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ANALYTICAL DATA ON THE PHOSPHORIA FORMATION WESTERN UNITED STATES

By

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Analytical Data on the Phosphoria Formation

by R. A. Gulbrandsen

Contents

Introduction

The stratigraphy and nomenclature of the Phosphoria, Park City, and Shedhorn Formations in the western phosphate field have been described by McKelvey and others (1959). Analytical data obtained by the Geological Survey in the course of its study of the phosphate deposits in the Phosphoria Formation have been included in many publications. The chief sources of these data are included in the references at the end of this report.

The analytical data on the Phosphoria Formation that are presented here are those of the Geological Survey that so far have not been incorporated in published reports. They include complete rock analyses and analyses of many rare elements. The samples analyzed are identified by geographic location, by rock type, and by stratigraphic position in published stratigraphic sections. The purpose of the report is to make the data available for public utilization.

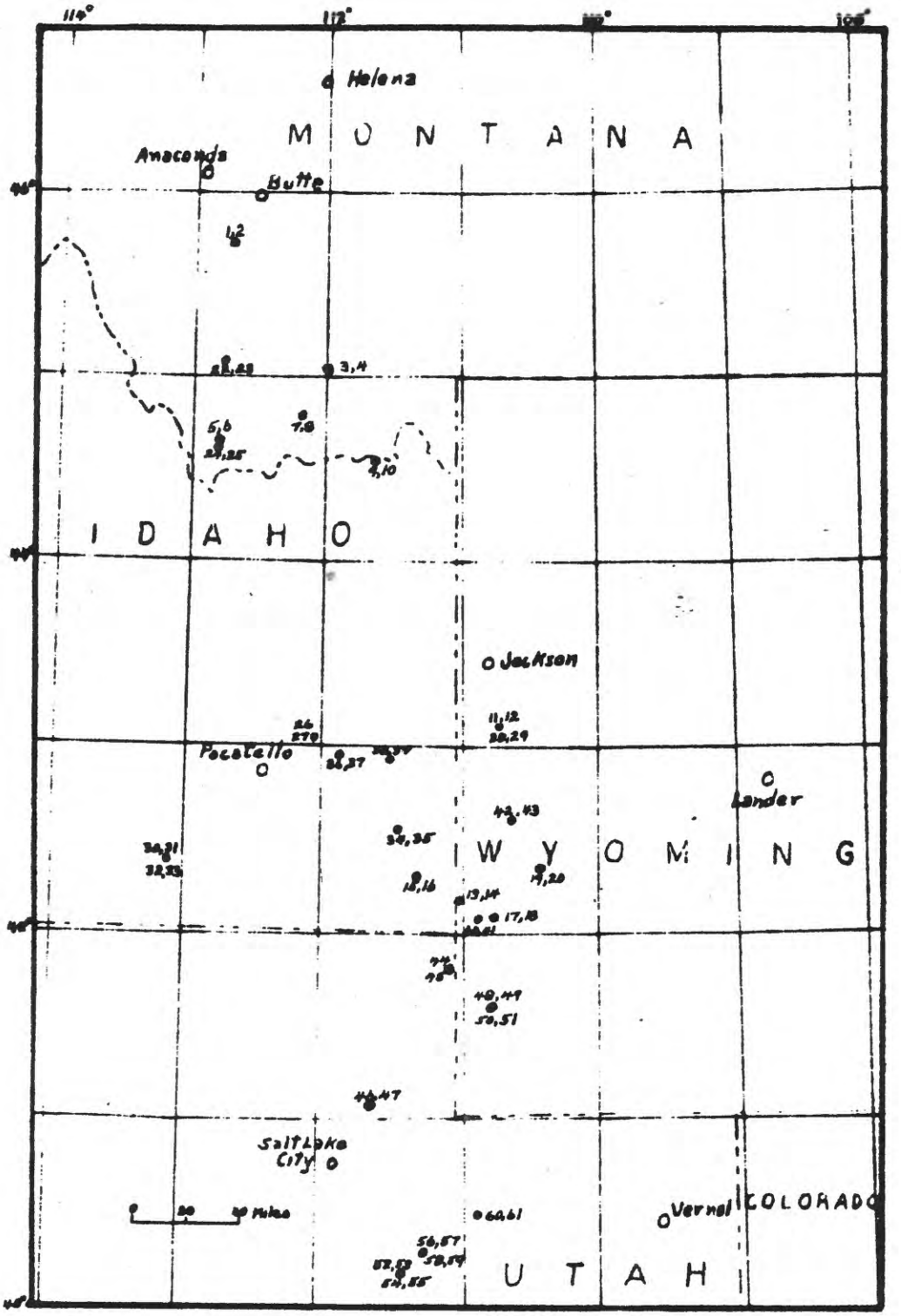

Figure 1.--Location of analyzed samples of quartz-silicate rocks of table 1. Numbers are the analysis numbers.

Table 1 a/ Chemical composition of the quartz-silicate rocks of the Phosphoria Formation

Retort Member

%

	RFG 5580	RFG 5584	CWT 700	RSJ 717	WRL 57	WRL 66	FSH 425	FSH 438	OAP 520	OAP 525	RAS 6497	TMC 6505	VEM 72
	1	2	3	4	5	6	7	8	9	10	11	12	13
SiO_2	71.3	62.5	69.7	61.2	63.4	58.5	78.4	77.0	58.6	75.7	59.6	65.1	68.4
Al_2O_3	13.8	10.0	2.1	11.9	12.0	11.5	8.9	1.0	11.7	9.2	11.9	8.9	1.7
Fe_2O_3 b/	1.6	4.0	.6	5.4	4.9	5.4	3.9	3.1	4.4	4.3	4.4	3.9	3.5
FeO	.23	.20	1.6	1.4	1.1	2.1	.90	1.9	2.6	1.2	.48	.38	2.0
MgO	1.6	1.5	.26	1.7	.83	.93	.53	.06	.79	.72	1.3	1.1	.42
CaO	1.7	6.6	12.5	3.7	2.6	4.7	.43	9.5	7.0	1.4	6.8	7.2	12.5
Na_2O	.11	.14	.22	.16	.51	.66	.14	.14	.24	.18	.24	.20	.14
K_2O	3.6	2.6	.26	3.9	3.3	3.2	2.1	.13	4.4	2.7	3.7	2.6	.42
H_2O^{tot}	3.7	5.5	4.4	4.8	6.2	7.5	3.9	1.0	3.6	4.1	5.2	3.7	1.0
H_2O^-	.5	1.8	0.1	0.8	1.2	.9	.4	.05	.7	0.6	1.2	0.8	0.1
TiO_2	.90	.70	.14	.70	.79	.77	.58	.04	.74	.58	.70	.42	.10
P_2O_5	.68	3.7	6.6	.48	1.7	3.0	.37	7.2	4.9	.95	4.3	3.8	4.8
CO_2	.65	1.23	3.22	2.81	.16	.29	.04	.35	.33	.23	.42	1.44	5.21
SO_3	—	—	—	—	—	—	.33	—	—	.28	—	—	—
Cl	—	—	—	—	—	—	—	—	—	—	—	—	—
F	.28	.50	0.75	.13	.23	.38	.08	.74	.60	.11	.58	.42	.50
Organic c/ Matter	2.0	2.6	1.1	4.0	5.4	6.3	2.8	.5	4.3	2.4	3.2	2.1	.5
Oil d/	.10	.13	.28	.20	.50	.84	.25	.02	.10	.10	.15	.10	.20
U	.001	.002	.004	.001	.001	.002	.001	.002	.003	.001	.001	.001	.001
eU	.001	.001	.004	.004	.003	—	.001	—	.005	.001	.002	.002	.001
Ag	.001	.001	.0001	.0003	.00003	.00003	.0001	.0003	.0003	.00003	.0001	.0001	.00003
As	.001	.005	.003	.005	.006	.003		.002	.002	.003	.006	.003	.006
B	.03	.03	< .005	.03	.03	.03	.01	< .005	.03	.01	.01	.03	.01
Ba	.03	.03	.01	.03	.03	.03	.03	.003	.03	.03	.01	.03	.01
Be	.0001	.0001	< .00005	.0001	.0001	< .00005	< .00005	< .00005	< .00005	< .00005	< .00005	< .00005	< .00005
Cd	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005	< .005
Co	< .001	< .001	< .001	.001	.003	.001	< .001	< .001	< .001	.001	< .001	< .001	< .001
Cr	.1	.1	.03	.1	.1	.1	.1	.03	.1	.03	.1	.1	.03
Cu	.003	.003	.003	.003	.01	.01	.003	.003	.01	.01	.003	.003	.003
Ga	.001	.001	< .001	.001	.001	.001	< .001	< .001	.001	.001	.001	.001	< .001
La	< .003	.003	.01	< .003	.01	.01	< .003	.01	.01	.003	.003	.003	.01
Mn	.003	.003	.01	.03	.03	.01	.003	.003	.01	.01	.003	.01	.03
Mo	.003	.01	.01	.01	.01	.01	.003	.003	.01	.003	.003	.003	< .0005
Ni	.003	.003	.01	.03	.03	.03	.01	.001	.01	.01	.003	.01	.003
Pb	.001	.001	< .001	.001	.001	.001	< .001	< .001	< .001	.001	.003	.01	< .001
Sb	.0002	.0001	< .0001	.0004	.0004	.0003		< .0001	.0007	.0005	.0001	.0001	.0002
Sc	.001	.003	< .0005	< .0005	.003	.003	.001	.0005	.001	.001	.001	.001	< .0005
Se	.002	.0003	.0007	.001	.0005	.0005		.001	.005	.0003	.0005	.0003	.0003
Sr	.01	.03	.03	.03	.03	.03	.03	.01	.01	.01	.03	.01	.01
V	.01	.01	.01	.01	.003	.003	.01	.01	.01	.01	.01	.01	< .001
Y	.003	.01	.03	.003	.01	.03	.003	.01	.03	.003	.01	.01	.01
Yb	.0003	.001	.001	.0003	.001	.001	.0003	.001	.001	.0003	.0003	.0003	.001
Zn	.01	< .008	.01	.01	.01	.03	.03	.03	.01	.03	< .008	.03	< .008
Zr	.03	.01	.003	.01	.03	.03	.01	.003	.03	.01	.01	.01	.003

Table 4 a/ Chemical composition of the quartz-silicste rocks of the Phosphoria Formation--Continued

	Retort Member -- Continued								Meade Peak Member				
	%												
	VEM 90	RAH 252	RAH 246	LES 27	LES 31	RAS 7204	RAS 7208	Ave. b/ Retort	WRL 264	WRL 265	WRL 153	WRL 156	WOM 2716
	14	15	16	17	18	19	20	21	22	23	24	25	26
SiO_2	61.8	77.3	66.2	65.2	62.0	75.8	75.3	76.50	63.4	67.5	67.7	81.4	63.5
Al_2O_3	9.7	4.6	9.4	2.5	5.8	7.6	6.6	8.04	10.1	9.8	3.0	3.9	11.2
Fe_2O_3 a/	4.8	4.3	3.8	3.2	2.7	2.9	2.9	3.70	5.8	1.9	3.5	3.6	3.7
FeO	.86	2.9	.71	1.9	.48	.23	.56	1.19	1.0	.24	2.3	2.3	.27
MgO	1.1	.86	1.9	1.8	.81	.92	1.0	1.01	.57	.60	2.6	1.0	.35
CaO	7.1	4.4	5.3	12.8	13,0	3.3	3.8	6.32	3.9	7.7	9.7	3.5	6.2
Na_2O	.29	.86	.51	.17	.16	.23	.17	.27	.30	.16	.18	.10	1.4
K_2O	2.9	.80	2.4	.57	1.6	2.3	2.0	2.27	1.8	1.2	.70	.94	2.7
H_2O^{tot}	4.4	1.5	4.3	1.1	2.1	1.5	3.2	3.64	5.9	3.8	1.5	1.7	3.8
H_2O -	1.0	.2	1.0	.05	.2	.7	0.8	.66	2.3	.7	0.4	0.2	.4
TiO_2	.54	.31	.54	.12	.32	.36	.33	.48	.73	.68	.20	.26	.72
P_2O_5	4.3	1.4	1.5	3.6	2.8	2.3	2.6	3.05	5.8	5.7	3.0	1.1	4.4
CO_2	.45	2.51	3.21	7.76	7.56	.20	0.22	1.91	.23	.18	6.95	2.36	.15
SO_3	-	.20	-	-	.23	-	-	.26	-	.20	.63	.30	.46
Cl	-	-	-	-	-	.02	-	.02	-	-	-	-	-
F	.58	.17	.33	.43	.38	.30	.37	.39	.43	.58	.32	.11	.45
Organic c/ Matter	3.0	1.1	3.0	1.0	1.5	2.0	2.6	2.57	2.4	1.7	1.1	1.6	2.2
Oil d/	.20	.10	.22	.10	.10	.20	.05	.197	.12	.20	.32	.04	.15
U	.001	.001	.001	.001	.001	.001	.001	.0014	.002	.002	.002	.001	.001
eU	-	.001	.002	.001	-	.002	.003	.001	.004	.003	-	-	.002
Ag	.00001	<.00001	.00001	<.00001	<.00001	.00003	.0001	.00003-.0001	.001	.0003	.0003	.00003	.0003
As	.003	.004	.001	.006	.004	.006	.006	.0038	.008	.008	.003	.001	.002
B	.03	.01	.03	.01	.01	.01	.01	.03 -.01	.01	.01	.01	.01	.01
Ba	.01	.03	.03	.01	.03	.03	.01	.03	.01	.01	.01	.03	.03
Be	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005
Cd	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Co	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Cr	.1	.01	.1	.03	.03	.1	.1	.1	.1	.03	.01	.01	.1
Cu	.01	.01	.003	.01	.003	.01	.003	.003	.03	.01	.01	.01	.003
Ga	.001	<.001	.001	<.001	<.001	.001	<.001	.001	.001	.001	<.001	<.001	.001
La	.01	<.003	.003	<.003	<.003	.003	<.003	<.003-.01	.003	.003	<.003	<.003	.01
Mn	.03	.03	.01	.03	.03	.01	.003	.03-.01	.003	.001	.03	.01	.001
Mo	.001	<.0005	<.0005	<.0005	<.0005	.003	.01	.003-.01	.003	<.0005	.003	.003	.01
Ni	.01	.003	.01	.003	.003	.03	.003	.003	.001	.0003	.003	.01	.01
Pb	.03	<.001	<.001	.003	<.01	.001	.003	<.001-.001	.01	.01	.001	<.001	.001
Sb	.0005	.0002	< 0001	<.0001	<.0001	<.0001	<.0001	.0002	.001	.0003	.0002	.0003	.0005
Sc	.001	<.0005	.001	<.0005	.001	.001	.001	.001	.001	.001	.001	.001	.001
Se	.002	.001	.0003	.001	.0003	.0005	.001	.001	.0003	.0001	.003	.001	.003
Sr	.01	.01	.01	.01	.01	.03	.01	.01	.01	.01	.01	.01	.03
V	.003	.001	.01	.001	.001	.01	.01	.01	.01	.01	.003	.001	.01
Y	.01	.003	.01	.003	.003	.01	.003	.01	.003	.003	.003	.003	.01
Yb	.001	.0003	.0003	.0001	.0003	.001	.0003	.0003	.0003	.0003	.0003	.0003	.001
Zn	.1	<.008	<.008	.01	.01	.01	.03	.01	<.008	<.008	<.008	.01	.03
Zr	.01	.01	.01	.001	.003	.01	.01	.01	.01	.03	.01	.01	.03

Table 8a/ Chemical composition of the quartz-silicate rocks of the Phosphoria Formation --Continued

Meade Peak Member

%

	RAS 6336	RAS 6455	MAW 6487	MAW 6425	RAS 6426	RAS 6432	RGW 6452	WOM 2974	WOM 2981	HWP 4340	RSJ 4331	MET 4300	RAS 4273
	27	28	29	30	31	32	33	34	35	36	37	38	39
SiO_2	62.7	61.1	63.1	72.4	65.6	58.6	67.0	72.3	71.8	63.5	70.5	56.6	75.0
Al_2O_3	10.5	7.5	9.5	13.1	8.0	7.9	9.9	11.7	11.2	11.2	12.5	10.6	9.4
Fe_2O_3 e/	2.6	2.6	4.1	2.7	3.3	2.5	3.8	4.0	4.0	3.9	5.0	3.9	2.9
FeO	.21	.89	1.4	.21	.39	.08	.47	.33	.61	.31	.48	.32	.35
MgO	.83	1.7	.59	.88	.61	.78	.84	.60	.40	.52	.56	.69	.64
CaO	7.7	10.1	.21	.76	8.8	12.9	4.3	.54	1.7	5.5	.49	8.0	2.6
Na_2O	.16	.25	.23	.21	.30	1.8	.50	1.0	1.5	1.1	1.0	1.2	1.5
K_2O	2.3	2.5	3.0	3.6	2.1	1.3	2.1	3.0	2.7	2.8	3.2	2.6	1.7
H_2O^{tot}	4.5	2.6	5.6	5.1	4.1	3.1	5.7	4.8	3.8	4.1	2.2	1.7	3.7
H_2O^-	0.8	0.5	1.7	.8	.8	.7	1.4	1.5	.7	1.4	1.0	1.3	.4
TiO_2	.62	.54	1.0	.74	.39	.48	.62	.78	.76	.74	.81	.82	.60
P_2O_5	4.9	8.4	.76	.64	6.8	9.6	3.5	.19	1.3	3.7	.27	4.7	1.7
CO_2	0.61	0.53	.03	.05	.19	.39	.28	.02	.07	.18	.16	.34	.13
SO_3	-	-	-	-	-	-	-	.21	.32	.46	-	-	-
Cl	-	-	-	-	-	-	-	-	-	.04	-	-	-
F	.50	1.15	.11	.20	.68	.93	.33	.13	.15	.45	.07	.50	.28
organic matter c/	1.0	1.8	11.6	2.1	1.5	1.1	.8	1.4	1.7	2.0	1.7	5.0	1.9
Oil d/	.10	.15	.22	.10	.13	.20	.25	.02	.38	.20	.06	.18	.15
U	.003	.005	.003	.001	.002	.003	.002	.001	.001	.001	.001	.002	.001
eU	.001	.005	-	.003	.002	.005	-	.002	.002	.001	.001	.004	-
Ag	.001	.001	.001	.001	.001	.0003	.0003	.0001	.0001	.0001	.00001	.001	.00003
As	.003	.02	.005	.003	.002	.002	.002	.003	.002	.003	.002	.005	.004
B	.01	<.005	.01	.03	.01	.003	.01	.01	.01	.01	.01	.01	.03
Ba	.03	.01	.01	.03	.03	.01	.3	.03	.03	.03	.03	.03	.03
Be	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	.0001	<.00005
Cd	<.005	.01	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Co	<.001	<.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	<.001	<.001	<.001	.001
Cr	.3	.03	.1	.3	.1	.03	.1	.03	.1	.1	.03	.3	.03
Cu	.01	.01	.003	.01	.01	.01	.01	.001	.003	.003	.003	.01	.003
Ga	.001	.001	.001	.001	.001	<.001	.001	<.001	.001	.001	.001	.001	.001
La	.003	.01	.003	.01	<.003	.003	.003	<.003	.003	.003	<.003	.003	.003
Mn	.03	.003	.001	.003	.001	.03	.001	.003	.01	.03	.01	.003	.03
Mo	.003	.03	.1	.003	<.0005	.003	.003	.003	.003	.003	.003	.01	.01
Ni	.01	.03	.003	.03	.01	.1	.03	.01	.01	.03	.01	.01	.03
Pb	.001	<.001	.001	.001	.001	<.001	<.001	.001	.001	<.001	<.001	.001	<.001
Sb	.001	.001	.001	.0003	.0001	.0005	.0002	.0003	.0003	.0001	.0005	.0005	.0001
Sc	.001	.001	.001	.003	.001	.001	.001	.001	.001	.001	.001	.001	.001
Se	.001	.003	.002	.0005	.0005	.0003	.0003	.01	.0005	.0007	.0005	.005	.0007
Sr	.01	.03	.01	.03	.01	.01	.03	.01	.01	.01	.01	.03	.01
V	.01	.01	.1	.01	.01	.01	.01	.003	.003	.01	.003	.01	.01
Y	.01	.03	.003	.01	.003	.01	.003	.003	.003	.01	.003	.01	.01
Yb	.001	.001	.0003	.001	.0003	.0003	.0003	.0003	.0003	.001	.0003	.001	.001
Zn	.03	.1	<.008	.01	.03	.03	.03	.03	.03	.01	<.008	.03	.01
Zr	.03	.03	.03	.03	.003	.01	.01	.03	.03	.03	.03	.01	.03

Table 4/ Chemical composition of the quartz-silicate rocks of the Phosphoria Formation--Continued

Meade Peak Member

%

	RPS 3626	DFD 3608	LDC 7015	RPS 7027	RGW 3962	VEM 3936	MAW 6102	RAS 6165	RAS 6191	RGW 6201	MAW 6230	MAW 6252	MDS 2489
	40	41	42	43	44	45	46	47	48	49	50	51	52
SiO_2	59.0	63.4	42.6	66.7	64.4	68.6	66.5	66.3	51.3	52.4	60.2	74.4	70.2
Al_2O_3	13.2	9.2	6.9	11.8	3.6	13.3	10.1	6.5	11.8	12.0	12.3	8.1	5.0
Fe_2O_3 e/	4.6	3.7	2.0	3.4	1.2	4.2	3.6	2.8	2.8	1.2	4.2	2.4	2.9
FeO	1.8	1.0	.24	1.4	.40	1.0	.75	.84	.37	.45	1.2	.32	1.6
MgO	1.1	3.3	8.4	.84	2.4	1.2	2.4	.76	1.7	1.1	1.1	.80	1.9
CaO	3.3	6.4	13.1	1.5	12.1	.62	4.8	9.6	12.2	12.4	1.1	4.6	8.2
Na_2O	.54	1.2	.24	.23	.21	.22	2.6	.29	.58	.66	.72	.36	.22
K_2O	3.6	2.2	1.8	3.1	1.0	3.9	2.2	1.7	3.5	3.7	2.9	1.6	1.4
H_2O^{tot}	6.7	2.4	2.9	5.8	1.4	5.3	2.0	3.1	3.8	4.6	7.2	3.9	2.7
H_2O^-	1.8	.3	.6	1.7	.2	1.2	.1	1.0	0.8	1.0	2.0	1.0	.5
TiO_2	1.0	.60	.47	1.0	.20	.90	.64	.38	.71	.66	1.1	.37	.22
P_2O_5	.39	.49	.77	.65	4.3	.19	.72	5.8	7.4	8.4	1.1	2.4	1.7
CO_2	1.54	7.32	.83	.29	6.92	.08	4.92	1.39	2.26	0.83	.13	.98	6.18
SO_3	1.02	.15	-	-	.38	-	-	-	-	-	-	-	-
Cl	-	-	-	-	-	-	-	-	.07	_	_	.15	_
F	.23	.18	.13	.20	.40	.18	.10	.56	0.88	0.82	.08	.27	.18
Organic c/ Matter	5.8	1.5	2.6	3.9	1.3	3.1	1.1	1.6	1.4	1.2	8.4	1.8	2.1
Oil d/	.15	.10	.10	.15	.05	.10	.08	.15	.20	.12	.44	.14	.11
U	.001	.001	.001	.002	.001	.001	.001	.001	.001	.003	.002	.001	.001
eU	.003	.002	-	.005	.001	-	.001	.002	.003	-	-	.001	-
Ag	.001	.0003	.0003	.001	.001	.001	.0001	.0003	.0001	.001	.001	.001	.00001
As	.02	.005	.003	.002	.001	.003	.002	.002	<.001	.001	.01	.002	.001
B	.03	.03	<.005	.01	.01	.03	.01	.01	.03	.03	.03	.01	.01
Ba	.03	.01	.003	.03	.01	.03	.03	.01	.03	.01	.03	.01	.01
Be	.0001	<.00005	<.00005	.0001	<.00005	.0001	<.00005	<.00005	.0001	.0001	<.00005	<.00005	<.00005
Cd	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Co	.003	<.001	<.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	<.001	<.001	<.001
Cr	.1	.03	.03	.1	.03	.1	.03	.1	.1	.1	.1	.1	.03
Cu	.01	.003	.003	.003	.003	.003	.003	.003	.003	.003	.01	.003	.003
Ga	.001	<.001	<.001	.001	<.001	.001	.001	<.001	.001	.001	.001	.001	<.001
La	<.003	<.003	<.003	.003	<.003	.003	<.003	<.003	.003	.003	.003	<.003	<.003
Mn	.01	.03	.003	.001	.003	.001	.01	.003	.01	.001	.003	.01	.01
Mo	.03	.003	.003	.03	<.0005	.03	.003	<.0005	<.0005	<.0005	.03	<.0005	<.0005
Ni	.03	.01	.003	.01	.01	.01	.01	.001	.01	.01	.01	.01	.003
Pb	.003	<.001	<.001	.001	<.001	.003	<.001	<.001	.001	<.001	.001	<.001	<.001
Sb	.0003	.0005	.0015	.0015	.0002	.0007	.0001	.0001	.0001	.0002	.004	.0001	<.0001
Sc	.003	.001	.001	.003	<.0005	.003	.001	.001	.001	.01	.003	.001	<.0005
Se	.007	.001	.002	.0007	.0003	.003	.0007	.0001	.0005	.001	.003	.0007	.0005
Sr	.01	.01	.003	.01	.01	.01	.01	.01	.01	.03	.01	.01	.01
V	.1	.003	.01	.1	.003	.1	.003	.003	.01	.01	.1	.003	.001
Y	.01	.003	.003	.003	.003	.003	.003	.003	.01	.01	.01	.003	.003
Yb	.001	.0003	.0003	.0003	.0001	.0003	.0003	.0003	.0003	.001	.001	.0003	.0003
Zn	.03	.01	.03	.03	.03	.03	<.008	.03	.01	.03	<.008	.03	<.008
Zr	.03	.01	.01	.03	.003	.03	.03	.01	.01	.01	.03	.003	.001

Table 8a/ Chemical composition of the quartz-silicate rocks of the Phosphoria Formation--Continued

Meade Peak Member

	DPS 2455	GFH 2340	GFA 2570	RSS 2224	DPS 2381	MDS 2181	LES 2290	JWH 2015	JBC 2163	Ave. Meade Peak b/	Ave. Phosphoria b/
	53	54	55	56	57	58	59	60	61	62	63
SiO_2	64.1	73.2	65.3	61.8	71.8	74.1	61.8	63.3	69.2	65.36	66.12
Al_2O_3	4.2	3.2	4.5	4.1	2.9	5.4	5.1	4.7	3.7	8.32	8.22
Fe_2O_3 a/	2.4	2.6	2.9	3.2	2.5	2.3	2.8	2.6	2.9	3.18	3.35
FeO	1.0	1.2	1.8	1.6	1.6	.72	1.4	1.3	1.5	.89	.99
MgO	3.3	.32	.81	3.0	.30	.60	3.6	4.4	2.3	1.51	1.34
CaO	10.6	10.3	12.3	11.8	11.0	6.7	10.5	8.7	9.7	6.9	6.71
Na_2O	.19	.22	.34	.31	.20	.32	.22	.18	.23	.60	4.77
K_2O	1.1	.52	1.1	1.0	.56	1.2	1.3	1.2	.76	2.04	2.12
H_2O^{tot}	2.1	1.8	2.9	2.0	1.6	2.6	2.2	2.6	1.3	3.46	3.52
H_2O^-	0.3	0.3	.4	.4	.1	0.8	0.6	0.3	.05	.81	.76
TiO_2	.20	.12	.20	.20	.13	.26	.27	.20	.18	.54	.52
P_2O_5	1.8	5.0	6.7	2.3	2.3	4.3	1.7	1.6	2.7	3.23	3.17
CO_2	9.43	2.84	3.04	9.70	6.35	.92	9.35	9.04	6.86	2.60	2.37
SO_3	-	.41	.64	-	-	-	-	.49	-	.44	.39
Cl	-	-	.02	-	-	-	.02	-	-	.06	.05
F	.23	.55	.68	.23	.23	.37	.20	0.20	.30	.36	.37
Organic c/ Matter	2.0	.5	1.8	2.1	1.4	1.4	3.1	3.1	1.5	2.38	2.44
Oil d/	.12	.10	.02	.05	.06	.20	.30	.10	.20	.15	.17
U	.001	.001	.001	.001	.001	.001	.001	.001	.001	.0015	.0015
eU	-	-	-	-	-	-	-	.002	-	.002	.001
Ag	.00003	.00003	.00003	.00003	.00003	.0001	<.00001	.0003	<.00001	.001	.001
As	<.001	.002	.001	<.001	<.001	.002	.002	.002	.002	.004	.004
B	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
Ba	.01	.01	.01	.01	.01	.003	.01	.01	.01	.01	.03
Be	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005
Cd	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Co	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Cr	.03	.03	.1	.03	.03	.1	.03	.1	03	.1	.1
Cu	.003	.003	.01	.003	.003	.003	.003	.003	.003	.003	.003
Ge	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.001	.001
La	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003
Mn	.01	.01	.01	.01	.01	.001	.01	.01	.01	.01	.01
Mo	<.0005	<.0005	<.0005	<.0005	.003	<.0005	<.0005	<.0005	<.0005	<.0005	.003
Ni	.003	.003	.003	.003	.003	.001	.003	.003	.003	.01	.01
Pb	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Sb	.0001	.0001	.0001	.0003	.0005	<.0001	.0001	<.0001	.0001	.0004	.0004
Sc	<.0005	<.0005	.001	.001	.001	.001	<.0005	.001	<.0005	.001	.001
Se	.0003	.0003	.002	.0003	.0003	.0001	.0001	.0001	.0003	.0014	.0013
Sr	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
V	.001	.001	.001	.001	<.001	.003	.001	.001	<.001	.01	.01
Y	.001	.003	.003	.001	.001	.003	.001	.001	.001	.003	.003
Yb	.0001	.0003	.0003	.0001	.0001	.0003	.0001	.0001	.0001	.0003	.0003
Zn	<.008	<.008	<.008	<.008	<.008	<.008	<.008	.01	<.008	.03	.03
Zr	.001	.001	.003	.001	.001	.003	.003	.001	.003	.03	.01

Table 8[a/] Chemical composition of the quartz-silicate rocks of the Phosphoria Formation

[a/] Chemical determinations of SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O, K_2O, TiO_2, and P_2O_5 by P.L.D. Elmore, S. D. Botts, P. W. Scott, K. E. White and S. Bethea; of U.F, CO_2, $H_2O^{(total)}$, H_2O^-, Organic Matter, and Oil by G. Edgington, A. Schrenk, W. Tucker, R. Moore and G. Daniels; and of SO_3 and Cl by S. M. Berthold.

Radiometric determinations of U (eU) by B. A. McCall.

Spectrographic determination of elements listed alphabetically (excluding As, Sb, and Se) by Charles Anneil.

Elements looked for but not detected (sensitivity limit shown in parentheses): Au (.001), Bi (.005), Ce (.03), Cs(.8), Dy (.006), Er (.003), Eu (.003), Gd (.006), Ge (.001), Hf (.007), Hg (.08), Ho (.001), In (.0004), Ir (.03), Li (.01), Lu (.005), Nb (.001), Nd (.006), Os (.1), Pd (.003), Pr (.01), Pt (.003), Rb (7.), Re (.04), Rh (.004), Ru (.008), Sm (.008), Ta (.1), Tb (.01), Te (.08), Th (.05), Ti (.04), Tm (.001) and W (.05).

Geochemical determinations of As, Sb and Se by H. E. Crowe, J.E. Swick, and R. R. Bains.

[b/] Model values used for minor elements listed alphabetically, except for average values of As, Sb and Se.

[c/] Organic matter by partial combustion

[d/] Oil by distillation

[e/] Total iron as Fe_2O_3

1. Sample No. RFG 5580, Lab No. 81410, Retort Member, LaMarch Gulch, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 553.)
2. Sample No. RFG 5584, Lab No. D-54752, Retort Member, LaMarch Gulch, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 553.)
3. Sample No. CWT 700, Lab No. D-42500, Retort Member, Canyon Camp, Madison County, Montana (Cressman and Swanson, 1964, p. 511.)
4. Sample No. RSJ 717, Lab No. D-42483, Retort Member, Canyon Camp, Madison County, Montana (Cressman and Swanson, 1964, p. 510.)
5. Sample No. WRL 57, Lab. No. 9612, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 27.)
6. Sample WRL 66, Lab. No. 9621, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 27.)
7. Sample No. FSH 425, Lab No. 6750, Retort Member, Sawtooth Mountain, Beaverhead County, Montana (Cressman and Swaneon, 1964, p.445.)
8. Sample No. FSH 438, Lab No. 6763, Retort Member, Sawtooth Mountain, Beaverhead County, Montana (Cressman and Swanson, 1964, p.445.)
9. Sample No. OAP 520, Lab. No. 19330, Retort Member, Centennial No. 2, Clerk County, Idaho (Cressman and Swanson, 1964, p. 469.)
10. Sample No. OAP 525, Lab. No. 19335, Retort Member, Centennial No. 2, Clark County, Idaho (Cressman and Swaneon, 1964, p. 469.)
11. Sample No. RAS 6497, Lab No. D-52274, Retort Member, Steer Creek, Lincoln County, Wyoming, (Shaldon, 1963, p. 217.)
12. Sample No. TMC 6505, Lab No. D-52266, Retort Member, Steer Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 217.)
13. Sample No. VEM 72, Lab No. 6930, Retort Member, Coal Canyon, Lincoln County, Wyoming, (McKalvey and others, 1953e, p. 11.)
14. Sample No. VFM 90, Lab No. 7375, Retort Member, Coal Canyon, Lincola County, Wyoming, (McKalvey and others, 1953a, p, 11.)
15. Sample No. RAH 252, Lab No. 8596, Retort Member, Montpelier Canyon, Bear Lake County, Idaho (McKelvey and others, 1953b p. 50)
16. Sample No. RAH 246, Lab no. 8311, Retort Member, Montpelier Canyon, Bear Lake County, Idaho (McKelvey and others, 1953b, p. 50.)
17. Sample No. LES 27, Lab No. 7260, Retort Member, Middle Fork Pine Creek, Lincoln County, Wyoming (McKelvey and others, 1953a, p. 28.)
18. Sample No. LES 31, Lab No. 7264, Retort Member, Middle Fork Pine Creek, Lincoln County, Wyoming (McKelvey and others, 1953a, p.28)
19. Sample No. RAS 7204, Lab No. 90941, Retort Member, Deadline Ridge, Lincoln County, Wyoming (Sheldon, 1963, p. 253.)
20. Sample No. RAS 7208, Lab. No. 90945, Retort Member, Deadline Ridge, Lincoln County, Wyoming (Sheldon, 1963, p. 253.)
21. Average quartz-silicate of Retort Member of Phosphoria Formation.
22. Sample No. WRL 264, Lab No. 9579, Meade Peak Member, Daly Spur, Beaverhead County, Montana (Swanson and others, 1953, p. 15.)
23. Sample WRL 265, Lab. No. 9580, Meade Peak Member, Daly Spur, Beaverhead County, Montana (Swanson and others, 1953, p. 15.)
24. Sample No. WRL 153, Lab. No. 9707, Meade Peak Member, Big Sheep Canyon, Beaverhead County, Montana (Swanson and others, 1953, p. 29.)
25. Sample No. WRL 156, Lab. No. 9710, Meade Peak Member, Big Sheep Canyon, Beaverhead County, Montana (Swanson and others, 1953, p. 29.)
26. Sample No. WOM 2716, Lab. No. 20174, Meade Peak Member, Fort Hall, Bingham County, Idano, (O'malley and others, 1953, p. 5.)
27. Sample No. RAS 6336, Lab No. D-51397, Meade Peak Member, Fort Hall, Bingham County, Idaho (Smart and others, 1954, p. 14.)
28. Sample No. RAS 6455, Lab No. D-52316, Meade Peak Member, Steer Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 217.)
29. Sample MAW 6487, Lab. No. D-52284, Meade Peak Member, Steer Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 217.)
30. Sample No. MAW 6425, Lab No. D-51964, Meade Peak Member, Mud Springs, Cassia County, Idaho (Smart and others, 1954, p. 21.)
31. Sample No. RAS 6426, Lab. No. D-51963, Meade Peak Member, Mud Springs, Cassia County, Idaho, (Smart and others, 1954, p. 21.)
32. Sample No. RAS 6432, Lab. No. D-51957, Meade Peak Member, Mud Springs, Cassia County, Idaho (Smart and others, 1954, p. 21.)
33. Sample No. RGW 6452, Lab No. D-51937, Meade Perk Member, Mud Springs, Cassia County, Idaho (Smart and others, 1954, p. 20.)
34. Sample No. WOM 2974, Lab. No. 19814, Meade Peak Member, Swan Lake Gulch, Caribou County, Idaho (McKelvey and others, 1953c, p. 44)
35. Sample No. WOM 2981, Lab. No. 19821, Meade Park Member, Swan Lake Gulch, Caribou County, Idaho (McKelvey and others, 1953c, p. 43.)
36. Sample No. HWP 4340, Lab No. 26612, Meade Peak Member, Rocky Canyon, Bannock County, Idaho (Davidson and others, 1953, p. 11.)
37. Sample No. RSJ 4331, Lab. No. 26669-F, Meade Peak Member, Rocky Canyon, Bannock County, Idaho (Davidson and others 1953, p. 10.)
38. Sample No. MET 4300, Lab. No. 45151, Meade Peak Member, Henry, Caribou County, Idaho (Davidson and others, 1953, p. 21.)
39. Sample No. RAS 4273, Lab. No. D-45128, Meade Peak Member, Henry, Caribou County, Idaho (Davidson and others, 1953, p. 20.)
40. Sample No. RPS 3626, Lab. No. 25057, Meade Peak Member, Cokeville, Lincoln County, Wyoming (Sheldon and others, 1953, p. 43.)
41. Sample No. DFD 3608, Lab. No. 24972, Meade Peak Member, Cokeville, Lincoln County, Wyoming (Sheldon and others, 1953, p. 42.)
42. Sample No. LDC 7015, Lab. No. 88729, Meade Peak Member, Middle Piney Lakes, Sublette County, Wyoming (Sheldon, 1963, p. 240.)
43. Sample No. RPS 7027, Lab. No. 88704, Meade Peak Member, Middle Piney Lakes, Sublette County, Wyoming (Sheldon, 1963, p. 241.)
44. Sample No. RGW 3962, Lab. No. 25304, Meade Peak Member, North Crawford, Rich County, Utah, (Cheney and others, 1953, p. 9.)
45. Sample No. VEM 3936, Lab. No. 25260, Meade Peak Member, North Crawford, Rich County, Utah (Cheney and others, 1953, p. 8.)
46. Sample No. MAW 6102, Lab. No. 51077, Meade Peak Member, Devils Slide, Morgan County, Uteh (Cheney end others, 1953, p. 14.)
47. Sample No. RAS 6165, Lab. No. D-51014, Meade Peak Member, Devils Slide, Morgan County, Utah (Cheney and othere, 1953, p. 12.)
48. Sample No. RAS 6191, Lab. No. D-51326, Meade Peak Member, Cumberland, Lincoln County, Wyoming (Sheldon, 1963, p. 267.)
49. Semple No. RGW 6201, Lab. No. D-51316, Meade Peak Member, Cumberland, Lincoln County, Wyoming, (Sheldon, 1963, p. 267.)
50. Sample No. MAW 6230, Lab. No. D-51287, Meade Peak Member, Cumberland, Lincoln County, Wyoming (Sheldon, 1963, p. 267.)
51. Sample No. MAW 6252, Lab. No. D-51265, Meade Peak Member, Cumberland, Lincoln County, Wyoming (Sheldon, 1963, p. 267.)
52. Sample No. MDS 2489, Lab. No. 20921, Meade Peak Member, Wanrhodes Canyon, Utah County, Utah (Smith and others, 1952, p. 47.)
53. Sample No. DPS 2455, Lab. No. 20802, Meade Peak Member, Wanrhodes Canyon, Utah County, Uteh (Smith and othare, 1952, p. 46.)
54. Sample No. GFH 2340, Lab. No. 20823, Meade Peak Member, Wanrhodes Canyon, Utah County, Utah (Smith and othere, 1952, p. 43.)
55. Sample No. GFH 2570, Lab. No. 20868, Meade Peak Member, Wanrhodes Canyon, Utah County, Utah (Smith and others, 1952, p. 43.)
56. Sample No. RSS 2224 Lab. No. 20341, Meade Peak Member, Right Fk. Hobble Creek, Utah County, Utah (Smith and others, 1952, p. 40.)
57. Sample No. DPS 2381, Lab. No. D-8437, Meade Peak Member, Right Fk. Hobble Creek, Utah County, Utah (Smith and others, 1952, p.39.)
58. Sample No. MDS 2181, Lab. No. 20307, Meade Peak Member, Right Fk Hobble Creek, Utah County, Uteh (Smith and others, 1952, p.38.)
59. Sample No. LES 2290, Lab. No. 20292, Meade Peak Member, Right Fk Hobble Creek, Utah County, Utah (Smith and others, 1952, p. 37.)
60. Sample No. JWH 2015, Lab. No. 5336, Meade Peak Member, Wolf Creek, Wasatch County, Utah (Smith and others, 1952, p. 26.)
61. Sample No. JBC 2163, Lab No. 5315, Meade Peak Member, Wolf Creek, Wesatch County, Utah (Smith and others, 1952, p. 25.)

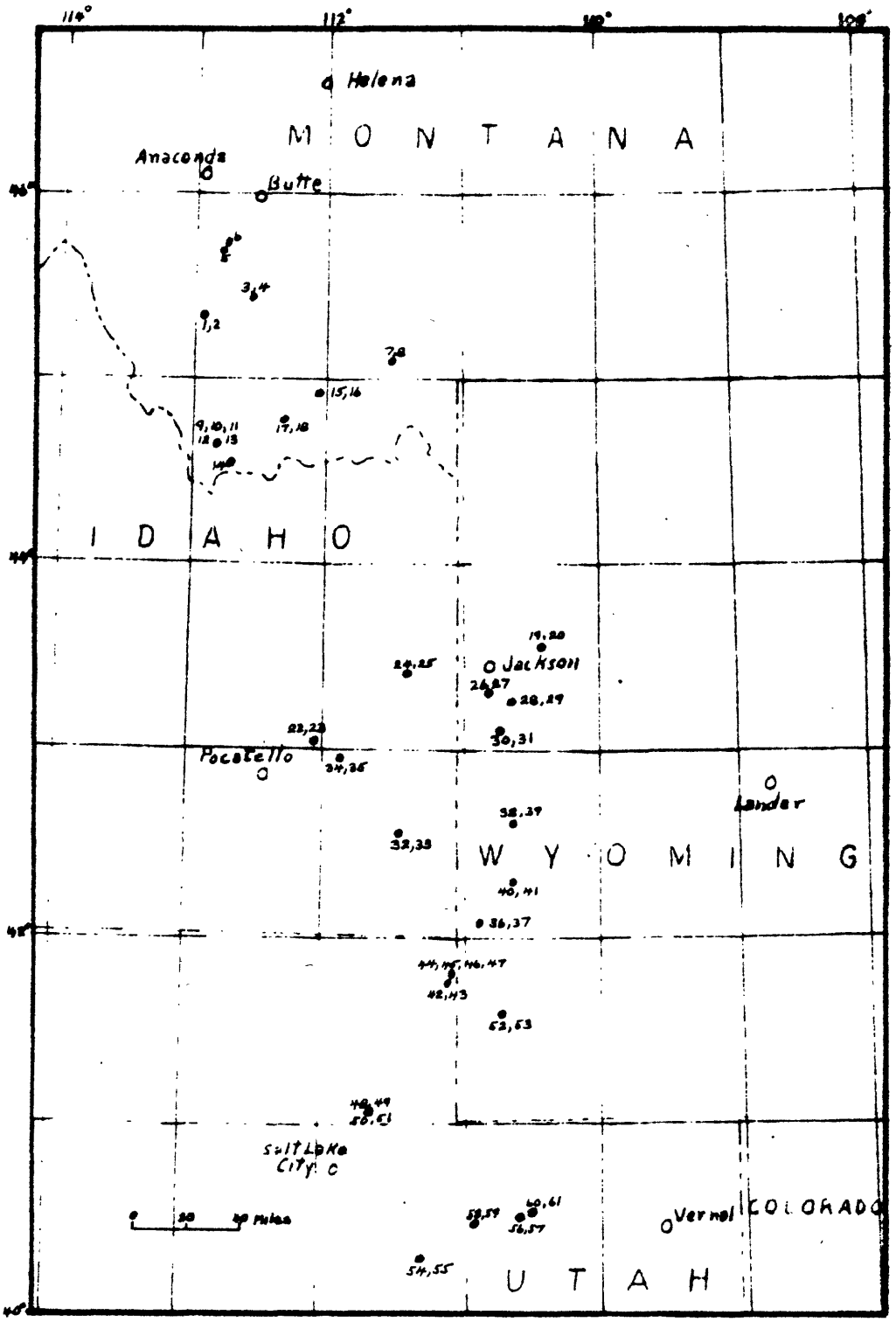

Figure 2.--Location of analyzed samples of carbonate rocks of table 2. Numbers are the analysis numbers.

Table 2[a/].--*Chemical composition of the carbonate rocks of the Phosphoria Formation*

	Retort Member %												
	RLP 193 1	DAB 205 2	JAP 5430 3	JAP 5438 4	JAP 5423 5	RFG 5573 6	RFG 5492 7	RFG 5496 8	WRL 49 9	WRL 53 10	WRL 74 11	WRL 78 12	WRL 94 13
SiO_2	19.6	9.8	5.6	5.2	14.6	18.8	7.2	8.8	16.6	16.6	14.3	13.6	16.8
Al_2O_3	1.4	1.8	1.2	1.2	3.0	3.7	2.2	2.1	3.2	3.2	3.0	2.6	2.1
Fe_2O_3[g/]	.47	.93	.78	.90	1.30	1.30	1.00	1.80	1.40	1.70	1.50	1.40	.96
FeO	.1	.1	.1	.2	.2	.1	.3	.4	.5	.8	.4	.4	.3
MgO	15.0	15.1	16.3	17.2	15.5	15.4	18.1	16.5	1.3	1.2	11.8	9.1	13.1
CaO	24.7	29.4	30.6	30.0	25.7	23.0	26.6	26.7	38.9	39.3	28.3	31.6	27.1
Na_2O	.09	.16	.12	.12	.37	.11	.10	.17	.12	.12	.26	.32	.17
K_2O	.35	.50	.30	.29	.74	.96	.58	.54	.82	.81	.76	.72	.48
$H_2O^{tot.}$	.50	2.00	1.22	1.04	---	.80	1.24	2.00	2.62[c/]	2.60[c/]	2.86[c/]	2.44	1.70[c/]
H_2O^{-}[f/]	.20	<.05	<.05	<.05	---	.20	.10	.30	.3	.3	.1	.2	<.05
TiO_2	.08	.10	.08	.06	.19	.25	.10	.10	.20	.22	.17	.16	.10
P_2O_5	1.8	5.4	2.9	2.2	.92	.54	.47	1.20	.65	.76	3.80	4.70	1.20
MnO	.04	.06	.04	.04	.08	.12	.30	.08	.04	.03	.06	.06	.04
CO_2	34.12	33.35	39.04	---	39.86	33.16	40.29	36.47	31.09	31.03	31.16	29.31	34.04
SO_3	---	---	---	---	---	---	---	---	---	---	.79	---	.66
Cl	---	---	---	---	---	---	---	---	---	---	---	---	---
F	.23	.52	.28	.23	---	.10	.08	.17	.08	.08	.33	.49	.10
Organic matter[g/]	1.0	1.3	1.5	1.3	---	1.3	2.4	3.7	3.4	2.9	3.5	3.6	3.1
Oil[d/]	.20	.10	.10	.13	---	.18	.12	.23	.59	.50	.42	.50	.40
U	.001	.001	.002	.002	---	.001	.001	.001	.001	.001	.001	.002	.001
eU	<.001	<.001	.002	<.001	---	.001	<.001	<.001	.001	.001	<.001	.002	<.001
Ag	.0003	.0003	.0001	.0001	.0001	.0003	.0001	.0001	.0003	.0001	.0001	.0001	.0001
As	.006	.002	.004	.003	wrong sample	.001	.005	.003	.001	.002	.002	.004	.003
B	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Ba	.003	.003	.001	.001	.01	.01	.003	.003	.01	.01	.01	.01	.003
Cd	<.005	<.005	<.005	<.005	<.005	.03	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cr	.03	.03	.1	.03	.03	.03	.03	.1	.1	.1	.1	.1	.03
Cu	.003	.003	.003	.003	.003	.003	.001	.003	.003	.003	.003	.003	.003
Ga	<.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	.001	.001	.001	.001	<.001
Mn	.01	.01	.01	.01	.03	.03	.1	.03	.01	.01	.03	.01	.01
Mo	<.0005	.003	.003	.003	.001	.01	.003	.003	.003	.003	.003	.003	<.0005
Ni	.01	.03	.01	.01	.01	.03	.003	.01	.01	.01	.01	.01	.01
Pb	<.001	<.001	<.001	<.001	<.001	.001	.001	.003	<.001	<.001	<.001	<.001	<.001
Sb	.0001	.0002	.0002	.0002	wrong sample	<.0001	.0001	.0001	.0001	.0002	.0001	.0001	.0002
Sc	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.001	.001	<.0005	<.0005	<.0005
Se	.0001	.0001	.003	.001	wrong sample	.003	.001	.0005	.0005	.0005	.0003	.0003	.005
Sr	.01	.01	.03	.01	.01	.01	.01	.03	.03	.03	.01	.03	.01
V	.001	<.001	.003	.003	.003	.001	.001	.003	.003	.003	.001	.001	.003
Y	.003	.01	.001	.003	.001	.001	.001	.003	.003	.003	.01	.01	.001
Yb	.0001	.0003	.0003	.0001	.0001	.0001	.0001	.0003	.0003	.0003	.0003	.0003	<.00001
Zn	.01	.01	.01	<.008	.01	.03	<.008	<.008	<.008	<.008	<.008	<.008	<.008
Zr	<.0008	.001	<.0008	<.0008	.001	.003	<.0008	.001	.003	.003	.003	.003	.001

Table 2[a/].--Chemical composition of the carbonate rocks of the Phosphoria Formation--Continued

	Retort Member--Continued							%	Meade Peak Member				
	ERC 349	ERC 683	CWT 687	CWT 673	ERC 669	MAW 4882	RGW 4888	Ave.[b/] Retort	WAM 2137	WAM 2274	RPS 5314	RGW 5322	RAS 4846
	14	15	16	17	18	19	20	21	22	23	24	25	26
SiO_2	18.8	10.6	7.0	19.2	9.0	20.8	9.0	13.10	4.8	3.9	5.8	12.6	1.2
Al_2O_3	3.6	2.2	1.7	3.4	2.0	4.0	2.2	2.49	.83	1.10	1.60	2.50	.30
Fe_2O_3[g/]	2.20	.98	.78	1.40	.76	2.30	1.40	1.26	.30	.41	.53	.82	.17
FeO	.2	.2	.4	.3	.2	.8	.3	.32	.1	.1	.3	.2	.1
MgO	5.8	16.2	15.0	13.3	14.9	12.8	16.8	13.02	17.0	16.0	14.8	14.0	18.1
CaO	32.0	27.7	30.8	22.9	28.0	21.8	27.6	28.64	30.8	32.4	30.5	29.3	31.1
Na_2O	.20	.11	.17	.12	.14	.16	.23	.17	.12	.11	.48	.72	.08
K_2O	.96	.68	.50	.97	.52	1.50	.67	.68	.32	.19	.52	.41	.09
$H_2O^{tot.}$	1.72	1.20	1.12	2.72[c/]	2.80[c/]	1.70	1.14	1.76	.80	---	1.92	.84	.90
H_2O^{-}[f/]	.4	<.05	.1	.2	.3	<.05	.1	.15	<.05	---	.80	.10	.10
TiO_2	.22	.13	.08	.17	.11	.25	.11	.14	.05	.06	.09	.15	.03
P_2O_5	2.40	.59	4.60	1.00	1.50	1.20	.39	1.91	2.2	3.6	5.2	2.5	2.3
MnO	.04	.06	.07	.04	.06	.12	.06	.07	.02	.02	.01	.04	.02
CO_2	29.45	38.39	36.04	28.16	37.25	29.44	39.59	34.28	41.17	---	34.18	35.45	42.09
SO_3	.32	.34	.62	1.08	---	---	---	.635	.31	---	---	---	---
Cl	---	---	---	---	---	---	---	---	---	---	---	.03	---
F	.27	.08	.42	.15	.15	.15	.08	.21	.18	---	.52	.23	.24
Organic matter[e/]	1.4	1.8	1.9	4.0	3.2	3.1	1.9	2.4	1.7	---	3.5	1.9	2.7
Oil[d/]	.15	.23	.10	.75	1.00	.45	.05	.33	.14	---	.10	.20	.12
U	.001	.001	.002	.001	.001	.001	.001	.0012	.001	---	.002	.001	.002
eU	.001	<.001	.002	<.001	.001	.002	<.001	---	.001	---	.001	.002	.002
Ag	<.00001	.0001	.0001	.0003	.0003	<.00001	<.00001	.0001	.0001	.0003	.001	.0003	.0001
As	.003	.006	.003	.002	.004	.002	.001	.003	.001		.004	.004	.008
B	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Ba	.01	.003	.003	.003	.003	.01	.01	.003-.01	.001	.001	.001	.001	.001
Cd	<.005	<.005	<.005	<.005	.01	<.005	<.005	<.005	.01	<.005	<.005	<.005	.01
Cr	.1	.03	.03	.1	.03	.1	.01	.03	.03	.03	.03	.03	.03
Cu	.003	.003	.003	.003	.003	.003	.001	.003	.003	.003	.003	.003	.003
Ga	.001	<.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	<.001	<.001	<.001	.001
Mn	.03	.01	03	.01	.01	.03	.01	.01	.01	.003	.003	.01	.01
Mo	.003	.003	.001	.003	.003	.01	.003	.003	<.0005	<.0005	.003	.003	.003
Ni	.03	.01	.01	.01	.003	.01	.003	.01	.01	.01	.03	.01	.03
Pb	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Sb	.0002	.0002	.0002	.0002	.0001	.0001	<.0001	.00015	.0001		.0005	.0005	.001
Sc	.001	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0003	<.0005
Se	.001	005	.0007	.001	.001	.007	.0003	.00142	.005		.003	.005	.0003
Sr	.03	.01	.03	.03	.03	.01	.01	.01	.03	.01	.03	.01	.01
V	.003	.001	.003	.003	.01	.001	<.001	.003	.003	.003	.01	.003	.003
Y	.003	.001	.01	.003	.003	.003	<.001	.003	.003	.003	.003	.001	<.001
Yb	.0003	<.00001	.0003	.0001	.0001	.0001	<.00001	.0003	.0001	.0003	.0001	<.00001	<.00001
Zn	.01	.01	.01	.01	.01	<.008	<.008	<.008	.01	<.008	.03	.01	.03
Zr	.003	.0008	.0008	.001	.001	.003	<.0008	<.0008-.003	<.0008	<.0008	<.0008	.001	<.0008

Table 2[a/].--*Chemical composition of the carbonate rocks of the Phosphoria Formation*--Continued

Meade Peak Member--Continued

	RGW 4862	RGW 4925	RGW 4935	RGW 6466	RGW 6471	WOM 2942	RGW 3006	RAS 4372	RAS 4400	FJA 3684	RGW 3653	RPS 7003	RPS 7033
	27	28	29	30	31	32	33	34	35	36	37	38	39
SiO_2	15.0	13.6	13.4	8.8	20.1	17.6	17.4	9.4	8.0	9.8	10.6	4.2	7.7
Al_2O_3	3.20	2.60	2.40	3.10	3.60	3.20	3.70	1.60	2.30	1.60	2.60	.95	.85
Fe_2O_3[g/]	1.00	1.20	.82	.64	1.20	1.00	1.40	.55	.66	.46	.91	.34	.54
FeO	.3	.5	.3	.2	.4	.1	.2	.1	.1	.2	.2	.2	.2
MgO	15.4	14.3	16.8	17.0	14.7	12.8	8.9	10.2	15.6	13.0	14.9	17.5	17.9
CaO	24.7	24.0	25.4	25.4	22.3	26.2	30.5	35.9	29.2	31.4	29.5	30.5	29.2
Na_2O	.13	.26	.58	.12	.10	.26	.27	.12	.11	.29	.29	.10	.09
K_2O	.64	.86	.45	1.60	1.10	.88	.74	.37	.47	.49	.82	.24	.09
$H_2O^{tot.}$	1.40	3.38	1.02	1.70	2.20	1.56	1.52	.96	1.80	.82	.90	.84	.46
H_2O^-[f/]	.20	1.00	.30	.50	.20	.70	.40	.30	.30	.30	.2	.3	.1
TiO_2	.20	.20	.16	.09	.29	.21	.21	.10	.10	.09	.14	.06	.05
P_2O_5	.74	1.80	.26	1.00	.84	1.40	.64	6.80	.91	6.80	1.00	1.40	1.50
MnO	.02	.02	.02	.02	.03	.02	.07	.02	.04	.02	.02	.02	.04
CO_2	35.25	31.89	37.34	37.75	32.50	32.67	32.82	32.04	39.39	32.54	30.14	41.17	41.29
SO_3	---	---	---	---	---	.34	.19	.33	.35	---	.20	---	---
Cl	---	---	---	---	---	---	.03	---	---	.02	---	---	---
F	.08	.18	.03	.10	.08	.16	.13	.60	.08	.68	.12	.17	.22
Organic matter[e/]	2.0	6.0	1.6	3 0	1.5	1.5	1.5	1.2	1.7	.2	1.4	1.8	.6
Oil[d/]	.10	.12	.10	.10	.15	.10	.10	.12	.16	.10	.05	.10	.17
U	.001	.003	.001	.001	.002	.001	.001	.002	.001	.002	.002	.001	.001
eU	<.001	.003	<.001	.002	.001	.002	<.001	.002	.002	.002	<.001	.001	<.001
Ag	.0003	.001	.0001	.001	.0003	.0003	<.00001	.001	.0003	.0003	.0001	.0003	.0001
As	.006	.004	.005	.003	.006	.002	.003	.002	.004	.006	.002	.004	.002
B	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Ba	.003	.003	.01	.001	.003	.003	.01	.003	.001	.01	.003	.001	.001
Cd	<.005	.03	---	.03	.01	<.005	<.005	.01	<.005	<.005	<.005	<.005	<.005
Cr	.03	.1	.01	.03	.03	.03	.1	.03	.03	.1	.03	.03	.03
Cu	.003	.01	.001	.01	.003	.001	.001	.003	.003	.003	.001	.003	.001
Ga	<.001	<.001	<.001	<.001	<.001	<.001	.001	<.001	<.001	.001	<.001	<.001	<.001
Mn	.01	.01	.01	.01	.01	.01	.03	.01	.01	.01	.01	.003	.03
Mo	.003	.03	.003	.003	.003	.01	.003	.01	.001	.003	.001	.01	<.0005
Ni	.01	.03	.003	.01	.01	.01	.01	.01	.01	.01	.01	.03	.003
Pb	<.001	.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Sb	.0005	.003	.0003	.001	.001	.0004	<.0001	.0004	.0002	.0001	.0002	.0003	<.0001
Sc	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	.001	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
Se	.01	.01	.003	.001	.003	.005	.003	.001	.005	.001	.001	.003	.0003
Sr	.01	.01	.01	.01	.01	.01	.03	.03	.01	.03	.01	.01	.01
V	.003	.03	.003	.01	.03	.01	.003	.01	.003	.01	.001	.003	.003
Y	<.001	.003	<.001	<.001	<.001	.001	.003	.01	.001	.003	<.001	<.001	.003
Yb	<.00001	.0003	<.00001	<.00001	<.00001	.0001	.0001	.0003	<.00001	.0001	<.00001	<.00001	.0001
Zn	.03	.1	.01	.01	.01	.01	<.008	.03	<.008	.03	<.008	.03	<.008
Zr	.001	.001	.001	<.0008	.01	.003	.003	.003	<.0008	.001	<.0008	<.0008	<.0003

Table 2[a/].--*Chemical composition of the carbonate rocks of the Phosphoria Formation*--Conti . 1

Meade Peak Member--Continued

%

	RAS 7095	ERC 7105	VEM 141	VEM 120	RGW 3953	RGW 3976	RAS 3899	RAS 3895	MAW 6096	MAW 6082	RAS 6160	TMC 6148
	40	41	42	43	44	45	46	47	48	49	50	51
SiO_2	14.3	20.8	16.0	19.7	16.2	18.1	3.4	7.4	12.5	6.6	13.9	22.2
Al_2O_3	2.70	4.20	1.20	1.00	.86	2.60	2.00	2.90	2.80	1.80	1.60	1.10
Fe_2O_3[g/]	.90	1.60	.46	.50	.36	.68	1.50	.68	1.20	.78	.66	.54
FeO	.3	.3	.1	.2	.2	.3	.1	.1	.1	.2	.2	.2
MgO	13.6	11.5	2.5	4.1	.76	.79	.96	.85	16.80	17.00	12.10	9.40
CaO	27.2	23.3	42.8	37.8	44.3	41.4	46.5	46.4	25.4	30.0	31.4	30.6
Na_2O	.12	.15	.09	.10	.08	.18	.12	.13	.28	.10	.14	.10
K_2O	.62	1.20	.28	.22	.14	.55	.11	.60	.70	.39	.30	.19
$H_2O^{tot.}$	2.20	2.50	94	.60	.60	.96	1.16	1.24	1.26	.82	.66	.80
H_2O^-[f/]	.7	.8	.7	.1	.1	.2	<.05	.2	<.05	<.05	.4	.2
TiO_2	.20	.28	.06	.06	.04	.16	.11	.08	.14	.10	.08	.06
P_2O_5	2.10	1.60	.94	1.00	1.00	2.40	2.60	2.40	.72	2.20	1.00	.26
MnO	.02	.04	.01	.02	.01	.02	.04	.02	.02	.02	.02	.02
CO_2	33.26	28.63	34.66	33.56	34.58	30.37	34.85	34.77	37.31	39.34	36.36	32.51
SO_3	---	---	---	.31	---	.32	---	---	---	---	---	---
Cl	---	---	---	---	---	---	---	---	---	---	---	---
F	.23	.18	.11	.12	.11	.32	.25	.24	.10	.24	.12	.11
Organic matter[g/]	2.4	3.3	1.2	1.3	.7	1.1	1.3	1.4	1.2	2.1	1.3	1.1
Oil[d/]	.13	.16	.14	.12	.13	.12	.13	.12	.10	.10	.12	.13
U	.002	.001	.001	.001	.001	.002	.001	.001	.001	.001	.001	.001
eU	.001	.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.001	<.001	<.001
Ag	.0003	.001	.00003	.0001	.0001	.0003	.0003	.0003	.0001	.0001	.0001	.0003
As	.002	.001	.002	<.001	.001	.002	.003	.003	<.001	.004	<.001	.001
B	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	.005
Ba	.01	.01	.003	.01	.003	.01	.01	.01	.003	.003	.01	.003
Cd	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cr	.1	.1	.03	.03	.03	.1	.1	.1	.03	.1	.1	.03
Cu	.003	.01	.001	.001	.003	.003	.003	.01	.001	.003	.003	.003
Ga	.001	.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	.001	<.001	<.001
Mn	.01	.01	.003	.01	.003	.01	.03	.01	.01	.01	.01	.01
Mo	.003	.01	<.0005	<.0005	<.0005	<.0005	.003	.003	.0005	.003	<.0005	<.0005
Ni	.03	.01	.003	.003	.003	.01	.03	.01	.003	.01	.003	.003
Pb	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.001	<.001	<.001
Sb	.0007	.0005	.0002	.0001	<.0001	.0002	.0003	.0005	<.0001	.0003	.0001	.0001
Sc	<.0005	<.0005	<.0005	<.0005	<.0005	.001	<.0005	<.0005	<.0005	.0005	<.0005	<.0005
Se	.001	.003	.0003	.0003	.0001	.0003	.003	.0003	.001	.001	.005	.001
Sr	.01	.01	.03	.03	.03	.03	.1	.03	.01	.03	.03	.01
V	.01	.03	<.001	<.001	.001	.003	.01	.003	<.001	.001	.001	.001
Y	.001	.003	.003	.001	.001	.01	.01	.003	.001	.003	.001	.001
Yb	.0001	.0003	.0001	<.00001	.0001	.0003	.0003	.0003	<.00001	.0001	<.00001	.00001
Zn	.01	.03	<.008	<.008	<.008	.008	.01	<.008	<.008	<.008	<.008	.008
Zr	.003	.01	.001	.001	.001	.003	.001	<.0008	<.0008	<.0008	.001	<.0008

Table 2[a/].--Chemical composition of the carbonate rocks of the Phosphoria Formation--Continued

Meade Peak Member--Continued

	RGW 6195	TMC 6211	RSS 2241	GFH 2313	JWH 2058	JWH 2063	JWH 2005	JWH 2008	JWH 2097	JWH 2109	Ave.[b/] Meade Peak	Ave.[b/] Phosphoria
	52	53	54	55	56	57	58	59	60	61	62	63
SiO_2	10.1	12.0	19.9	11.2	15.1	15.6	9.8	14.8	19.9	17.1	12.64	12.79
Al_2O_3	1.40	2.80	2.80	1.00	1.40	3.00	.42	1.60	1.60	1.50	2.01	2.17
Fe_2O_3[g/]	1.00	1.80	1.40	.86	1.10	1.00	.38	.97	1.20	.78	.83	.98
FeO	.1	.7	.3	.3	.3	.3	.1	.2	.5	.3	.23	.26
MgO	15.70	12.00	.71	1.00	16.00	15.50	15.4	15.9	15.0	16.2	12.07	12.38
CaO	28.4	23.6	39.4	46.4	25.5	24.8	31.3	26.0	25.0	24.4	31.00	30.22
Na_2O	.32	.40	.14	.15	.13	.18	.12	.15	.16	.12	.19	.18
K_2O	.43	.68	.74	.19	.37	.76	.09	.37	.49	.40	.50	.56
$H_2O^{tot.}$	.68	4.50	1.76	.56	---	1.36	.50	.70	.92	1.48	1.30	1.45
H_2O^{-}[f/]	.1	1.7	.2	<.05	---	.3	<.05	<.05	.2	.2	.32	.26
TiO_2	.08	.20	.12	.04	.08	.14	.03	.08	.08	.08	.11	.12
P_2O_5	4.20	4.00	2.40	4.10	1.40	2.00	.24	1.60	1.00	.92	2.02	1.99
MnO	.04	.04	.02	.00	.02	.01	.02	.02	.02	.01	.02	.04
CO_2	35.13	27.25	28.59	34.10	---	33.52	41.30	36.11	33.68	36.13	35.10	34.83
SO_3	---	---	.54	---		---	.16	---	.54	.53	.343	.441
Cl	---	---	---	---	---	.03	---	---	---	---	---	---
F	.38	.35	.23	.34	---	.22	.04	.18	.13	.12	.21	.21
Organic matter[e/]	2.2	7.7	2.0	.8	---	1.8	.7	2.0	1.6	1.9	1.92	2.09
Oil[d/]	.20	.10	.13	.12	---	.13	.10	.12	.14	.10	.12	.19
U	.001	.003	.002	.001	---	.002	.001	.001	.001	.001	.0014	.0013
eU	<.001	.005	.002	<.001	---	.001	.001	.001	.001	<.001	---	---
Ag	.0003	.0003	.0001	<.00001	.001	.0001	.0003	.0001	<.00001	.0001	.0093	.0001
As	<.001	.001	.002	.001		.005	.002	.006	.001	.002	.00281	.00288
B	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Ba	.003	.01	.01	.003	.003	.003	<.0005	.003	.003	.003	.003	.003
Cd	<.005	.01	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cr	.03	.1	.1	.1	.03	.1	.003	.03	.03	.03	03	.03
Cu	.003	.01	.003	.001	.003	.003	.001	.001	.003	.01	.003	.003
Ga	<.001	<.001	.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Mn	.01	.01	.01	.003	.003	.003	.01	.01	.01	.01	.01	.01
Mo	<.0005	.03	<.0005	<.0005	.001	<.0005	<.0005	.001	<.0005	<.0005	<.0005	.003
Ni	.03	.03	.01	.003	.003	.01	.003	.01	.003	.003	.01	.01
Pb	<.001	.001	<.001	<.001	.001	<.001	.001	.003	<.001	<.001	<.001	<.001
Sb	<.0001	.001	.0001	<.0001		.0005	<.0001	<.0001	.0001	<.0001	.00039	.00020
Sc	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
Se	.001	.002	.001	.0007		.0003	.0005	.0003	.002	.0003	.00221	.002
Sr	.01	.01	.03	.03	.01	.01	.003	.01	.01	.01	.01	.01
V	<.001	.03	.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.003	.003
Y	.001	.01	.01	.003	<.001	.001	<.001	<.001	.001	.001	.003	.003
Yb	.0001	.0003	.0003	.0001	<.00001	<.00001	<.00001	<.00001	<.00001	<.00001	<.00001	<.00001
Zn	.03	.03	<.008	<.008	.03	.01	.03	.03	<.008	.01	<.008	<.008
Zr	.001	.003	.001	<.0008	<.0008	<.0008	<.0008	<.0008	.0008	<.0008	<.0008	<.0008

Table 2[a/].--*Chemical composition of the carbonate rocks of the Phosphoria Formation*--Continued

[a/] Chemical determinations of SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, and MnO by L. Shapiro, P. L. D. Elmore, S. D. Botts, and M. D. Mack; of U, F, CO_2, H_2O^{total}, H_2O^-, organic matter, and oil by G. Edgington, W. Tucker, J. Budinsky, and R. Mooze; and SO_3 and Cl by S. M. Berthold

Radiometric determinations of U (eU) by B. McCall.

Spectrographic determination of elements listed alphabetically (excluding As, Sb, and Se) by Joseph Haffty. Elements looked for but not detected (sensitivity limit shown in parenthesis): Au(.001), Be(.00005), Bi(.005), Ce(.03), Co(.001), Cs(.8), Dy(.006), Er(.003), Eu(.003), Cd(.006), Ge(.001), Hf(.007), Hg(.08), Ho(.001), In(.0004), Ir(.03), La(.003), Li(.01), Lu(.005), Nb(.001), Nd(.006), Os(.1), Pd(.003), Pr(.01), Rb(7.), Re(.04), Rh(.004), Ru(.008), Sn(.001), Sm(.008), Ta(.1), Tb(.01), Te(.08), Th(.05), Tl(.04), Tm(.001), and W(.05).

Geochemical determinations of As, Sb, and Se by H. E. Crowe, J. E. Swick, and R. R. Beins.

[b/] Modal values used for minor elements listed alphabetically, except for average values of As, Sb, and Se.

[c/] Values are approximate because of the distillation of oil.

[d/] Oil by distillation.

[e/] Organic matter by partial combustion.

[f/] Loss at 110° C.

[g/] Total iron as Fe_2O_3.

1. Sample No. RLP-193, Lab. No. 140538, Retort Member, Kelly Gulch, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 459).
2. Sample No. DAB-205, Lab. No. 140542, Retort Member, Kelly Gulch, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 458).
3. Sample No. JAP 5430, Lab. No. D53316, Retort Member, North Big Hole Canyon, Madison County, Montana (Cressman and Swanson, 1964, p. 537).
4. Sample No. JAP 5438, Lab. No. D53308, Retort Member, North Big Hole Canyon, Madison County, Montana (Cressman and Swanson, 1964, p. 537).
5. Sample No. JAP 5423, Lab. No. 150106, Retort Member, Canyon Creek 3, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 541).
6. Sample No. RFG 5573, Lab. No. 140471, Retort Member, La Marche Gulch, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 553).
7. Sample No. RFG 5492, Lab. No. 140480, Retort Member, Indian Creek, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 545).
8. Sample No. RFG 5496, Lab. No. 140554, Retort Member, Indian Creek, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 544).
9. Sample No. WRL 49, Lab. No. 9604, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 27).
10. Sample No. WRL 53, Lab. No. 9608, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 27).
11. Sample No. WRL 74, Lab. No. 9629, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 26).
12. Sample No. WRL 78, Lab. No. 9633, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 26).
13. Sample No. WRL 94, Lab. No. 9649, Retort Member, Hidden Pasture Creek, Beaverhead County, Montana (Swanson and others, 1953, p. 26).
14. Sample No. ERC 349, Lab. No. 25455, Retort Member, Little Sheep Creek, Beaverhead County, Montana (Cressman and Swanson, 1964, p. 477).
15. Sample No. ERC 683, Lab. No. 25706, Retort Member, Sliderock Mountain, Madison County, Montana (Cressman and Swanson, 1964, p. 498).
16. Sample No. CWT 687, Lab. No. 25691, Retort Member, Sliderock Mountain, Madison County, Montana (Cressman and Swanson, 1964, p. 497)
17. Sample No. CWT 673, Lab. No. 25722, Retort Member, West Fork of Blacktail Creek, Beaverhead County, Montana (Cressman and others, 1953, p. 11).
18. Sample No. ERC 669, Lab. No. 25744, Retort Member, West Fork of Blacktail Creek, Beaverhead County, Montana (Cressman and others, 1953, p. 11).
19. Sample No. MAW 4882, Lab. No. D45450, Retort Member, Crystal Creek, Teton County, Wyoming (Sheldon, 1963, p. 187).
20. Sample No. RGW 4888, Lab. No. D45444, Retort Member, Crystal Creek, Teton County, Wyoming (Sheldon, 1963, p. 187).
21. Average carbonate of Retort Member of Phosphoria Formation.
22. Sample No. WOM 2137, Lab. No. 20181, Meade Peak Member, Fort Hall, Bingham County, Idaho (O'Malley and others, 1953, p. 6).
23. Sample No. WOM 2274, Lab. No. 150105, Meade Peak Member, Fort Hall, Bingham County, Idaho (O'Malley and others, 1953, p. 6).
24. Sample No. RPS 5314, Lab. No. 77845, Meade Peak Member, Fall Creek, Bonneville County, Idaho (Smart and others, 1954, p. 6).
25. Sample No. RGW 5322, Lab. No. D46143, Meade Peak Member, Fall Creek, Bonneville County, Idaho (Smart and others, 1954, p. 6).
26. Sample No. RAS 4846, Lab. No. D45420, Meade Peak Member, Hoback, Teton County, Wyoming (Sheldon, 1963, p. 207).
27. Sample No. RGW 4862, Lab. No. D45404, Meade Peak Member, Hoback, Teton County, Wyoming (Sheldon, 1963, p. 207).
28. Sample No. RGW 4925, Lab. No. D46052, Meade Peak Member, Buck Creek, Teton County, Wyoming (Sheldon, 1963, p. 211).
29. Sample No. RGW 4935, Lab. No. D46042, Meade Peak Member, Buck Creek, Teton County, Wyoming (Sheldon, 1963, p. 211).
30. Sample No. RGW 6466, Lab. No. D52305, Meade Peak Member, Steer Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 217).
31. Sample No. RGW 6471, Lab. No. D52300, Meade Peak Member, Steer Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 217).
32. Sample No. WOM 2542, Lab. No. 18782, Meade Peak Member, Swan Lake Gulch, Caribou County, Idaho (McKelvey and others, 1953, p. 44).
33. Sample No. RGW 3006, Lab. No. 19748, Meade Peak Member, Swan Lake Gulch, Caribou County, Idaho (McKelvey and others, 1953, p. 42).
34. Sample No. RAS 4372, Lab. No. 26650, Meade Peak Member, Rocky Canyon, Bannock County, Idaho (Davidson and others, 1953, p. 11).
35. Sample No. RAS 4400, Lab. No. 26662, Meade Peak Member, Rocky Canyon, Bannock County, Idaho (Davidson and others, 1953, p. 11).
36. Sample No. FJA 3684, Lab. No. 24981, Meade Peak Member, Cokeville, Lincoln County, Wyoming (Sheldon and others, 1953, p. 45).
37. Sample No. RGW 3653, Lab. No. 25027, Meade Peak Member, Cokeville, Lincoln County, Wyoming (Sheldon and others, 1953, p. 43).
38. Sample No. RPS 7003, Lab. No. 88717, Meade Peak Member, Middle Piney Lakes, Sublette County, Wyoming (Sheldon, 1963, p. 241).
39. Sample No. RPS 7033, Lab. No. 88710, Meade Peak Member, Middle Piney Lakes, Sublette County, Wyoming (Sheldon, 1963, p. 240).
40. Sample No. RAS 7095, Lab. No. 88612, Meade Peak Member, Fontenelle Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 250).
41. Sample No. ERC 7105, Lab. No. 88622, Meade Peak Member, Fontenelle Creek, Lincoln County, Wyoming (Sheldon, 1963, p. 250).
42. Sample No. VEM 141, Lab. No. 7143, Meade Peak Member, Brazer Canyon, Rich County, Utah (Smith and others, 1952, p. 10).
43. Sample No. VEM 120, Lab. No. 7122, Meade Peak Member, Brazer Canyon, Rich County, Utah (Smith and others, 1952, p. 9).
44. Sample No. RGW 3953, Lab. No. 25295, Meade Peak Member, North Crawford, Rich County, Utah (Cheney and others, 1953, p. 9).
45. Sample No. RGW 3976, Lab. No. 25318, Meade Peak Member, North Crawford, Rich County, Utah (Cheney and others, 1953, p. 8).
46. Sample No. RAS 3899, Lab. No. 25235, Meade Peak Member, North Crawford, Rich County, Utah (Cheney and others, 1953, p. 8).
47. Sample No. RAS 3895, Lab. No. 25231, Meade Peak Member, North Crawford, Rich County, Utah (Cheney and others, 1953, p. 8).
48. Sample No. MAW 6096, Lab. No. D51083, Meade Peak Member, Devils Slide, Morgan County, Utah (Cheney and others, 1953, p. 14).
49. Sample No. MAW 6082, Lab. No. D51097, Meade Peak Member, Devils Slide, Morgan County, Utah (Cheney and others, 1953, p. 15).
50. Sample No. RAS 6160, Lab. No. D51019, Meade Peak Member, Devils Slide, Morgan County, Utah (Cheney and others, 1953, p. 12).
51. Sample No. TMC 6148, Lab. No. D51031, Meade Peak Member, Devils Slide, Morgan County, Utah (Cheney and others, 1953, p. 12).
52. Sample No. RGW 6195, Lab. No. D51322, Meade Peak Member, Cumberland, Lincoln County, Wyoming (Sheldon, 1963, p. 267).
53. Sample No. TMC 6211, Lab. No. D51306, Meade Peak Member, Cumberland, Lincoln County, Wyoming (Sheldon, 1963, p. 267).
54. Sample No. RSS 2241, Lab. No. 20358, Meade Peak Member, Right Fork of Hobble Creek, Utah County, Utah (Smith and others, 1952, p. 40).
55. Sample No. GFH 2313, Lab. No. 20264, Meade Peak Member, Right Fork of Hobble Creek, Utah County, Utah (Smith and others, 1952, p. 37).
56. Sample No. JWH 2057, Lab. No. 150107, Meade Peak Member, Dry Canyon, Duchesne County, Utah (Smith and others, 1952, p. 30).
57. Sample No. JWH 2063, Lab. No. 5117, Meade Peak Member, Dry Canyon, Duchesne County, Utah (Smith and others, 1952, p. 30).
58. Sample No. JWH 2005, Lab. No. 5326, Meade Peak Member, Wolf Creek, Wasatch County, Utah (Smith and others, 1952, p. 26).
59. Sample No. JWH 2008, Lab. No. 5329, Meade Peak Member, Wolf Creek, Wasatch County, Utah (Smith and others, 1952, p. 26).
60. Sample No. JWH 2097, Lab. No. 6778, Meade Peak Member, Lake Fork, Duchesne County, Utah (Smith and others, 1952, p. 32).
61. Sample No. JWH 2109, Lab. No. 6790, Meade Peak Member, Lake Fork, Duchesne County, Utah (Smith and others, 1952, p. 32).

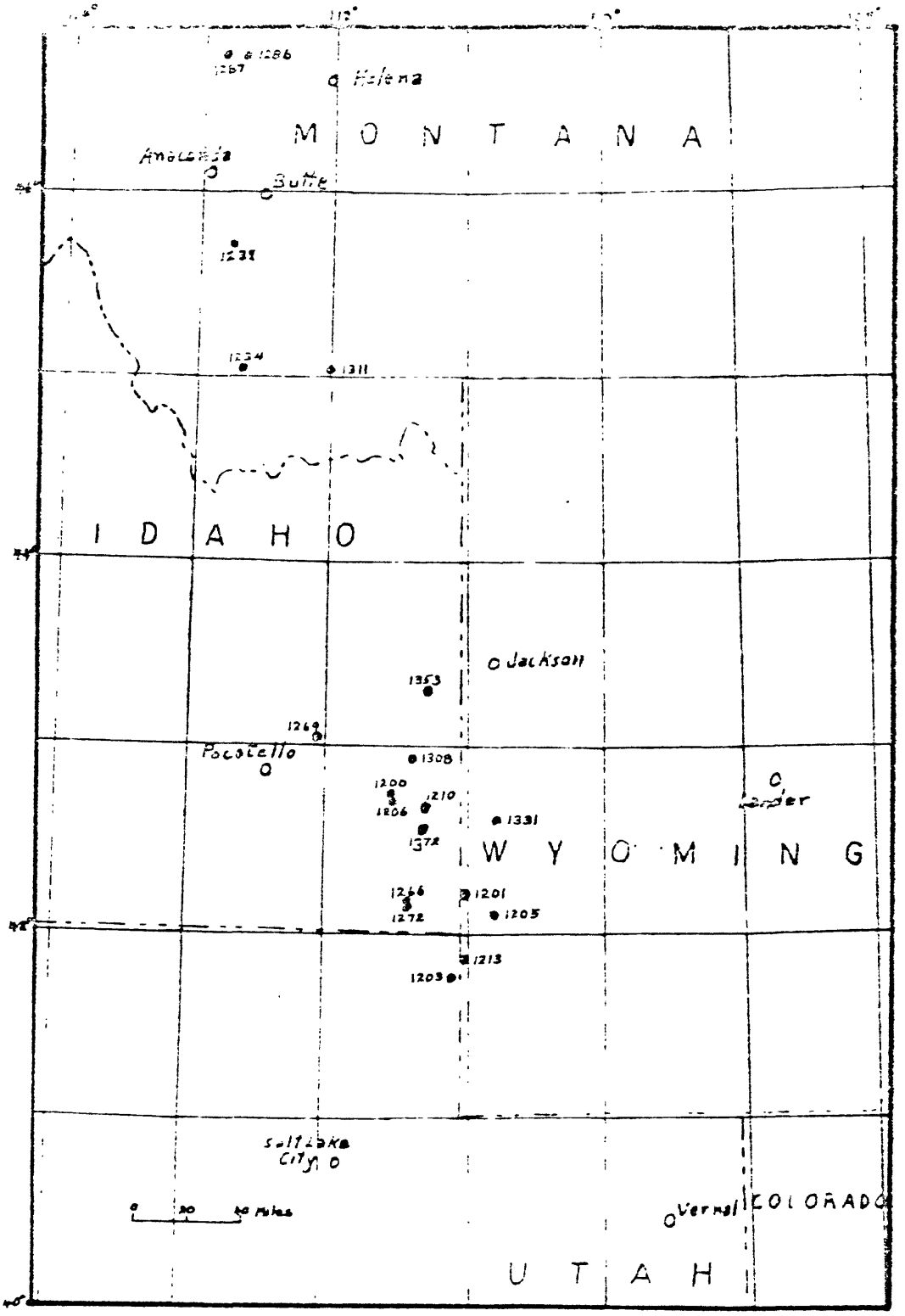

Figure 3.--Location of analyzed samples of tables 3 to 10. Numbers are the lot numbers of the localities.

Table 3 . Mercury, thallium, and total nitrogen in samples of the Meade Peak Member of the Phosphoria Formation at Conda (lot 1200), Idaho[1]

[Analyses by E. Campbell]

Bed no.	Sample no.	Rock type[2]	Hg ppm	Tl ppm	N(total) percent
P-138	FCA-144	M	0.42	0.9	0.40
P-134	FCA-135	M	.62	9.2	.62
P-131	FCA-132	P	.49	2.3	.46
P-125	FCA-126	P	.28	2.2	.30
P-117	FCA-118	M	.62	9.1	.89
P-112	FCA-111	C	.52	4.1	.63
P-92	FCA-102	M	.31	.7	.54
P-78	LES-232	M	.34	.9	.40
P-72	LES-226	P	.42	.4	.49
P-65	LES-219	M	.28	.8	.61
P-54	FCA-88	C	.27	.7	.61
P-46	LES-212	M	.48	.6	.96
P-42	LES-208	M	.56	.8	.78
P-20	FCA-74	P	.44	3.4	.31
P-10	LES-200	P	.41	9.1	.26
P-4	LES-194	M	.48	9.7	.19

[1]Stratigraphic section and other analyses in McKelvey, V. E., Davidson, D. F., O'Malley, F. W., and Smith, L. E., 1953, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1947-48, Part 1: U.S. Geol. Survey Circ. 208, p. 25-33.

[2]P = phosphate rock, M = mudstone, and C = carbonate rock.

Table 4 . Mercury, thallium, and total nitrogen in samples of the Mead Peak Member of the Phosphoria Formation at Trail Canyon (lot 1206), Idaho[1]

[Analyses by E. Campbell]

Bed no.	Sample no.	Rock type[2]	Hg ppm	Tl ppm	N(total) percent
P-205	VEM-269	M	0.22	1.8	0.35
P-196	RAG-1	P	.52	3.5	.28
P-192	VEM-262	M	.81	16	.35
P-191	VEM-259	P	.19	1.6	.09
P-180	VEM-246	M	.58	8.8	.58
P-177	VEM-243	M	.46	4.6	.36
P-162	LES-343	P	.46	4.2	.34
P-155	LES-336	P	.62	2.4	.56
P-136	VEM-225	M	.38	1.3	.44
P-129	VEM-218	M	.23	1.0	.35
P-41	LES-267	M	.78	1.6	.46
P-36	LES-260	P	.56	1.9	.34
P-20	LES-244	M	.41	7.8	.40
P-18	VEM-179	P	.44	2.7	<.1
P-13	RAH-189	P	.44	4.5	.39
P-9	RAH-185	P	.37	1.7	.20
P-6	RAH-182	M	.42	12	.19
P-3[3]	RAH-179	M	.22	130	.44

[1]Stratigraphic section and other analyses in McKelvey, V. E., Armstrong, F. C., Gulbrandsen, R. A., and Campbell, R. M., 1953, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1947-48, Part 2: U.S. Geol. Survey Circ. 301, p. 21-31.

[2]P = phosphate rock and M = mudstone.

[3]Sample also contains 4.9 ppm Ag, 210 ppm B, 850 ppm Ba, 3.7 ppm Be, 590 ppm Cd, 150 ppm Co, 370 ppm Cr, 350 ppm Cu, 10 ppm Ga, 9 ppm Ge, 88 ppm La, 16,000 ppm Mn, 130 ppm Mo, >1,000 ppm Ni, 16 ppm Pb, 14 ppm Sc, 480 ppm Sr, 1,000 ppm V, 99 ppm Y, 13,000 ppm Zn, and 340 ppm Zr (analyses by J. Fletcher). In addition, 3.5 ppm Se was determined by J. S. Wahlberg, J. O. Johnson, and R. J. Young; and 280 ppm As was determined by E. J. Fennelly.

Table 5 . Chemical composition of samples from the vanadiferous zone, Bloomington Canyon (lot 1272), Idaho[1]

[Emission spectrographic analysis by J. D. Fletcher for all constituents except those indicated here. Tl, Hg, and N(total) analyzed by E. Campbell. Se analyzed by J. S. Wahlberg, J. O. Johnson, and R. J. Young. As analyzed by E. J. Fennelly]

Sample No.	RMC-827	RMC-828	RMC-829	RMC-830	RLP-832	RLP-833	RLP-835	DAB-837	DAB-840	DAB-841
Lab. No.	8986	8987	8988	8989	8991	8992	8994	8996	8999	9000
Element	%	%	%	%	%	%	%	%	%	%
Si	30	33	>34	38	35	28	12	12	12	9.6
Al	3.6	3.9	4.4	4.1	3.8	3.3	1.8	2.6	1.8	1.7
Fe	1.3	2.1	1.4	1.5	2.5	2.4	.68	2.4	.61	1.2
Mg	.51	.35	.35	.37	.25	.24	.14	.21	.24	.17
Ca	3.5	3.2	1.2	1.0	1.1	4.3	5.6	19.5	7.9	6.5
Na	.08	.09	.08	.07	>.32	>.32	.09	>.32	>.32	.14
K	1.4	1.4	1.4	1.7	1.4	1.2	.39	.60	.55	.49
Ti	.24	.30	.28	.28	.26	.22	.08	.13	.11	.09
P	2.1	2.9	1.6	1.2	1.4	4.0	6.2	>6.8	>6.8	7.0
N(total)	.70	1.5	1.2	1.1	1.3	1.0	1.0	.41	2.1	2.4
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Ag	16	16	14	14	12	14	16	14	22	22
As	12	25	20	20	50	50	25	40	20	50
Au	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
B	190	200	190	190	140	130	25	68	140	49
Ba	350	360	380	340	300	340	180	240	270	130
Be	2.9	3.3	2.7	2.1	2.3	3.7	2.4	3.3	2.9	1.9
Bi	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6
Cd	180	170	180	170	980	970	380	420	760	460
Ce	130	<63	69	73	110	130	99	<63	<63	150
Co	1.4	2.1	3.5	2.6	10	9.5	1.0	2.2	2.3	2.8
Cr	1,600	1,200	980	1,200	940	850	860	1,400	1,500	1,300
Cu	260	170	250	180	110	180	120	99	420	260
Dy	7.8	14	8.7	<6.8	17	24	9.8	19	14	14
Er	<4.6	8.7	6.6	<4.6	11	27	7.9	10	9.3	12
Eu	2.4	2.5	1.6	1.9	3.5	3.3	1.9	1.8	2.5	1.9
Ga	7.9	8.2	9.1	9.2	8.9	7.2	3.8	5.6	9.8	5.1
Gd	<15	16	23	19	26	18	<4.6	<15	23	<4.6
Ge	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Hf	<22	<22	<22	<22	<22	<22	<22	<22	<22	<22
Hg	1.1	1.6	.80	.86	.78	.80	1.3	.60	.94	.91

Table 5 . Chemical composition of samples from the vanadiferous zone, Bloomington Canyon (lot 1272), Idaho[1]--Cont.

Sample No.	RMC-827	RMC-828	RMC-829	RMC-830	RLP-832	RLP-833	RLP-835	DAB-837	DAB-840	DAB-841
Lab. No.	8986	8987	8988	8989	8991	8992	8994	8996	8999	9000
Element	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Ho	<3.2	3.8	<3.2	<3.2	<3.2	6.7	3.4	<3.2	3.7	4.4
In	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6
La	90	96	68	58	100	150	130	140	170	240
Lu	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Mn	83	91	98	79	270	140	34	120	66	64
Mo	4.6	23	22	30	280	140	6.1	33	44	61
Nb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nd	<68	<68	<68	<68	<68	<68	<68	<68	120	180
Ni	160	150	290	180	540	340	120	73	410	530
Pb	13	14	11	19	14	10	<6.8	11	14	8.1
Pr	25	<32	<32	<32	26	33	25	22	<32	<32
Re	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Sc	16	19	17	17	17	20	10	12	14	11
Se	280	940	1,200	480	590	440	430	21	820	420
Sm	5.7	6.8	6.6	6.8	7.6	7.4	6.3	<4.6	6.7	7.4
Sn	31	28	26	32	19	17	32	25	100	78
Sr	790	550	470	440	370	460	780	1,500	2,200	1,900
Tb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tl	35	36	36	26	110	74	7.1	10	35	11
Tm	3.3	<3.2	<3.2	<3.2	<3.2	2.9	<3.2	<3.2	<3.2	<3.2
U	<150	180	<150	<150	<150	<150	<150	<150	<150	210
V	2,400	3,700	4,000	4,100	2,900	2,900	2,400	1,700	>4,000	4,700
W	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Y	130	150	95	80	140	370	220	180	240	280
Yb	21	7.2	5.6	4.3	7.7	14	7.3	16	7.9	6.7
Zn	360	380	1,600	490	10,000	4,700	580	620	1,400	3,800
Zr	220	430	240	250	280	310	150	410	190	170

[1]Stratigraphic section in O'Malley, F. W., Davidson, D. F., Hoppin, R. A., and Sheldon, R. P., Stratigraphic Sections of the Phosphoria Formation in Idaho, 1947-48, Part 3: U.S. Geol. Survey Circ. 262, p. 38-43.

Table 6 . Analyses of two samples of the vanadiferous zone at Coal Canyon (lot 1201), Wyoming[1]

[Semiquantitative spectrographic analyses by Harry Bastron]

(ppm)

Bed no.	P-73	P-72
Sample no.	VEM-42	VEM-41
Element		
Ag	10	7
B	100	70
Ba	300	300
Be	1	---
Co	7	7
Cr	1,000	500
Cu	100	70
Ga	15	10
Mn	150	200
Mo	300	150
Ni	700	200
Pb	20	20
Sc	15	15
Sr	150	150
V	7,000	5,000
Y	30	50
Yb	20	7
Zn	15,000	700
Zr	300	300

[1]Stratigraphic section and other analyses in Gulbrandsen, 1960, Petrology of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation at Coal Canyon, Wyoming: U.S. Geol. Survey Bull. 1111-C, 146 p.

Table 7 . Vanadium analyses of the Phosphoria Formation at Bear Creek (lot 1353), Idaho[1]

[Analyses by C. L. Waring and Katherine Vallentine]

(percent by weight)

Bed no.	Sample no.	Rock type[2]	V
U-1	MAW-6571	P	0.05
P-61	MAW-6567	P	0.04
P-60	MAW-6566	P	0.008
P-59	MAW-6565	P	0.05
P-58	MAW-6564	P	0.006
P-57	MAW-6563	P	0.004
P-56	MAW-6562	P	0.006
P-55	MAW-6561	P	0.004
P-54	MAW-6560	P	0.004
P-53	MAW-6559	P	0.02
P-52	MAW-6558	P	0.006
P-51	MAW-6557	M	0.05
P-50	MAW-6556	M	0.06
P-49	MAW-6555	P&M	0.06
P-48	MAW-6554	M	0.09
P-47	MAW-6553	P	0.08
P-46	MAW-6552	M	0.35
P-45	MAW-6551	M	0.40
P-44	MAW-6550	M	0.08
P-43	RGW-6549	M	0.04
P-42	RGW-6548	M	0.05
P-41	RGW-6547	M	0.05
P-40	TMC-6546	M	0.20
P-39	TMC-6545	M	0.08
P-38	TMC-6544	M	0.08
P-37	TMC-6543	M	0.06
P-36	TMC-6542	M	0.09
P-35	TMC-6541	M	0.06
P-34	TMC-6540	M	0.20
P-33	TMC-6539	M	0.15
P-32	TMC-6538	P&M	0.30
P-31	TMC-6537	M	0.20
P-30	TMC-6536	M&P	0.30
P-29	TMC-6535	P	0.35
P-28	TMC-6534	P	0.35
P-27	TMC-6533	M	0.25
P-26	TMC-6532	M	0.20
P-25	TMC-6531	M	0.20
P-24	TMC-6530	M	0.09
P-23	TMC-6529	M	0.20

Table 7. Vanadium analyses of the Phosphoria Formation at Bear Creek (lot 1353), Idaho[1]--Continued

Bed no.	Sample no.	Rock type[2]	V
P-22	TMC-6528	M	0.40
P-21	TMC-6527	M	0.25
P-20	TMC-6526	P	0.10
P-19	TMC-6525	P	0.20
P-18	RPS-6524	M	0.35
P-17	RPS-6523	P	0.10
P-16	RPS-6522	P	0.10
P-15	RPS-6521	P	0.07
P-14	RPS-6520	P	0.25
P-13	RPS-6519	P	0.25
P-12	RPS-6518	P	0.08
P-11	RPS-6517	P	0.06
P-10	RPS-6516	M	0.25
P-9	RPS-6515	P	0.07
P-8	RPS-6514	P	0.04
P-7	RPS-6513	P	0.08
P-6	RPS-6512	P	0.06
P-5	RPS-6511	M	0.09
P-4	RPS-6510	P	0.05
P-3	RPS-6509	M	0.20
P-2	RPS-6508	P	0.04
P-1	RPS-6570	C	0.04
Cw-23	TMC-6569	Ch&P	0.04
Cw-17	TMC-6568	M	0.03

[1]Stratigraphic section and other analyses in Smart, R. A., Waring, R. G., Cheney, T. M., and Sheldon, R. P., 1954, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1950-51: U.S. Geol. Survey Circ. 327, p. 11-13.

[2]P = phosphate rock, M = mudstone, C = carbonate rock, and Ch = chert.

Table 8 . Vanadium analyses of the Phosphoria Formation at Gravel Creek Divide (lot 1308), Idaho[1]

[Analyses by C. L. Waring and Katherine Vallentine]

(percent by weight)

Bed no.	Sample no.	Rock type[2]	V
P-74	RGW-5849	M	0.06
P-73	RGW-5848	M	0.03
P-72	RGW-5847	M	0.05
P-71	RGW-5846	M	0.04
P-70	RGW-5844	M	0.03
P-69	RGW-5843	M	0.03
P-68	RGW-5842	M	0.03
P-67	RGW-5841	M	0.01
P-66	RGW-5840	M	0.07
P-65	RGW-5839	M & Ch	0.03
P-64	RGW-5838	Ch	0.06
P-63	RGW-5837	P	0.02
P-62	HWP-5821	M	0.04
P-61	HWP-5820	M	0.05
P-60	HWP-5819	M	0.05
P-59	HWP-5818	P	0.04
P-58	HWP-5817	P	0.04
P-57	HWP-5816	P	0.03
P-56	HWP-5815	P	0.04
P-55	HWP-5814	P	0.03
P-54	HWP-5813	P	0.09
P-53	HWP-5812	P	0.05
P-52	HWP-5811	M	0.06
P-51	HWP-5810	C	0.02
P-50	RAS-5870	P	0.02
P-49	RAS-5869	P	0.06
P-48	RAS-5868	M	0.04
P-47	RAS-5867	M	0.04
P-46	RAS-5866	P	0.02
P-45	RAS-5865	C	0.005
P-44	RAS-5864	M	0.02
P-43	RAS-5863	M	0.04
P-42	RAS-5862	M	0.02
P-41	RAS-5861	M	0.05
P-40	RAS-5860	C	0.01
P-39	RAS-5859	M	0.04
P-38	RAS-5858	P	0.04
P-37	RAS-5857	M	0.009

Table 8 . Vanadium analyses of the Phosphoria Formation at Gravel Creek Divide (lot (1308), Idaho--Continued

Bed no.	Sample no.	Rock type[2]	V
P-36	RAS-5856	P	0.02
P-35	RAS-5855	P	0.03
P-34	RAS-5854	M	0.09
P-33	RAS-5853	P	0.04
P-32	RAS-5852	M & P	0.07
P-31	RAS-5851	C	0.04
P-30	HWP-5809	P	0.03
P-29	HWP-5808	P	0.03
P-28	HWP-5807	C	0.005
P-27	HWP-5806	C	0.004
P-26	HWP-5805	M	0.05
P-25	HWP-5804	P	0.03
P-24	HWP-5803	M	0.03
P-23	HWP-5802	P	0.04
P-22	HWP-5801	P	0.25
P-21	RGW-5836	P	0.09
P-20	RGW-5835	P	0.05
P-19	RGW-5834	P	0.07
P-18	RGW-5833	P	0.09
P-17	RGW-5832	P	0.01
P-16	RGW-5831	P	0.05
P-15	RGW-5829	M	0.06
P-14	RGW-5828	P	0.05
P-13	RGW-5827	P	0.20
P-12	RGW-5826	C	0.05
P-11	HWP-5889	P	0.1
P-10	HWP-5888	M	0.1
P-9	HWP-5887	C	0.06
P-8	HWP-5886	P	0.2
P-7	HWP-5885	P	0.2
P-6	MAW-5881	P	0.07
P-5	MAW-5880	P	0.2
P-4	MAW-5879	P	0.2
P-3	MAW-5878	P	0.2
P-2	MAW-5877	C	0.05
P-1	MAW-5876	P	0.02

[1]Stratigraphic section and other analyses in Davidson, D. F., Smart, R. A., Peirce, H. W., and Weiser, J. D., 1953, Stratigraphic sections of the Phosphoria Formation in Idaho, 1949, Part 2: U.S. Geol. Survey Circ. 305, p. 16-18.

[2]P = phosphate rock, M = mudstone, C = carbonate rock, and Ch = chert.

Table 9. Selenium analyses of parts of the Phosphoria Formation at 13 localities

[Analyses by J. H. McCarthy, J. L. Sierly, and E. J. Hackney]

(ppm)

Locality	Bed no.	Sample no.	Rock type[1]	Se
Conda, ID.[2] (lot 1200)	P-133	FCA-134	P	20
	P-132	FCA-133	P	10
	P-131	FCA-132	P	50
	P-130	FCA-131	P	<10
	P-129	FCA-130	P	20
	P-128	FCA-129	P	30
	P-127	FCA-128	P	20
	P-126	FCA-127	P	40
	P-125	FCA-126	P	30
	P-15	LES-205	P	30
	P-14	LES-204	P	30
	P-13	LES-203	P	20
	P-12	LES-202	P	70
	P-11	LES-201	M	100
	P-10	LES-200	P	50
	P-9	LES-199	P	80
Mabie Canyon, ID.[2] (lot 1210)	P-11	RAW-37	P	70
	P-10	RAW-36	P	80
	P-9	RAW-35	P	200
	P-8	RAW-34	P	100
	P-7	RAW-33	P	100
	P-6	RAW-32	P	150
Paris Canyon, ID.[3] (lot 1266)	P-84	WOM-3142	M	20
	P-83	WOM-3141	M	7
	P-82	WOM-3140	P	15
	P-81	WOM-3139	M	10
	P-80	WOM-3138	M	15
	P-79	WOM-3137	P	8
	P-78	WOM-3136	M	30
	P-76	WOM-3134	M	20
	P-75	WOM-3133	M	10
	P-74	WOM-3132	M	8
	P-73	WOM-3131	M	10
	P-72	WOM-3130	M	9
	P-71	WOM-3129	P	10
	P-70	WOM-3128	M	30

Table 9. Selenium analyses of parts of the Phosphoria Formation at 13 localities--Continued

Locality	Bed no.	Sample no.	Rock type[1]	Se
Fort Hall, ID[3]	P-16	WOM-2148	P	7
(lot 1269)	P-15	WOM-2147	P	50
	P-14	WOM-2146	P	50
	P-13	WOM-2145	P	8
	P-12	WOM-2144	P	8
	P-7	WOM-2655	P	<10
	P-6	WOM-2654	P	<10
	P-4	WOM-2279	P	<10
	P-3	WOM-2278	P	4
Leefe, WY[4]	P-16	WOM -3319	P&M	10
(lot 1213)	P-15	WOM-3318	P	8
	P-14	RH-3317	P	8
	P-13	RH-3316	P	5
	P-12	RH-3315	P	3
	P-11	WOM-3314	P	7
	P-10	WOM-3313	P	20
	P-9	WOM-3312	P	7
Middle Fork,	P-58	LES-43	M	15
Pine Creek, WY[4]	P-57	LES-44	P	10
(lot 1205)	P-56	LES-45	M	40
	P-45	LES-68	M	60
	P-44	FCA-17	M	80
	P-43	FCA-18	M	80
	P-42	FCA-19	M	10
	P-41	FCA-20	M	60
Poison Creek, WY[5]	P-48	MAW-5130	M	15
(lot 1331)	P-47	MAW-5129	M&P	80
	P-46	MAW-5128	P&M	50
	P-45	MAW-5127	P	50
	P-44	MAW-5126	M	80
	P-43	MAW-5125	M	100
	P-42	MAW-5124	M	60
	P-41	MAW-5123	M	50
	P-40	MAW-5122	M	30
	P-39	MAW-5121	M	40
	P-38	MAW-5120	M	30
	P-37	MAW-5119	M	30
Brazer Canyon, UT[6]	P-124	RAH-111	P	<10
(lot 1203)	P-123	RAH-110	P	10
	P-122	RAH-109	P	320
	P-121	RAH-108	P	<5

Table 9 . Selenium analyses of parts of the Phosphoria Formation at 13 localities--Continued

Locality	Bed no.	Sample no.	Rock type[1]	Se
Sheep Creek, MT[7]	D-39	OAP-10	M	50
(lot 1234)	D-27	LAT-22	M	100
	D-26	LAT-23	M	60
	D-25	LAT-24	M	150
	D-24	ERC-25	M	80
	D-23	ERC-26	M	150
	D-15	DAB-34	P&M	80
	D-12	ERC-37	P&M	150
Canyon Camp, MT[8]	D-13	CWT-712	P	80
(lot 1311)	D-6	CWT-705	P	50
Melrose, MT[9]	D-10	MRK-293	P	40
(lot 1239)	D-9	MRK-792	P&M	25
	D-8	MRK-291	P	20
	D-7	MRK-290	M	100
	D-6	MRK-289	P	8
	D-5	MRK-288	M	80
	D-4	MRK-287	P	40
	D-3	MRK-286	M&P	30
	D-2	MRK-285	P	20
	D-1	MRK-284	P	100
Anderson mine, MT[9]	D-7	MRK-313	P	15
(lot 1287)	D-6	MRK-312	P	8
	D-5	MRK-311	P	5
	D-4	MRK-310	P	10
	D-3	MRK-309	P	8
	D-2	MRK-308	P	25
Graveley mine, MT[9]	D-4	MRK-299	P	<2
(lot 1286)	D-3	MRK-298	P	4
	D-2	MRK-297	P	15

[1]P = Phosphate rock and M = Mudstone.

[2]Stratigraphic section and other analyses in McKelvey, V. E., Davidson, D. F., O'Malley, F. W., and Smith, L. E., 1953, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1947-48, Part I: U.S. Geol. Survey Circ. 208.

[3]Stratigraphic section and other analyses in O'Malley, F. W., Davidson, D. F., Hoppin, R. A., and Sheldon, R. P., 1953, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1947-48, Part 3: U.S. Geol. Survey Circ. 262.

Table 9 . Selenium analyses of parts of the Phosphoria Formation at 13 localities--Continued

[4]Stratigraphic section and other analyses in 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 Circ. 210.

[5]Stratigraphic section and other analyses in Sheldon, R. P., Waring, R. G., Warner, M. A., and Smart, R. A., 1953, Stratigraphic Sections of the Phosphoria Formation in Wyoming, 1949-50: U.S. Geol. Survey Circ. 307.

[6]Stratigraphic section and other analyses in Smith, L. E., Hosford, G. F., Sears, R. S., Sprouse, D. P., and Stewart, M. D., 1952, Stratigraphic Sections of the Phosphoria Formation in Utah, 1947-48: U.S. Geol. Survey Circ. 211.

[7]Stratigraphic section and other analyses in 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 Circ. 209.

[8]Stratigraphic section and other analyses in Swanson, R. W., Cressman, E. R., Jones, R. S., and Replogle, B. K., 1953, Stratigraphic Sections of the Phosphoria Formation in Montana, Part 2, 1949-50: U.S. Geol. Survey Circ. 303.

[9]Stratigraphic section and other analyses in Klepper, M. R., Honkala, F. S., Payne, O. A., and Ruppel, E. T., 1953, Stratigraphic Sections of the Phosphoria Formation in Montana, 1948: U.S. Geol. Survey Circ. 260.

Table 10 . Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]

[Geochemical analyses by J. H. McCarthy and C. E. Thompson]

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-156	JAP	6774	P	---	<10	20	200	.5	50	8	30	1	.21	25	300
P-155	JAP	6773	M	.3	10	5	50	2.2	400	10	15	3	.67	15	300
P-154	JAP	6772	M	.6	<10	10	50	1.5	250	8	150	3	.69	25	300
P-153	JAP	6771	M	<.2	10	10	50	2.1	250	2	15	1	.67	10	<300
P-152	JAP	6770	M	<.2	10	5	50	3	500	1	15	3	.76	10	300
P-151	JAP	6769	M	<.2	20	5	50	2.3	400	4	100	3	.67	15	300
P-150	JAP	6768	M	.4	20	5	50	3	1,000	6	150	5	.52	15	600
P-149	JAP	6767	M	.2	20	5	50	1	250	16	30	3	.58	25	300
P-148	JAP	6766	M	.2	20	5	50	.2	250	12	60	5	.75	15	300
P-147	JAP	6765	M	2	<10	10	125	2.5	125	50	100	10	.52	40	1,000
P-146	JAP	6764	P	.2	<10	5	50	1.5	125	10	15	5	.11	30	300
P-145	JAP	6763	M	.2	40	10	50	.7	750	12	15	3	.60	10	600
P-144	JAP	6762	M	.6	20	10	50	3.3	250	8	60	5	.78	15	400
P-143	JAP	6761	P	.6	<10	5	25	2.5	25	1	30	1	.025	40	300
P-142	JAP	6760	P	5	<10	5	25	.4	125	2	30	3	.05	30	600
P-141	JAP	6759	P	3	10	5	25	.4	75	2	15	3	.15	25	600
P-140	JAP	6758	M	.8	20	10	50	2.3	500	2	100	5	.67	40	600
P-139	ERC	6757	P	3	10	10	50	1	175	2	60	5	.42	60	600
P-138	ERC	6756	P	2	10	5	50	.7	50	2	15	5	.25	80	600
P-137	ERC	6755	P	5	<10	5	50	.6	25	1	15	3	.11	80	600

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-136	ERC	6754	P	2	<10	5	75	.5	25	1	<15	3	.20	80	600
P-135	ERC	6753	P	2	10	10	100	.7	75	4	15	5	.28	80	600
P-134	RGW	6752	P	1.5	20	5	75	1.3	250	16	30	10	.45	40	600
P-133	RGW	6751	P & M	2	20	5	100	.6	175	16	60	10	.40	80	1,500
P-132	RGW	6750	P	5	<10	5	50	.4	125	2	15	3	.10	80	600
P-131	RGW	6749	P	1.5	10	5	50	.7	250	4	30	5	.26	60	1,000
P-130	RGW	6748	P	2	<10	5	75	.2	50	1	15	3	.08	80	600
P-129	RGW	6747	P	8	<10	5	75	.3	25	1	15	3	.1	120	1,000
P-128	RGW	6746	P	8	<10	5	125	.5	75	1	15	3	.11	120	1,500
P-127	RGW	6745	P	10	20	10	150	.9	125	20	60	10	.26	120	2,000
P-126	RGW	6744	P	6	<10	5	115	.5	25	20	60	10	.25	80	3,000
P-125	RGW	6743	P	6	10	5	100	.8	<25	24	60	10	.31	80	2,000
P-124	RGW	6742	P	8	<10	5	175	.6	<25	2	30	3	.31	80	1,500
P-123	RGW	6741	P	10	10	5	100	1	<25	2	15	3	.21	60	1,000
P-122	RGW	6740	P	8	10	10	150	1	<25	6	60	3	.31	60	1,000
P-121	RGW	6739	P	5	20	5	150	3.5	<25	16	100	5	.36	40	1,500
P-120	RGW	6738	M	2	20	5	100	2.8	50	16	15	15	.50	40	1,000
P-119	RGW	6737	M	1	30	5	75	2	75	2	15	10	.68	30	1,000
P-118	RGW	6736	M	1.5	30	5	100	1.4	<25	6	30	10	.46	30	600
P-117	RGW	6735	P	2.4	20	5	150	1	<25	6	60	10	.31	40	600

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-116	RGW	6734	P	2	20	5	125	.8	<25	8	15	5	.28	40	600
P-115	RGW	6733	M	2	30	5	100	1.3	<25	10	15	10	.50	40	400
P-114	RGW	6732	P	1	30	5	100	1	25	10	30	10	.42	30	400
P-113	RGW	6731	M	1	20	<5	100	1.1	<25	8	30	10	.55	30	300
P-112	RGW	6730	P	1.5	30	5	50	1.2	25	6	<15	5	.21	25	400
P-111	RGW	6729	M	<.2	20	5	50	1.8	50	6	15	10	.75	10	600
P-110	RGW	6728	M	<.2	20	5	50	1.5	50	4	30	10	.60	30	300
P-109	RGW	6727	P	1.5	20	10	115	.9	75	4	60	10	.29	60	400
P-108	RGW	6726	M	.2	20	5	50	1.1	125	4	15	5	.40	25	400
P-107	RGW	6725	M	.2	20	20	50	1.3	600	8	15	5	.45	30	400
P-106	RGW	6724	M	.6	20	5	50	1.8	1,750	16	150	10	.67	25	400
P-105	RGW	6723	P & M	.8	10	10	115	.9	50	12	30	10	.58	30	300
P-104	RGW	6722	P	2	10	10	100	.9	400	6	30	5	.29	30	400
P-103	RGW	6721	M	1.5	20	5	150	1.5	50	12	100	10	.62	25	400
P-102	RGW	6720	M	.2	20	5	100	2	25	8	30	10	.68	15	400
P-101	RAS	6719	M	2	10	5	100	2	25	24	60	10	.60	15	600
P-100	RAS	6718	M	1	20	5	75	2.5	25	10	15	10	.69	10	400
P- 99	RAS	6717	M	.4	20	10	50	2.5	100	8	60	20	.82	10	400
P- 98	RAS	6716	M	.6	10	5	75	1.2	<25	10	<15	10	.75	10	300
P- 97	RAS	6715	P	1	10	5	150	1	<25	8	15	5	.48	25	400

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-96	RAS	6714	M	.4	10	5	75	1.2	<25	4	<15	5	.69	15	400
P-95	RAS	6713	M	1.5	<10	10	200	1	<25	2	15	3	.48	25	600
P-94	RAS	6712	P	1.5	<10	5	135	.8	<25	2	<15	3	.38	25	300
P-93	RAS	6711	P	1	<10	10	135	1.1	25	2	<15	3	.11	30	300
P-92	RAS	6710	P	2	<10	10	200	.7	<25	4	15	3	.29	40	400
P-91	RAS	6709	M	1.5	10	5	150	1.1	25	2	15	3	.50	25	300
P-90	RAS	6708	M	1	10	5	115	1.1	25	4	15	5	.59	25	400
P-89	RAS	6707	P	.8	<10	5	100	1	25	2	15	5	.38	25	300
P-88	RAS	6706	M	.2	10	5	50	1.3	25	4	15	5	.70	10	300
P-87	RAS	6705	C	<.2	10	5	50	1.3	50	4	30	30	.76	10	400
P-86	RAS	6704	M	.2	20	5	25	1.5	50	8	15	5	.59	15	300
P-85	RAS	6703	M	.2	30	10	25	2	25	6	15	5	.70	10	<300
P-84	RAS	6702	P	.2	30	10	25	1.4	50	8	30	10	.36	15	300
P-83	RAS	6701	M	.4	20	5	50	1	25	4	15	3	.69	15	300
P-82	RAS	6700	P	<.2	20	10	150	1.2	50	6	15	5	.36	30	300
P-81	RAS	6699	M	.2	20	5	50	1.8	25	6	60	10	.78	10	300
P-80	TMC	6698	M	2	20	20	350	1	<25	6	100	10	.38	40	300
P-79	TMC	6697	P	10	<10	20	350	.4	<25	6	100	5	.29	60	300
P-78	TMC	6696	M & P	1.5	20	10	300	1	<25	12	150	10	.29	80	400
P-77	TMC	6695	M	1	20	10	100	1.7	<25	12	150	20	.70	30	300

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample No.		Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-76	TMC	6694	P	---	30	5	180	1.4	<25	1	100	5	.18	80	300
P-75	TMC	6693	M	1.5	20	5	100	1.4	<25	2	150	5	.58	30	300
P-74	TMC	6692	P	5	<10	5	100	.5	<25	4	100	5	.40	30	300
P-73	TMC	6691	M	2	30	5	100	1.5	<25	8	300	15	.52	15	300
P-72	TMC	6690	P & M	3	30	5	150	1.3	<25	40	200	30	.42	15	400
P-71	TMC	6689	P & M	5	10	20	150	1.5	<25	32	100	30	.31	15	400
P-70	TMC	6688	M	3	10	20	130	1.4	25	24	300	30	.50	25	400
P-69	TMC	6687	P & M	5	10	10	130	.9	25	24	150	30	.39	25	300
P-68	TMC	6686	M	2	20	5	100	1	50	36	200	5	.36	25	300
P-67	TMC	6685	M	1	20	10	100	1	125	32	200	3	.42	15	400
P-66	TMC	6684	M	.3	40	5	50	1.6	125	8	150	20	.58	15	300
P-65	TMC	6683	M	.2	10	5	50	1	150	1	150	10	.36	10	300
P-64	TMC	6682	M	<.2	10	10	50	1.1	50	6	100	5	.38	10	<300
P-63	TMC	6681	M	.6	20	5	50	1.8	50	12	150	15	.70	10	300
P-62	TMC	6680	M	.5	20	10	100	2	25	12	150	15	.78	10	400
P-61	TMC	6679	M	.2	10	10	50	.9	50	8	150	20	.70	10	300
P-60	TMC	6678	M	<.2	20	10	50	2.3	25	12	100	20	.75	10	300
P-59	TMC	6677	M	.5	30	5	100	1.8	25	12	150	20	.50	25	300
P-58	TMC	6676	P	.4	30	10	100	1.5	25	12	200	15	.45	25	300
P-56	TMC	6675	M	.2	30	5	100	2.2	50	12	150	20	.60	15	600
P-56	RMC	6674	P	.2	30	10	100	1.6	50	12	100	18	.32	15	600
P-55	TMC	6673	P	.8	30	20	130	1.6	25	12	150	15	.28	15	600
P-54	TMC	6672	P	1.5	20	10	130	1.2	25	40	100	20	.38	25	600

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-53	TMC	6671	P & M	2.4	30	20	130	1.5	25	50	150	15	.35	25	600
P-52	TMC	6670	P & M	2	30	10	100	1.6	25	36	200	10	.42	25	600
P-51	TMC	6669	M	.2	30	5	50	1.8	50	8	150	20	.75	10	600
P-50	TMC	6668	M	.4	30	5	85	2	25	20	100	20	.50	25	600
P-49	TMC	6667	M	.6	20	5	85	1.8	25	18	200	20	.39	25	600
P-48	TMC	6666	M	.6	30	10	115	1.6	125	16	100	20	.28	25	600
P-47	TMC	6665	P	1.5	10	20	100	1.5	75	44	200	15	.40	30	600
P-46	TMC	6664	P	.4	10	10	115	1.5	150	32	150	15	.46	30	600
P-45	TMC	6663	M	.2	20	20	100	2	50	28	300	15	.45	25	600
P-44	TMC	6662	M	.8	30	10	100	1.6	50	16	200	15	.39	40	600
P-43	TMC	6661	P	---	30	10	115	1	25	38	200	15	.31	40	600
P-42	TMC	6660	P	---	40	10	115	1.5	50	26	200	15	.31	30	600
P-41	TMC	6659	P	2	40	20	180	1	100	36	150	15	.20	30	600
P-40	TMC	6658	P	---	30	5	150	1	50	20	60	5	.15	15	600
P-39	TMC	6657	P	---	30	5	230	.9	50	28	60	8	.21	25	600
P-38	TMC	6656	P	---	20	10	100	1	50	26	200	8	.31	30	1,500
P-37	TMC	6655	P	---	20	5	100	.6	25	12	100	5	.18	30	600
P-36	TMC	6654	P	.4	60	5	120	.8	50	32	60	20	.25	60	1,500
P-35	TMC	6653	M	.6	60	10	500	1.9	<25	90	500	30	.50	40	3,000
P-34	TMC	6652	P	1	20	5	200	1	25	48	200	8	.20	120	2,000
P-33	TMC	6651	P	2.5	30	<5	150	1	50	40	150	5	.26	80	3,000
P-32	TMC	6650	P & M	3	20	5	100	1	125	60	200	12	.38	120	3,000
P-31	TMC	6649	P	---	20	5	50	1	125	48	100	10	.25	80	1,500

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample	No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
				ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-30	JAP	6648	M	<.2	40	5	65	1.5	600	24	200	15	.52	15	600
P-29	JAP	6647	M	.6	50	30	65	1.8	900	20	200	15	.58	25	600
P-28	JAP	6646	M	.4	40	10	25	2.2	750	12	300	20	.67	15	600
P-27	JAP	6645	P	---	20	5	30	.85	75	1	150	8	.26	30	600
P-26	JAP	6644	P	1	30	<5	50	.4	25	12	<15	5	.15	60	1,500
P-25	JAP	6643	P	---	30	<5	75	.55	50	18	100	5	.25	80	3,000
P-24	JAP	6642	P	---	20	<5	50	1	75	36	100	4	.35	80	2,000
P-23	JAP	6641	M	.5	20	5	50	1.5	500	36	150	10	.55	40	1,500
P-22	JAP	6640	P	.2	10	5	60	.85	25	36	30	8	.18	80	1,500
P-21	JAP	6639	P	---	10	5	70	.5	25	12	15	4	.25	80	1,500
P-20	JAP	6638	P	---	10	5	60	.45	25	18	60	4	.12	60	2,000
P-19	JAP	6637	P	---	20	<5	60	.7	25	12	60	4	.26	60	1,500
P-18	JAP	6636	P	---	40	<5	50	1.05	175	40	150	10	.26	60	1,500
P-17	JAP	6635	P	---	30	<5	60	.7	50	36	15	4	.26	80	600
P-16	JAP	6634	M	2	40	10	60	1.15	500	36	100	10	.39	25	1,000
P-15	JAP	6633	P	---	30	20	50	.8	75	32	100	4	.20	30	600
P-14	JAP	6632	P & M	.6	30	10	45	1.5	600	28	500	10	.26	25	600
P-13	JAP	6631	P	1	<10	5	50	.25	25	18	15	4	.12	60	1,000
P-12	JAP	6630	P	.8	<10	<5	60	.15	25	14	<15	2	.15	60	1,000
P-11	JAP	6629	P	---	10	5	50	.25	25	12	<15	2	.18	40	600

Table 10. Analytical data on Meade Peak Member of Phosphoria Formation at Snowdrift Mountain (lot 1372), Idaho[1]--Continued

Bed No.	Sample No.	Rock Type[2]	Ag	As	Co	Cu	Fe	Mn	Mo	Ni	Sb	TiO_2	U	V
			ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm
P-10	JAP 6628	P	---	<10	<5	50	.25	<25	6	15	1	.10	160	1,000
P- 9	JAP 6627	P	---	30	5	50	.4	25	10	15	2	.10	120	600
P- 8	JAP 6626	C	.4	10	10	25	1.1	125	8	30	5	.35	<4	400
P- 7	JAP 6625	C	.8	20	5	15	1	125	6	15	2	.31	<4	300
P- 6	JAP 6624	C	.6	20	5	25	1.5	125	36	15	10	.45	10	400
P- 5	JAP 6623	P	.6	<10	10	25	.3	50	12	15	2	.05	100	300
P- 4	JAP 6622	C	.4	<10	5	15	.2	75	4	15	1	.03	10	<300
P- 3	JAP 6621	P	.2	10	5	25	.2	50	12	15	1	.11	60	300
P- 2	JAP 6620	C	.2	20	5	25	1	125	14	15	4	.25	<4	300
P- 1	JAP 6619	P	.4	<10	5	25	.4	50	12	15	2	.11	80	300

[1]Stratigraphic section and other analytical data in Smart, R. A., Waring, R. G., Cheney, T. M., and Sheldon, R. P., 1964, Stratigraphic Sections of the Phosphoria Formation in Idaho, 1950-51: U.S. Geol. Survey Circular 327, p. 15-19.

[2]P = phosphate rock, M = mudstone, and C = carbonate rock.

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