68	7.48	5.6	174.9	2,547.45
P- 5	Phosphate rock -----	4505-RGW	.8	32.7	1.1	.46	5.68	7.2	175.7	2,573.61
P- 4	Mudstone -----	4506-RGW	1.9	2.8	--	--	--	65.2	177.6	2,578.93
P- 3	Carbonate rock, argillaceous -----	4507-RGW	2.7	.3	--	--	--	33.9	180.3	2,579.74
P- 2	Mudstone, carbonatic -----	4508-RGW	2.0	1.1	--	--	--	63.8	182.3	2,581.94
P- 1	Phosphate rock -----	4509-RGW	.5	34.4	--	--	--	5.0	182.8	2,599.14

Wells formation— top bed only

Cw-1	Carbonate rock -----	--	1.1	0.8	--	--	--	3.6	1.1	--
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Georgetown Canyon, Idaho, lot 1320

Portion of the phosphatic shale member of the Phosphoria formation sampled from diamond drill hole on east limb of the Georgetown syncline in Georgetown Canyon, NE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 30, T. 10 S., R. 45 E., Bear Lake County, Idaho. Beds strike S. 10° W. and dip 70° W. Hole drilled in the summer of 1949 by Central Farmers' Fertilizer Company. Drill cores described by D. F. Davidson in September 1949. Samples analyzed by U. S. Bureau of Mines laboratory, Albany, Oreg.

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)		Cumulative thickness (feet)	Thickness x percent P <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Acid insoluble		
Phosphatic shale member of Phosphoria formation							
P-15	Mudstone -----	4616-DFD	2.0	4.0	68.9	2.0	8.00
P-14	Mudstone, phosphatic, carbonatic -----	4617-DFD	.6	9.5	46.1	2.6	13.70
P-13	Mudstone, carbonatic -----	4618-DFD	1.3	5.1	55.5	3.9	20.33
P-12	Carbonate rock, argillaceous -----	4619-DFD	1.2	.9	32.9	5.1	21.41
P-11	Mudstone, phosphatic, carbonatic -----	4620-DFD	1.3	8.9	45.3	6.4	32.98
P-10	Mudstone, carbonatic -----	4621-DFD	2.5	2.5	57.1	8.9	39.23
P- 9	Mudstone -----	4622-DFD	2.5	2.5	66.0	11.4	45.48
P- 8	Carbonate rock, argillaceous -----	4623-DFD	5.5	1.9	29.0	16.9	55.93
P- 7	Carbonate rock, argillaceous -----	4624-DFD	3.5	.2	17.9	20.4	56.63
P- 6	Carbonate rock, argillaceous -----	4625-DFD	.7	.3	29.9	21.1	56.84
P- 5	Carbonate rock, argillaceous -----	4626-DFD	3.0	.2	30.4	24.1	57.44
P- 4	Mudstone, carbonatic -----	4627-DFD	5.0	1.4	62.0	29.1	64.44
P- 3	Carbonate rock, argillaceous -----	4628-DFD	5.0	7.1	20.7	34.1	99.94
P- 2	Mudstone -----	4629-DFD	2.5	22.4	27.3	36.6	155.94
P- 1	Mudstone -----	4630-DFD	2.0	17.5	31.8	38.6	190.94

Dingle, Idaho, lot 1293

Phosphatic shale member of the Phosphoria formation sampled in bulldozer trench on the east limb of the Hot Springs anticline, SE $\frac{1}{4}$  sec. 36, T. 14 S., R. 44 E., Bear Lake County, Idaho. Beds strike N. 10° W. and dip 60° W. Section measured by M. A. Warner, R. A. Smart, R. G. Waring, and R. P. Sheldon and sampled by Warner, Smart, and Waring in July 1949. Samples analyzed for P<sub>2</sub>O<sub>5</sub> and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Rex chert member of Phosphoria formation—basal beds only										
R- 2	Chert -----	4074-MAW	1.3	—	--	--	--	--	1.3	--
--	Fault breccia -----	4073-MAW	(.3)	--	--	--	--	--	--	--
R- 1	Chert, phosphatic -----	4072-MAW	1.7	11.6	--	--	--	53.8	3.0	--
Phosphatic shale member of Phosphoria formation										
P-84	Mudstone, phosphatic -----	4071-MAW	0.5	11.2	--	--	--	42.8	0.5	5.60
P-83	Mudstone -----	4070-MAW	1.1	1.5	--	--	--	66.7	1.6	7.25
P-82	Mudstone, carbonatic -----	4069-MAW	1.5	.6	--	--	--	56.8	3.1	8.15
P-81	Mudstone, carbonatic -----	4068-MAW	2.7	.6	--	--	--	62.5	5.8	9.77
P-80	Mudstone, carbonatic -----	4067-MAW	1.8	.5	--	--	--	60.3	7.6	10.67
P-79	Carbonate rock, argillaceous -----	4066-MAW	.7	.8	--	--	--	25.0	8.3	11.23
P-78	Mudstone, carbonatic -----	4065-MAW	1.1	2.5	--	--	--	51.7	9.4	13.98
P-77	Mudstone, carbonatic -----	4064-MAW	1.2	2.4	--	--	--	61.0	10.6	16.86
P-76	Mudstone, carbonatic -----	4063-MAW	1.2	4.9	--	--	--	53.7	11.8	22.74
P-75	Mudstone -----	4062-MAW	1.5	2.6	--	--	--	68.0	13.3	26.64
P-74	Mudstone -----	4061-MAW	1.8	.4	--	--	--	68.5	15.1	27.36
P-73	Mudstone -----	4060-MAW	1.2	4.5	--	--	--	65.2	16.3	32.76
P-72	Phosphate rock-----	4059-MAW	1.4	36.3	0.77	0.22	2.78	4.7	17.7	83.58
P-71	Mudstone, phosphatic, phosphate rock, and mudstone -----	4058-MAW	2.3	14.6	7.0	1.79	4.52	49.3	20.0	117.16
P-70	Phosphate rock-----	4057-MAW	1.2	34.7	.98	.31	2.56	9.5	21.2	158.80
P-69	Phosphate rock, argillaceous -----	4056-MAW	.3	20.5	6.8	1.84	4.64	34.0	21.5	164.95
P-68	Phosphate rock-----	4055-MAW	.4	35.6	.92	.21	2.64	8.0	21.9	179.19
	Bed P-68 is slumped.									
P-67	Phosphate rock, argillaceous -----	4054-MAW	.9	21.0	5.8	1.61	4.78	34.8	22.8	198.09
P-66	Phosphate rock-----	4053-MAW	.6	36.2	.74	.30	2.86	6.1	23.4	219.81
P-65	Phosphate rock, argillaceous -----	4052-MAW	.6	22.9	4.6	1.08	5.30	30.2	24.0	233.55
P-64	Phosphate rock-----	4051-MAW	1.2	38.1	.56	.27	3.32	1.8	25.2	279.27
P-64	Phosphate rock-----	4051-MAW	1.2	38.1	.56	.27	3.32	1.8	25.2	279.27
P-63	Phosphate rock-----	4050-MAW	.8	36.9	1.1	.34	3.34	3.0	26.0	308.79
P-62	Phosphate rock-----	4034- RAS	.9	36.8	.94	.34	2.40	4.3	26.9	341.91

## Dingle—Continued

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-61	Phosphate rock, argillaceous-----	4033- RAS	1.4	24.3	4.5	0.93	4.18	28.7	28.3	375.93
P-60	Phosphate rock, argillaceous-----	4032- RAS	.7	29.4	3.5	1.19	4.58	16.3	29.0	396.51
P-59	Mudstone, phosphatic-----	4031- RAS	1.0	15.6	6.5	1.98	7.82	39.3	30.0	412.11
P-58	Phosphate rock -----	4030- RAS	.5	34.1	1.9	.61	2.94	8.7	30.5	429.16
P-57	Phosphate rock -----	4029- RAS	1.1	37.8	.86	.33	2.62	2.8	31.6	470.74
P-56	Phosphate rock -----	4028- RAS	1.6	35.6	1.4	.57	2.94	6.2	33.2	527.70
P-55	Mudstone, phosphatic-----	4027- RAS	1.5	10.8	--	--	--	58.8	34.7	543.90
P-54	Mudstone-----	4026- RAS	1.6	5.3	--	--	--	69.2	36.3	552.38
P-53	Mudstone, phosphatic-----	4025- RAS	1.9	13.8	--	--	--	47.3	38.2	578.60
P-52	Mudstone and phosphate rock -----	4043- RGW	2.0	4.5	--	--	--	67.5	40.2	587.60
P-51	Mudstone and chert-----	4042- RGW	2.0	5.4	--	--	--	63.0	42.2	598.40
	Bed P-51 is slumped.									
P-50	Mudstone, carbonatic-----	4041- RPS	1.2	.8	--	--	--	48.4	43.4	599.36
P-49	Phosphate rock, argillaceous-----	4040- RPS	1.8	19.3	--	--	--	40.9	45.2	634.10
P-48	Mudstone-----	4039- RPS	1.5	1.1	--	--	--	83.8	46.7	635.75
P-47	Phosphate rock, argillaceous and mudstone -----	4038- RPS	1.6	18.3	--	--	--	35.8	48.3	665.03
P-46	Mudstone-----	4037- RPS	.6	5.4	--	--	--	65.8	48.9	668.27
P-45	Mudstone and phosphatic mudstone -----	4036- RPS	2.0	10.0	--	--	--	49.7	50.9	688.27
P-44	Mudstone, phosphatic-----	4035- RPS	3.2	10.3	--	--	--	34.3	54.1	721.23
	Beds P-44 and P-45 are highly crumpled.									
P-43	Mudstone, contains carbonate rock and chert lenses-----	4049-MAW	2.4	.6	--	--	--	12.3	56.5	722.67
P-42	Mudstone-----	4048-MAW	.7	3.2	--	--	--	81.0	57.2	724.91
P-41	Mudstone-----	4047-MAW	2.5	2.0	--	--	--	75.3	59.7	729.91
P-40	Mudstone, phosphatic-----	4046-MAW	1.2	9.5	--	--	--	56.7	60.9	741.31
P-39	Mudstone-----	4045-MAW	1.7	1.6	--	--	--	77.2	62.6	744.03
P-38	Mudstone-----	4000-MAW	3.5	3.8	--	--	--	72.6	66.1	757.33
P-37	Mudstone, phosphatic-----	3999-MAW	1.7	10.2	--	--	--	49.3	67.8	774.67
P-36	Mudstone, phosphatic-----	3998-MAW	2.0	10.1	--	--	--	51.3	69.8	794.87
P-35	Carbonate rock -----	3997-MAW	1.1	1.0	--	--	--	15.7	70.9	795.97
P-34	Mudstone, phosphatic-----	3996-MAW	2.0	12.8	--	--	--	37.7	72.9	821.57
P-33	Mudstone, phosphatic-----	3995-MAW	1.5	9.7	--	--	--	47.8	74.4	836.12
P-32	Phosphate rock, argillaceous-----	3994-MAW	1.5	16.6	--	--	--	34.6	75.9	861.02

P-31	Mudstone-----	3993-MAW	1.0	6.8	--	--	--	65.2	76.9	867.82
P-30	Mudstone, phosphatic -----	3992-MAW	2.6	12.6	--	--	--	45.1	79.5	900.58
P-29	Mudstone, phosphatic -----	3991-MAW	2.3	12.9	--	--	--	52.1	81.8	930.25
P-28	Phosphate rock -----	3990-MAW	2.7	26.5	3.9	1.65	13.34	12.9	84.5	1,001.80
P-27	Mudstone, phosphatic -----	3989-MAW	1.1	13.7	7.9	3.01	8.86	46.3	85.6	1,016.87
P-26	Phosphate rock, argillaceous-----	3988-MAW	.8	22.3	5.7	2.00	9.86	26.7	86.4	1,034.71
P-25	Phosphate rock, argillaceous-----	3987-MAW	.8	18.0	6.7	2.81	11.02	34.8	87.2	1,049.11
P-24	Phosphate rock -----	4024- RAS	1.3	31.6	2.2	1.00	7.06	9.0	88.5	1,090.19
P-23	Phosphate rock -----	4023- RAS	.9	29.6	3.4	1.52	4.62	16.5	89.4	1,116.83
P-22	Phosphate rock, argillaceous-----	4022- RAS	2.4	21.6	4.4	1.83	5.34	33.0	91.8	1,168.67
P-21	Mudstone, phosphatic -----	4021- RAS	1.4	16.2	--	--	--	45.8	93.2	1,191.35
P-20	Mudstone-----	4020- RAS	1.3	7.6	--	--	--	62.8	94.5	1,201.23
P-19	Mudstone-----	4019- RAS	2.2	4.2	--	--	--	70.4	96.7	1,210.47
P-18	Mudstone, phosphatic -----	4018- RAS	.9	9.9	--	--	--	58.5	97.6	1,219.38
P-17	Phosphate rock, argillaceous-----	4017- RAS	1.9	23.4	3.7	1.04	5.46	32.5	99.5	1,263.84
P-16	Phosphate rock, argillaceous-----	4016- RAS	1.5	28.9	3.2	.60	6.66	17.8	101.0	1,307.19
P-15	Phosphate rock, argillaceous-----	4015- RAS	2.4	25.7	4.1	.70	4.30	27.2	103.4	1,368.87
P-14	Phosphate rock, argillaceous-----	4014- RAS	2.0	24.5	3.9	.94	5.54	28.3	105.4	1,417.87
P-13	Phosphate rock, argillaceous-----	4013- RAS	2.2	18.3	7.0	1.91	4.64	42.0	107.6	1,458.13
P-12	Mudstone-----	4012- RAS	.9	4.7	10.0	3.50	3.92	72.5	108.5	1,462.36
P-11	Phosphate rock, argillaceous-----	4011- RAS	2.0	26.5	3.1	1.48	3.04	26.5	110.5	1,515.36
P-10	Phosphate rock, argillaceous-----	4010- RAS	1.0	22.3	3.6	6.53	3.64	30.7	111.5	1,537.66
P- 9	Phosphate rock, argillaceous-----	4009- RAS	1.8	27.4	4.3	1.34	3.12	23.0	113.3	1,586.98
P- 8	Phosphate rock, argillaceous-----	4008- RAS	.7	22.4	3.6	1.60	2.66	35.3	114.0	1,602.66
P- 7	Phosphate rock, argillaceous-----	4007- RAS	.9	25.0	4.7	2.92	3.14	27.2	114.9	1,625.16
P- 6	Phosphate rock -----	4006- RAS	2.8	35.5	1.3	.34	3.04	4.5	117.7	1,724.56
P- 5	Phosphate rock -----	4005- RAS	1.9	35.6	1.3	.20	3.12	4.2	119.6	1,792.20
P- 4	Phosphate rock -----	4004- RAS	1.8	35.6	1.2	.34	3.48	3.8	121.4	1,856.28
P- 3	Mudstone-----	4003- RAS	2.6	2.5	9.2	2.89	3.28	77.7	124.0	1,862.78
P- 2	Mudstone-----	4002- RAS	1.7	1.2	9.9	3.12	3.14	79.0	125.7	1,864.82
P- 1	Phosphate rock -----	4001- RAS	.3	32.3	2.8	1.94	3.06	10.5	126.0	1,874.51

Wells formation—top part only

Cw-1	Chert and mudstone -----	--	94.0	--	--	--	--	--	94.0	--
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Upper part of the phosphatic shale member of the Phosphoria formation measured and sampled in a tunnel near the bulldozer trench. Beds strike N. 15° W. and dip approximately 70° W. Section measured and sampled by D. F. Davidson and R. A. Smart in June 1949.

Rex chert member of Phosphoria formation—basal bed only

R- 1	Chert, phosphatic -----	3901- DFD	1.1	10.0	--	--	--	56.4	1.1	--
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Dingle—Continued

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Phosphatic shale member of Phosphoria formation										
P-33	Mudstone, phosphatic -----	3902-DFD	0.5	10.6	--	--	--	55.0	0.5	5.30
P-32	Mudstone -----	3903-DFD	.9	2.0	--	--	--	73.9	1.4	7.10
P-31	Mudstone -----	3904-DFD	.7	3.5	--	--	--	67.0	2.1	9.55
P-30	Mudstone, carbonatic -----	3905-DFD	2.0	.3	--	--	--	60.0	4.1	10.15
P-29	Mudstone, carbonatic -----	3906-DFD	3.4	.5	--	--	--	51.0	7.5	11.85
--	Mudstone, carbonatic lens in bed P-29----	3907-DFD	--	.2	--	--	--	60.1	--	--
P-28	Mudstone, carbonatic -----	3908-RAS	2.1	1.5	--	--	--	61.3	9.6	15.00
P-27	Carbonate rock, argillaceous -----	3909-RAS	.7	.8	--	--	--	26.7	10.3	15.56
P-26	Mudstone -----	4080-RAS	2.0	6.3	--	--	--	54.3	12.3	28.16
P-25	Phosphate rock, argillaceous -----	4081-RAS	.8	17.9	--	--	--	41.8	13.1	42.48
P-24	Mudstone -----	4082-RAS	1.8	3.4	--	--	--	69.5	14.9	48.60
P-23	Mudstone -----	4083-RAS	2.4	.5	--	--	--	73.7	17.3	49.80
P-22	Phosphate rock -----	4084-RAS	1.7	33.8	1.6	0.47	2.56	9.5	19.0	107.26
P-21	Mudstone and argillaceous phosphate rock -----	4085-RAS	.8	8.7	9.1	1.63	3.86	62.4	19.8	114.22
P-20	Mudstone -----	4086-RAS	1.0	5.0	9.6	1.69	3.90	72.7	20.8	119.22
P-19	Phosphate rock -----	4087-RAS	.4	35.6	1.5	.43	2.32	6.4	21.2	133.46
P-18	Phosphate rock and phosphatic mudstone---	4088-RAS	1.0	23.5	7.0	1.22	3.80	30.3	22.2	156.96
P-17	Phosphate rock -----	4089-RAS	1.1	34.4	1.3	.34	1.96	9.4	23.3	194.80
P-16	Phosphate rock -----	4090-RAS	.7	33.3	2.8	.67	2.76	11.1	24.0	218.11
P-15	Phosphate rock, argillaceous and phosphate rock -----	4091-RAS	1.0	25.8	4.8	1.74	6.40	22.7	25.0	243.91
P-14	Phosphate rock -----	4092-RAS	.9	35.5	1.1	.64	5.28	4.3	25.9	275.86
P-13	Mudstone, phosphatic and phosphate rock --	4093-RAS	.8	26.6	4.1	1.88	6.62	20.5	26.7	297.14
P-12	Phosphate rock -----	4094-RAS	1.9	36.9	.73	.38	5.66	1.7	28.6	367.25
P-11	Phosphate rock -----	4095-RAS	2.1	35.3	1.2	.84	6.08	3.4	30.7	441.38
P-10	Phosphate rock, argillaceous -----	4096-RAS	1.5	23.8	5.8	2.43	7.88	25.0	32.2	477.08
P- 9	Phosphate rock -----	4097-RAS	1.9	36.9	1.4	.61	3.14	2.7	34.1	547.19
P- 8	Phosphate rock -----	4098-RAS	1.0	35.7	1.4	.71	3.94	3.7	35.1	582.89
P- 7	Phosphate rock, argillaceous -----	4099-RAS	1.6	24.4	4.0	1.77	11.62	19.5	36.7	621.93
P- 6	Mudstone, phosphatic -----	5000-RAS	1.2	11.7	--	--	--	52.0	37.9	635.97
P- 5	Mudstone -----	5001-RAS	1.5	5.4	--	--	--	66.1	39.4	644.07
P- 4	Mudstone -----	5002-RAS	2.6	1.7	--	--	--	80.3	42.0	648.49
P- 3	Mudstone -----	5003-RAS	2.0	4.9	--	--	--	71.8	44.0	658.29
P- 2	Phosphate rock -----	5004-RAS	.4	28.6	--	--	--	13.4	44.4	669.73
P- 1	Mudstone -----	5005-RAS	.5	5.1	--	--	--	56.0	44.9	672.28

Hot Springs, Idaho, lot 1317

Portion of the phosphatic shale member of the Phosphoria formation sampled on overturned east limb of Hot Springs anticline in the Hot Springs crosscut, sec. 13, T. 15 S., R. 44 E., Bear Lake County, Idaho. Beds strike N. 24° W. and dip 43° W. Section measured by R. G. Waring, J. D. Weiser, and H. W. Peirce and sampled by Waring and Peirce in September 1949. Samples analyzed for  $P_2O_5$  and acid insoluble by U. S. Bureau of Mines laboratory, Albany, Oreg., 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 <sub>2</sub> O <sub>5</sub> (cumulative)
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
Upper portion of phosphatic shale member of Phosphoria formation										
	Strata between bed P-36 and Rex chert member not measured because of faulting and crumpling.									
P-36	Mudstone -----	4615-JDW	1.3	2.3	--	--	--	67.2	1.3	2.99
P-35	Carbonate rock -----	4614-JDW	5.0	.4	--	--	--	16.6	6.3	4.99
P-34	Phosphate rock, argillaceous -----	4613-JDW	.4	24.6	--	--	--	21.1	6.7	14.83
P-33	Mudstone -----	4612-JDW	1.3	3.2	--	--	--	65.9	8.0	18.99
P-32	Mudstone -----	4611-JDW	3.0	1.0	--	--	--	72.8	11.0	21.99
P-31	Phosphate rock-----	4610-JDW	2.0	34.3	0.56	0.39	6.17	2.4	13.0	90.59
P-30	Mudstone and carbonate rock -----	4609-JDW	2.0	4.1	4.96	1.75	21.63	36.4	15.0	98.79
P-29	Phosphate rock-----	4608-JDW	.5	30.0	.90	.61	9.48	4.9	15.5	113.79
P-28	Carbonate rock, argillaceous -----	4607-JDW	1.3	5.5	4.72	1.86	23.15	30.0	16.8	120.94
P-27	Phosphate rock-----	4606-JDW	.8	31.2	.70	.36	6.58	3.6	17.6	145.90
P-26	Phosphate rock-----	4605-HWP	1.3	31.0	1.62	.84	7.50	7.9	18.9	186.20
P-25	Phosphate rock, argillaceous -----	4604-HWP	.8	22.8	4.16	1.75	7.55	26.0	19.7	204.44
P-24	Phosphate rock-----	4603-HWP	.8	31.7	1.27	.63	7.01	7.8	20.5	229.80
P-23	Phosphate rock, argillaceous -----	4602-HWP	.75	19.5	3.84	1.75	12.85	24.6	21.25	244.43
P-22	Phosphate rock -----	4601-HWP	.8	33.8	1.00	.63	9.38	3.6	22.05	271.47
P-21	Phosphate rock, argillaceous -----	4600-HWP	.8	24.1	2.78	1.26	11.42	16.9	22.85	290.75
P-20	Phosphate rock, argillaceous -----	4599-HWP	.7	24.4	2.60	1.12	13.30	15.6	23.55	307.83
P-19	Phosphate rock, argillaceous -----	4598-HWP	1.4	22.4	4.60	1.80	11.43	27.1	24.95	339.19
P-18	Phosphate rock-----	4597-HWP	.8	32.4	.62	.46	8.83	2.6	25.75	365.11
P-17	Phosphate rock-----	4596-HWP	2.1	25.4	1.10	.48	9.83	4.3	27.85	418.45
P-16	Phosphate rock-----	4595-HWP	1.6	32.0	2.19	1.06	15.73	10.6	29.45	469.65
P-15	Phosphate rock-----	4594-HWP	.9	30.2	1.21	.56	14.32	5.0	30.35	496.83
P-14	Phosphate rock, argillaceous -----	4593-HWP	1.9	28.1	3.16	1.36	14.16	17.9	32.25	550.22
P-13	Phosphate rock, argillaceous -----	4592-HWP	1.5	18.6	--	--	--	19.9	33.75	578.12
P-12	Phosphate rock, argillaceous -----	4591-HWP	2.7	15.7	--	--	--	37.7	36.45	620.51
P-11	Mudstone, carbonatic -----	4590-HWP	2.7	5.7	--	--	--	40.2	39.15	635.90
P-10	Phosphate rock, argillaceous -----	4589-HWP	1.4	16.7	--	--	--	35.0	40.55	659.28
P-9	Phosphate rock, argillaceous -----	4588-HWP	.6	16.5	--	--	--	35.4	41.15	669.18

Hot Springs—Continued

Bed no.	Rock description	Sample no.	Thickness (feet)	Chemical analyses (percent)					Cumulative thickness (feet)	Thickness x percent P <sub>2</sub> O <sub>5</sub> (cumulative) <sup>5</sup>
				P <sub>2</sub> O <sub>5</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Loss on ignition	Acid insoluble		
P-8	Mudstone, phosphatic -----	4587-HWP	2.2	12.9	--	--	--	42.6	43.35	697.56
P-7	Mudstone, phosphatic -----	4586-HWP	1.5	13.0	--	--	--	47.6	44.85	717.06
P-6	Mudstone -----	4585-HWP	1.4	1.7	--	--	--	72.0	46.25	719.44
P-5	Phosphate rock, argillaceous -----	4584-HWP	.7	20.7	--	--	--	32.5	46.95	733.93
P-4	Mudstone, phosphatic -----	4583-HWP	2.3	11.5	--	--	--	51.8	49.25	760.38
P-3	Carbonate rock -----	4582-HWP	1.3	1.3	--	--	--	13.8	50.55	762.07
P-2	Mudstone, phosphatic -----	4581-HWP	2.2	27.0	--	--	--	26.4	52.75	821.46
P-1	Phosphate rock, argillaceous -----	4580-HWP	1.2	16.9	--	--	--	31.6	53.95	841.74

A fault at base of bed P-1 causes omission of an unknown thickness of strata.