DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Analytical and stratigraphic data on the Retort Phosphatic Shale Member of the Phosphoria Formation in the Hawley Creek area, Lemhi County, Idaho

by

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and

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Open-File Report 86-427

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature

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1986

Units of Measurement

The following metric units are used throughout this report. These metric units can be converted to English units by multiplying by the following factors.

Metric unit To convert	Multiply by	English unit To obtain
Meters (m).....	3.281	Feet (ft)
Kilometers(km).....	0.6214	Miles (mi)

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INTRODUCTION

This report presents a generalized stratigraphic section and chemical analyses for sampling units of the Retort Phosphatic Shale Member of the Phosphoria Formation from sample locality CP-71. This sample locality is in Lemhi County, about 13 km east of Leadore (fig. 1). An abbreviated stratigraphic description and detailed chemical analysis of section CP-71 are listed in Table 1. The analytical data is presented without interpretation in this report. A previous report by Oberlindacher and Hovland (1979) presented a detailed geologic map and description of the phosphate resources in the Hawley Creek area. Included in this previous report are detailed stratigraphic sections and P_2O_5 analyses for trenches CP-71 and CP-72, a structure contour map on the top of the Retort, and phosphate resource calculations.

This study was supported by a program of the U.S. Geological Survey, Conservation Division to evaluate Federal phosphate mineral resources in Idaho. This program is now being conducted by the Bureau of Land Management.

Method of Investigation

A reconnaissance of the Hawley Creek area in June 1976 was followed by a 3-week sampling and selected mapping program in August 1976. Section CP-71 was measured and sampled from a bulldozer trench located in sec. 24, T. 16 N., R. 27 E., Boise Meridian, Idaho. The main trench for CP-71 was cut to a length of 61.0 m and to a maximum depth of 4.3 m. A second, 21.4 m long trench was cut 3.1 m to the east and parallel to the main trench. This second trench exposed the lower part of the Retort and underlying Park City Formations. Both trenches were cut perpendicular to the strike of bedding to expose true bedding thickness. Samples were recovered from the lower and middle parts of the Retort (Oberlindacher and Hovland, 1979). Trench CP-71 was backfilled and the top soil replaced upon completion of the sampling. The procedures for sampling and rock descriptions are similar to those used by Gere and others (1966), and by Cressman and Swanson (1964).

Phosphate allochems and grain size were identified in the field with a hand lens. The term "oolitic" refers to rounded accretionary grains as large as 2mm in diameter having an internal concentric structure that formed around a nucleus.

Acknowledgments

The authors are grateful to W.C. Gere for providing helpful suggestions during the initial phase of this study and assisting in the trenching and sampling of trench CP-71.

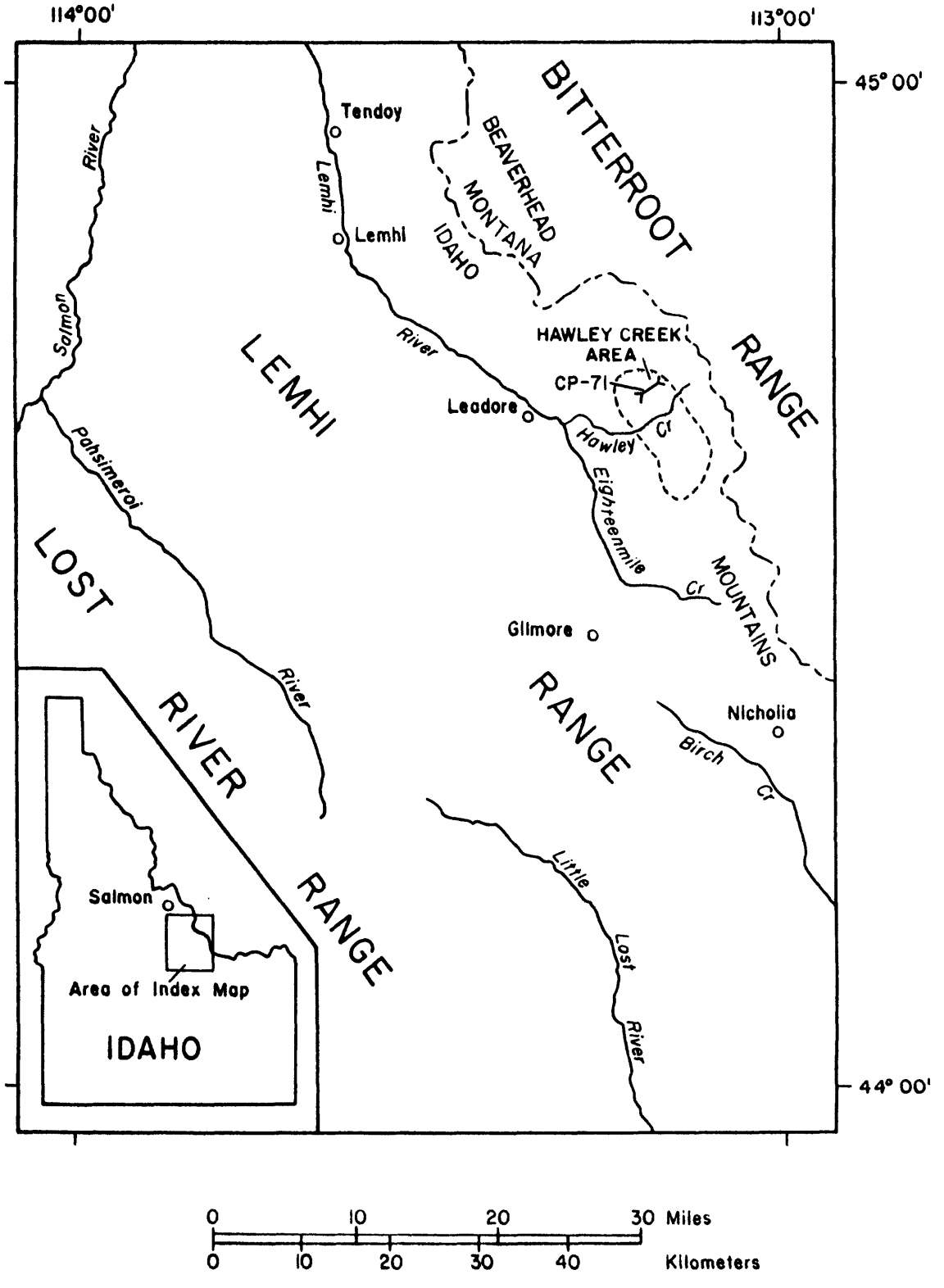

Figure 1. Index map showing location of phosphate trench locality CP-71 in the Hawley Creek area, Idaho.

REFERENCES CITED

Cressman, E. R., and Swanson, R. W., 1964, Stratigraphy and petrology of the Permian rocks of southwestern Montana: U. S. Geological Survey Professional Paper 313-C, p. 275-569.

Gere, W. C., Shell, E. M., and Moore, K. P., 1966, Stratigraphic sections and phosphate analyses of Permian rocks in the Teton Range and parts of the Snake River and Gros Ventre Ranges, Idaho and Wyoming: U. S. Geological Survey Open-File Report, 71 p.

Oberlindacher, Peter, and Hovland, R. D., 1979, Geology and phosphate resources of the Hawley Creek area, Lemhi County, Idaho: U. S. Geological Survey Open-File Report 79-1283, 18 p.

Table 1 Chemical composition and lithology of the Park City Formation (Pc), the Retort Phosphatic Shale Member (Rt) and Tosi Chert Member (To) of the Phosphoria Formation from the Hawley Creek Trench CP-71 (SE1/4 NW1/4 Sec. 24, T. 16 N., R. 27 E.), Lemhi County, Idaho

SAMPLE	BED	THICKNESS (meters)	LITHOLOGY	Ag!	As!	Au!	B!	Ba!	Ba"
CP-71-1	Pc-1	7.90	Sandstone (S)	9.40	<150	<10	92	170	---
CP-71-2	Pc-2	13.85	Dolomite & S.	3.40	<150	<10	<3.2	22	---
CP-71-3	Pc-3	0.03	Chert	4.60	<150	<10	27	63	---
CP-71-4	Pc-4	0.50	Dolomite	3.10	<150	<10	5.8	20	---
CP-71-5	Rt-1	0.02	Mudstone	7.20	<150	<10	79	210	<432
CP-71-6	Rt-2	0.40	Phosphorite	14.00	<150	<10	79	170	---
CP-71-7	Rt-3	0.40	Sandstone	3.90	<150	<10	56	220	---
CP-71-8	Rt-4	0.20	Phosphorite	8.50	<150	<10	18	140	<417
CP-71-9	Rt-5	0.17	Phosphorite	8.40	<150	<10	56	170	---
CP-71-10	Rt-6	0.20	Mudstone	12.00	<150	<10	37	120	---
CP-71-11	Rt-7	0.80	Phosphorite	11.00	<150	<10	24	110	---
CP-71-12	Rt-8	0.80	Siltstone	15.00	<150	<10	32	80	<344
CP-71-13	Rt-9	0.03	Mudstone	11.00	<150	<10	55	150	---
CP-71-14	Rt-10	0.41	Chert	6.00	<150	<10	28	91	---
CP-71-15	Rt-11	0.55	Siltstone	6.90	<150	<10	56	200	---
CP-71-16	Rt-12	0.20	Phosphorite	5.60	<150	<10	10	180	---
CP-71-17	Rt-13	0.60	Mudstone	13.00	<150	<10	69	170	---
CP-71-18	Rt-14	0.70	Siltstone	9.90	<150	<10	28	110	<265
CP-71-19	Rt-15	1.70	Siltstone	14.00	<150	<10	38	85	---
CP-71-20	Rt-16	0.60	Phosphorite	17.00	<150	<10	4.2	64	---
CP-71-21	Rt-17	0.06	Mudstone	12.00	<150	<10	130	280	---
CP-71-22	Rt-18	0.16	Phosphorite	14.00	<150	<10	60	130	---
CP-71-23	Rt-19	0.20	Phosphorite	17.00	<150	<10	6.6	82	<448
CP-71-24	Rt-20	0.60	Phosphorite	18.00	<150	<10	22	130	---
CP-71-25	Rt-21	0.70	Phosphorite	14.00	<150	<10	53	290	---
CP-71-26	Rt-22	0.40	Dolomite	4.10	<150	<10	<3.2	31	---
CP-71-27	Rt-23	0.70	Phosphorite	12.00	<150	<10	14	120	<477
CP-71-28	Rt-24	1.20	Siltstone	14.00	<150	<10	30	130	---
CP-71-29	Rt-25	7.80	Covered	---	---	---	---	---	---
CP-71-30	To-1	7.06	Covered	---	---	---	---	---	---
CP-71-31	To-2	20.90	Chert	0.10	<150	<10	26	83	---

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

! in ppm, semiquantitative emission spectrographic analysis by J.L. Harris

* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.

** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 1

SAMPLE	Be!	Bi!	Cd!	Ce!	Ce"	Co!	Co"	Cr!	Cr"	Cs"	Cu!	Dy!
CP-71-1	1.2	<22	<32	<93	---	4.9	---	37	---	---	60	<32
CP-71-2	<0.68	<22	<32	<93	---	2.0	---	17	---	---	61	<32
CP-71-3	0.68	<22	<32	<29	---	4.4	---	45	---	---	32	<32
CP-71-4	0.68	<22	<32	<93	---	1.6	---	66	---	---	22	<32
CP-71-5	3.3	<22	96	150	161	5.5	5.8	340	543.4	5.8	79	39
CP-71-6	2.6	<22	47	110	---	2.4	---	660	---	---	57	<32
CP-71-7	0.69	<22	51	<93	---	2.2	---	140	---	---	18	<32
CP-71-8	3.1	<22	84	110	53	2.9	1.1	640	1041.4	3.2	54	33
CP-71-9	4.9	<22	47	<93	---	2.8	---	770	---	---	81	<32
CP-71-10	2.1	<22	100	<93	---	4.7	---	580	---	---	60	<32
CP-71-11	3.3	<22	79	110	---	4.1	---	700	---	---	75	<32
CP-71-12	1.5	<22	33	<93	64	2.8	1.8	440	812.3	2.7	87	<32
CP-71-13	3.8	<22	65	87	---	4.9	---	820	---	---	56	33
CP-71-14	1.1	<22	34	<93	---	2.9	---	250	---	---	31	<32
CP-71-15	1.9	<22	59	<93	---	3.6	---	290	---	---	140	<32
CP-71-16	1.1	<22	250	93	---	2.4	---	100	---	---	32	<32
CP-71-17	3.6	<22	50	<93	---	2.6	---	800	---	---	85	<32
CP-71-18	1.0	<22	450	<93	44	8.2	12.4	93	226.7	1.6	52	<32
CP-71-19	1.1	<22	42	<93	---	2.1	---	490	---	---	62	<32
CP-71-20	0.92	<22	55	<93	---	6.0	---	280	---	---	51	<32
CP-71-21	5.6	<22	37	150	---	5.3	---	1500	---	---	230	<32
CP-71-22	3.2	<22	37	100	---	2.6	---	710	---	---	130	<32
CP-71-23	1.2	<22	66	<93	46	4.1	2.9	210	319.3	0.8	74	<32
CP-71-24	1.9	<22	50	130	---	3.7	---	600	---	---	95	44
CP-71-25	3.5	<22	48	130	---	5.8	---	920	---	---	130	<32
CP-71-26	<0.68	<22	<32	<93	---	3.4	---	200	---	---	49	<32
CP-71-27	2.2	<22	74	130	56	3.7	2.0	460	765.9	1.8	73	40
CP-71-28	1.4	<22	42	<93	---	4.1	---	660	---	---	110	<32
CP-71-29	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	0.68	<22	<32	<29	---	1.9	---	18	---	---	60	<32

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA
*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.
! in ppm, semiquantitative emission spectrographic analysis by J.L. Harris
* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.
** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.
1) Sulfate sulfur as SO3
--- Not determined
Pc is Park City Formation
Rt is Retort Phosphatic Shale Member of Phosphoria Formation
To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 2

SAMPLE	Er!	Eu!	Eu"	Ga!	Gd!	Gd"	Ge!	Hf!	Hf"	Ho!	In!	Ir!
CP-71-1	<10	<1.5	---	5.0	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-2	<10	<1.5	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-3	<10	<1.5	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-4	<10	<1.5	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-5	30	9.7	11.96	3.3	43.0	71.9	<4.6	<100	8.7	9.3	<6.8	<15
CP-71-6	15	4.0	---	<2.2	14.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-7	<10	<1.5	4.90	<2.2	<6.8	33.4	<4.6	<100	2.4	<6.8	<6.8	<15
CP-71-8	31	6.7	---	<2.2	36.0	---	<4.6	<100	---	11.0	<6.8	<15
CP-71-9	12	3.0	---	2.5	11.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-10	<10	<1.5	---	2.3	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-11	21	5.6	---	<2.2	21.0	---	<4.6	<100	---	<10.0	<6.8	<15
CP-71-12	14	3.7	6.19	<2.2	21.0	43.0	<4.6	<100	5.2	<6.8	<6.8	<15
CP-71-13	22	6.6	---	<2.2	31.0	---	<4.6	<100	---	6.9	<6.8	<15
CP-71-14	<10	3.2	---	<2.2	7.6	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-15	<10	2.4	---	4.3	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-16	15	5.4	---	<2.2	21.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-17	15	5.7	---	2.7	15.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-18	<10	1.9	2.38	<2.2	8.3	16.7	<4.6	<100	7.7	<6.8	<6.8	<15
CP-71-19	<10	1.8	---	<2.2	11.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-20	18	4.6	---	<2.2	16.0	---	<4.6	<100	---	<6.89	<6.8	<15
CP-71-21	13	4.3	---	11.0	10.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-22	19	6.8	---	<2.2	31.0	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-23	23	8.1	5.58	<2.2	37.0	34.8	<4.6	<100	2.5	<6.8	<6.8	<15
CP-71-24	33	10.0	---	<2.2	45.0	---	<4.6	<100	---	12.0	<6.8	<15
CP-71-25	19	6.2	---	2.7	32.0	---	<4.6	<100	---	<10.0	<6.8	<15
CP-71-26	<10	1.6	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-27	30	9.3	5.79	<2.2	45.0	41.8	<4.6	<100	1.5	12.0	<6.8	<15
CP-71-28	<10	2.3	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15
CP-71-29	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	10	<1.5	---	<2.2	<6.8	---	<4.6	<100	---	<6.8	<6.8	<15

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

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** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 3

SAMPLE	La!	La"	Li!	Lu!	Lu"	Mn!	Mo!	Nb!	Nd!	Nd"	Ni!	Os!
CP-71-1	20	---	<68	<22	---	280	26	7.1	<46	---	19	<10
CP-71-2	17	---	<68	<22	---	150	5.0	<3.2	<46	---	7.8	<10
CP-71-3	<10	---	<68	<22	---	73	<2.2	<3.2	<46	---	35	<10
CP-71-4	15	---	<68	<22	---	100	4.4	<3.2	<46	---	35	<10
CP-71-5	440	476	<68	<22	4.21	110	27	<3.2	280	244	180	<10
CP-71-6	350	---	<68	<22	---	37	14	<3.2	110	---	97	<10
CP-71-7	52	---	<68	<22	---	190	9.1	<3.2	<46	---	50	<10
CP-71-8	490	286	<68	<22	3.11	72	20	<3.2	150	108	91	<10
CP-71-9	230	---	<68	<22	---	50	21	<3.2	91	---	170	<10
CP-71-10	70	---	<68	<22	---	180	39	<3.2	<46	---	230	<10
CP-71-11	380	---	<68	<22	---	78	22	<3.2	150	---	110	<46
CP-71-12	190	270	<68	<22	2.63	110	14	<3.2	110	58	97	<10
CP-71-13	370	---	<68	<22	---	130	20	<3.2	210	---	170	<10
CP-71-14	140	---	<68	<22	---	100	9.3	<3.2	110	---	85	<10
CP-71-15	72	---	<68	<22	---	110	12	6.8	<46	---	230	<10
CP-71-16	260	---	<68	<22	---	24	13	<3.2	130	---	97	<10
CP-71-17	180	---	<68	<22	---	27	14	<3.2	89	---	210	<10
CP-71-18	65	82	<68	<22	1.01	260	25	3.7	<46	67	160	<10
CP-71-19	97	---	<68	<22	---	71	16	<3.2	<46	---	150	<10
CP-71-20	240	---	<68	<22	---	230	29	<3.2	150	---	150	<10
CP-71-21	88	---	<68	<22	---	99	69	4.8	67	---	490	<10
CP-71-22	270	---	<68	<22	---	25	45	<3.2	150	---	260	<10
CP-71-23	350	217	<68	<22	2.10	64	24	<3.2	150	108	140	<10
CP-71-24	500	---	<68	<22	---	72	42	<3.2	270	---	220	<10
CP-71-25	400	---	<68	<22	---	130	53	<3.2	200	---	250	<10
CP-71-26	36	---	<68	<22	---	180	15	<3.2	<46	---	77	<10
CP-71-27	510	276	<68	<22	2.65	52	20	<3.2	180	112	130	<10
CP-71-28	130	---	<68	<22	---	120	32	<3.2	82	---	200	<10
CP-71-29	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	<10	---	<68	<22	---	42	<2.2	<3.2	<46	---	5.9	<10

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

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** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 4

SAMPLE	Pb!	Pd!	Pr!	Pt!	Rb"	Re!	Rh!	Ru!	Sb!	Sb"	Sc!	Sc"
CP-71-1	36	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	5.2	---
CP-71-2	130	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	1.4	---
CP-71-3	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	<1.0	---
CP-71-4	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	1.9	---
CP-71-5	110	<1.5	86	<6.8	48	<10	<1.0	<3.2	<100	2.9	9.5	11.14
CP-71-6	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	7.6	---
CP-71-7	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	3.8	---
CP-71-8	<10	<1.5	<68	<6.8	15	<10	<1.0	<3.2	<100	2.9	13	9.17
CP-71-9	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	9.1	---
CP-71-10	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	6.2	---
CP-71-11	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	10.0	---
CP-71-12	13	<1.5	<68	<6.8	19	<10	<1.0	<3.2	<100	2.2	6.8	8.81
CP-71-13	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	11.0	---
CP-71-14	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	6.0	---
CP-71-15	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	10.0	---
CP-71-16	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	7.1	---
CP-71-17	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	11.0	---
CP-71-18	<10	<1.5	<68	<6.8	33	<10	<1.0	<3.2	<100	3.2	6.1	5.81
CP-71-19	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	4.2	---
CP-71-20	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	8.3	---
CP-71-21	18	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	13.0	---
CP-71-22	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	9.1	---
CP-71-23	<10	<1.5	<68	<6.8	26	<10	<1.0	<3.2	<100	2.5	8.6	5.05
CP-71-24	<10	<1.5	120	<6.8	---	<10	<1.0	<3.2	<100	---	12.0	---
CP-71-25	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	12.0	---
CP-71-26	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	3.5	---
CP-71-27	<10	<1.5	<68	<6.8	29	<10	<1.0	<3.2	<100	3.3	9.5	5.88
CP-71-28	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	6.0	---
CP-71-29	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	<10	<1.5	<68	<6.8	---	<10	<1.0	<3.2	<100	---	1.1	---

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

! in ppm, semiquantitative emission spectrographic analysis by J.L. Harris

* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.

** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 5

SAMPLE	Sm!	Sm"	Sn!	Sr!	Ta!	Ta"	Tb!	Tb"	Th*!	Tl!	Tm!	Tm"
CP-71-1	<46	---	<6.8	34	<320	---	<32	---	6.86	<10	<4.6	---
CP-71-2	<46	---	<6.8	26	<320	---	<32	---	1.63	<10	<4.6	---
CP-71-3	<46	---	<6.8	23	<320	---	<32	---	0.30	<10	<4.6	---
CP-71-4	<46	---	<6.8	17	<320	---	<32	---	3.03	<10	<4.6	---
CP-71-5	<46	40.5	10.0	490	<320	0.74	<32	9.71	16.13	<10	<4.6	4.98
CP-71-6	<46	---	<6.8	390	<320	---	<32	---	5.57	<10	<4.6	---
CP-71-7	<46	---	<6.8	150	<320	---	<32	---	1.38	<10	<4.6	---
CP-71-8	<46	13.9	<6.8	680	<320	0.38	<32	4.57	7.19	<10	<4.6	3.18
CP-71-9	<46	---	<6.8	500	<320	---	<32	---	3.86	<10	<4.6	---
CP-71-10	<46	---	<6.8	150	<320	---	<32	---	5.44	<10	<4.6	---
CP-71-11	<46	---	<6.8	870	<320	---	<32	---	17.37	<10	<4.6	---
CP-71-12	<46	24.4	17	210	<320	0.39	<32	5.21	8.48	<10	<4.6	3.14
CP-71-13	<46	---	<6.8	440	<320	---	<32	---	17.74	<10	<4.6	---
CP-71-14	<46	---	<6.8	270	<320	---	<32	---	10.19	<10	<4.6	---
CP-71-15	<46	---	9.6	250	<320	---	<32	---	9.89	<10	<4.6	---
CP-71-16	<46	---	<6.8	790	<320	---	<32	---	9.17	<10	<4.6	---
CP-71-17	<46	---	<6.8	370	<320	---	<32	---	21.80	<10	<4.6	---
CP-71-18	<46	13.2	<6.8	270	<320	0.56	<32	1.99	10.61	<10	<4.6	1.22
CP-71-19	<46	---	<6.8	170	<320	---	<32	---	2.02	<10	<4.6	---
CP-71-20	<46	---	10	680	<320	---	<32	---	13.23	<10	<4.6	---
CP-71-21	<46	---	19	350	<320	---	<32	---	24.57	<10	<4.6	---
CP-71-22	<46	---	<6.8	560	<320	---	<32	---	17.44	<10	<4.6	---
CP-71-23	<46	17.5	7.2	1300	<320	0.43	<32	4.57	20.31	<10	<4.6	2.69
CP-71-24	51	---	<6.8	1300	<320	---	<32	---	16.37	<10	<4.6	---
CP-71-25	<46	---	13	910	<320	---	<32	---	20.60	<10	<4.6	---
CP-71-26	<46	---	9.3	240	<680	---	<32	---	2.42	<10	<4.6	---
CP-71-27	<46	16.4	<6.8	1500	<320	0.42	<32	4.92	24.71	<10	<4.6	3.26
CP-71-28	<46	---	<6.8	430	<320	---	<32	---	9.47	<10	<4.6	---
CP-71-29	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	<46	---	<6.8	6.3	<320	---	<32	---	0.37	<10	<4.6	---

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

! in ppm, semiquantitative emission spectrographic analysis by J.L. Harris

* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.

** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 6

SAMPLE	U*!	V!	W!	Y!	Yb!	Yb"	Zn!	Zn"	Zr!	Zr"	Org.C**
CP-71-1	3.15	37	<10	19	3.2	---	270	---	440	---	0.26
CP-71-2	4.09	29	<10	16	1.1	---	410	---	260	---	1.33
CP-71-3	1.41	28	<10	7.6	0.71	---	190	---	24	---	0.56
CP-71-4	1.80	34	<10	7.4	0.60	---	440	---	27	---	1.96
CP-71-5	49.88	200	<10	450	24	30.6	2100	1942	390	674	0.31
CP-71-6	54.57	170	<10	320	13	---	970	---	200	---	0.33
CP-71-7	9.63	71	<10	52	2.5	---	520	---	36	---	0.08
CP-71-8	56.72	200	<10	590	19	20.8	1000	984	330	537	0.26
CP-71-9	71.07	250	<10	250	14	---	2000	---	300	---	0.55
CP-71-10	22.89	210	<10	77	4.8	---	2300	---	170	---	0.18
CP-71-11	69.92	180	<10	330	16	---	1100	---	240	---	0.74
CP-71-12	36.84	82	<10	230	9.8	18.1	940	905	200	378	0.11
CP-71-13	64.00	130	<10	360	18	---	1100	---	290*	---	0.33
CP-71-14	16.55	61	<10	140	8.8	---	860	---	170	---	2.45
CP-71-15	11.07	130	<10	85	9.1	---	1600	---	350	---	0.36
CP-71-16	30.25	110	<10	260	14	---	1100	---	390	---	0.38
CP-71-17	36.30	170	<10	220	17	---	1700	---	350	---	0.24
CP-71-18	13.17	120	<10	80	5.3	7.1	1500	1601	280	445	0.46
CP-71-19	38.63	120	<10	120	4.5	---	1200	---	160	---	1.64
CP-71-20	32.20	72	<10	230	11	---	1100	---	190	---	1.27
CP-71-21	84.33	310	<10	96	14	---	2600	---	200	---	0.20
CP-71-22	76.52	140	<10	230	13	---	2600	---	240	---	0.23
CP-71-23	40.91	85	<10	300	14	14.4	980	977	220	346	0.39
CP-71-24	58.14	100	<10	410	18	---	1100	---	240	---	0.37
CP-71-25	70.29	240	<10	330	17	---	1500	---	210	---	0.34
CP-71-26	9.19	70	<10	31	1.3	---	460	---	26	---	0.25
CP-71-27	56.45	150	<10	500	23	17.4	970	899	180	463	0.37
CP-71-28	22.79	140	<10	130	5.8	---	970	---	130	---	0.49
CP-71-29	---	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---	---
CP-71-31	0.90	5.3	<10	3.6	0.17	---	400	---	14	---	0.10

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

! in ppm, semiquantitative emission spectrographic analysis by J.L. Harris

* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.

** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 7

SAMPLE	SiO2*	Al2O3*	Fe2O3*	FeO*	MgO*	CaO*	Na2O*	K2O*	H2O+*	H2O-*
CP-71-1	67.7	6.4	2.9	0.05	3.8	5.5	0.43	2.3	1.6	0.57
CP-71-2	43.0	0.68	4.0	0.04	10.2	17.0	0.02	0.11	0.69	0.19
CP-71-3	91.2	1.2	0.18	0.04	0.40	3.8	0.03	0.18	0.71	0.14
CP-71-4	36.40	1.4	0.41	0.01	11.6	19.5	0.03	0.34	0.69	0.16
CP-71-5	37.3	5.6	4.0	0.04	0.58	25.1	0.41	1.6	2.4	0.89
CP-71-6	22.5	3.1	0.53	0.04	1.6	36.3	0.63	0.82	1.4	0.65
CP-71-7	7.7	2.3	0.22	0.00	16.9	30.5	0.08	0.69	0.92	0.18
CP-71-8	14.0	2.0	0.59	0.04	4.7	37.9	0.63	0.59	1.1	0.58
CP-71-9	28.1	4.7	1.5	0.06	0.98	30.3	0.62	1.6	2.0	1.1
CP-71-10	33.6	4.3	1.1	0.06	9.2	22.1	0.23	1.4	0.87	0.77
CP-71-11	15.8	1.9	0.54	0.04	1.5	40.0	0.73	0.56	1.2	0.56
CP-71-12	39.7	2.9	0.74	0.04	5.1	23.9	0.30	0.96	1.2	0.53
CP-71-13	38.6	4.5	1.2	0.04	0.97	27.4	0.43	1.5	1.8	0.89
CP-71-14	35.6	4.0	1.2	0.04	5.2	26.2	0.47	1.4	1.4	0.60
CP-71-15	59.6	7.4	1.9	0.04	0.65	13.0	0.39	2.5	1.3	1.0
CP-71-16	22.6	1.8	0.76	0.04	0.18	38.9	0.60	0.51	0.97	0.51
CP-71-17	51.8	6.2	2.0	0.04	0.57	17.7	0.29	2.3	2.0	1.1
CP-71-18	43.1	4.6	1.4	0.00	0.41	25.2	0.22	1.3	1.6	0.55
CP-71-19	34.1	3.9	1.0	0.00	5.3	25.2	0.29	1.4	1.3	0.74
CP-71-20	19.5	1.6	0.76	0.00	6.7	35.1	0.37	0.45	0.87	0.28
CP-71-21	55.0	11.0	4.5	0.04	1.1	9.6	0.21	3.9	3.4	1.8
CP-71-22	35.6	4.9	1.8	0.04	0.49	27.1	0.44	1.6	1.9	1.3
CP-71-23	16.0	1.3	0.99	0.04	0.14	42.6	0.62	0.28	1.1	0.53
CP-71-24	16.1	2.3	1.1	0.04	0.30	39.2	0.67	0.71	1.3	0.67
CP-71-25	23.3	4.3	1.5	0.05	0.67	35.6	0.58	1.5	1.7	0.94
CP-71-26	4.3	0.88	0.49	0.00	17.0	33.7	0.09	0.27	0.44	0.22
CP-71-27	11.5	1.9	0.82	0.00	0.35	45.3	0.72	0.44	1.2	0.76
CP-71-28	26.7	3.6	1.3	0.00	6.7	30.6	0.35	1.3	1.3	0.69
CP-71-29	---	---	---	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---	---	---	---
CP-71-31	95.3	0.78	0.99	0.00	0.23	0.90	0.21	0.67	0.58	0.13

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

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* in percent "single solution" rapid rock analysis by N. Skinner & H Smith, U.S. Geological Survey, Reston VA.

** in percent, standard chemical analysis by Sarah T. Neil, U.S. Geological Survey, Menlo Park, Ca.

1) Sulfate sulfur as SO3

--- Not determined

Pc is Park City Formation

Rt is Retort Phosphatic Shale Member of Phosphoria Formation

To is Tosi Chert Member of Phosphoria Formation

Table 1 - Continuation Page 8

SAMPLE	TiO2*	P2O5*	MnO*	CO2*	F**	S*	SO3**1)
CP-71-1	0.48	0.14	0.01	6.9	0.10	0.03	0.05
CP-71-2	0.08	1.1	0.01	22.6	0.11	0.08	0.20
CP-71-3	0.04	0.21	0.01	2.2	0.04	0.04	0.02
CP-71-4	0.08	0.38	0.00	26.9	0.07	0.10	0.07
CP-71-5	0.46	16.8	0.00	1.1	2.07	0.05	0.77
CP-71-6	0.13	23.5	0.00	4.0	2.88	0.09	1.17
CP-71-7	0.03	2.9	0.01	37.8	0.25	0.06	0.20
CP-71-8	0.13	21.6	0.00	11.3	2.80	0.13	1.02
CP-71-9	0.31	21.3	0.01	2.0	2.48	0.12	0.97
CP-71-10	0.32	5.5	0.01	20.3	0.41	0.06	0.32
CP-71-11	0.13	27.5	0.00	4.5	3.21	0.12	1.20
CP-71-12	0.22	10.9	0.01	11.1	0.76	0.06	0.52
CP-71-13	0.33	17.1	0.00	2.8	2.01	0.12	0.70
CP-71-14	0.31	12.1	0.00	11.2	0.77	0.09	0.55
CP-71-15	0.62	7.8	0.00	1.1	0.66	0.01	0.37
CP-71-16	0.16	26.2	0.00	3.0	2.99	0.11	1.02
CP-71-17	0.47	12.0	0.00	0.60	1.05	0.04	0.47
CP-71-18	0.38	9.3	0.03	9.2	0.62	0.01	0.47
CP-71-19	0.31	12.1	0.01	11.1	0.85	0.03	0.50
CP-71-20	0.08	17.4	0.02	15.4	1.99	0.07	0.67
CP-71-21	0.64	5.9	0.01	0.21	0.77	0.03	0.20
CP-71-22	0.33	19.2	0.00	0.82	2.20	0.10	0.62
CP-71-23	0.08	28.4	0.01	2.9	3.14	0.05	1.04
CP-71-24	0.15	29.7	0.01	1.2	3.32	0.11	1.10
CP-71-25	0.25	24.1	0.00	1.3	2.77	0.09	0.77
CP-71-26	0.04	3.4	0.02	39.9	0.25	0.06	0.20
CP-71-27	0.10	30.9	0.01	2.3	3.38	0.11	1.17
CP-71-28	0.22	13.3	0.01	14.4	0.72	0.07	0.50
CP-71-29	---	---	---	---	---	---	---
CP-71-30	---	---	---	---	---	---	---
CP-71-31	0.04	0.13	0.07	0.10	0.02	0.01	0.05

FOOTNOTES:

" in ppm, neutron activation analysis by P.A. Bedecker, U.S. Geological Survey, Reston, VA

*! in ppm, delayed neutron analysis H. T. Millard, Jr., & others, U.S. Geological Survey Denver, CO.

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