UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Organic carbon and selected element distribution in the phosphatic shale members of the Permian Phosphoria Formation, eastern Idaho and parts of adjacent states

By

Edwin K. Maughan

Open-File Report 76-577

1976

Contents

Illustrations

Tables

ORGANIC CARBON AND SELECTED ELEMENT DISTRIBUTION IN THE PHOSPHATIC SHALE MEMBERS OF THE PERMIAN PHOSPHORIA FORMATION, EASTERN IDAHO AND PARTS OF ADJACENT STATES

by Edwin K. Maughan

Introduction

Organic carbon-rich Meade Peak and Retort Phosphatic Shale Members of the Permian Phosphoria Formation in eastern Idaho and adjacent parts of Utah, Wyoming, and Montana are probable source beds of oil and gas found in upper Paleozoic rocks of the region. The Meade Peak contains an average of as much 8.8 weight percent and the Retort as much as 9.7 weight percent residual organic carbon. Some thin beds in these members contain as much as 30.7 and 21.4 percent, respectively.

Trace elements, especially silver, barium, chromium, copper, lanthanum, molybdenum, neodymium, nickel, lead, strontium, titanium, vanadium, yttrium, ytterbium, and zinc also are found in high concentrations in these shale beds, and commonly in approximately the same areal distribution as the organic carbon.

This report presents the analytical results for organic carbon content that augment a recently published summary report on the distribution of the organic carbon (Maughan, 1975) and the analytical data preserted here augment that report and others that are in preparation (Claypool and others, written commun., 1976). Analytical data of the trace element content are included also. Petroleum derived from these Phosphoria sources include trace elements probably derived mostly from these rocks; and some of these minor elements also may be resources amenable to recovery associated with recovery of the phosphorite.

Gulbrandsen (1975) presented analytical trace element data stemming from extensive studies relating to the phosphate resources of the Phosphoria and a comprehensive bibliography to previously published chemical data for these rocks is given (Gulbrandsen, 1975, p. 38-45).

The present study was initiated in 1973 to determine the amount and distribution of organic carbon in the shale beds of the Phosphoria Formation in the region shown in figure 1 as a step to understand better the role of these rocks as sources of petroleum. Samples were collected in the summer of 1973 with the assistance of Thomas L. Sewell and Bob Tsinnie, and in the summer of 1974 with the assistance of Richard L. Rexroad and Fernando Fernandez. Much of the compilation of data and other work that aided in the preparation of the report was done by Daniel R. Grogan, Craig A. Stiles, and Roland Connors.

Geologic setting

The Meade Peak occupies an area of approximately 118,000 km^2 (73,300 mi^2) and has a maximum thickness approaching 100 m (330 ft) in northern Utah. The Retort occupies an area of approximately 143,000 km^2 (88,900 mi^2) and has a maximum thickness of about 35 m (115 ft) in western Montana. Volumetrically, the Meade Peak comprises about 1,400 km^3 (870 mi^3) of sediment and the Retort about 1,450 km^3 (900 mi^3). The stratigraphic relations are shown in figure 2; the areal extent of the two members are illustrated by Maughan (1975, fig. 3 and 4).

The Phosphoria sediments were deposited in a bight along the continental shelf east of the late Paleozoic mobile belt. At times of transgression of the sea across the region, represented by the deposits of the Meade Peak and the Retort, upwelling currents in deepened marine water nourished an abundant biota whose remains accumulated on the sea floor. Subsequently, at least 2 km (6,500 ft) of overlying sediment was deposited in the western part of the region by the end of the Triassic and in the eastern part (because of lower rates of deposition) by the end of the Cretaceous. Maximum burial of these Permian source rocks in most of the region, as much as 9 km (30,000 ft) in eastern Idaho, occurred approximately at the end of the Cretaceous and produced adequate pressure and temperature for generation of hydrocarbons from the organic substances in the organic-rich shales (Claypool and others, written commun., 1976).

In parts of southwestern Montana, however, maximum burial of the Retort Member has not exceeded 2 km (6500 ft) and much of the petroleum potential remains in the unconverted organic matter in those shales. But elsewhere, petroleum has been generated within the Retort and the Meade Peak and probably has either migrated from these shale beds, or else has been metamorphosed and the organic carbon and hydrocarbons have been thermally degraded.

Sampling method

Samples for determining the organic carbon content were collected from 45 localities in the four-State area. These places are listed in table 1, and their geographic locations are shown in figure 1. Table 2 presents a summary of stratigraphic position, thickness and brief lithologic description of the samples.

Effects of extreme weathering were minimized as much as possible by taking the samples at places where the rocks were naturally or artificially well exposed. Weathering to the depth of 75 m (250 ft) has been noted in these rocks (Hale, 1967, p. 153-156) by an increase of the organic content with increasing depth as evidenced by ignition loss. Many of our samples are from prospect trenches excavated between 1947 and 1954 where the shale members had been previously uncovered, measured, sampled, and analyzed for their content of P_2O_5 (USGS Circulars, cited by Gulbrandsen, 1975, p. 38-45). Most natural exposures are cut banks adjacent to streams where relatively fresh and little weathered rocks have been uncovered recently by stream erosion. Road cuts and excavations for the strip mining of phosphorite provide artificial exposures of fresh rock which we sampled. A few natural exposures (locs. 3, 5, and 39) are places of accelerated erosion,

but weathering probably affected the rock to a greater extent than at stream banks and in the artificial exposures at other sample localities The sample from the Anderson phosphate mine (loc.1) near Garrison, Montana, is from underground and probably is unaffected or only slightly affected by recent weathering. At another underground mine located on Canyon Creek in the Pioneer Mountains, Montana, (loc. 33) the sample could be collected only from the mine dump and may not be very reliable nor representative.

Samples were taken mostly in increments of 1-3 m (3-10 ft) although thin, lithologically distinct beds were sampled separately. The sample material was collected after removing covering soil or debris, and generally from 0.25-0.5 m (1-2 ft) of the surface of the rock was removed also. Most samples were taken in channel from freshly handcut trenches across the member at the older excavations or at the most favorable part of the natural exposures. At a few places where soil or debris cover was thick or where the rock seemed especially deeply weathered, representative samples were taken at regular intervals spaced 1-3 m (3-10 ft), or where the shale member is very thick samples were spaced as much as 20 m (66 ft) apart. Roots were a problem at a few places, and they were removed from joint faces and bedding planes before the sample was placed into the collecting bag.

Laboratory procedures

Organic carbon content and trace elements were determined in the Analytical Laboratories of the U.S. Geological Survey at Lakewood, Colorado. Total carbon was determined with the Leco induction furnace by V. E. Shaw, and mineral carbon was determined gasometrically by T. L. Yager. The organic carbon is calculated as the difference between the two values. Results of these carbon analyses are summarized in table 3. Semiquantitative data for elements other than carbon in table 3 were determined by J.C. Hamilton and L. A. Bradley, analysts, using the six-step emission spectrographic method. Areal distributions of organic carbon and of selected elements in the Meade Peak and Retort Members are shown in figures 3-21. The values shown are weighted average contents calculated for the entire thickness of the member at each of the sample localities. The following elements generally were looked for, but were not detected in the spectrographic analyses and probably are not components or occur as very minute amounts in these rocks: As, Au, Bi, Cd, Co, Dy, Er, Eu, Gd, Ge, Hf, Ho, Li, Lu, Pd, Pt, Re, Sb, Sm, Sn, Ta, Tb, Te, Th, Tl, Tm, U, and W. Lithium, $<$.01%, was detected in samples 21 A-E and G-K, and in 22 A, B, E-K, and P. Dysprosium, $<$.005%, was detected in samples 22 G and H and at .007% in sample 37G. Gadolinium, $<$.005%, was detected in sample 22H, and at .007% in sample 37G. Samarium, .015%, holmium, .003%, and erbium, .007%, were also detected in sample 37G.

References

Gulbrandsen, R. A., 1975, Analytical data on the Phosphoria Formation, western United States: U.S. Geol. Survey Open-file Report 75-554, 45 p.

Hale, L. A., 1967, Phosphate exploration using gamma-radiation logs, Dry Valley, Idaho, in Anatomy of the western phosphate field, Intermountain Assoc. Geologists, 15th Ann. Field Conf.: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 147-159.

Maughan, E. K., 1975, Organic carbon in shale beds of the Permian Phosphoria Formation of eastern Idaho and adjacent States--a summary report. in Wyoming Geol. Assoc. Guidebook 27th Ann. Field Conf., Geology and mineral resources of the Bighorn Basin: p. 107-115.

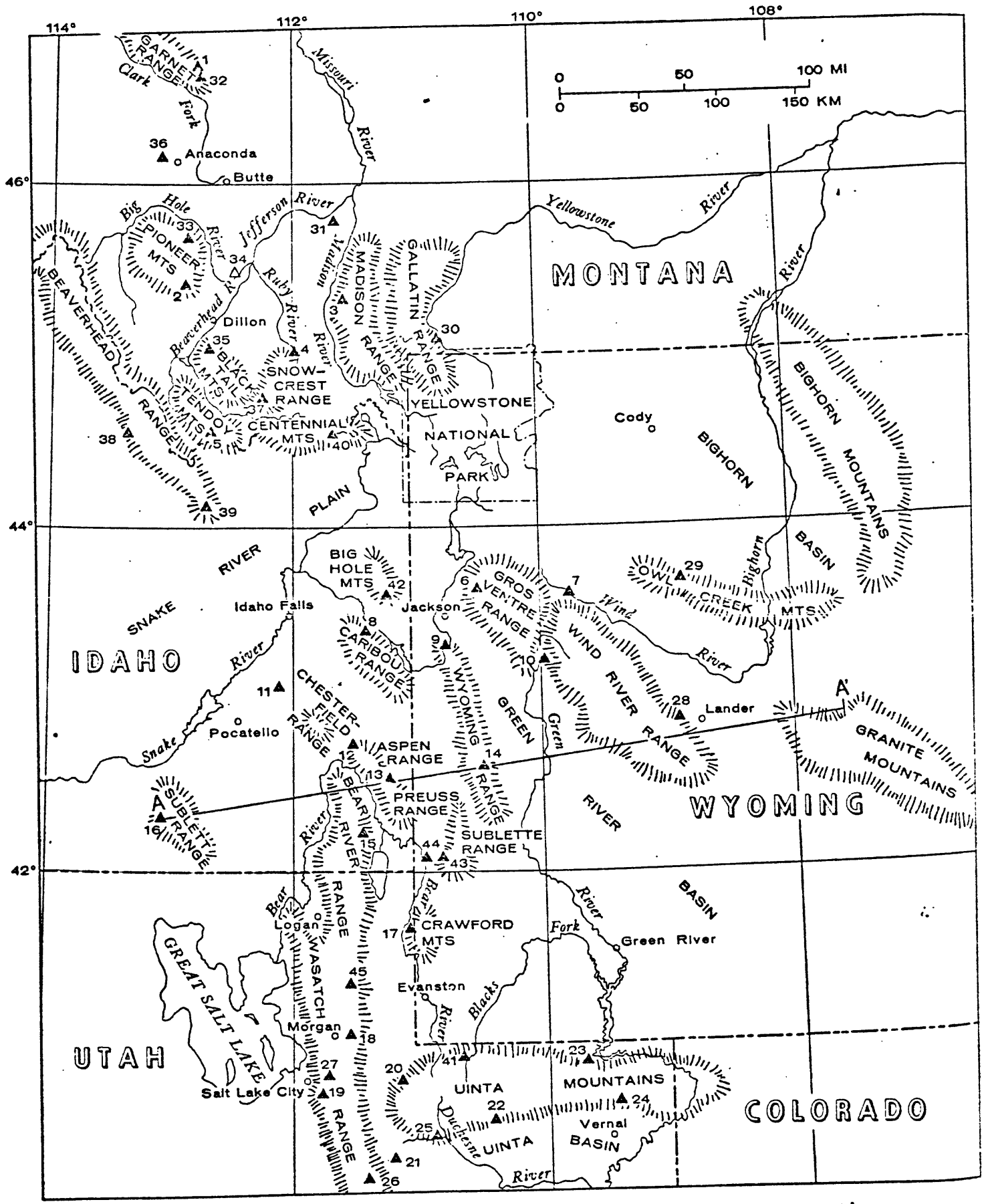

Figure 1.--Map showing sample localities. See figure 2 for cross section AA'.

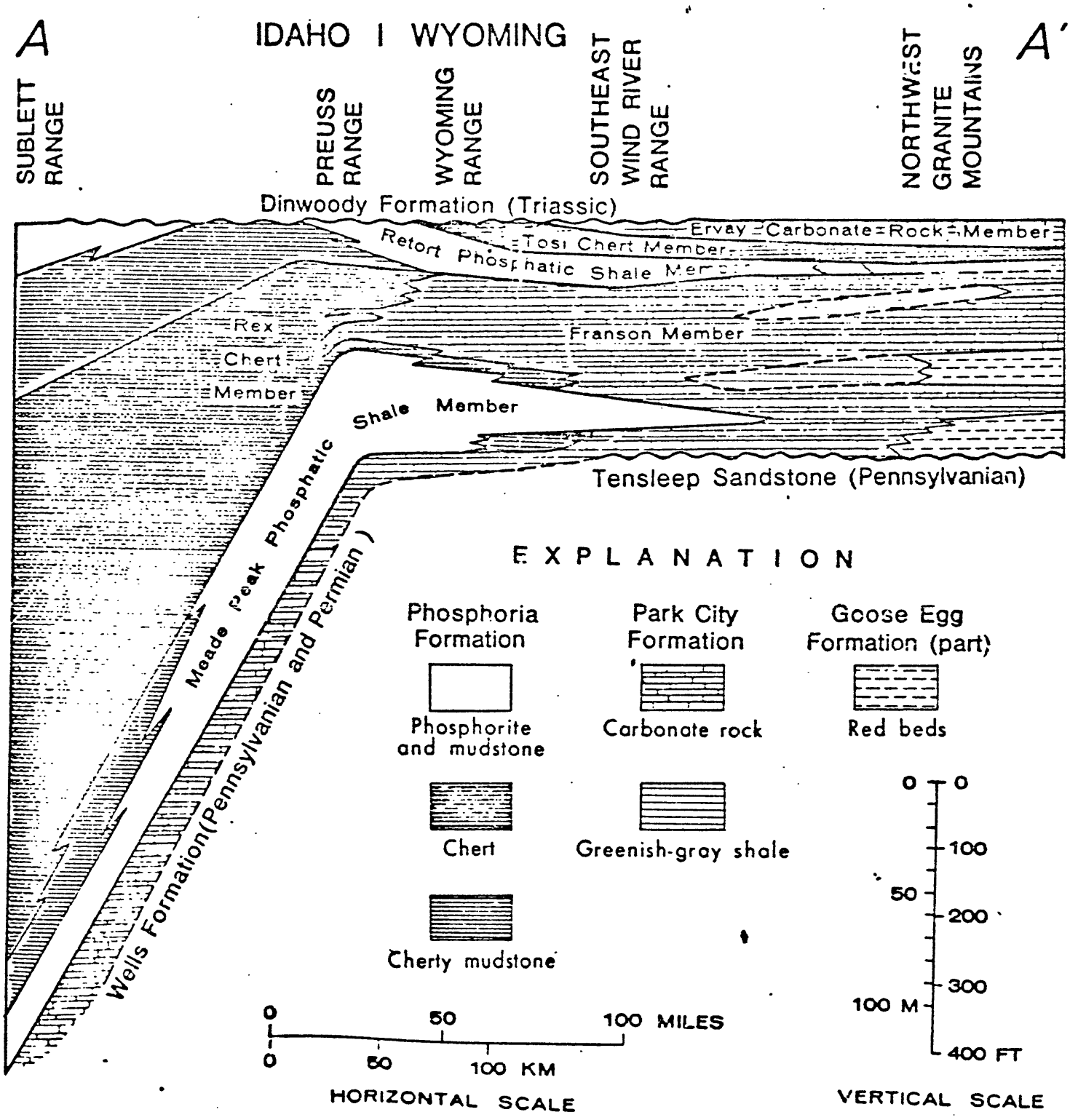

Figure 2.--Cross section AA' showing stratigraphic relations of Permian rocks in Idaho and Wyoming. Approximate location of cross section shown on figure 1.

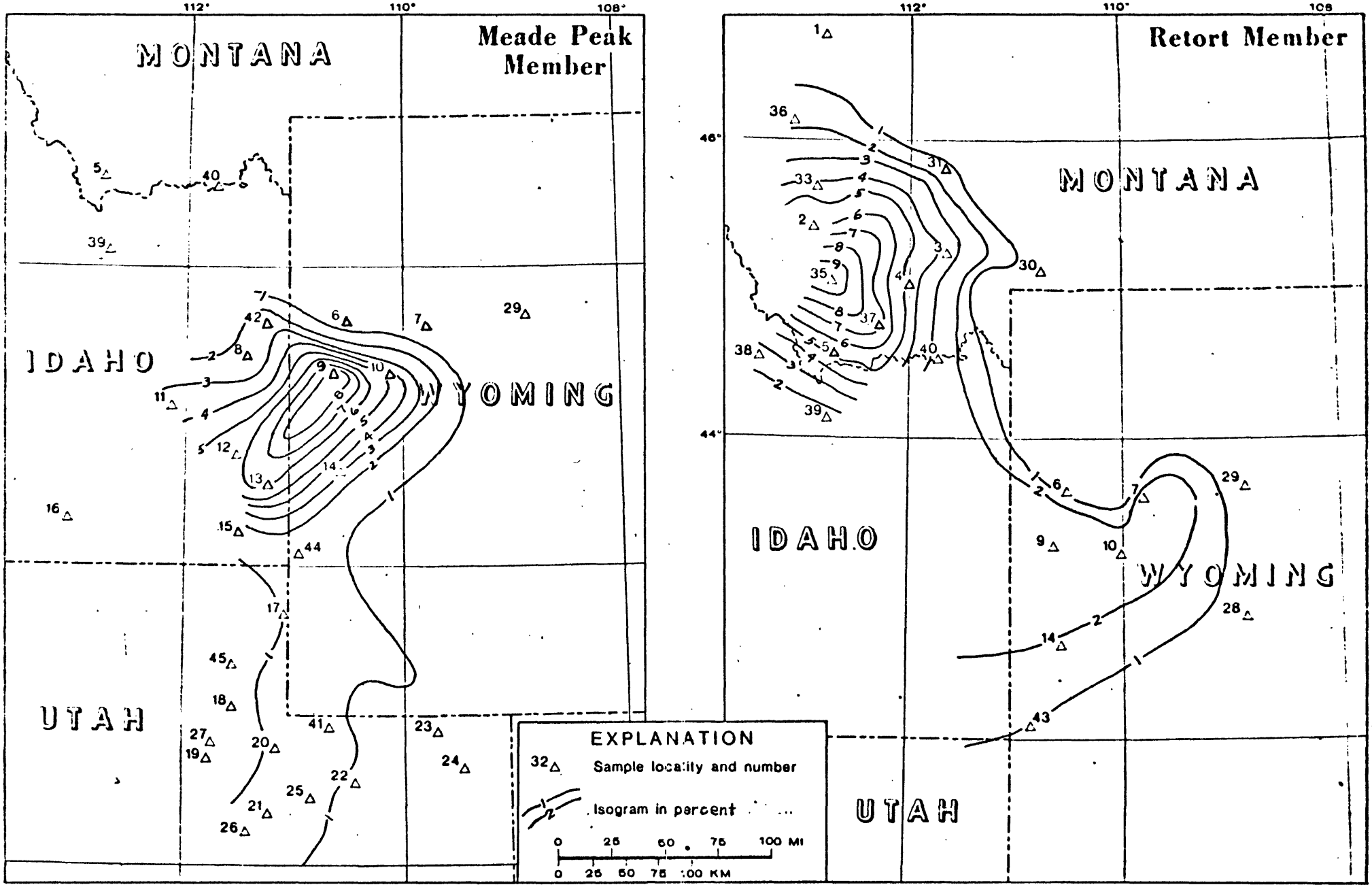

Figure 3.--Areal distribution of organic carbon in phosphatic shale members of the Phosphoria Formation.

8 (follows p. 7a)

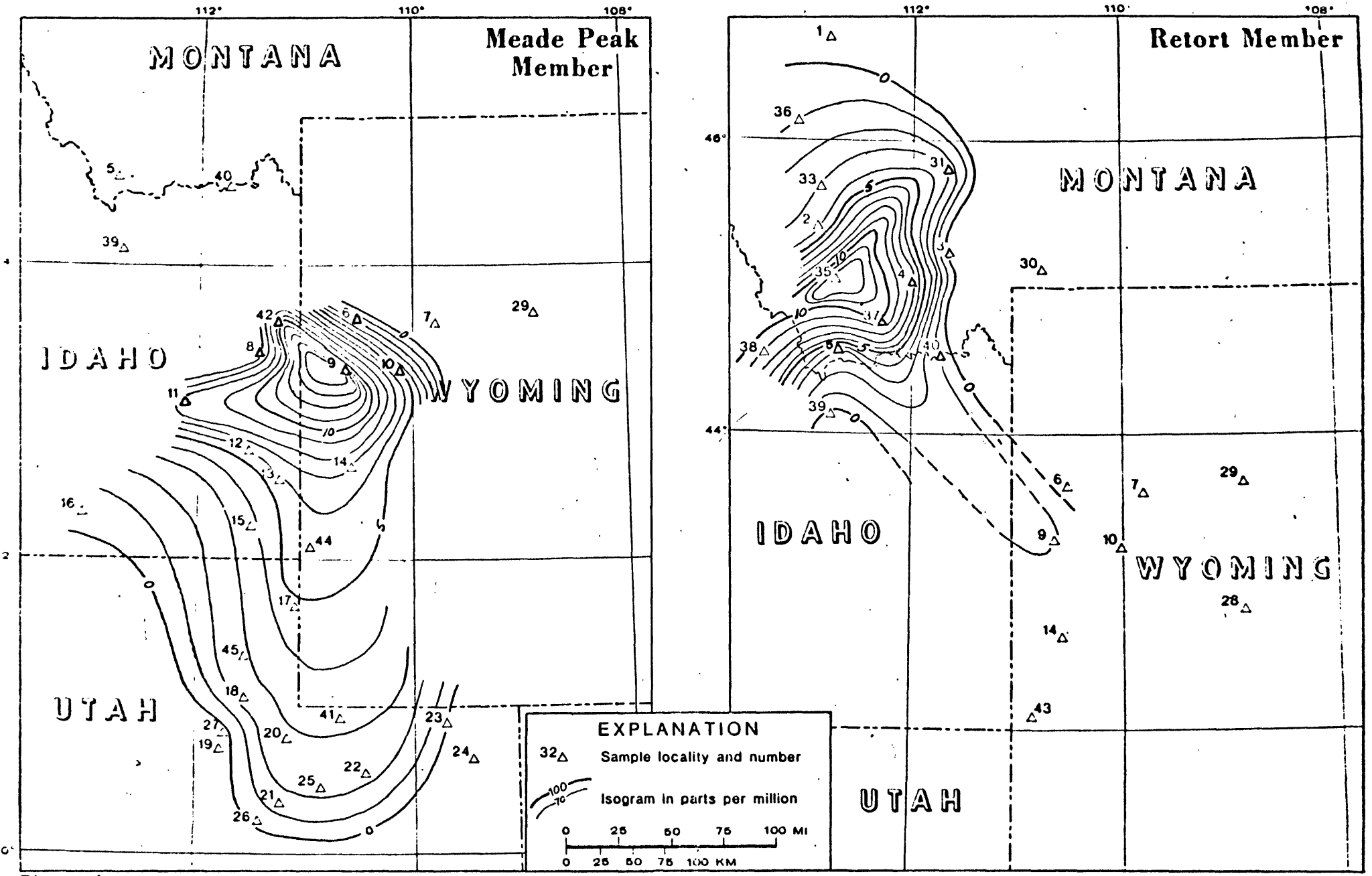

Figure 4.--Areal distribution of silver in phosphatic shale members of the Phosphoria Formation.

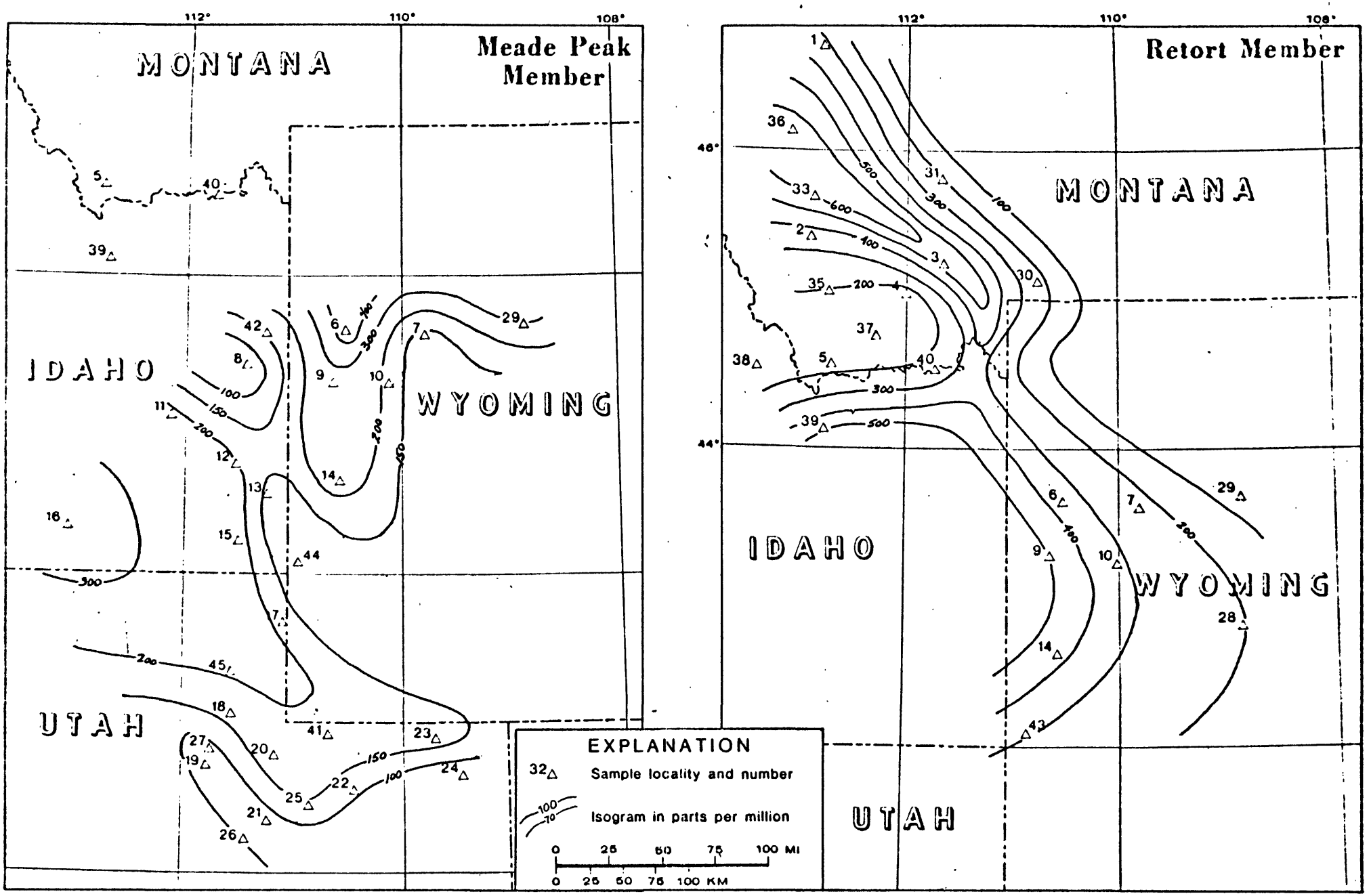

Figure 5.--Areal distribution of barium in phosphatic shale members of the Phosphoria Formation.

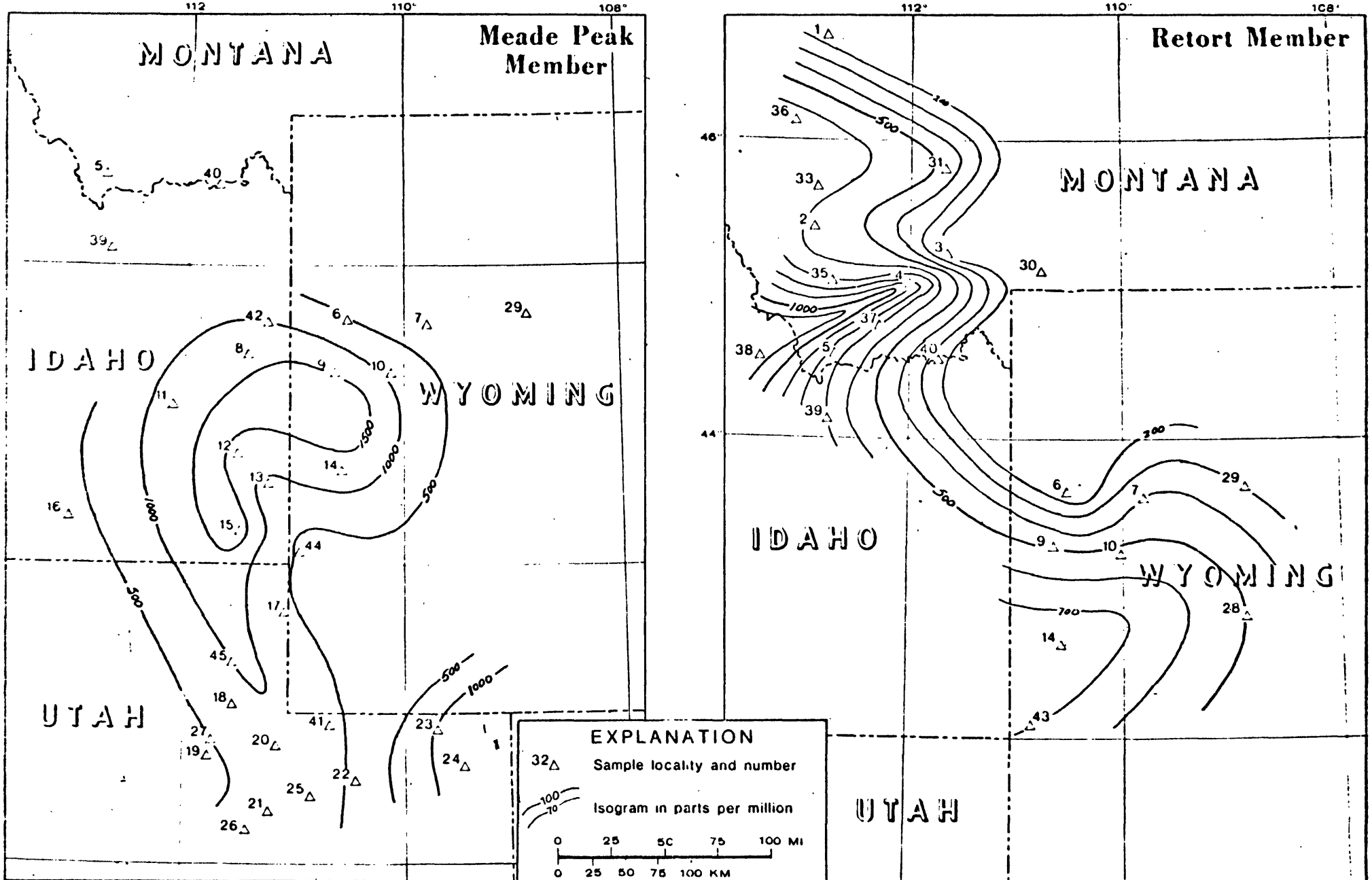

Figure 6.--Areal distribution of chromium in phosphatic shale members of the Phosphoria Formation.

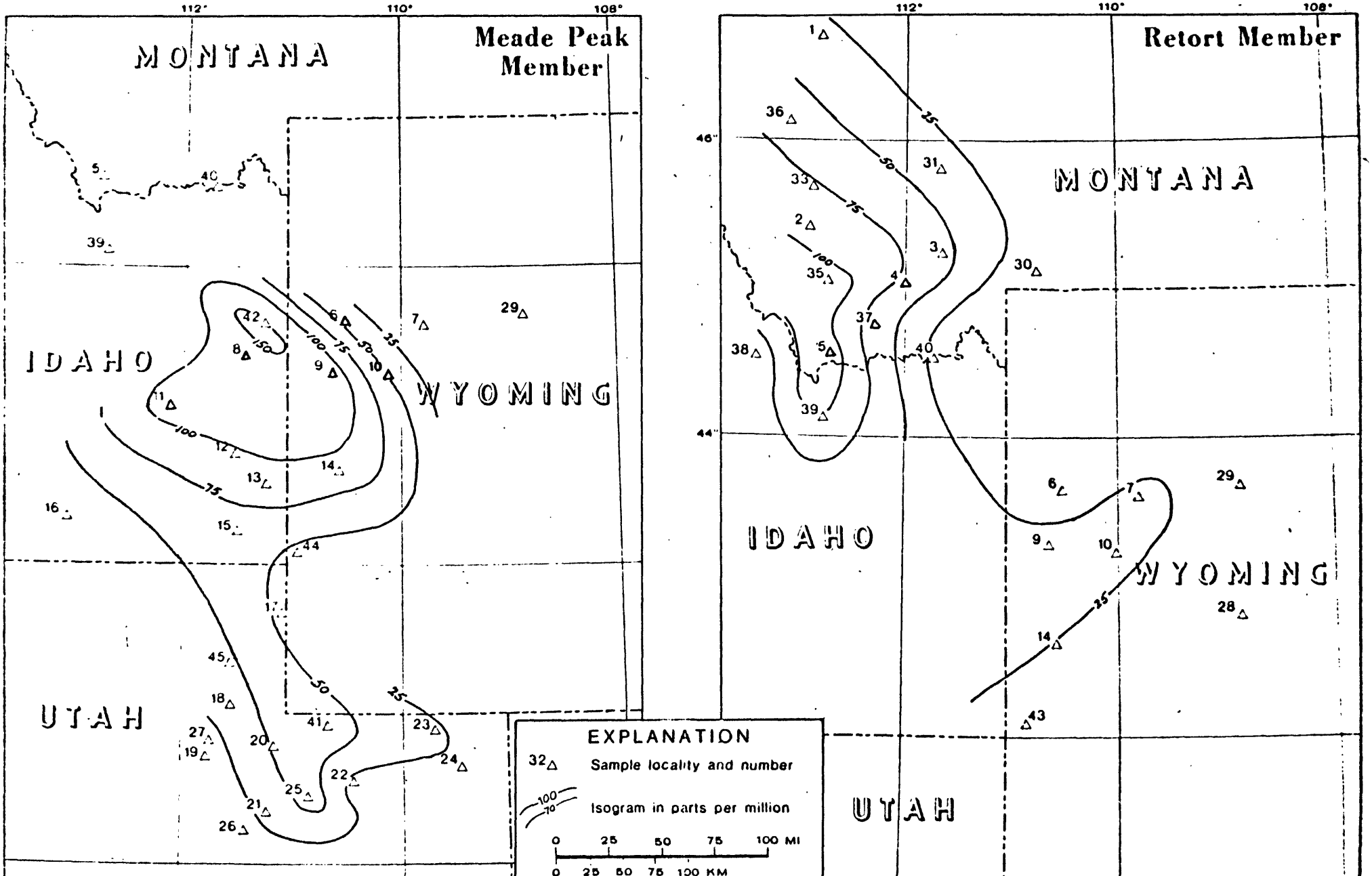

Figure 7.--Areal distribution of copper in phosphatic shale members of the Phosphoria Formation.

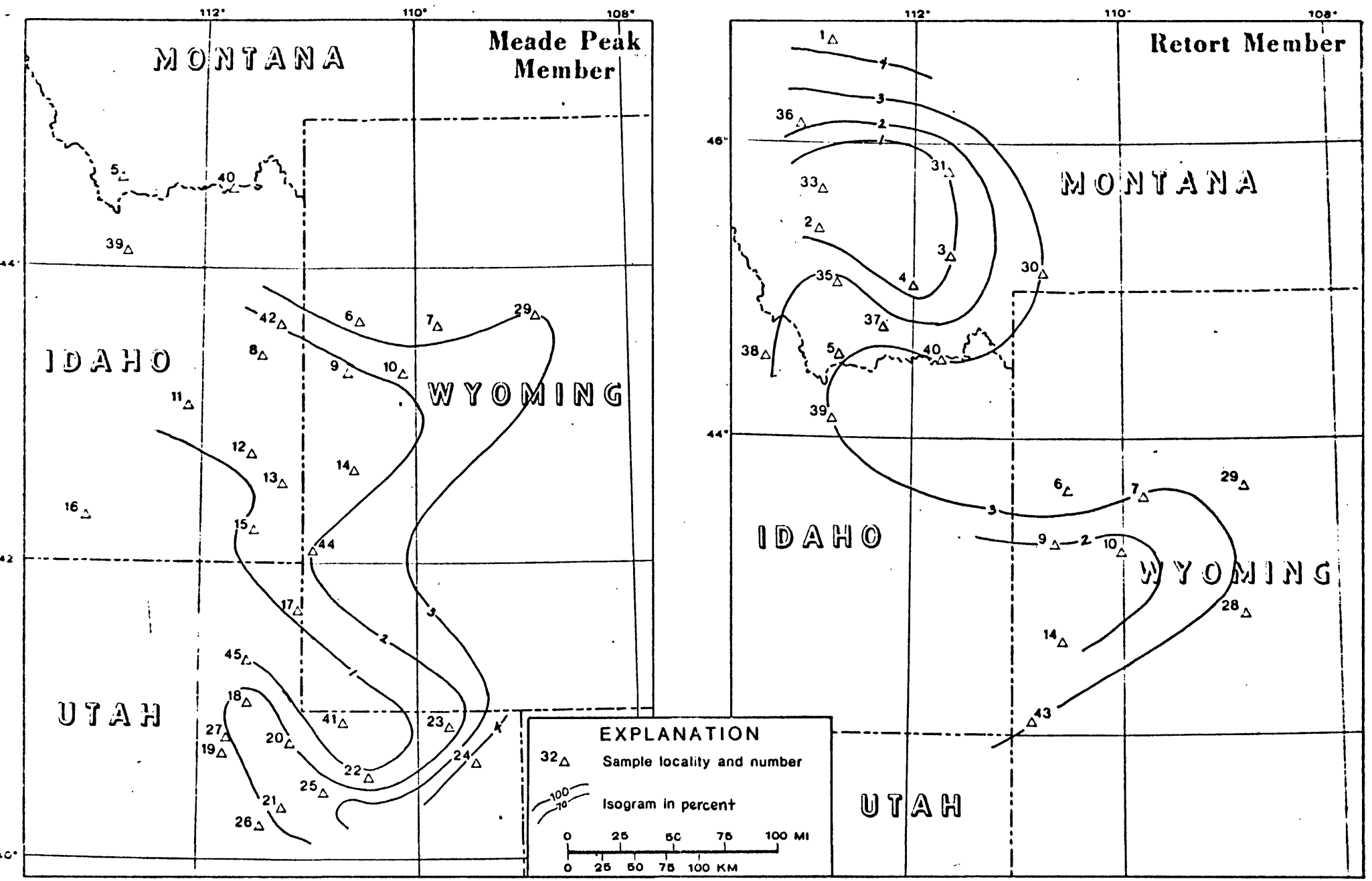

Figure 8.--Areal distribution of potassium in phosphatic shale members of the Phosphoria Formation.

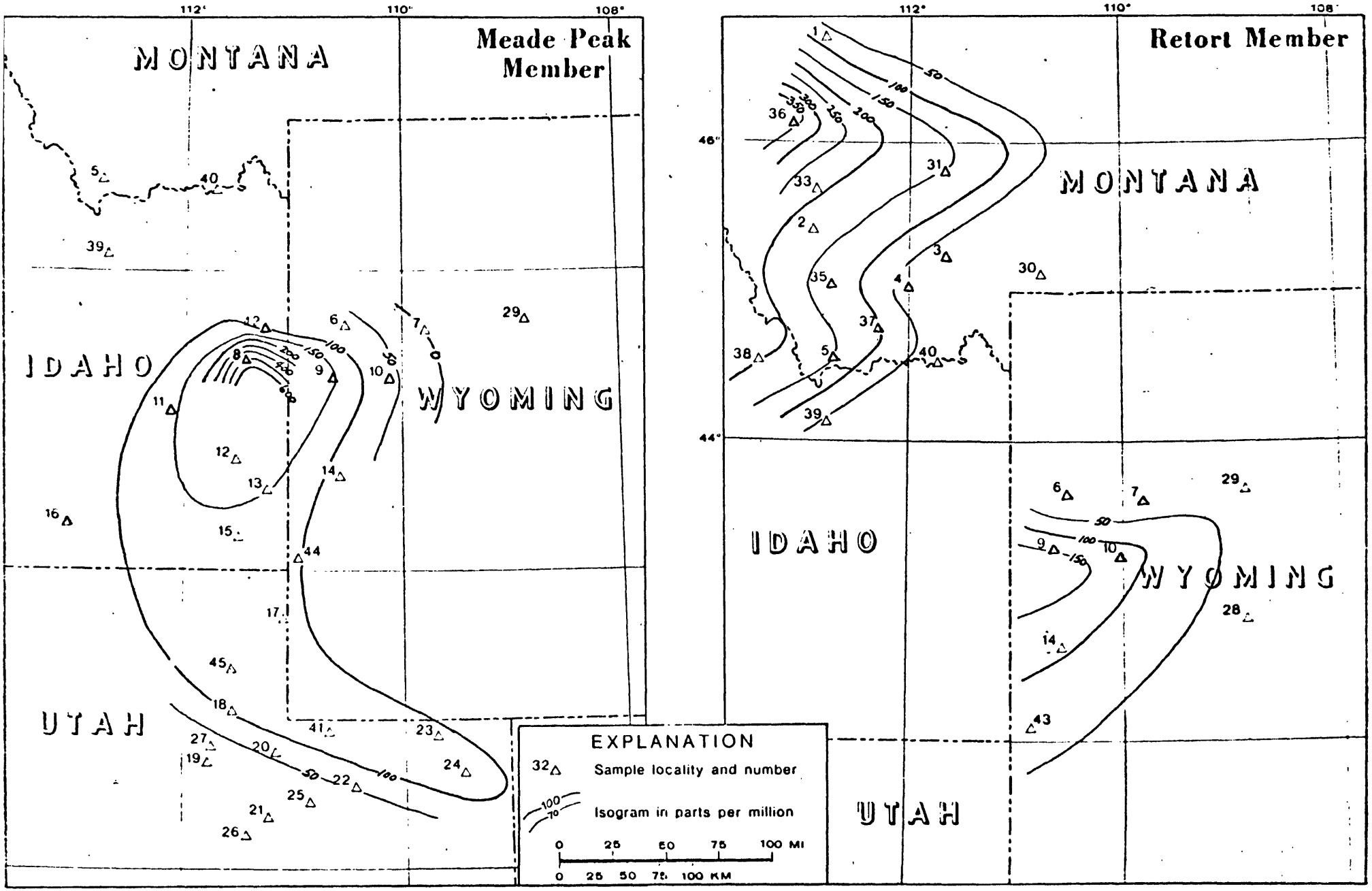

Figure 9.--Areal distribution of lanthanum in phosphatic shale members of the Phosphoria Formation.

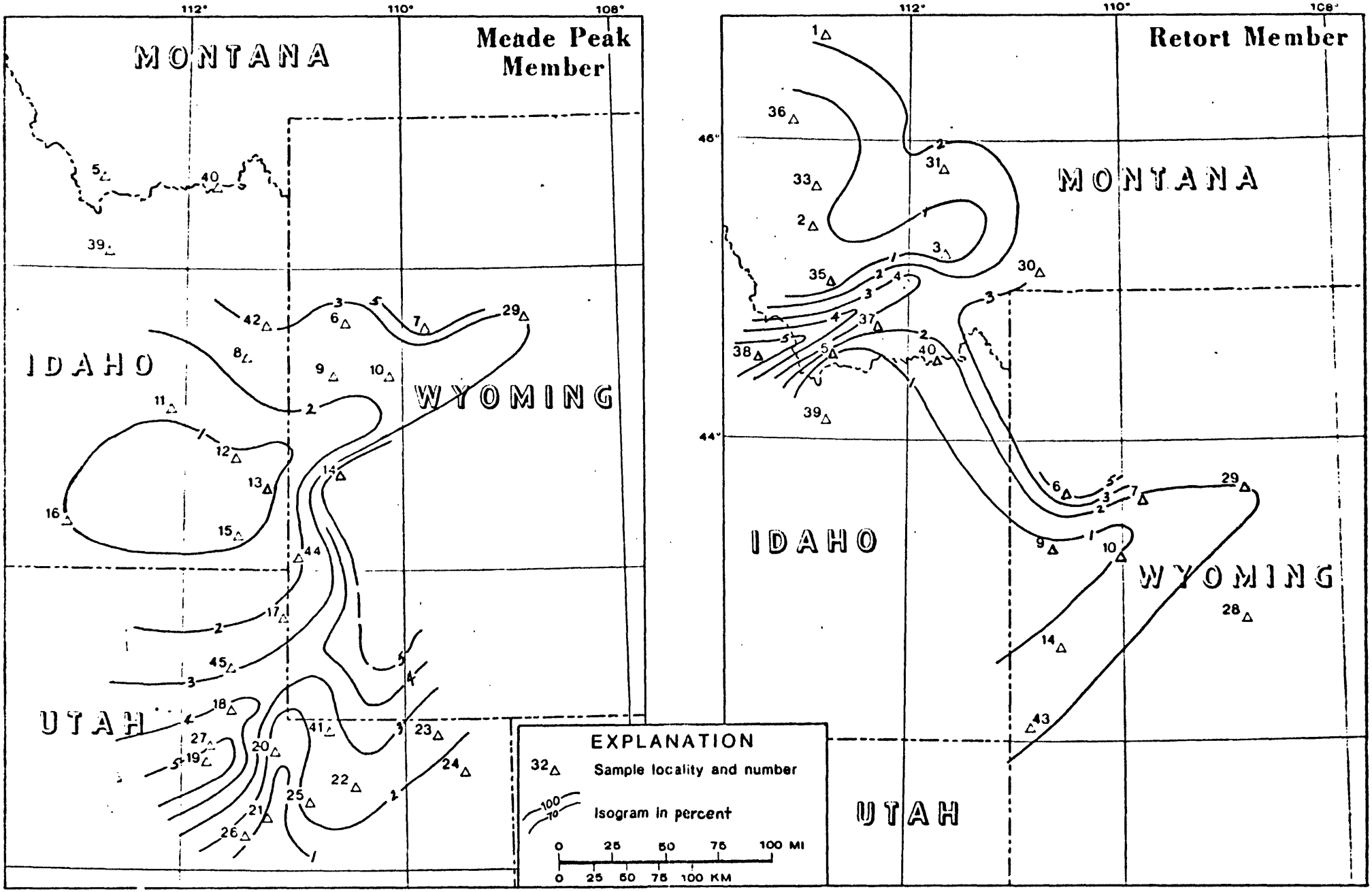

Figure 10.--Areal distribution of magnesium in phosphatic shale members of the Phosphoria Formation.

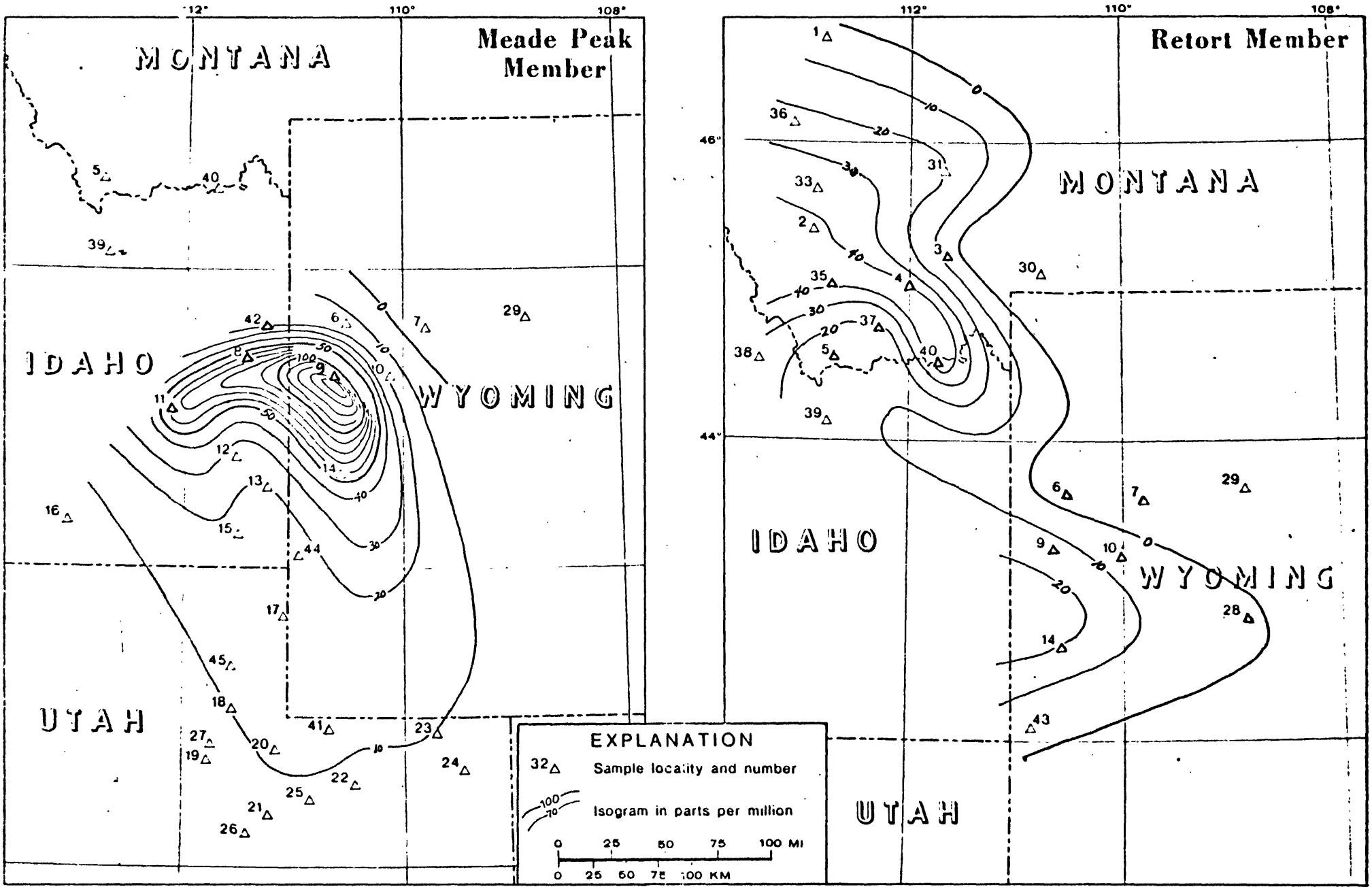

Figure 11.--Areal distribution of molybdenum in phosphatic shale members of the Phosphoria Formation.

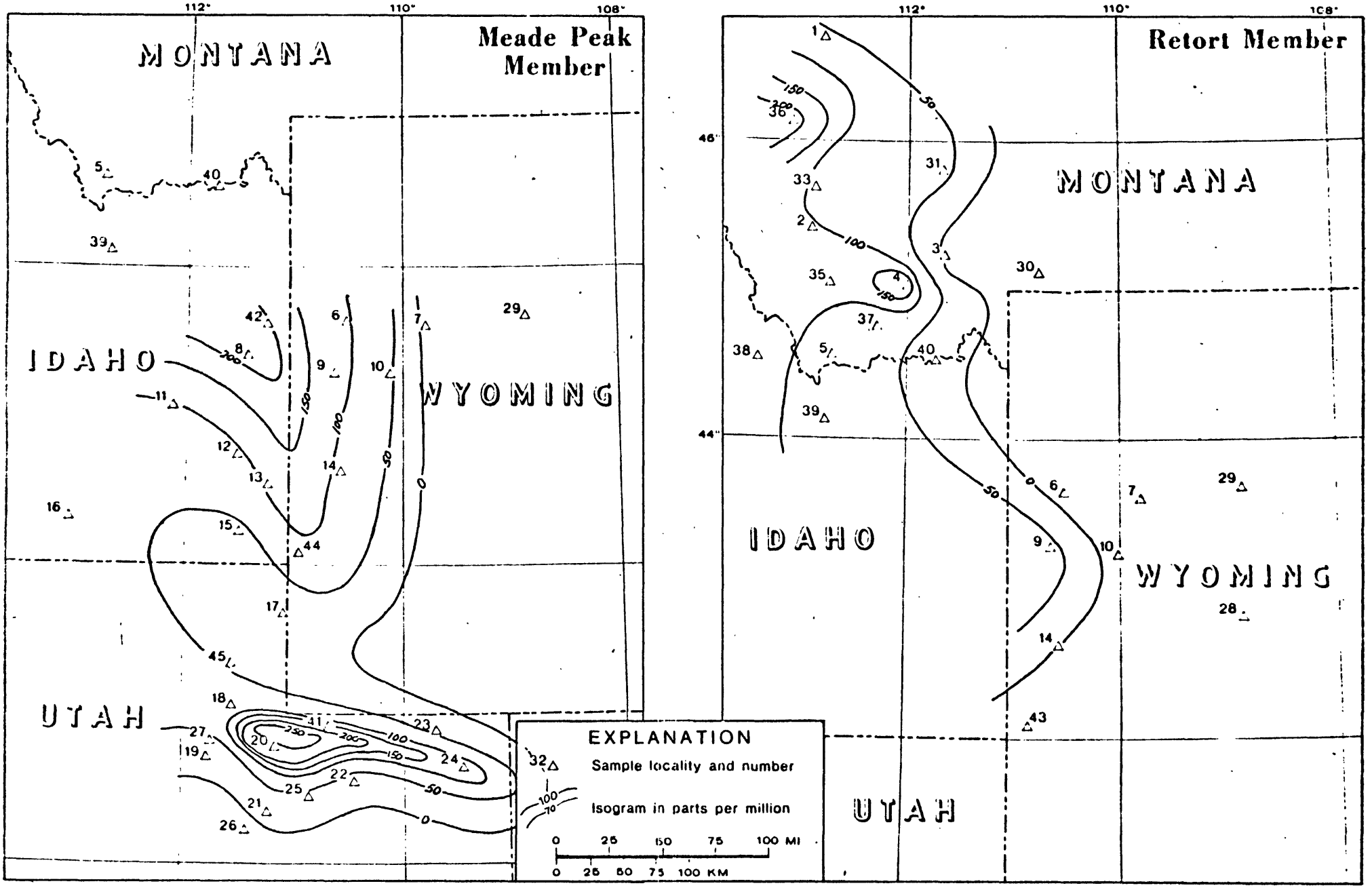

Figure 12.--Areal distribution of neodymium in phosphatic shale members of the Phosphoria Formation.

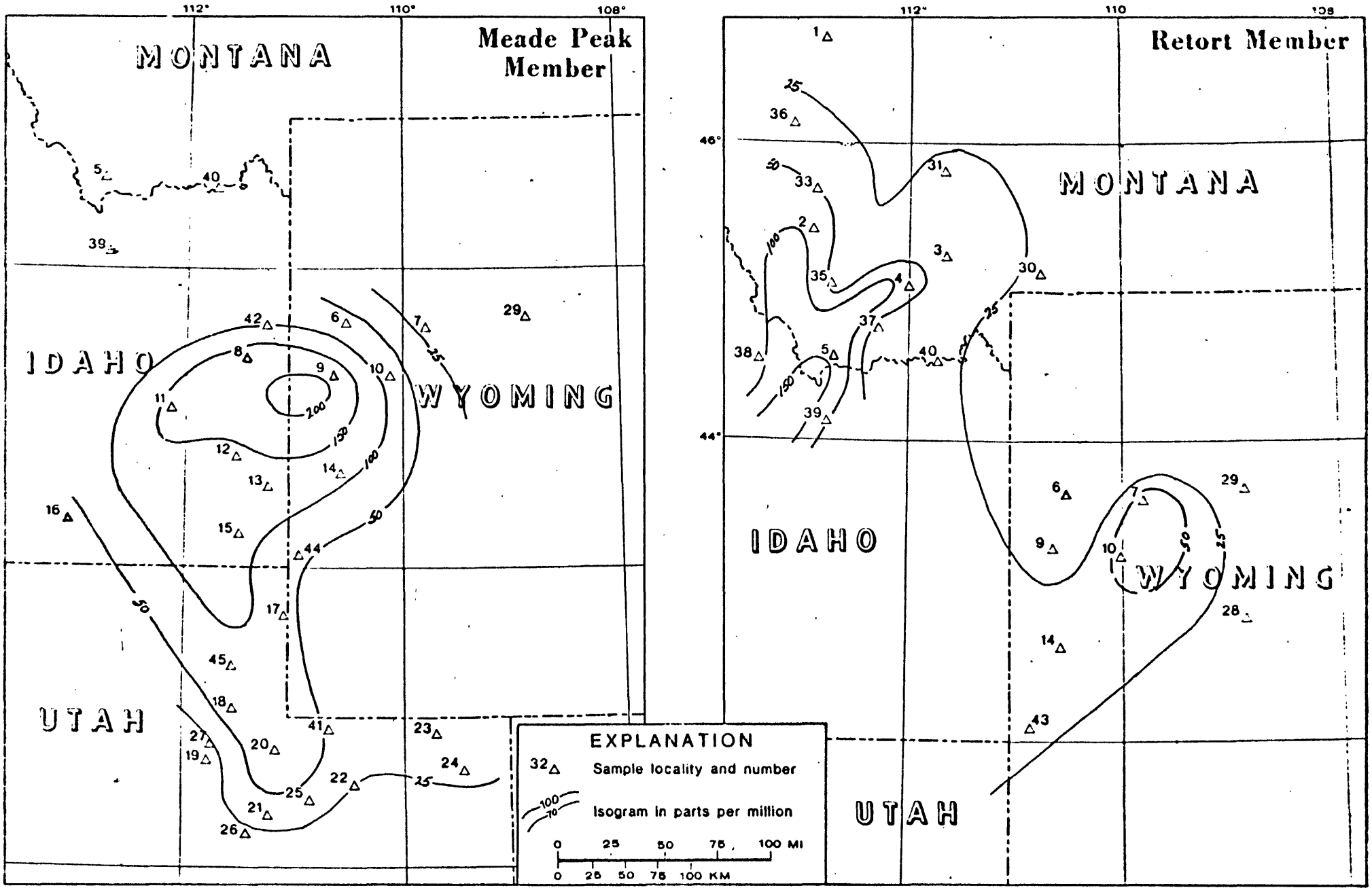

Figure 13.--Areal distribution of nickel in phosphatic shale members of the Phosphoria Formation.

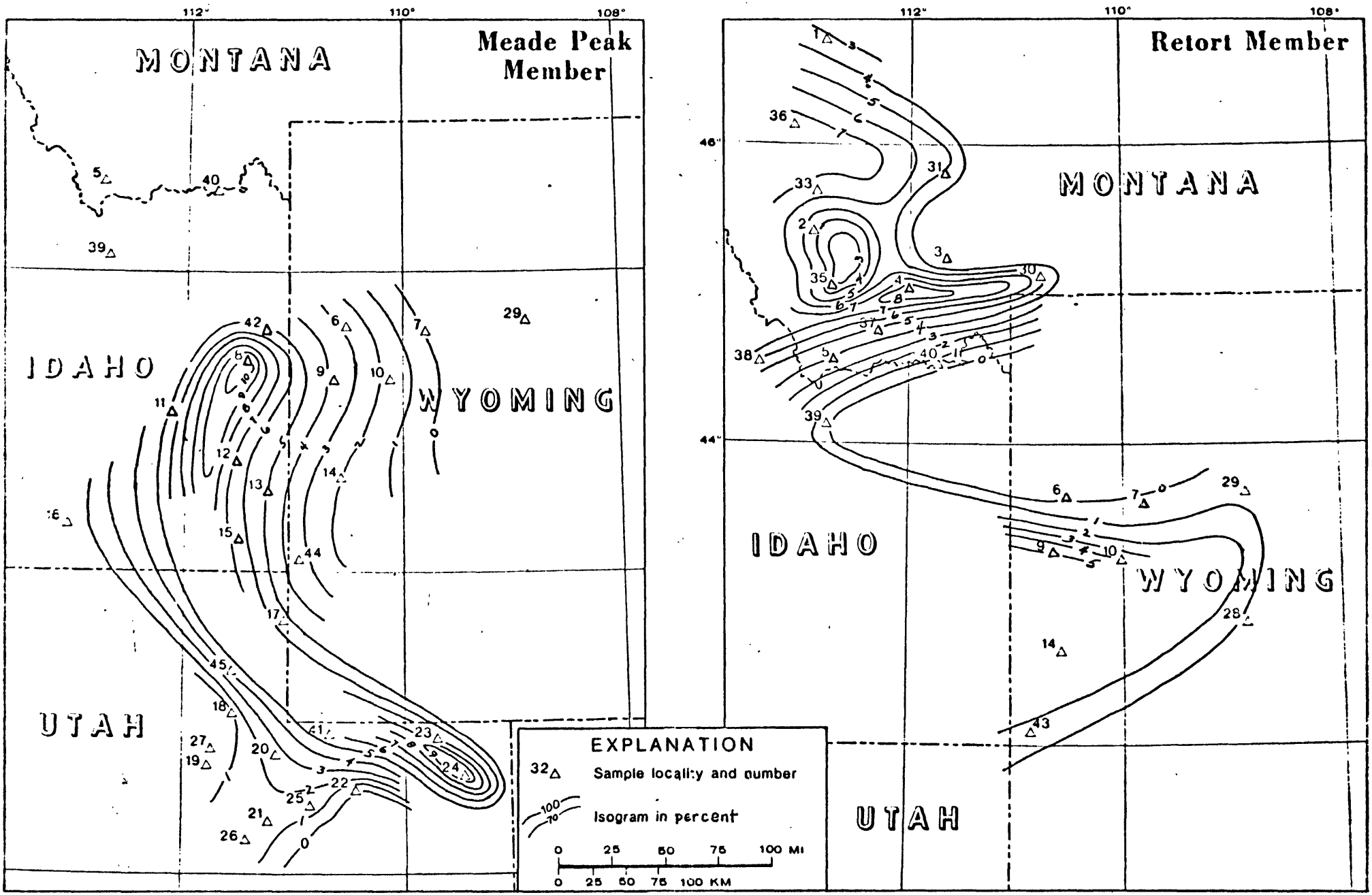

Figure 14.--Areal distribution of phosphorus in phosphatic shale members of the Phosphoria Formation.

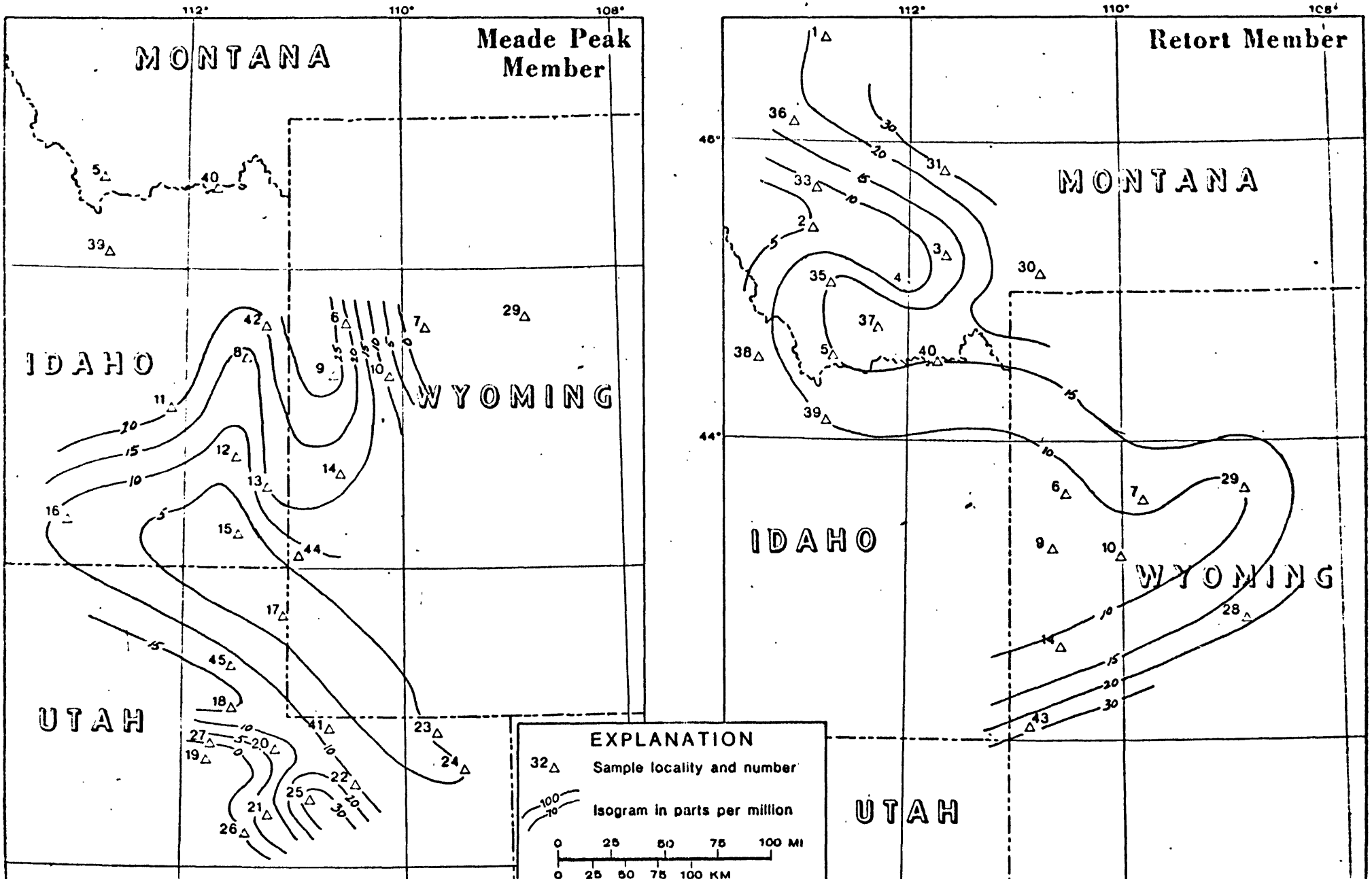

Figure 15.--Areal distribution of lead in phosphatic shale members of the Phosphoria Formation.

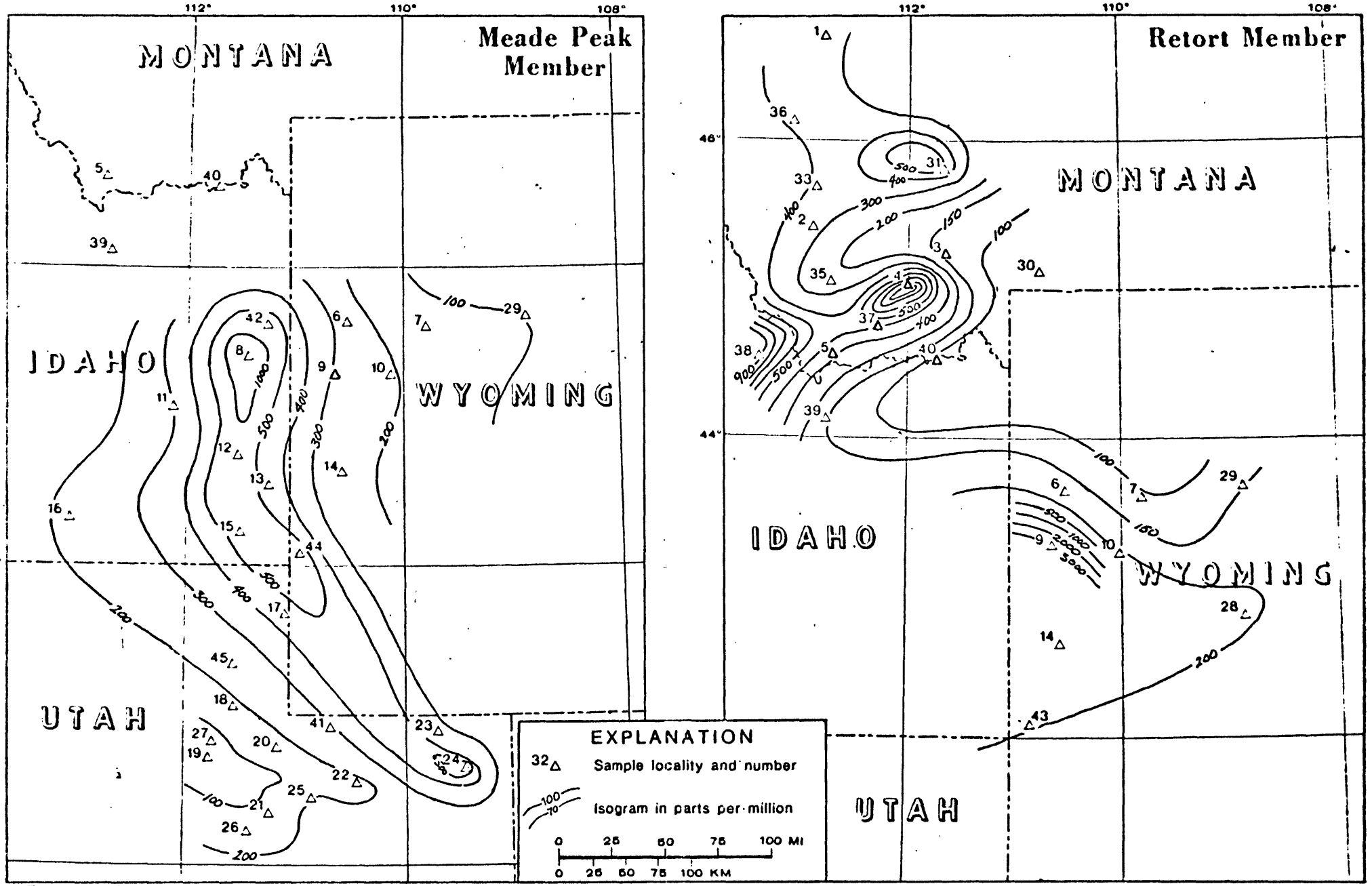

Figure 16.--Areal distribution of strontium in phosphatic shale members of the Phosphoria Formation.

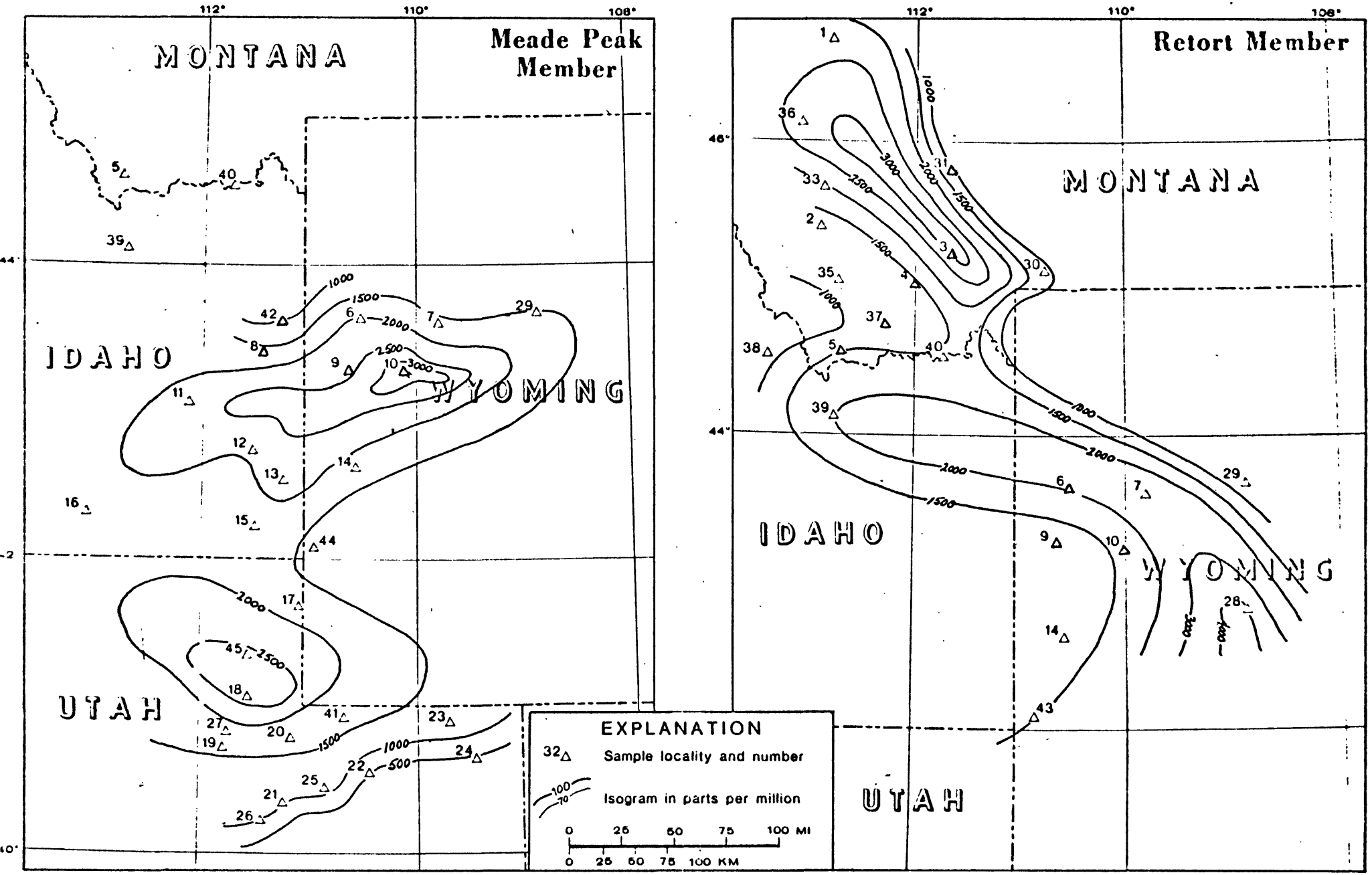

Figure 17.--Areal distribution of titanium in phosphatic shale members of the Phosphoria Formation.

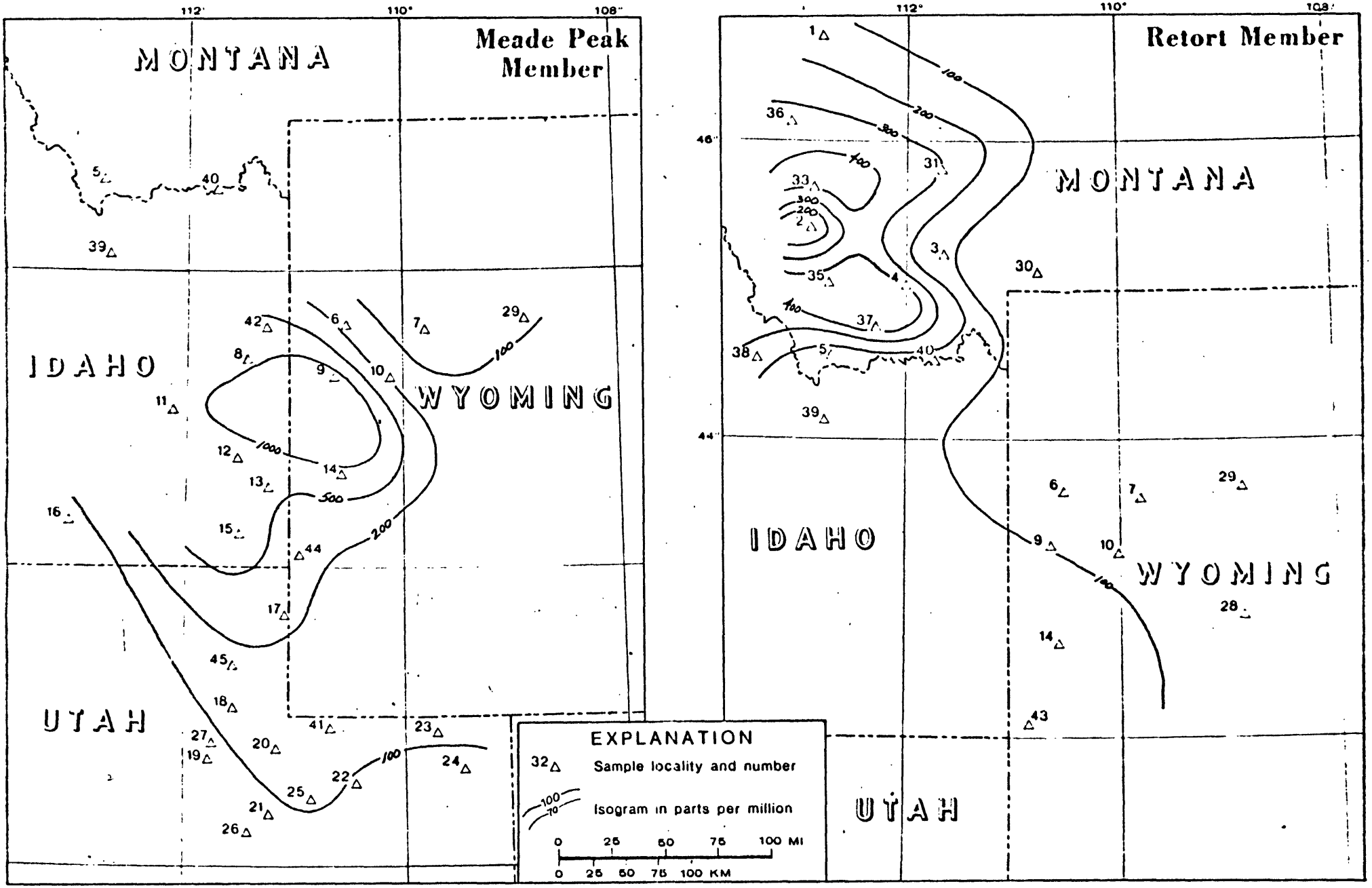

Figure 18.--Areal distribution of vanadium in phosphatic shale members of the Phosphoria Formation.

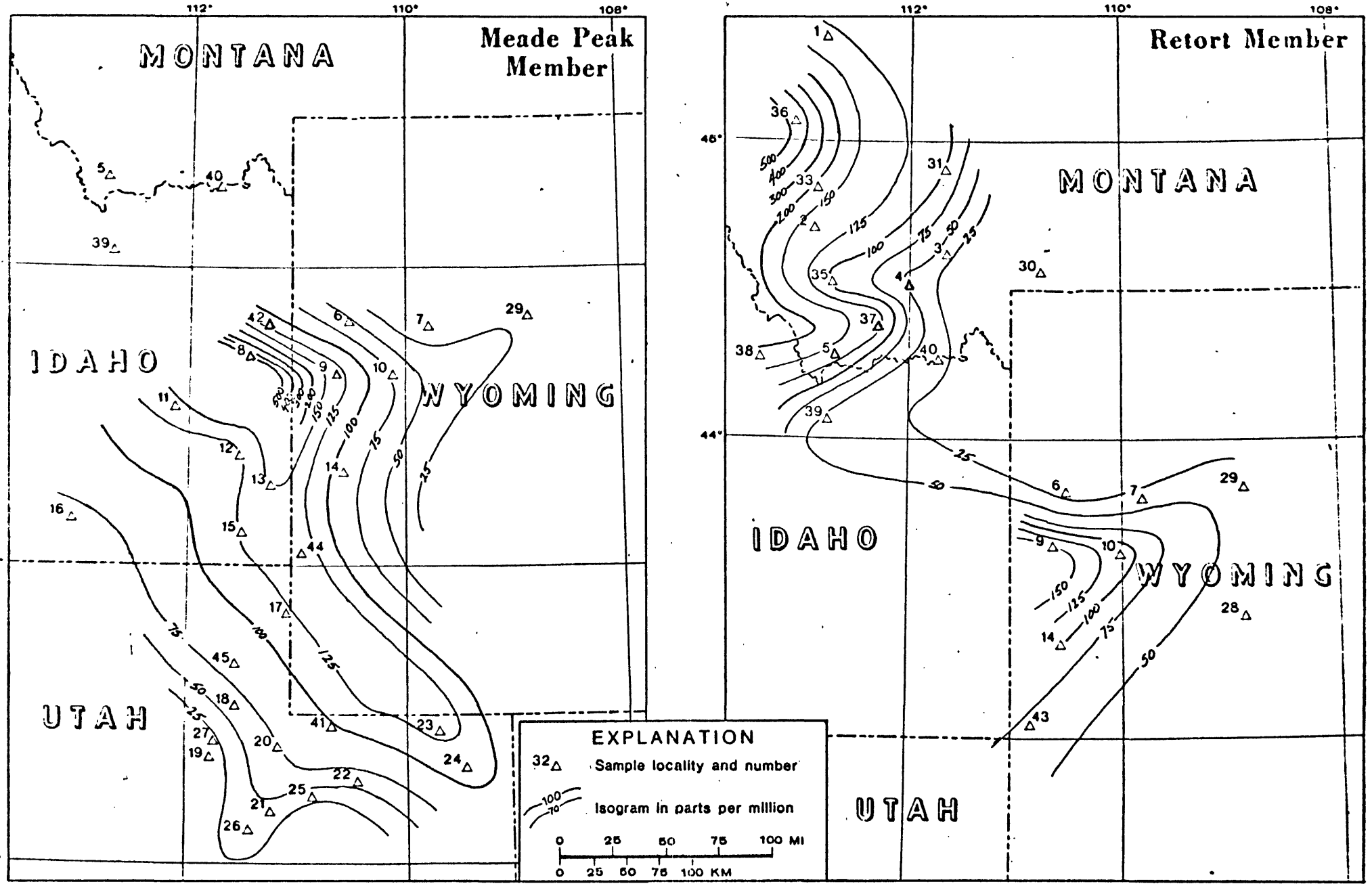

Figure 19.--Areal distribution of yttrium in phosphatic shale members of the Phosphoria Formation.

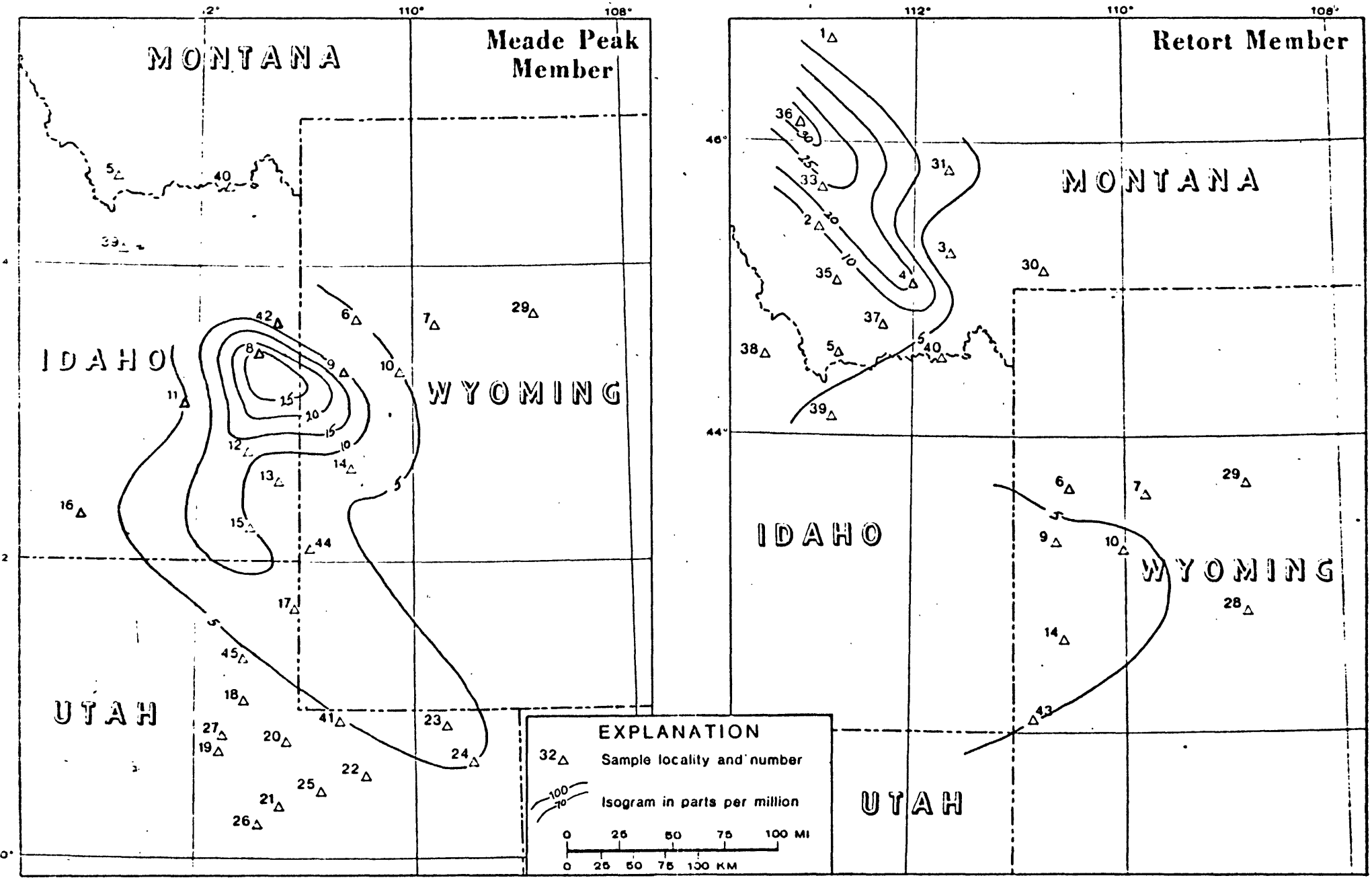

Figure 20.--Areal distribution of ytterbium in phosphate shale members of the Phosphoria Formation.

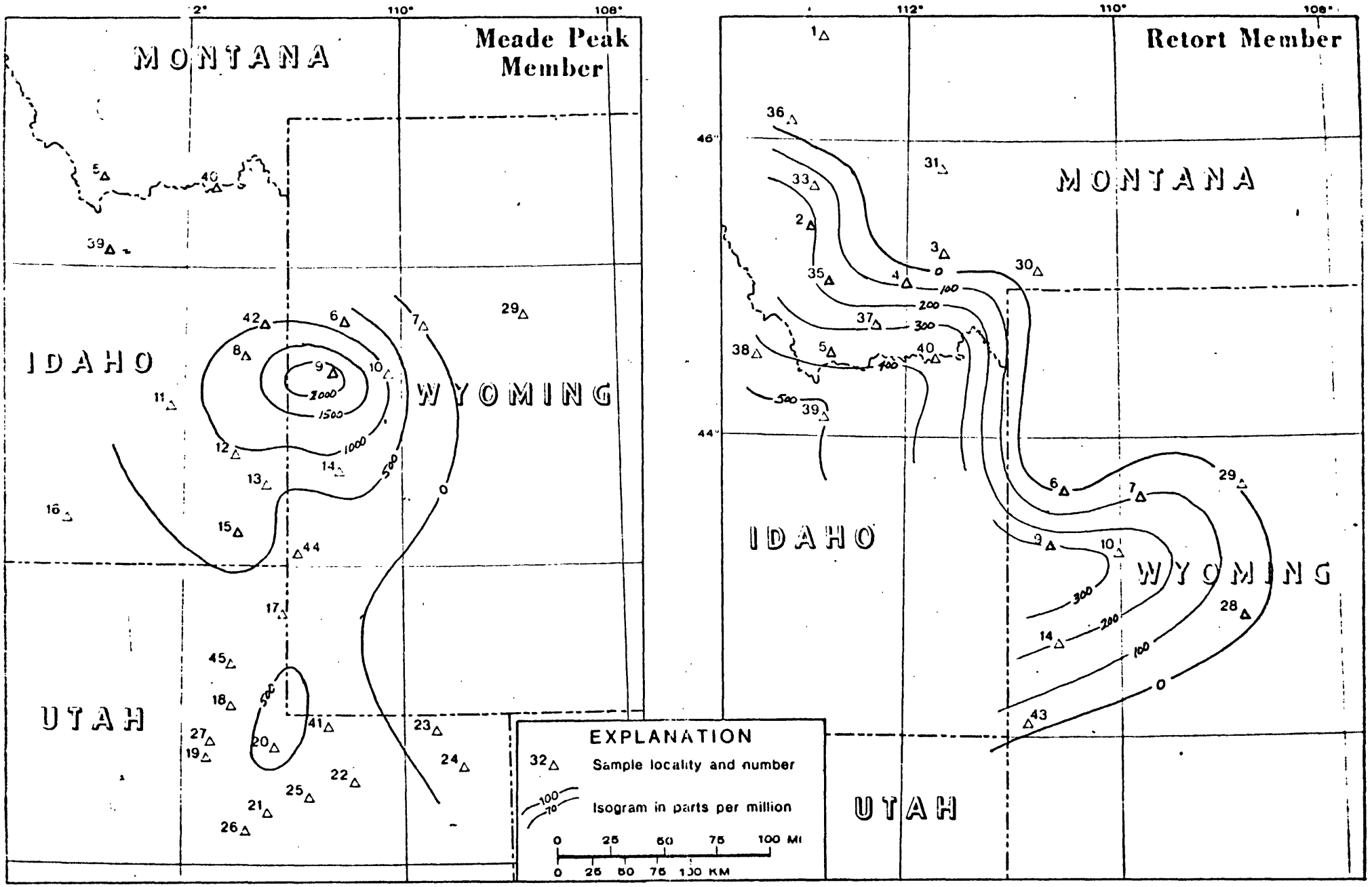

Figure 21.--Areal distribution of zinc in phosphatic shale members of the Phosphoria Formation.

Table 1.--Sample collection localities

Map index number	Field number	Place	Section, township and range	Type of exposure
1.	73 M46	Anderson Mine, Garnet Range, Mont.	SE¼,S10,T10N,R10W	Underground mine
2.	73M 41	Kelley Gulch, Pioneer Mts., Mont.	NE¼,SE¼S3,T6S,R11W	Prospect trench
3.	73M 47	Aspen Valley, Madison Range, Mont.	NE¼,S14,T6S,R1E	Natural exposure
4.	73M 42	Canyon Camp, Ruby River, Mont.	NW¼,SE¼,S18,T9S,R3W	Excavated face
5.	73M 44 74M 30	Middle Fk., Little Sheep Cr., Tendoy Mts., Mont.	NE¼,S4,T15S,R9W	Natural exposure
6.	73M 31 73M 32	Gros Ventre Slide, Gros Ventre Range, Wyo.	C,E½,S5,T42N,R43E	Natural exposure
7.	73M 34	Stony Point on Wind River, Wyo.	C,S½,S24,T42N,R108W	Natural exposure
8.	73M 28,29	Fall Creek, Caribou Range, Idaho	NW¼,S17,T1N,R43E	Prospect trench
9.	74M 40 73M 33	Astoria Hot Springs, Snake River Canyon, Wyo.	SW¼,SE¼,S32,T39N,R116W	Road cut
10.	73M 35	Kendall Warm Springs, Wind River Range, Wyo.	SE¼,S11,T38N,R110W	Natural exposure
11.	73M 25	Gay Mine, Idaho	S15,T4S,R37E	Strip mine face
12.	73M 23	Conda Mine, Aspen Range, Idaho	SE¼,S14,T8S,R42E	Strip mine face
13.	73M 21	Georgetown Canyon, Preuss Range, Idaho	S19,T10S,R45E	Strip mine face
14.	73M 36	Middle Piney Lake, Wyoming Range, Wyo.	S8,T30N,R115W	Natural exposure
15.	73M 19	Paris Canyon, Bear River Range, Idaho	SE¼,S8,T14S,R43E	Prospect trench
16.	73M 27	Sublett Reservoir, Sublett Range, Idaho	S34,T12S,R29E	Road cut
17.	73M 17	Benjamin Mine, Crawford Mts., Utah	SE¼,S18,T11N,R8E	Excavated face
18.	73M 16 73M 15	Devils Slide, Weber Canyon, Utah	NW¼,S26,T4N,R3E	Prospect trench

Table 1.--Sample collection localities (continued)

Map index number	Field number	Place	Section, township and range	Type of exposure
19.	73M 12	Mill Creek Canyon, Wasatch Range, Utah	NW 1/4,S31,T1S,R2 E	Excavated flume
20.	73M 11	Fremson (Pinon) Canyon, Uinca Mts., Utah	SW 1/4,SW 1/4 (?)S14, T1S,R6E	Prospect trench
21.	73M 9	Strawberry Valley, Utah	SE 1/4,NW 1/4,S14,T2S, R12W	Prospect trench
22.	73M 5	MacKintire Draw, Uinta Mts., Utah	S 1/2,S27,T2N,R5W	Natural exposure
23.	73M 39	Sheep Creek Bay, Flaming Gorge Reservoir, Utah	SE 1/4,NW 1/4,S17,T2N, R20E	Road cut
24.	73M 38	Little Brush Creek, Uinta Mts., Utah	Approx. NE 1/4,S22, T2N,R20E	Road cut
25.	74M 2	W. Fk. Duchesne River, Uinta Mts., Utah	N 1/2,S2,T1N,R9W	Road cut
26.	74M 4	Rt. Fk. Hobble Creek, Wasatch Mts., Utah	SE 1/4,NE 1/4,S19,T7S, RSE	Natural exposure
27.	74M 7	Head of Red Butte Creek, Wasatch Mts., Utah	SE 1/4,NE 1/4,S17,T1N, R2E	Prospect trench
28.	74M 10	Baldwin Creek, Wind River Range, Wyo.	C,SW 1/4,S18,T33N,R100W	Natural exposure
29.	74M 12	Anchor dam on Owl Creek, Wyo.	SW 1/4,NW 1/4,S25,T43N, R100W	Natural exposure
30.	74M 13	Cinnabar Mt., Gallatin Range, Mont.	C,S31,T8S,R8E	Natural exposure
31.	74M 22	Sappington Canyon, Jefferson River, Mont.	SE 1/4,NE1/4,S26,T1N, R2W	Natural exposure
32.	74M 25	Garrison Warm Springs Creek, Garret Range, Mont.	SW 1/4,NW 1/4,S10,T10 N,R9W	Natural exposure
33.	74M 27	Canyon Creek, Pioneer Mts., Mont.	C,S6,T2S,R9W	Mine dump
35.	74M 29	Retort Mtn., Blacktail Mts., Mont.	NW1/4,SW1/4,S23,T9S R9W	Prospect trench

Table 1.--Sample collection localities

Map index number	Field number	Place	Section, township and range	Type of exposure
36.	73M 45	Anaconda Warm Springs Creek, Flint Creek Range, Mont.	Approx. S24,T5N,R12W	Excavated face
37.	74M 31	W. Fk. Blacktail Deer Creek, Snowcrest Range, Mont.	C,N 1/2,S½, S26,T12S, R6W	Prospect trench
38.	74M 33	Hawley Creek,Beaverhead Range, Idaho	SE 1/4,NW 1/4,S36,T16N, R27E	Prospect trench
39.	74M 35	Snakey Canyon, Southern Beaverhead Range, Idaho	NW 1/4,SW 1/4,S16,T9N, R32E	Natural exposure
40.	74M37	Taylor Creek, Centennial Mts., Idaho	NE 1/4,NE 1/4,S14,T14N, R40E	Road cut
41.	74M 8	W. Fk. of Blacks Fork, Uinta Mts., Utah	C of Line, S27 & 28,T2N, R11E	Natural exposure
42.	74M 41	Red Mt., Big Hole Mts., Idaho	SW 1/4,SW 1/4,S34,T4N, R44E	Prospect trench
43.	74M 42	Cokeville Hydroelectric Plant, Tump Range, Wyo.	W 1/2,SE 1/4,S35,T25N, R118W	Gullied flume
44.	74M 43	Cokeville Butte, Sublette Range, Wyo.	Approx. NW 1/4,S4,T42N, R119 unsurveyed	Natural exposure and prospect trench
45.	74M 45	Dry Dread Hollow, Wasatch Mts., Utah	C,W 1/2,E 1/2,S14,T7N, R3E	Natural exposure

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples.

Sample 1/ Number	Stratigraphic unit	Thickness 2/ (in metres)	Cumulative thickness of shale members	Rock description
1 A	Retort	1.2	1.2	Phosphorite
1B	Retort	4.8	6.0	Chert, phosphatic
2 A	Franson	not measured*		Dolomite, cherty
2 B	Retort	1.0*	1.0	Mudstone, dolomitic
2 C	Retort	1.0*	2.0	Mudstone
2 D	Retort	1.0*	3.0	Mudstone, calcareous
2 E	Retort	3.0	6.0	Mudstone, slightly calcareous, carbonaceous
2 G	Retort	3.0*	9.0	Mudstone, siliceous
2 H	Retort	3.2	12.2	Mudstone, siliceous
2 J	Retort	2.6	14.8	Siltstone, siliceous
2 K	Retort	4.0	18.8	Mudstone, siliceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
3 A	Retort	2+*	2.0	Mudstone, siliceous
3 A	Retort	2.5	4.5	Mudstone, carbonaceous, siliceous
3 C	Retort	3.0	7.5	Mudstone, siliceous
3 D	Retort	1.6	9.1	Mudstone, siliceous
3 E	Retort	0.5	9.6	Mudstone, siliceous
3 F	Retort	1.7	11.3	Mudstone, siliceous
3 G	Retort	1.0	12.3	Siltstone, siliceous, dolomitic
3 H	Retort	2.0	14.3	Mudstone
3 J	Retort	2.7	17.0	Mudstone, siliceous
3 K	Retort	2.0	19.0	Claystone, siliceous
4 A	Franson	5.0*		Dolomite, calcareous, phosphatic
4 B	Retort	1.1	1.1	Mudstone
4 C	Retort	0.4	1.5	Phosphorite, argillaceous, calcareous
4 D	Retort	1.0	2.5	Mudstone, phosphatic
4 E	Retort	1.1	3.6	Phosphorite, argillaceous, calcareous
4 F	Retort	0.6	4.2	Mudstone, calcareous, phosphatic
4 G	Retort	0.7	4.9	Mudstone, carbonaceous, phosphatic
4 H	Retort	1.8	6.7	Mudstone, carbonaceous, phosphatic
4 J	Retort	1.0	7.7	Mudstone, carbonaceous, phosphatic
4 K	Retort	0.4	8.1	Phosphorite, argillaceous, calcareous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
4 L 4 M	Retort	3.4	11.5	Mudstone, phosphatic, carbonaceous
4 N	Tosi	1+*		Chert
5 A	Franson	3+*		Dolomite, argillaceous
5 B	Retort	0.5*	0.5	Mudstone, phosphatic
5 C	Retort	1.0*	1.5	Mudstone
5 D	Retort	3.0*	4.5	Mudstone, carbonaceous, phosphatic
5 E	Retort	1.5*	6.0	Mudstone, carbonaceous
5 F	Retort	1.0*	7.0	Mudstone, carbonaceous
5 G	Retort	1.0*	8.0	Mudstone, calcareous
5 H	Retort	1.0*	9.0	Mudstone, carbonaceous
5 J	Retort	0.25*	9.25	Mudstone, carbonaceous
5 K	Retort	0.25*	9.5	Mudstone, carbonaceous
5 L	Retort	0.25*	9.75	Mudstone, carbonaceous
5 M	Retort	0.25*	10.0	Mudstone, carbonaceous
5 N	Retort	0.25*	10.25	Mudstone, carbonaceous
5 P	Retort	0.25*	10.5	Mudstone, carbonaceous
5 Q	Retort	0.25*	10.75	Mudstone, carbonaceous
5 R	Retort	0.25*	11.0	Mudstone, carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
5 AB	Retort	3.5†	3.5	Mudstone, carbonaceous, calcareous
5 C	Retort	0.4	3.9	Limestone, argillaceous, petroliferous
5 DG	Retort	8.0†	11.9	Mudstone, carbonaceous, calcareous
6 A	Meade Peak	1.0	1.0	Phosphorite
6 B	Meade Peak	1.2	2.2	Mudstone, dolomitic, phosphatic
6 C	Meade Peak	1.0	3.2	Mudstone, dolomitic, phosphatic
6 D	Meade Peak	0.6	3.8	Mudstone, dolomitic, phosphatic
6 E	Meade Peak	0,5	4.3	Mudstone, siliceous, dolomitic
6 F	Meade Peak	0.8	5.1	Mudstone, siliceous, dolomitic
6 G	Retort	7.0	7.0	Mudstone, carbonaceous, siliceous
6 H	Retort	1.7	8.7	Mudstone, carbonaceous, siliceous
6 J	Lower Shedhorn	1.0*		Sandstone, calcareous
6 K	Lower Shedhorn	1.2*		Sandstone, calcareous
6 L	Retort	1.4*	1.4	Chert, argillaceous, phosphatic
6 M	Retort	3.3	4.7	Mudstone, calcareous
6 N	Retort	3.0	7.7	Mudstone and claystone, calcareous
6 P	Retort	1.5	9.2	Mudstone
6 Q	Retort	2.7	11.9	Mudstone, dolomitic (?)
6 R	Retort	3.7	15.6	Mudstone and claystone, calcareous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
7 A	Meade Peak	1.2	1.2	Mudstone
7 B	Meade Peak	2.8	4.0	Mudstone, calcareous
7 C	Meade Peak	2.4	6.4	Mudstone, calcareous
7 D	Retort	1.0	1.0	Mudstone
7 E	Retort	1.0	2.0	Mudstone, calcareous
7 F	Retort	1.0	3.0	Mudstone
7 G	Retort	2.0	5.0	Mudstone
8 A	Grandeur	3.0		Siltstone, argillaceous, calcareous
8 B	Grandeur	3.0		Siltstone, argillaceous, calcareous
8 C	Grandeur	3.0		Mudstone, calcareous
8 D	Grandeur	2.4		Mudstone, dolomitic
8 E	Grandeur	0.7		Mudstone, calcareous
8 F	Grandeur	3.0		Chert and calcareous Mudstone
8 G	Grandeur	3.0		Chert and Mudstone, Slightly calcareous
8 H	Grandeur	3.7*		Chert and dolomite, argillaceous, calcareous
8 J	Grandeur	2.2*		Dolomite, argillaceous, calcareous
8 K	Grandeur	1.4		Mudstone, dolomitic
8 L	Grandeur	7.0		Dolomite, argillaceous, calcareous
8 M	Meade Peak	3.0	3.0	Mudstone, phosphatic
8 N	Meade Peak			Phosphorite, dolomitic, argillaceous
8 P	Meade Peak	2.0	5.0	Mudstone, phosphatic, dolomitic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
8 Q	Meade Peak	3.3	8.3	Mudstone, Phosphatic, carbonaceous
8 R	Meade Peak	0.9	9,2	Mudstone, dolomitic, phosphatic
8 S	Meade Peak	1.7	10.9	Mudstone, phosphatic, carbonaceous
8 T	Meade Peak	2.0	12.9	Claystone, calcareous, siliceous
8 U	Meade Peak	0.7	13.6	Mudstone, phosphatic, siliceous
9 A	Meade Peak	4.0	4.0	Phosphorite, argillaceous, carbonaceous
9 B	Meade Peak	0.5	4.5	Mudstone, calcareous, phosphatic
9 C	Meade Peak	3.0	7.5	Phosphorite, clayey, carbonaceous
9 D	Meade Peak	2.4	9.9	Phosphorite, clayey, carbonaceous
9 E	Meade Peak	0.6	10.5	Mudstone, dolomitic
9 F	Meade Peak	0.4	10.9	Phosphorite, carbonaceous
9 G	Meade Peak	0.3	11.2	Mudstone, carbonaceous
9 H	Meade Peak	0.1	11.3	Phosphorite, clayey
9 J	Meade Peak	0.5	11.8	Mudstone, dolomitic
9 K	Meade Peak	0.3	12.1	Phosphorite, clayey, carbonaceous
9 L	Meade Peak	1.8	13.9	Mudstone
9 M	Meade Peak	1.8	15.7	Phosphorite, clayey
9 AE	Retort	5.5*	5.5	Mudstone, very carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
10 A	Meade Peak	0.2	0.2	Claystone
10 B	Meade Peak	0.3	0.5	Claystone, calcareous
10 C	Meade Peak	2.2	2.7	Claystone, dolomitic
10 D	Meade Peak	1.3	4.0	Claystone, calcareous
10 E_1	Meade Peak	0.25	4.25	Mudstone
10 E_2	Meade Peak	0.25	4.5	Mudstone
10 F	Meade Peak	0.5	5.0	Mudstone
10 G	Meade Peak	1.4	6.4	Mudstone, phosphatic, calcareous
10 H	Meade Peak	2.7	9.1	Mudstone
10 J	Meade Peak	1.1	10.2	Mudstone, phosphatic, dolomitic
11 A	Meade Peak	1.0*	1.0	Siltstone
11 B	Meade Peak	1.0*	2.0	Siltstone, calcareous
11 C	Meade Peak	2.5	4.5	Siltstone, phosphatic, calcareous
11 D	Meade Peak	1.3	5.8	Phosphorite
11 E	Meade Peak	3.1	8.9	Claystone, phosphatic, calcareous
11 F	Meade Peak	2.6	11.5	Claystone, phosphatic, calcareous
11 G	Meade Peak	2.2	13.7	Claystone, phosphatic, calcareous
11 H	Meade Peak	2.3	16.0	Claystone, phosphatic, calcareous
11 J	Meade Peak	3.0	19.0	Claystone, phosphatic
11 K	Meade Peak	3.0	22.0	Claystone, phosphatic, calcareous
11 L	Meade Peak	2.8	24.8	Claystone, phosphatic calcareous
11 M	Meade Peak	7.5	32.3	Siltstone, calcareous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
11 N	Meade Peak	3.8	36.1	Phosphorite, argillaceous
11 P	Meade Peak	3.0	39.1	Mudstone, phosphatic, calcareous
11 Q	Meade Peak	3.3	42.4	Mudstone, phosphatic, calcareous
11 R	Meade Peak	1.0	43.4	Mudstone, phosphatic, calcareous
12 A	Meade Peak	1.8	1.8	Phosphorite
12 B	Meade Peak	1.8	3.6	Mudstone, phosphatic
12 C	Meade Peak	3.0	9.6	Mudstone, phosphatic calcareous
12 D	Meade Peak	2.5	12.1	Phosphorite, argillaceous
12 E	Meade Peak	0.5	12.6	Limestone, silty
12 F	Meade Peak	3.0	15.6	Phosphorite, argillaceous
12 G	Meade Peak	3.0	18.6	Phosphorite, argillaceous
12 H	Meade Peak	3.0	21.6	Phosphorite, argillaceous
12 J_1	Meade Peak	1.9	23.5	Phosphorite, argillaceous
12 J_2	Meade Peak			
12 K	Meade Peak	1.0	24.5	Limestone, argillaceous, phosphatic
12 L_1	Meade Peak	1.1	25.6	Phosphorite, argillaceous
12 L_2	Meade Peak	0.8	26.4	Limestone, argillaceous, phosphatic
12 L_3	Meade Peak	1.1	27.5	Phosphorite, argillaceous, calcareous
12 M	Meade Peak	4.0	31.5	Claystone, carbonaceous, phosphatic
12 N	Meade Peak	2.0	33.5	Claystone, carbonaceous, phosphatic
12 P	Meade Peak	3.0	36.5	Mudstone, carbonaceous, phosphatic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
12 Q	Meade Peak	4.5	41.0	Mudstone, carbonaceous, phosphatic
12 R	Meade Peak	5 1/2+	46.5	Mudstone, carbonaceous, phosphatic
12 S	Meade Peak	4.3	50.8	Mudstone, carbonaceous, phosphatic
12 T	Meade Peak	2.5	53.3	Mudstone, carbonaceous,
12 U	Meade Peak	1.0	54.3	Mudstone, carbonaceous,
12 V	Meade Peak	1.5	55.8	Mudstone, carbonaceous,
12 W	Meade Peak	3.0	58.8	Mudstone, carbonaceous,
12 X	Meade Peak	3.1	61.9	Mudstone, phosphatic
12 Y	Meade Peak	3.0	64.9	Phosphorite
12 Z	Meade Peak	6.0	70.9	Mudstone, phosphatic
13 A	Meade Peak	3.0	3.0	Mudstone, carbonaceous
13 B	Meade Peak	4.0	7.0	Mudstone, carbonaceous
13 C	Meade Peak	0.8	7.8	Limestone, argillaceous
13 D	Meade Peak	1.5	9.3	Claystone, argillaceous
13 E	Meade Peak	0.9	10.2	Limestone, argillaceous
13 F	Meade Peak	2.3	12.5	Claystone, carbonaceous
13 Fa	Meade Peak	(.075) [a]		Claystone, very carbonaceous
13 G	Meade Peak	3.0	15.5	Claystone, carbonaceous, phosphatic
13 H	Meade Peak	3.0	18.5	Claystone, carbonaceous, phosphatic
13 J	Meade Peak	0.3	18.8	Limestone, argillaceous
13 K	Meade Peak	2.0	20.8	Claystone, carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
13 L	Meade Peak	4.0	24.8	Claystone
13 M	Meade Peak	4.0	28.8	Mudstone, phosphatic, calcareous
13 N	Meade Peak	4.0	32.8	Claystone, siliceous, phosphatic
13 Q	Meade Peak	4.0	36.8	Phosphorite, argillaceous, calcareous
13 R	Meade Peak	4.0	40.8	Phosphorite, argillaceous calcareous
13 S	Rex	1.6+*		Chert
14 A	Grandeur	0.6		Mudstone, calcareous
14 B	Meade Peak	0.3	0.3	Mudstone, siliceous, calcareous
14 C	Meade Peak	1.4	1.7	Mudstone, phosphatic, carbonaceous
14 D	Meade Peak	4.0	5.7	Mudstone, phosphatic, carbonaceous
14 E	Meade Peak	1.4	7.1	Mudstone, calcareous
14 F	Meade Peak	0.5	7.6	Mudstone, siliceous
14 G	Meade Peak	1.2	8.8	Mudstone, carbonaceous, phosphatic
14 H	Meade Peak	3.0	11.8	Mudstone, carbonaceous
14 J	Meade Peak	1.0	12.8	Mudstone, carbonaceous
14 K	Meade Peak	2.9	15.7	Mudstone, dolomitic
14 L	Meade Peak	2.4	18.1	Mudstone, carbonaceous, phosphatic
14 M	Meade Peak	1.8	19.9	Mudstone, siliceous, phosphatic
14 N	Meade Peak	2.9	22.8	Mudstone, carbonaceous, phosphatic
14 P	Meade Peak	1.9	24.7	Mudstone, siliceous
14 Q	Meade Peak	2.5	27.2	Mudstone, carbonaceous
14 R	Meade Peak	2.0	29.2	Mudstone, phosphatic, cherty

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
15 A	Grandeur			Dolomite siliceous
15 B	Meade Peak	2.4	2.4	Mudstone, calcareous, phosphatic
15 C	Meade Peak	0.1	2.5	Phosphorite, cherty
15 D	Meade Peak	1.1	3.6	Mudstone, phosphatic, calcareous
15 E	Meade Peak	1.0	4.6	Phosphorite
15 F	Meade Peak	1.0	5.6	Phosphorite, calcareous
15 G	Meade Peak	1.0	6.6	Mudstone, phosphatic, calcareous
15 H	Meade Peak	3.0	9.6	Mudstone, calcareous
15 J	Meade Peak	3.0	12.6	Mudstone, carbonaceous
15 K	Meade Peak	3.0	15.6	Mudstone, calcareous
15 L	Meade Peak	2.0	17.6	Mudstone, calcareous, silty
15 M	Meade Peak	2.0	19.6	Mudstone, silty, phosphatic
15 N	Meade Peak	5.0	24.6	Mudstone, calcareous
15 P	Meade Peak	2.0	26.6	Mudstone, carbonaceous
15 Q	Meade Peak	1.5	28.1	Mudstone, phosphatic
15 R	Meade Peak	3.5	31.6	Mudstone, phosphatic, calcareous
15 S	Rex	2.0		Chert, phosphatic
15 T	Meade Peak	not measured b/		Mudstone, carbonaceous, phosphatic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
16 A	Meade Peak	4.4	4.4	Mudstone, calcareous
16 B	Meade Peak	4.4	8.8	Mudstone
16 C	Meade Peak	4.4	13.2	Mudstone, slightly carbonaceous
16 D	Meade Peak	4.4	17.6	Mudstone, slightly carbonaceous
16 E	Meade Peak	4.4	22.0	Mudstone
16 F	Meade Peak	6.5	28.5	Mudstone, phosphatic, siliceous
16 G	Meade Peak	6.5	35.0	Mudstone, Phosphatic, siliceous
16 H	Meade Peak	30.0	65.0	Mudstone, calcareous, siliceous
16 J	Meade Peak	3.4	68.4	Mudstone, siliceous
16 K	Meade Peak	3.4	71.8	Mudstone, siliceous
17 A	Meade Peak	4.0	4.0	Mudstone, calcareous, phosphatic
17 B	Meade Peak	5.0	9.0	Mudstone, dolomitic, siliceous
17 C	Meade Peak	3.0	12.0	Mudstone, dolomitic, siliceous
17 D	Meade Peak	2.0	14.0	Mudstone, phosphatic, calcareous
17 E	Meade Peak	2.0	16.0	Mudstone, calcareous, phosphatic
17 F	Meade Peak	2.0	18.0	Mudstone, calcareous, phosphatic
17 G	Meade Peak	2.0	20.0	Mudstone, siliceous
17 H	Meade Peak	2.0	22.0	Mudstone, siliceous
17 J	Meade Peak	3.0	25.0	Mudstone, calcareous
17 K	Meade Peak	1.8	26.8	Dolomite, clayey
17 L	Meade Peak	2.4	29.2	Mudstone, dolomitic, siliceous
17 M	Meade Peak	0.8	30.0	Mudstone, phosphatic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
17 N	Meade Peak	0.7	30.7	Mudstone, dolomitic
17 P	Meade Peak	1.4	32.1	Phosphorite, silty
17 Q	Meade Peak	1.2	33.3	Phosphorite, calcareous
17 R	Meade Peak	2.0	35.3	Mudstone, calcareous
17 S	Meade Peak	5.5	40.8	Mudstone, calcareous
17 T	Meade Peak	3.4	44.2	Mudstone, calcareous
18 A	Grandeur	5.8		Mudstone, dolomitic
18 B	Grandeur	0.5		Mudstone, phosphatic, calcareous
18 C	Grandeur	0.8		Mudstone, calcareous
18 D	Grandeur	1.0		Claystone, calcareous, siliceous
18 E	Grandeur	6.3		Claystone, siliceous
18 F	Grandeur	0.5		Limestone, clayey
18 G	Grandeur	2.0		Dolomite
18 H	Meade Peak	0.3	0.3	Phosphorite, clayey, calcareous
18 J	Meade Peak	8.0*	8.3	Mudstone
18 K	Meade Peak	8.0*	16.3	Mudstone
18 L	Meade Peak	8.0*	24.3	Mudstone
18 M	Meade Peak	8.0*	32.3	Mudstone
18 N	Meade Peak	8.0*	40.3	Mudstone, siliceous, calcareous
18 P	Meade Peak	8.0*	48.3	Mudstone, siliceous, calcareous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued)

Sample number[1]	Stratigraphic unit	Thickness (in metres)[2]	Cumulative thickness of shale members	Rock description
18 Q	Meade Peak	8.0*	56.3	Mudstone, siliceous, calcareous
	(samples missing)	26.0	82.3	Mudstone, siliceous, calcareous
18 R	Meade Peak	10.0*	92.3	Mudstone, siliceous, calcareous
19 A	(Grandeur)[c]	10.0*		Dolomite, silty
19 B	(Grandeur)	4.0*		Dolmite, silty
19 C	(Grandeur)	10.0*		Dolomite, silty
19 D	(Grandeur)	10.0*		Dolomite, silty
19 E	(Grandeur)	6.0*		Dolomite, silty
	(Grandeur)	16.0		Dolomite, silty
19 F		2.0*		Dolomite, silty
19 G	(Meade Peak)	10.0*		Claystone, siliceous, dolomitic
19 H		10.0*		Claystone, siliceous, dolomitic
19 J		10.0*		Claystone, siliceous, dolomitic
19 K		10.0*		Claystone, siliceous, dolomitic
19 L		10.0*		Mudstone, siliceous, reddish
19 M		20.0*		Mudstone, siliceous, reddish
19 N	(Franson)	45.0*		Limestone, silty, dolomitic
19 P	(Franson)	45.0*		Limestone, dolomitic
19 Q	(Franson)	35.0*		Dolomite, siliceous
19 R	(Franson)	30.0*		Dolomite and limestone, cherty
19 S	(Franson)	20.0*		Dolomite, siliceous
19 T	(Retort)	23.0*		Mudstone, siliceous, calcareous
19 U		20.0*		Mudstone, siliceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
19 V	(Retort)	20.0*		Limestone, argillaceous, silty
19 W	(Retort)	10.0*		Mudstone, siliceous
19 X	(Meade Peak)	1.0*		Claystone, calcareous
19 Y	(Meade Peak)	1.0*		Claystone, calcareous
19 Z_1	(Meade Peak)	1.0*		Claystone, calcareous
19 Z_2	(Meade Peak)	1.0*		Claystone, calcareous
20 A	Grandeur	5+*		Sandstone, dolomitic
20 B	Grandeur	1.0*		Sandstone
20 C	Meade Peak	0.1	0.1	Phosphorite
20 X	Meade Peak	6.0	6.1	Claystone, phosphatic, dolomitic
20 D	Meade Peak	1.0	7.1	Claystone, dolomitic
20 E	Meade Peak	1.0	8.1	Claystone, dolomitic
20 F	Meade Peak	0.3	8.4	Dolomite, argillaceous
20 G	Meade Peak	1.0	9.4	Claystone, dolomitic, silty
20 H	Meade Peak	1.3	10.7	Claystone, silty, calcareous
20 J	Meade Peak	0.2	10.9	Dolomite, argillaceous, calcareous
20 K	Meade Peak	0.9	11.8	Claystone, silty, dolomitic
20 L	Meade Peak	0.9	12.7	Claystone, silty, dolomitic
20 M	Meade Peak	0.9	13.6	Claystone, silty, dolomitic
20 N	Meade Peak	0.9	14.5	Claystone, silty, dolomitic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
20 P	Meade Peak	0.9	15.4	Claystone, silty, calcareous
20 Q	Meade Peak	0.9	16.3	Claystone, silty calcareous
20 R	Meade Peak	0.2	16.5	Dolomite, argillaceous, phosphatic
20 S	Meade Peak	0.5	17.0	Siltstone, argillaceous, dolomitic
20 T	Meade Peak	1.0	18.0	Siltstone, siliceous, dolomitic
20 U	Rex	6.0		Chert
20 V	Rex	1.0		Chert, argillaceous, dolomitic
20 W	Rex	not measured		Dolomite, cherty
21 A	Meade Peak	3.0*	12.0	Claystone, phosphatic
21 B	Meade Peak	2.0*	14.0	Claystone, phosphatic
21 C	Meade Peak	3.0*	17.0	Claystone, siliceous
21 D	Meade Peak	3.0*	20.0	Claystone
21 E	Meade Peak	3.0*	23.0	Claystone
21 F	Meade Peak	3.0*	26.0	Claystone
21 G	Meade Peak	3.0*	29.0	Claystone
21 H	Meade Peak	3.0*	32.0	Claystone
21 J	Meade Peak	15.0*	47.0	Claystone
21 K	Meade Peak	10.0*	57.0	Claystone

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
22 A	Grandeur	10.0*		Limestone, sandy
22 B	Grandeur	2.0*		Dolomite, argillaceous
22 C	Grandeur	4.0*		Dolomite, calcareous
22 D	Grandeur	3.5*		Limestone and chert
22 E	Grandeur	3.5*		Limestone and chert
22 F	Grandeur	0.7*		Limestone,
22 G	Meade Peak	1.0	1.0	Phosphorite
22 H	Meade Peak	2.0	3.0	Claystone, phosphatic
22 I	Meade Peak	3.2	6.2	Claystone, phosphatic
22 J	Meade Peak	2.4	8.6	Claystone, phosphatic
22 K	Meade Peak	3.2	11.8	Claystone, phosphatic
22 L	Meade Peak	3.2	15.0	Claystone, phosphatic
22 M	Meade Peak	3.8	18.8	Mudstone, phosphatic
22 N	Meade Peak	3.2	22.0	Mudstone, phosphatic
22 P	Meade Peak	5.0*	27.0	Mudstone phosphatic siliceous
22 Q	Meade Peak	3.0*	30.0	Mudstone, phosphatic, siliceous
23 A	Meade Peak	1.0	1.0	Phosphorite and mudstone, phosphatic
23 B	Meade Peak	0.9	1.9	Claystone, some dolomitic
23 C	Meade Peak	1.2	3.1	Phosphorite, calcareous, argillaceous
23 D	Meade Peak	1.3	4.4	Mudstone, dolomitic
23 E	Meade Peak	0.3	4.7	Phosphorite, calcareous, argillaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
23 F	Meade Peak	3.9	8.6	Mudstone, phosphatic, dolomitic
23 G	Rex	not measured*		Limestone, cherty, phosphatic
24 A	Meade Peak	0.9	1.1	Phosphorite, argillaceous, cherty
24 B	Meade Peak	0.8	1.9	Phosphorite, argillaceous
24 C	Meade Peak	0.2	2.1	chert
24 D	Meade Peak	1.0	3.1	Mudstone, phosphatic calcareous
24 E	Meade Peak	1.4	4.5	Mudstone, phosphatic, calcareous
24 F	Meade Peak	0.8	5.3	Phosphorite, calcareous
25A	Grandeur	not measured*		Limestone, petroliferous vugs
25B	Grandeur	0.4*	0.4	Limestone, dolomitic, argillaceous
25C	Meade Peak	1.4*	1.8	Claystone, dolomitic, phosphatic
25D	Meade Peak	1.9*	3.7	Claystone, dolomitic, phosphatic
25E	Meade Peak	1.5	5.2	Claystone, dolomitic, phosphatic
25F	Meade Peak	0.4	5.6	Dolomite, argillaceous
25G	Meade Peak	2.7	8.3	Claystone, siliceous
25H	Meade Peak	1.8	10.1	Claystone, siliceous, slightly cherty
25J	Meade Peak	2.5	12.6	Claystone
25K	Meade Peak	2.5	15.1	Claystone

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
25L	Franson	not measured		Limestone
26A	Meade Peak	5.0	5.0	Claystone, phosphatic, dolomitic
26B	Meade Peak	7.3	12.3	Claystone, phosphatic, dolomitic
26C	Meade Peak	10.0	22.3	Claystone, phosphatic, dolomitic
26D	Meade Peak	11.0	33.3	Claystone, phosphatic dolomitic
26E	Meade Peak	2.0	35.3	Dolomite, cherty, calcareous
26F	Meade Peak	5.0	40.3	Claystone, phosphatic, dolomitic
26G	Meade Peak	5.0	45.3	Claystone, phosphatic, dolomitic
26H	Meade Peak	5.2	50.5	Claystone, phosphatic dolomitic
26J	Franson	4.5		Dolomite, cherty, calcareous
27A	Grandeur	not measured		Limestone, fossiliferous
27B	Grandeur	12.0*		Limestone, argillaceous, phosphatic
27C	Grandeur	50.0*		Limestone, argillaceous to siliceous
27D	Grandeur	40.0*		Limestone, argillaceous to siliceous
27E	Grandeur	10.0*		Limestone, argillaceous to siliceous, cherty

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued)

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
27F	Meade Peak	12.5*	12.5	Claystone, phosphatic calcareous
27G	Meade Peak	3.0*	15.5	Claystone, phosphatic, calcareous
27H	Meade Peak	3.0*	18.5	Claystone, phosphatic, calcareous
27J	Meade Peak	4.5*	23.0	Claystone, phosphatic, calcareous
27K	Rex	1.5*	24.5	Limestone, argillaceous, siliceous
27L	Rex	3.0*	27.5	Limestone, argillaceous, siliceous
27M	Rex	3.0*	30.5	Limestone, argillaceous, siliceous
27N	Rex	3.0*	33.5	Limestone, argillaceous, siliceous
27P	Rex	6.5*	40.0	Limestone, argillaceous, siliceous
27Q	Rex	7.0*	47.5	Limestone, argillaceous, siliceous
27R	Rex	6.5*	54.0	Claystone
27S	Franson	not measured		Dolomite, argillaceous
28A	Franson	1.0		Limestone, phosphatic
28B	Retort	1.0	1.0	Phosphorite
28C	Retort	3.0	4.0	Claystone
28D	Retort	3.0	7.0	Claystone

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued)

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
28E	Retort	3.0	10.0	Claystone
28F	Retort	3.0	13.0	Claystone
28G	Retort	0.2	13.2	Dolomite, argillaceous, phosphorite
28H	Retort	4.0	17.2	Claystone, silty
28J	Retort	1.0	18.2	Claystone, silty, sideritic (?)
29A	Meade Peak	1.8*	1.8	Claystone, silty
29B	Meade Peak	0.5*	2.3	Chert, crystalline
29C	Meade Peak	3.7	6.0	Claystone, silty
29D	Meade Peak	2.0	8.0	Claystone, silty
	Franson	not measured		
29E	Retort	1.0	1.0	Limestone, argillaceous
29F	Retort	15.	2.5	Limestone, argillaceous
29G	Retort	1.0	3.5	Limestone, argillaceous
31A	Shedhorn	1.3		Sandstone, phosphatic
31B	Retort	1.8	1.8	Claystone, phosphatic and phosphorite
31C	Retort	1.7	3.5	Claystone, phosphatic and phosphorite
31D	Retort	0.2	3.7	Phosphorite
31E	Retort	0.6	4.3	Claystone, phosphatic
31F	Tosi	not measured		Chert in phosphatic limestone matrix
35A	Shedhorn	not measured		Sandstone
35B	Retort	1.5	1.5	Siltstone

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued)

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
35C	Retort	2.0	3.5	Siltstone
35D	Retort	2.0	5.5	Siltstone
35E	Retort	2.0	7.5	Siltstone
35F	Retort	1.0	8.5	Claystone, siliceous (?)
35G	Retort	3.0	11.5	Claystone, siliceous (?)
35H	Retort	3.0	14.5	Claystone, siliceous (?)
35I	Retort	2.5	16.5	Claystone, siliceous (?)
35J	Retort	0.8	17.3	Claystone, silty
35K	Retort	3.0	20.3	Claystone, silty
35L	Retort	7.5	27.8	Claystone, silty, siliceous
36A	Retort (?)	2.1		Mudstone, phosphertic carbonaceous
36B	Shedhorn	1.0		Quartzite
36C	Retort (?)	1.7		Mudstone, carbonaceous phosphatic
	Shedhorn	10.0		Quartzite
	Retort (?)	7.0		Mudstone, silicified
36D	Retort (?)	3.0		Claystone and mudstone
37A	Franson	not measured		Chert in phosphatic limestone matrix
37B	Retort	3.0*	3.0	Siltstone, phosphatic, calcareous
37C	Retort	1.5*	4.5	Mudstone and claystone, carbonaceous
37D	Retort	0.5*	5.0	Mudstone and claystone, carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
37E	Retort	1.0	6.0	Dolomite, argillaceous, phosphatic
37F	Retort	2.0	8.0	Claystone, carbonaceous
37G	Retort	0.6	8.6	Phosphorite, carbonaceous
37H	Retort	3.0	11.6	Mudstone, phosphatic, carbonaceous
37J	Retort	5.0	16.6	Mudstone, phosphatic, carbonaceous
37K	Retort	7.0	23.6	Mudstone, phosphatic, carbonaceous
37L	Retort	1.5*	25.1	Mudstone, silty, phosphatic
37M	Retort	1.5*	26.6	Mudstone, silty, phosphatic
37N	Shedhorn	not measured		Phosphorite, sandy; sandstone
38A	Retort	0.5*	0.5	Phosphorite
38B	Retort	1.2*	1.7	Siltstone, phosphatic, carbonaceous
38C	Retort	1.5*	3.2	Siltstone, phosphatic, carbonaceous
38D	Retort	1.4*	4.6	Siltstone, phosphatic, carbonaceous
38E	Retort	1.8*	6.4	Siltstone, phosphatic, carbonaceous
38F	Retort	1.0*	7.4	Claystone, carbonaceous
38G	Retort	0.8*	8.2	Siltstone, phosphatic
38H	Retort	1.7*	9.9	Mudstone, phosphatic, carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
38J	Retort	1.9*	11.8	Mudstone, phosphatic, carbonaceous
38K	Retort	1.8*	13.6	Mudstone, phosphatic, carbonaceous
38L	Tosi	1.0+*		Chert
39A	Retort	0.7	0.7	Mudstone
39B	Retort	0.7	1.4	Mudstone
39C	Retort	0.7	2.1	Mudstone
39D	Retort	0.7	2.8	Mudstone
39E	Retort	0.7	3.5	Mudstone
39F	Retort	0.7	4.2	Mudstone
39G	Retort	0.7	4.9	Mudstone
39H	Retort	0.7	5.6	Mudstone
39J	Retort	0.7	6.3	Mudstone
39K	Retort	0.7	7.0	Mudstone
39L	Retort	0.7	7.7	Mudstone
39M	Retort	0.7	8.4	Mudstone
39N	Retort	0.7	10.1	Mudstone
39P	Retort	0.7	10.8	Mudstone
40A	Retort	0.5	0.5	Phosphorite, sandy
40B	Retort	1.0	1.5	Phosphorite, sandy

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
40C	Retort	0.7	2.2	Phosphorite, pelletal
40D	Retort	0.2	2.4	Claystone, phosphatic, carbonaceous
40E	Retort	0.2	2.6	Claystone, phosphatic, carbonaceous
40F	Retort	0.4	3.0	Phosphorite, calcareous
40G	Retort	0.14	3.1	Claystone, very carbonaceous
40H	Retort	1.0	4.1	Siltstone, argillaceous carbonaceous
40J	Retort	1.0	5.1	Siltstone, argillaceous, carbonaceous
40K	Retort	1.0	6.1	Siltstone, argillaceous, carbonaceous
40L	Retort	1.0	7.1	Mudstone, siliceous, carbonaceous
40M	Retort	2.0	9.1	Mudstone, siliceous, carbonaceous
40N	Retort	2.0	11.1	Mudstone, siliceous, carbonaceous
40P	Retort	5.0	16.1	Mudstone, siliceous, carbonaceous
40Q	Tosi	not measured		Chert
42A	Meade Peak	1.2	1.2	Phosphorite
42B	Meade Peak	0.8	2.0	Siltstone
42C	Meade Peak	0.7*	2.7	Phosphorite
42D	Meade Peak	1.3*	4.0	Claystone, very carbonaceous
42E	Meade Peak	2.2*	6.2	Mudstone, carbonaceous

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number [1]	Stratigraphic unit	Thickness (in metres) [2]	Cumulative thickness of shale members	Rock description
42F	Meade Peak	1.8*	8.0	Claystone, carbonaceous
42G	Meade Peak	1.0	9.0	Mudstone
42H	Meade Peak	1.3*	10.3	Siltstone
42J	Meade Peak	1.0*	11.3	Siltstone, argillaceous
42K	Franson	0.7		Chert; carbonate rock
43A	Retort	0.1	0.1	Phosphorite
43B	Retort	0.5	0.6	Mudstone, calcareous, phosphatic
43C	Retort	1.2	1.8	Limestone, argillaceous, phosphatic
43D	Retort	3.0	4.8	Mudstone, calcareous
43E	Retort	0.7	5.5	Mudstone
43F	Tosi	13.0*		Chert in phosphatic carbonate matrix
44A	Meade Peak	4.2	4.2	Mudstone
44B	Meade Peak	4.4	8.6	Mudstone
44C	Meade Peak	4.4	13.0	Mudstone, calcareous
44D	Meade Peak	3.2	16.2	Claystone, phosphatic and phosphorite
44E	Meade Peak	12.0	28.2	Limestone, argillaceous
44F	Meade Peak	0.5	28.7	Mudstone
44G	Meade Peak	1.3	30.0	Phosphorite
44H	Meade Peak	0.7	30.7	Limestone, phosphatic

Table 2.--Stratigraphic unit, thickness, and brief lithologic description of samples (continued).

Sample number 1/	Stratigraphic unit	Thickness (in metres) 2/	Cumulative thickness of shale members	Rock description
44J	Meade Peak	0.5	41.2	Phosphorite, calcareous
44K	Meade Peak	0.4	41.6	Mudstone
44L	Meade Peak	2.1	43.7	Mudstone
44M	Meade Peak	2.0	45.7	Mudstone, siliceous
44N	Meade Peak	2.0	47.7	Mudstone, calcareous
44P	Meade Peak	2.2	49.9	Mudstone, calcareous
44Q	Franson	7.0		Limestone, argillaceous; chert

1/ Number is map index number; individual samples tabulated alphabetically in ascending stratigraphic sequence.

2/ Individual samples are mostly collected in channels across this thickness. Those marked with * are spot samples probably representative for the indicated thickness. Those marked with † are composite samples, mostly collected in channels; but combined proportionately before laboratory analyses. a/ Auxiliary sample also included as part of sample 13 F. b/ Sample from little weathered material of underground mine dump. c/Parentheses indicate that stratigraphic assignment is uncertain.

Table 3.--Analytical data, values reported in percent

Total carbon determined by induction furnace, carbonate carbon determined gasometrically, organic carbon determined as the difference; analysts: V. E. Shaw and T. L. Yager. Elemental data obtained by six-step semiquantitative spectrographic method; analysts: J. C. Hamilton and L. A. Bradley. Leaders (---) indicate element looked for but not detected; blank spaces indicate no data.

	Anderson Mine		Kelley Gulch							
Sample No.	1A	1B	2B	2C	2D	2E	2G	2H	2J	2K
Thickness in metres	1.2	4.8	1.0	1.0	1.0	3.0	3.0	3.2	2.6	4.0
Carbon, total	0.51	0.45	0.84	0.82	11.0	0.98	1.13	0.49	0.24	0.87
as carbonate	---	---	---	---	11.1	---	.56	---	---	---
as organic	---	---	---	---	< .1	---	.6	---	---	---
Ag	---	---	.0007	.001	---	.0015	---	---	---	---
Al	1	2	7	7	.7	7	.7	.7	10	.7
B	---	---	.007	.007	---	.015	---	---	.005	---
Ba	.015	.015	.07	.05	.005	.05	.005	.007	.1	.015
Be	.0003	.0003	.0003	.0003	---	.0003	---	---	---	---
Ca	>10	>10	10	>10	>10	>10	>10	7	.3	1.5
Cd	---	---	---	---	.01	---	.01	---	---	---
Ce			.03			.03		.03		
Co	---	---	---	---	---	---	---	---	---	---
Cr	.05	.03	.15	.1	.02	.2	.02	.02	.0002	.01
Cu	.0015	.005	.02	.01	.003	.03	.005	.0015	.0003	.0007
Fe	1	.7	5	3	.3	1.5	.7	.7	2	.3
Ga	---	---	.0015	.0015	---	.0015	---	---	.0015	---
K	---	---	3	3	---	2	---	---	1.5	---
La	.03	.03	.015	.03	.007	.02	.03	.02	.007	---
Mg	.2	.2	.7	1	10	.7	.2	.2	.7	.15
Mn	.002	.0015	.005	.002	.03	.003	.1	.02	.015	.01
Mo	.0015	<.0007	.002	.001	---	.002	.0007	---	---	---
Nb	---	---	.002	.002	---	---	---	---	.002	---
Nd	.02	.03	015	.02	---	.015	.02	.015	---	
Ni	.003	.0015	.01	.015	.01	.02	.02	.005	.001	.0015
P	>10	>10	3	7	.5	5	>10	3	---	---
Pb	.002	.002	---	---	---	.002	---	---	.002	---
Sc	.0015	.001	.0015	.002	---	.0015	---	---	.001	---
Sr	.15	.1	.03	.05	.03	.05	.05	.03	.03	.003
Ti	.05	.07	.3	.3	.03	.3	.03	.03	.3	.03
V	.03	.02	.05	.015	.005	.03	.007	.005	.007	.005
Y	.05	.05	.02	.05	.002	.02	.02	.02	.002	.003
Yb	.003	.003	.0015	.002	---	.002	.0015	.001	.0002	.0002
Zn	---	---	---	<.07	<.07	.07	<.07	---	---	---
Zr	.007	.007	.02	.02	.003	.02	.003	.007	.03	.003

Table 3.--Analytical data, values reported in percent (continued)

Place	Aspen Valley										Canyon Camp
Sample No.	3A	3B	3C	3D	3E	3F	3G	3H	3J	3K	4A
Thickness in metres	2±	2.5	3.0	1.6	0.5	1.7	1.0	2.0	2.7	2.0	5.0
Carbon, total	0.58	0.47	0.14	0.29	0.32	0.31	0.14	0.30	0.18	0.50	3.66
as carbonate	---	---	---	---	---	---	---	---	---	---	3.49
as organic	---	---	---	---	---	---	---	---	---	---	.02
Ag	---	---	---	---	---	---	---	---	---	---	---
Al	3	10	5	7	7	>10	5	10	7	10	.5
B	.005	.005	.005	.005	.005	.007	.005	.007	.005	.005	.005
Ba	.05	.05	.05	.2	.03	.03	.02	.05	.05	.03	.02
Be	---	---	---	---	---	.0003	---	.0003	---	.0003	---
Ca	.2	.1	.5	.1	.07	.1	.07	.3	.07	.1	>10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	<.05	---	---	---	---	---	---	---	---	---	---
Co	---	---	---	---	---	.001	.0015	.001	---	---	---
Cr	.002	.003	.007	.005	.003	.005	.005	.007	.005	.007	.007
Cu	.001	.0015	.0015	.007	.003	.007	.003	.003	.0015	.005	.0003
Fe	3	2	1.5	1.5	.7	1.5	.7	1.5	3	1.5	.3
Ga	.001	.0015	.001	.0015	.0015	.002	.0015	.002	.0015	.003	---
K	---	---	1.5	---	---	1.5	---	1.5	1.5	1.5	---
La	.015	---	---	---	---	---	.007	.007	.007	---	---
Mg	.2	.2	.5	.2	.15	.3	.2	.7	.3	.5	7
Mn	.002	.007	.015	.007	.003	.007	.007	.01	.02	.005	.03
Mo	---	---	---	.0007	---	---	---	---	---	---	---
Nb	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	---
Nd	.015	---	---	---	---	---	---	---	---	---	
Ni	---	.0015	.0015	.0015	---	.001	.001	.001	.001	.001	.0015
P	---	---	---	---	---	---	---	---	---	---	.5
Pb	.003	.002	---	.002	---	.003	---	.002	---	.003	---
Sc	.001	---	.001	.001	---	.001	---	.001	.001	.0015	---
Sr	.1	.01	.02	.007	.05	.01	.01	.02	.02	.01	.007
Ti	.3	.3	.3	.5	.5	.5	.3	.5	.3	.3	.015
V	.007	.015	.015	.01	.007	.015	.007	.01	.007	.015	.002
Y	.007	.002	.003	.002	.002	.002	.002	.003	.003	.003	.003
Yb	.0007	.0003	.0005	.0003	.0003	.0003	.0002	.0005	.0003	.0003	.0002
Zn	---	---	---	---	---	---	---	---	---	---	---
Zr	.03	.02	.03	.02	.015	.02	.015	.015	.02	.007	.003

Table 3.--Analytical data, values reported in percent (continued)

Place	Canyon Camp (continued)										Little Sheep Creek
Sample No.	4B	4C	4D	4E	4F	4G	4H	4J	4K	4N	5B
Thickness in metres	1.1	0.4	1.0	1.1	0.6	0.7	1.8	1.0	0.4	1±	0.5
Carbon, total	6.34	7.05	3.90	6.30	12.0	13.0	10.9	8.71	5.32	1.60	8.99
as carbonate	0.72	1.25	1.64	0.81	11.2	0.24	3.10	6.54	1.30	0.53	0.48
as organic	5.6	5.8	2.3	5.5	0.9	12.8	7.8	2.2	4.0	1.1	8.5
Ag	.0007	.0005	.0003	.0005	---	.002	.0015	---	.0007	---	.0003
Al	5	3	7	3	1	7	3	.7	1.5	1	3
B	.007	.005	.01	.005	---	.01	.005	---	---	.005	.01
Ba	.03	.015	.03	.02	.003	.05	.015	.01	.015	.015	.015
Be	.0003	.0003	.0003	.0003	---	.0003	---	---	---	---	---
Ca	10	>10	>10	>10	>10	>10	>10	>10	>10	2	7
Cd	.01	.01	---	---	---	.01	.015	---	---	---	---
Ce	---					---				---	<.05
Co	---	---	.001	---	---	.001	---	---	---	---	.001
Cr	.07	.15	.07	.1	.015	.15	.1	.05	.07	.01	.07
Cu	.007	.007	.007	.007	.0007	.02	.007	.002	.007	.002	.01
Fe	2	1	3	1	.7	3	1	.5	1	.5	1.5
Ga	.0015	.001	.0015	---	---	.0015	.001	---	---	---	.0015
K	1.5	---	2	---	---	5	1.5	---	---	---	1.5
La	.007	.05	.015	.07	---	.015	.02	.03	.05	.007	.01
Mg	1	1.5	2	1	>10	1	5	10	1	.3	.5
Mn	.015	.01	.02	.01	.02	.01	.02	.1	.015	.015	.015
Mo	.005	.005	.005	.003	.0007	.02	.007	.0007	.0015	---	.0007
Nb	---	---	---	---	---	---	---	---	---	---	<.002
Nd	---	.02	---	.03		---	.015	.015	.03	---	<.015
Ni	.01	.01	.01	.01	.002	.02	.015	.003	.007	.002	.015
P	.7	>10	1.5	>10	---	1.5	7	7	>10	---	1.5
Pb	.002	.002	.002	---	---	.002	.002	---	---	---	---
Sc	.001	.0015	.0015	.0015	---	.0015	.001	---	.001	---	.001
Sr	.015	.1	.07	.1	.03	.05	.1	.1	.1	.01	.015
Ti	.3	.1	.5	.15	.03	.3	.1	.03	.07	.05	.3
V	.05	.1	.03	.03	.007	.15	.07	.02	.02	.01	.01
Y	.01	.07	.015	.1	---	.015	.02	.03	.07	.003	.007
Yb	.0007	.003	.0007	.003	---	.0015	.0015	.0015	.003	.0002	.0007
Zn	.15	.07	.07	.05	---	.15	.15	---	.07	---	---
Zr	.03	.015	.03	.015	.002	.02	.015	.007	.01	.005	.01

Table 3.--Analytical data, values reported in percent (continued)

Little Sheep Creek (continued)

Place											
Sample No.	5C	5D	5E	5F	5G	5H	5J	5K	5L	5M	5N
Thickness in metres	1.0	3.0	1.5	1.0	1.0	1.0	0.25	0.25	0.25	0.25	0.25
Carbon, total	2.75	16.2	19.0	19.1	11.9	11.9	16.3	19.2	16.4	1.53	15.6
as carbonate	.24	4.26	.12	.10	7.99	.29	.11	.09	.03	.10	<.01
as organic	2.5	11.9	18.9	19.0	3.9	11.6	16.2	19.2	16.4	15.2	15.6
Ag	.0002	.0005	.0007	.001	.0001	.0003	.0007	.0005	.0003	.0007	.0007
Al	3	3	3	3	2	7	3	3	3	5	5
B	.01	.007	.01	.007	<.005	.015	.01	.01	.01	.01	.01
Ba	.015	.01	.015	.015	.005	.03	.015	.02	.015	.02	.02
Be	---	---	.0003	.0003	---	.0003	<.0002	.0003	<.0003	.0003	<.0003
Ca	2	>10	5	7	>10	7	10	5	.5	1.5	1.5
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	<.05		<.05	<.05	---	<.05	<.05	<.05	<.05	<.05	<.05
Co	<.001	---	<.001	---	.003	<.001	---	---	---	---	---
Cr	.03	.07	.1	.15	.015	.07	.1	.1	.07	.1	.07
Cu	.005	.01	.02	.015	.003	.005	.015	.02	.02	.03	.015
Fe	1.5	1	1.5	1.5	.7	2	2	2	3	3	3
Ga	.0015	.001	.0015	.0015	<.001	.0015	.001	.0015	.0015	.0015	.0015
K	---	1.5	2	1.5	---	3	1.5	3	3	3	3
La	<.01	.015	.015	.015	---	.01	.015	.015	.01	.02	.015
Mg	.5	.5	.7	.5	.7	.7	.5	.5	.5	.5	.5
Mn	.015	.03	.007	.007	.07	.007	.007	.007	.007	.007	.007
Mo	.0007	.0015	.005	.005	.0015	.005	.003	.002	.0015	.003	.003
Nb	<.002	<.002	<.002	<.002	<.002	.002	<.002	<.002	<.002	<.002	<.002
Nd	---	<.015	.015	.015		<.015	<.015	<.	<.015	.02	.015
Ni	.007	.015	.015	.015	.015	.01	.01	.015	.01	.015	.015
P	.7	3	3	3	1	3	5	3	.7	1.5	1.5
Pb	---	---	.002	.002	---	.002	.002	.002	---	.002	.002
Sc	<.001	.0015	.0015	.0015	.000	.0015	.0015	.0015	.0015	.0015	.0015
Sr	.007	.03	.015	.02	.03	.015	.03	.015	.007	.015	.015
Ti	.15	.1	.2	.2	.05	.3	.2	.3	.3	.3	.3
V	.007	.015	.02	.03	.007	.02	.015	.015	.015	.02	.015
	.005	.015	.015	.015	.002	.007	.01	.015	.007	.03	.015
Yb	.0003	.0007	.0007	.0015	<.0002	.0005	.001	.001	.0005	.002	.001
Zn	---	.15	.07	.07	.07	---	---	---	<.01	.07	<07
Zr	.01	.007	.01	.01	.003	.015	.01	.01	.01	.01	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Little Sheep Creek (continued)						Gros Ventre Slide				
Sample No.	5P	5Q	5R	5AB	5CM	5DG	6A	6B	6C	6D	6E
Thickness in metres	0.25	0.25	0.25	3.5	0.4	8.0	1.0	1.2	1.0	0.6	0.5
Carbon, total	15.8	21.5	18.9	12.1	11.7	3.24	1.03	6.67	1.95	3.51	4.95
as carbonate	.09	.09	.07	.05	10.1	.17	.68	6.51	1.59	3.12	4.65
as organic	15.7	21.4	18.8	12.0	1.6	3.1	.4	.2	.4	.4	.3
Ag	.0005	.0007	.001	.0007	---	.00015	---	---	---	---	---
Al	3	5	5	3	1.5	3	1	3	7	5	3
B	.01	.01	.01	.007	---	.01	---	.01	.015	.015	.007
Ba	.02	.03	.02	.02	.007	.02	.02	.05	.05	.03	.02
Be	.0003	<.0003	<.0003	.0002	---	.0002	---	---	.0003	.0003	---
Ca	2	.7	.7	7	>10	10	>10	>10	5	7	>10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	<.05	<.05	<.05						---	---	---
Co	---	<.001	---	---	---	.0005	---	---	---	---	---
Cr	.07	.15	.01	.1	.015	.07	.1	.015	.07	.05	.03
Cu	.015	.03	.03	.015	.0007	.01	.007	.002	.001	.0007	.0005
Fe	3	2	3	1.5	.5	3.	1.5	.7	1.5	2	1
Ga	.0015	.0015	.0015	.0015	---	.0015	---	.001	.0015	.0015	.001
K	3	3	2	3	.7	3	---	5	7	7	3
La	.015	.015	.01	.015	---	.015	.03	---	---	.007	---
Mg	.5	.5	.5	.7	.7	1	.3	10	2	5	7
Mn	.007	.007	.007	.003	.02	.01	.003	.015	.005	.007	.01
Mo	.002	.003	.0015	.0015	.0007	.0015	.001	.0007	.0007	.0007	.0007
Nb	<.002	<.002	<.002	---	---	>.001	---	---	<.002	---	---
Nd	<.015	.015	.015	.015		.007	.015			---	
Ni	.01	.015	.015	.015	.002	.015	.003	.002	.005	.01	.005
P	2	.7	.7	2	---	5	>10	---	---	---	---
Pb	<.002	.002	.002	.0015	---	.0015	.007	---	<.002	---	---
Sc	.001	.0015	.0015	.0007	---	.001	<.001	.0015	.0015	.0015	<.001
Sr	.015	.015	.015	.03	.05	.03	.1	.015	.015	.015	.015
Ti	.3	.3	.3	.15	.07	.15	.05	.2	.3	.2	.15
V	.015	.02	.015	.03	.007	.015	.03	.015	.05	.02	.01
Y	.015	.01	.015	.015	.002	.015	.03	.002	.003	.003	.002
Yb	.001	.0007	.001	.001	.0001	.0007	.0015	.0002	.0003	.0003	.0002
Zn	<.07	---	<07	.07	---	.05	---	---	---	---	.07
Zr	.015	.015	.015	.01	.005	.015	.005	.015	.02	.01	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Gros Ventre Slide (continued)										
Sample No.	6F	6G	6H	6J	6K	6L	6M	6N	6P	6Q	6R
Thickness in metres	0.8	7.0	1.7			1.4	3.3	3.0	1.5	2.7	3.7
Carbon, total	2.68	3.83	3.18	1.95	8.71	2.17	4.08	10.1	4.32	3.78	7.77
as carbonate	2.38	.63	.60	1.82	8.56	1.95	3.82	9.63	4.19	3.40	7.63
as organic	.3	3.2	2.6	.1	.2	.2	.3	.5	.1	.4	.1
Ag	---	.0003	.0003	---	---	---	---	---	---	---	---
Al	3	5	5	.5	.7	1.5	3	2	7	5	3
B	.01	.01	.015	---	---	.005	.007	---	.007	.01	.005
Ba	.05	.05	.05	.07	.02	.02	.05	.02	.07	.05	.02
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	7	7	3	10	>10	5	10	>10	10	7	>10
Cd	---	<.01	<.01	---	---	---	---	---	---	---	---
Ce	---	---	---	---		---	---		---	---	
Co	---	---	---	---	---	---	<.001	---	<.001	<.001	<.001
Cr	.03	.05	.05	.007	.01	.01	.007	.0015	.007	.005	.003
Cu	.001	.005	.007	.0003	.0003	.0007	.0015	.0007	.002	.005	.002
Fe	1	1.5	2	.2	.5	.7	1.5	1.5	2	2	1.5
Ga	.001	.0015	.0015	---	---	---	.001	<.001	.0015	.0015	<.001
K	3	3	5	---	---	---	3	1.5	7	7	3
La	---	.01	.007	.007	---	---	---	---	.007	.007	---
Mg	3	1	1.5	2	>10	2	5	>10	7	5	7
Mn	.007	.015	.02	.03	.2	.15	.3	1.5	.3	.3	.5
Mo	---	.0015	.002	---	---	---	---	---	---	---	---
Nb	---	---	---	---	---	---	---	---	---	---	---
Nd		.015	.015	---					---	---	
Ni	.007	.007	.007	<.001	<.001	<.001	.001	<.001	.001	.001	.001
P	---	3	1.5	1.5	1	---	---	---	---	---	---
Pb	---	.002	.005	<.002	.003	.002	.002	---	---	---	---
Sc	<.001	.001	.001	---	---	---	<.001	---	.0015	.001	<.001
Sr	.01	.02	.015	.01	.015	.007	.015	.01	.03	.03	.015
Ti	.2	.2	.3	.02	.02	.07	.3	.1	.3	.3	.2
V	.01	.015	.02	.002	.005	.002	.005	.0015	.01	.007	.005
Y	.002	.01	.005	.005	.003	.002	.003	.002	.003	.002	<.002
Yb	.0002	.0007	.0005	.0003	.0002	.0002	.0003	---	.0002	.0002	---
Zn	---	.1	.15	---	---	---	---	---	---	---	---
Zr	.01	.01	.01	.01	<.002	.01	.03	.005	.015	.01	.005

Table 3.--Analytical data, values reported in percent (continued)

Place	Stony Point							Fall Creek			
Sample No.	7A	7B	7C	7D	7E	7F	7G	8A	8B	8C	8D
Thickness in metres	1.2	2.8	2.4	1.0	1.0	1.0	2.0	3.0	3.0	3.0	2.4
Carbon, total	2.55	5.71	8.23	4.35	3.40	3.64	3.41	1.87	1.05	2.85	4.88
as carbonate	2.14	5.40	8.14	1.41	1.41	1.99	1.25	1.26	.94	2.86	4.59
as organic	.4	.3	<.1	2.9	2.0	1.6	2.2	.6	.1	<.1	.3
Ag	---	---	---	---	---	---	---	---	---	---	---
Al	3	3	3	3	5	3	3	2	5	5	2
B	.015	.007	.007	.01	.015	.01	.01	.007	.015	.01	.007
Ba	.02	.015	.01	.015	.03	.02	.02	.02	.05	.03	.02
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	7	≥10	≥10	10	10	10	7	2	2	7	10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---	---
Co	---	---	---	---	---	---	---	<.001	.001	.001	.001
Cr	.015	.005	.005	.05	.05	.05	.03	.003	.007	.005	.005
Cu	.0015	.002	.0015	.005	.003	.003	.005	.0007	.001	.001	.001
Fe	1.5	1	1.5	2	3	2	2	1	3	2	1.5
Ga	---	---	.001	.0015	.0015	.0015	.001	.001	.0015	.0015	.001
K	2	3	5	2	5	3	2	2	3	3	3
La	---	---	---	.007	.007	.007	---	---	---	---	---
Mg	1.5	7	7	1.5	2	3	1	1.5	1.5	5	5
Mn	.01	.015	.02	.015	.015	.02	.015	.01	.015	.02	.02
Mo	---	---	---	---	---	---	---	---	---	---	---
Nb	---	---	---	---	---	---	---	<.002	<.002	<.002	---
Nd				---	---	---					
Ni	.0015	.001	.0015	.007	.007	.005	.007	.0007	.001	.0015	.003
P	---	---	---	1.5	.5	---	---	---	---	---	---
Pb	---	---	---	.002	.002	.002	---	---	---	---	---
Sc	.001	---	---	.001	.001	.001	.001	---	<.001	.001	<.001
Sr	.015	.01	.015	.015	.015	.01	.007	.003	.007	.007	.007
Ti	.2	.15	.15	.2	.3	.2	.2	.2	.3	.2	.1
V	.002	.0015	.002	.003	.005	.003	.003	.005	.007	.005	.007
Y	.003	---	---	.007	.005	.003	.003	.002	.003	.002	.002
Yb	.0003	---	---	.0007	.0003	.0003	.0003	.0002	.0003	.0003	.0002
Zn	---	---	---	.05	---	---	---	---	---	---	---
Zr	.01	.01	.007	.01	.015	.01	.015	.05	.05	.03	.02

Table 3.--Analytical data, values reported in percent (continued)

Place	Fall Creek (continued)										
Sample No.	8E	8F	8G	8H	8J	8K	8L	8M	8N	8P	8Q
Thickness in metres	0.7	3.0	3.0	3.0	1.5	1.4	7.0	3.0	3.0	2.0	3.3
Carbon, total	10.66	5.19	5.18	5.01	9.68	7.73	5.09	4.32	2.19	5.35	7.33
as carbonate	10.61	5.08	4.77	4.59	9.74	6.69	4.55	3.27	.46	3.72	2.89
as organic	<.1	.1	.4	.4	<.1	1.0	.5	1.0	1.7	1.6	4.4
Ag	---	---	---	---	---	.0003	---	.0003	.0015	.001	.002
Al	.7	.5	.5	1	.3	2	.5	2	2	3	3
B	---	---	---	---	---	.005	<.005	.005	<.005	<.005	.005
Ba	.002	.005	.005	.007	.001	.01	.003	.02	.02	.015	.015
Be	---	---	---	---	---	---	---	---	.0003	---	---
Ca	10	10	10	10	>10	>10	7	>10	>10	>10	>10
Cd	---	---	---	---	---	---	---	---	.01	<.01	.015
Ce	---	---	---	---			---	---			
Co	---	---	---	---	---	---	---	---	---	---	---
Cr	.005	.003	.005	.015	.015	.05	.015	.03	.1	.1	.2
Cu	.0007	.0003	.001	.0015	.0007	.003	.001	.003	.01	.01	.02
Fe	.2	.15	.2	.3	.15	1.5	.15	.7	.7	1	1
Ga	---	---	---	---	---	.001	---	.001	---	---	---
K	---	---	---	---	---	1.5	---	1.5	---	---	---
La	---	---	---	---	.007	---	---	.007	.07	.02	.03
Mg	>10	5	7	7	10	10	5	5	.5	5	5
Mn	.03	.01	.01	.007	.007	.007	.007	.01	.003	.01	.007
Mo	---	---	.0007	.0007	.0007	.007	---	.003	.005	.01	.007
Nb	---	---	---	<.002	---	<.002	---	---	---	---	---
Nd					---			---	.03	.015	.015
Ni	.002	.002	.003	.003	.002	.01	.002	.01	.015	.02	.03
P	---	---	---	---	.7	---	---	2	>10	7	10
Pb	---	---	---	---	---	---	---	---	<.002	<.002	.002
Sc	---	---	---	---	---	<.001	---	---	.0015	<.001	.001
Sr	.015	.005	.007	.005	.015	.01	.003	.015	.2	.1	.15
Ti	.03	.03	.02	.05	.02	.1	.03	.15	.15	.2	.15
V	.007	.005	.005	.003	.007	.02	.002	.015	.07	.07	.15
Y	.002	.002	.002	.002	.005	.003	.002	.007	.07	.02	.03
Yb	---	---	---	---	.0003	.0003	.0002	.0005	.003	.0015	.002
Zn	---	---	---	---	---	.1	---	.15	.15	.15	.15
Zr	.007	.02	.015	.007	.007	.01	.005	.015	.02	.015	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Fall Creek (continued)				Astoria Hot Springs						
Sample No.	8R	8S	8T	8U	9A	9B	9C	9D	9E	9F	9G
Thickness in metres	0.9	1.7	2.0	0.7	4.0	0.5	3.0	2.4	0.6	0.4	0.3
Carbon, total	7.33	3.51	1.35	1.70	13.7	13.5	13.9	14.6	11.4	7.15	6.38
as carbonate	6.50	.33	.78	.45	1.85	11.6	2.30	3.84	10.3	.45	2.13
as organic	.8	3.2	.6	1.2	11.9	1.9	11.6	10.8	1.0	6.7	4.2
Ag	.0005	.001	.0003	.0007	.0015	.0002	.002	.0015	.0002	.0015	.0007
Al	3.	5	.7	2	2	.7	3	2	1.5	3	5
B	<.005	.01	---	<.003	.007	<.005	.01	.007	---	.007	.007
Ba	.01	.02	.015	.015	.015	.0015	.015	.02	.003	.015	.02
Be	---	---	---	---	<.0003	---	---	---	---	.0003	---
Ca	>10	>10	>10	>10	10	>10	>10	>10	>10	>10	5
Cd	.01	.015	---	---	<.05	---	<.05	<.05	---	<.05	---
Ce			.07		<.05	---	<.05	<.05	---	<.05	<.05
Co	---	<.001	---	---	<.001	<.001	<.001	---	<.001	<.001	<.001
Cr	.07	.1	.1	.15	.3	.02	.15	.15	.007	.15	.02
Cu	.007	.01	.0007	.005	.015	.0015	.015	.015	0015	.015	.005
Fe	1.5	2	.3	.7	1.5	2	1.5	1	.5	1.5	1.5
Ga	---	.0015	---	---		---	.001	.001	---	.0015	.001
K	1.5	1.5	---	---	1.5	---	3	1.5	---	1.5	3
La	.007	.015	.15	.03	.015	---	.015	.015	---	.03	---
Mg	10	.7	.3	.2	1.5	10	1.5	3	>10	.5	2.
Mn	.015	.015	.01	.002	.01	.015	.01	.01	.015	.005	.03
Mo	.007	.015	---	.0007	.02	.002	.02	.015	.0015	.007	.0015
Nb	---	<.002	---	---	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Nd	---	.015	.05	.015	.015		<.015	<.015		.015	
Ni	.015	.02	.003	.003	.03	.005	.03	.015	.003	.015	.007
P	1	3	>10	>10	5	---	3	5	---	10	.7
Pb	<.002	.002	---	<.002	.003	---	.003	.003	---	.003	.002
Sc	<.001	.0015	<.001	.001	<.001	---	.001	<.001	---	.0015	.001
Sr	.03	.03	.3	.07	.05	.015	.02	.03	.01	.05	.007
Ti	.2	.3	.05	.15	.15	.02	.2	.15	.07	.15	.3
V	.07	.2	.015	.02	.15	.03	.2	.15	.015	.07	.03
Y	.005	.015	.15	.05	.015	<.002	.01	.015	<.002	.02	.003
Yb	.0005	.0015	.007	.002	.0015	<.0002	.001	.001	<.0002	.0015	.0003
Zn	.1	.15	---	.1	.2	---	.5	.2	---	.15	.07
Zr	.015	.02	.007	.01	.01	.003	.01	.007	.007	.015	.03

Table 3.--Analytical data, values reported in percent (continued)

Place	Astoria Hot Springs (continued)						Kendall Warm Springs				
Sample No.	9H	9J	9K	9L	9M	9AE	10A	10B	10C	10D	10E
Thickness in metres	0.1	0.5	0.3	1.8	1.8	5.5	0.2	0.3	2.2	1.3	0.25
Carbon, total	5.86	11.0	7.50	1.56	7.18	2.67	3.91	5.12	3.92	5.60	4.69
as carbonate	.23	9.73	.74	.31	.38	.09	1.50	3.96	1.90	4.62	.21
as organic	5.6	1.3	6.8	1.2	6.8	2.6	2.4	1.2	2.0	1.0	4.5
Ag	.001	.0001	.0007	.0002	.001	.0001	---	---	---	---	.0003
Al	3	1.5	3	7	3	2	3	1.5	5	5	7
B	.01	<.005	.007	.007	.01	.007	.015	.007	.015	.015	.02
Ba	.02	.007	.015	.03	.02	.05	.015	.01	.015	.015	.03
Be	.0003	---	.0003	---	.0003	.00015	---	---	---	---	.0003
Ca	>10	>10	>10	1	>10	10	5	10	7	10	5
Cd	<.05	---	<.05	---	<.05	---	---	---	---	---	---
Ce	---	---	<.05	---	<.05		---	---	---	---	---
Co	<.001	<.001	<.001	<.001	<.001	---	---	---	---	---	.001
Cr	.15	.007	.15	.015	.1	.05	.05	.02	.05	.03	.1
Cu	.01	.0007	.01	.002	.01	.003	.003	.0015	.002	.0015	.007
Fe	1.5	.7	1	2	1.5	2	1.5	1	1.5	1.5	3
Ga	.0015	<.001	.001	.0015	.0015	.0015	.0015	<.001	.001	.001	.002
K	3	---	---	3	1.5	2	5	---	3	3	7
La	.015	---	.03	<.01	.03	.015	.007	---	---	---	.007
Mg	.7	7	.7	.7	.7	.5	2	5	2	5	1
Mn	.01	.02	.007	.015	.007	.0015	.015	.015	.015	.02	.015
Mo	.007	.001	.007	.003	.015	.0015	---	---	---	---	.0015
Nb	<.002	<.002	<.002	.002	<.002	---	---	---	---	---	---
Nd	<.015		.03	---	.015	.007	---	---	---	---	---
Ni	.015	.005	.015	.007	.015	.0015	.003	.002	.003	.003	.01
P	5	---	7	---	7	5	1	.7	.7	.3	.5
Pb	.003	---	.003	.003	.003	.015	---	---	---	---	---
Sc	.0015	---	.0015	.0015	.0015	.0007	.001	---	.001	.001	.015
Sr	.02	.005	.05	.015	.03	.3	.015	.015	.015	.015	.015
Ti	.3	.07	.15	.3	.3	.1	.15	.07	.15	.2	.3
V	.07	.015	.07	.015	.2	.01	.01	.007	.015	.01	.02
Y	.015	<.002	.03	.003	.03	.015	.005	.003	.005	.003	.007
Yb	.001	<.0002	.0015	.0003	.0015	.0007	.0003	---	.0003	.0002	.0005
Zn	.15	---	.15	<.07	.15	.03	<.07	---	---	---	.07
Zr	.015	.01	.015	.05	.03	.007	.01	.005	.01	.007	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Kendall Warm Springs (continued)					Gay Mine					
Sample No.	10E$_2$	10F	10G	10H	10J	11A	11B	11C	11D	11E	11F
Thickness in metres	0.25	0.5	1.4	2.7	1.1	1.0	1.0	2.5	1.3	3.1	2.6
Carbon, total	4.26	5.20	4.59	3.30	2.58	.78	6.60	2.51	2.50	4.88	2.61
as carbonate	.55	1.67	1.84	1.24	1.64	---	6.32	.90	.79	2.81	.27
as organic	3.7	3.5	2.8	2.0	.9	---	.3	1.6	1.7	2.1	2.3
Ag	---	----	---	---	---	.0005	.0002	.0005	.0003	.0007	.0007
Al	7	5	2	3	2	7	2	3	1	2	3
B	.02	.015	.01	.015	.007	.015	.007	.007	.005	.005	.007
Ba	.03	.02	.01	.015	.01	.03	.01	.02	.05	.01	.015
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	10	7	7	10	5	5	10	>10	>10	>10	>10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---	---
Co	.001	---	---	---	---	.001	<.001	<.001	---	---	---
Cr	.1	.07	.05	.07	.03	.05	.02	.07	.07	.1	.07
Cu	.005	.005	.003	.003	.001	.007	.002	.007	.007	.015	.007
Fe	3	2	1	1.5	1	2	.7	1	.5	.3	.3
Ga	.002	.001	---	.001	---	.001	<.001	.001	<.001	<.001	<.001
K	5	5	1.5	2	---	3	2	1.5	---	---	1.5
La	.01	---	---	.007	---	<.01	---	.01	.015	.015	.015
Mg	1	1.5	1.5	1.5	1.5	.5	5	.5	.5	3	.2
Mn	.015	.015	.01	.01	.01	.015	.015	.007	.003	.007	.007
Mo	.0015	.001	.0007	.0007	---	.015	.0015	.002	.002	.0015	.001
Nb	---	---	---	---	---	<.002	<.002	<.002	<.002	<.002	<.002
Nd	---	---	---	---	---	<.015		---	---	---	---
Ni	.01	.007	.005	.003	.002	.02	.01	.015	.007	.015	.015
P	1.5	.5	.5	2	---	1.5	.5	7	10	7	10
Pb	---	---	---	---	---	.003	.002	.002	<.002	.002	.002
Sc	.0015	.001	---	.001	---	.001	<.001	<.001	---	<.001	<.001
Sr	.03	.015	.007	.02	.007	.02	.015	.03	.05	.03	.03
Ti	.3	.2	.15	.15	.1	.3	.2	.2	.07	.1	.2
V	.02	.02	.01	.015	.007	.15	.07	.15	.1	.1	.15
Y	.01	.005	.003	.007	.003	.003	.002	.005	.007	.01	.01
Yb	.0007	.0003	.0002	.0005	.0002	.0007	.0003	.0007	.0007	.0007	.001
Zn	.07	.07	.07	<.07	---	.15	.07	.15	.07	.07	.1
Zr	.007	.007	.005	.007	.005	.05	.015	.015	.015	.015	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Gay Mine (continued)									Conda Mine	
Sample No.	11G	11H	11K	11L	11M	11N	11P	11Q	11R	12A	12B
Thickness in metres	2.2	2.3	3.0	2.8	7.5	3.8	3.0	3.3	1.0	1.8	1.8
Carbon, total	2.36	3.06	7.98	4.09	2.29	3.58	7.24	5.36	2.13	2.62	6.36
as carbonate	.20	.20	2.93	.10	.02	.12	.16	.14	.09	.93	5.20
as organic	2.2	2.9	5.0	4.0	2.3	3.5	7.1	5.2	2.0	1.7	1.2
Ag	.002	.003	.0007	.0003	.0001	.0015	.0015	.002	.001	.0003	.0007
Al	5	3	3	5	7	3	3	3	3	.7	1.5
B	.005	.007	.007	.01	.007	.007	.007	.007	.007	---	---
Ba	.02	.02	.015	.02	.03	.015	.015	.02	.03	015	.01
Be	---	---	---	---	---	.0003	.0003	<.0003	---	---	---
Ca	>10	>10	>10	>10	1.5	>10	>10	>10	10	>10	>10
Cd	---	---	---	---	---	---	.02	.02	<.01	<.01	<.01
Ce	<.05	<.05	<.05	---	---	---	<.05	<.05	<.05		
Co	<.001	<.001	.001	<.001	<.001	---	<.001	---	<.001	---	---
Cr	.1	.15	.2	.1	.03	.2	.15	.2	.1	.15	.1
Cu	.015	.015	.015	.007	.005	.015	.02	.02	.01	.007	.007
Fe	1	1	1.5	2	2	1.5	1	1.5	1.5	.3	.7
Ga	.001	.001	.001	.0015	.0015	.0015	.0015	.001	.0015	---	---
K	2	1.5	1.5	2	3	1.5	---	1.5	1.5	---	---
La	.03	.03	.02	.015	<.01	.015	.015	.015	<.01	.015	.015
Mg	.2	.2	1.5	.2	.15	.2	.3	.3	.3	.3	5
Mn	.05	.1	.015	.007	.015	.0015	.02	.005	.0015	.003	.01
Mo	.0015	.003	.007	.005	.003	.003	.005	.005	.0015	.0007	.0007
Nb	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	---	---
Nd	.02	.03	.015	.015	---	.02	.015	.015	<.015	---	---
Ni	.02	.03	.02	.015	.01	.005	.02	.02	.015	.007	.01
P	7	7	3	3	3	10	7	5	3	>10	7
Pb	.002	.002	<.002	.002	<.002	.002	.002	.003	.002	<.002	---
Sc	.0015	.0015	.001	.001	.001	.001	.0015	.0015	.001	---	---
Sr	.03	.03	.05	.03	.015	.05	.03	.03	.015	.2	.05
Ti	.3	.2	.2	.3	.3	.2	.2	.3	.3	.05	.07
V	.15	.15	.02	.015	.015	.15	.07	.07	.07	.15	.03
Y	.02	.03	.015	.015	.005	.02	.02	.02	.007	.01	.01
Yb	.0015	.003	.0007	.0007	.0003	.0015	.002	.0015	.0007	.001	.0007
Zn	.1	.15	.07	.07	<.07	---	.15	.15	.1	.07	.07
Zr	.015	.015	.01	.02	.03	.01	.015	.02	.02	.007	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Conda Mine (continued)										
Sample No.	12C	12D	12E	12F	12G	12H	$12J_1$	$12J_2$	12K	$12L_1$	12_2
Thickness in metres	3.0	2.5	0.5	3.0	3.0	3.0	1.0	0.9	1.0	1.0	1.0
Carbon, total	2.40	2.34	6.90	2.63	3.61	4.67	6.84	5.27	10.2	3.56	8.41
as carbonate	.35	.59	6.05	.53	1.21	.72	.69	.91	9.75	1.34	7.26
as organic	2.0	1.8	.8	2.1	.2	4.0	6.2	4.4	.5	2.2	1.2
Ag	.0007	.0003	.0003	.001	.0007	.0007	.0007	.0007	---	.0005	.0003
Al	2	1.5	1.5	5	2	5	3	7	1.5	7	3
B	.005	---	---	---	.005	.015	.01	.015	---	.015	.005
Ba	.015	.015	.01	.015	.015	.02	.02	.02	.003	.03	.015
Be	---	---	---	---	---	---	---	.0003	---	.0003	---
Ca	>10	>10	>10	>10	>10	>10	>10	>10	>10	10	>10
Cd	.01	.01	<.01	<.01	---	---	---	---	---	---	---
Ce										---	
Co	---	---	---	---	---	.001	.001	---	---	.001	.001
Cr	.1	.1	.07	.2	.15	.2	.3	.2	.02	.15	.07
Cu	.005	.007	.005	.007	.015	.015	.02	.015	.0015	.01	.005
Fe	.7	.5	.5	1	1	1.5	1.5	2	.5	2	1
Ga	---	---	---	.001	.001	.0015	.001	.0015	---	.0015	.001
K	---	---	---	3	1.5	3	1.5	3	---	3	2
La	.015	.015	.015	.015	.02	.015	.03	.015	---	.01	.007
Mg	.2	.2	7	.3	1	1	.7	1	10	.7	10
Mn	.015	.007	.01	.007	.01	.03	.01	.01	.02	.015	.03
Mo	.001	.0007	.001	.0007	.0015	.003	.005	.005	---	.002	.0007
Nb	---	---	---	---	---	---	---	---	---	---	---
Nd	---	---	---	---	.015	.015	.015	.015	---	.015	---
Ni	.01	.01	.01	.015	.015	.02	.03	.02	.005	.02	.01
P	>10	>10	7	7	>10		7	5	---	3	.7
Pb	---	<.002	---	---	---	<.002	---	<.002	---	<.002	---
Sc	.001	---	---	.001	.001	.0015	.0015	.0015	---	.0015	.001
Sr	.1	.2	.07	.3	.1	.1	.2	.1	.02	.05	.03
Ti	.1	.07	.07	.1	.1	.2	.2	.3	.1	.3	.15
V	.1	.2	.05	.15	.07	.02	.03	.03	.007	.015	.015
Y	.01	.01	.01	.015	.015	.01	.02	.015	.002	.007	.007
Yb	.001	.001	.007	.0015	.0015	.001	.0015	.001	.0002	.0005	.0003
Zn	.07	.07	<.07	<.07	<.05	.1	.15	.1	---	.1	---
Zr	.01	.01	.007	.01	.007	.015	.01	.015	.007	.02	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Conda Mine (continued)										
Sample No.	$12L_3$	12M	12N	12P	12Q	12R	12S	12T	12U	12V	12W
Thickness in metres	1.0	4.0	2.0	3.0	4.5	5.5	4.3	3.0	1.0	1.0	3.0
Carbon, total	6.85	9.30	5.60	5.24	7.97	8.31	7.90	12.3	10.9	27.5	9.24
as carbonate	.45	.13	.16	.08	.08	.09	.06	.09	.09	.08	.15
as organic	6.4	9.2	5.4	5.2	7.9	8.2	7.8	12.2	10.8	27.4	9.1
Ag	.0015	.001	---	---	.0003	.0003	.0003	.0007	.0007	.0015	.001
Al	5	5	5	5	3	5	5	3	3	2	5
B	.015	.015	.01	.01	.007	.01	.015	.01	.01	.007	.01
Ba	.02	.02	.02	.03	.02	.02	.03	.02	.02	.015	.02
Be	---	---	---	---	---	---	---	---	.0003	.0003	.0003
Ca	>10	10	5	3	7	7	2	>10	>10	>10	>10
Cd	---	---	---	---	---	---	---	<.01	<.01	.03	.015
Ce		---	---	---	---	---	---		---	---	---
Co	---	---	---	.001	---	.001	---	.001	.001	---	---
Cr	.3	.2	.05	.05	.05	.1	.1	.15	.15	.2	.2
Cu	.015	.015	.007	.007	.007	.015	.007	.015	.01	.015	.01
Fe	1.5	1.5	1.5	2	1	1.5	1.5	1.5	1.5	1	1.5
Ga	.0015	.0015	.0015	.001	.001	.001	.0015	.0015	.0015	.001	.001
K	2	1.5	1.5	2	1.5	1.5	2	2	2	---	2
La	.03	.02	.01	.007	.01	.015	.01	.02	.015	.01	.02
Mg	.7	.5	.3	.3	.2	.3	.5	.3	.3	.2	.3
Mn	.015	.007	.01	.015	.002	.007	.002	.007	.007	.003	.002
Mo	.003	.003	.0015	.001	.0007	.002	.0015	.005	.005	.02	.002
Nb	---	---	.002	.002	---	---	---	---	---	---	---
Nd	.015	.015	.015	---	.015	.015	.015	.015	.015	---	.015
Ni	.03	.015	.01	.01	.01	.015	.007	.02	.02	.03	.007
P	7	5	3	1.5	3	3	2	7	5	7	7
Pb	<.002	---	---	---	---	---	---	---	---	<.002	---
Sc	.0015	.001	.001	.001	.001	.001	.0015	.0015	.0015	.001	.0015
Sr	.07	.03	.03	.015	.02	.05	.015	.07	.07	.1	.07
Ti	.3	.2	.3	.5	.2	.2	.3	.2	.3	.1	.2
V	.03	.02	.007	.01	.015	.02	.03	.05	.07	.3	.15
Y	.02	.015	.007	.005	.01	.02	.01	.015	.015	.01	.02
Yb	.0015	.001	.0007	.0007	.0007	.0015	.001	.0015	.0015	.0015	.0015
Zn	.15	.07	.07	.07	<.07	.1	---	.15	.15	.3	.07
Zr	.02	.02	.03	.03	.02	.02	.02	.02	.02	.01	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Conda Mine (continued)			Georgetown Canyon							
Sample No.	12X	12Y	12Z	13A	13B	13C	13D	13E	13F	$13F_a$	13G
Thickness in metres	3.1	3.0	6.0	3.0	4.0	0.8	1.5	0.9	2.3	3.0	3.0
Carbon, total	4.41	1.75	2.53	5.49	5.78	10.9	7.04	9.13	9.69	30.7	11.0
as carbonate	.14	.26	.25	1.14	.30	9.04	.33	5.85	.22	<.01	.14
as organic	4.3	1.5	2.3	4.4	5.5	1.8	6.7	3.3	9.5	30.7	10.9
Ag	.001	.0007	.0007	.0007	.0007	.0002	.0007	.0003	.002	.005	.0007
Al	5	2	5	2	2	1.5	3	2	2	3	3
B	.015	.007	.02	.007	.007	<.005	.01	<.005	.007	.02	.007
Ba	.03	.015	.03	.01	.015	.005	.02	.01	.015	.015	.01
Be	.0003	---	---	---	---	-----	.0003	---	.0003	.0003	---
Ca	>10	>10	3	>10	>10	>10	>10	>10	>10	.15	>10
Cd	.02	.015	.015	< .1	< .1	---	---	---	< .1	< .1	---
Ce	---		---	---	---	---	---	---	---	---	<.05
Co	---	---	.001	<.001	---	<.001	<.001	<.001	<.001	<.001	<.001
Cr	.2	.15	.15	.1	.07	.015	.1	.05	.2	.5	.2
Cu	.01	.005	.007	.007	.007	.0015	.007	.005	.02	.015	.015
Fe	2	7	2	.7	.7	.7	1.5	.7	1.5	3	1
Ga	.0015	.001	.0015	<.001	<.001	<.001	.0015	<.001	<.001	.0015	<.001
K	2	---	3	---	---	---	3	1.5	1.5	3	---
La	.015	.015	.007	.015	.015	---	.015	.01	.03	<.01	.01
Mg	.5	.3	.5	.7	.2	7	.7	5	.2	.3	.2
Mn	.015	.02	.02	.01	.003	.015	.007	.01	.005	.0015	.0015
Mo	.005	.001	.002	.003	.002	---	.0015	.0015	.005	.015	.0015
Nb	.002	---	.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Nd	---	.015	---	.015	.015		.015	---	.03	.015	.02
Ni	.015	.007	.015	.015	.01	.005	.015	.007	.015	.03	.015
P	7	>10	1.5	10	10	.7	5	2	10	---	10
Pb	.003	.002	.002	---	---	---	---	---	.003	.003	.002
Sc	.0015	.001	.0015	<.001	.001	---	.0015	<.001	.0015	.0015	.0015
Sr	.07	.1	.02	.03	.03	.015	.02	.015	.03	.007	.07
Ti	.3	.1	.3	.15	.15	.07	.3	.1	.15	.3	.15
V	.3	.07	.15	.1	.15	.015	.03	.02	.15	.3	.03
Y	.015	.015	.007	.015	.015	.003	.015	.007	.05	.003	.03
Yb	.002	.0015	.0007	.0007	<.001	.0002	.001	.0003	.002		.0015
Zn	.15	.15	.15	.15	.07	---	.1	---	---	---	---
Zr	.02	.015	.03	.015	.015	.007	.02	.007	.015	.03	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Georgetown Canyon (continued)										Middle Piney Lake
Sample No.	13H	13J	13K	13L	13M	13N	13P	13Q	13R	13S	14A
Thickness in metres	3.0	0.3	2.0	4.0	4.0	4.0	4.0	4.0	5.0		0.6
Carbon, total	11.2	11.4	9.01	2.93	2.04	5.32	10.9	4.70	1.98	3.36	9.14
as carbonate	.05	10.0	.04	.05	.07	.17	.09	.07	.33	1.07	9.02
as organic	11.1	1.4	9.0	2.9	2.0	5.2	10.8	4.6	1.6	2.3	.1
Ag	.0005	---	.0003	.0003	---	.0003	.0007	.001	.0005	---	---
Al	3	1.5	3	3	1	3	3	3	3	.7	3
B	.01	<.005	.007	.01	.005	.007	.007	.007	.01	<.005	---
Ba	.015	.003	.015	.02	.005	.02	.015	.015	.015	.003	.01
Be	<.0003	<.0003	---	---	---	---	<.0003	<.0003	<.0003	---	---
Ca	>10	>10	10	7	1	>10	>10	>10	>10	10	>10
Cd	---	---	---	---	---	---	---	---	< .1	---	---
Ce	<.05	<.05	---	<.05	---	---	---	---	---	---	
Co	<.001	<.001	<.001	.0015	---	<.001	<.001	<.001	<.001	---	---
Cr	.15	.02	.1	.15	.015	.07	.15	.1	.07	.007	.003
Cu	.01	.0015	.007	.01	.0015	.005	.015	.01	.007	.0007	.0015
Fe	1.5	.5	1.5	2	.5	1.5	1.5	1.5	1.5	.2	1.5
Ga	.0015	---	.001	.0015	---	.0015	.0015	.0015	.001	---	---
K	1.5	---	1.5	3	---	1.5	1.5	1.5	1.5	---	1.5
La	.015	---	.015	.015	---	.015	.03	.015	.01	---	---
Mg	.2	7	.2	.2	.07	.2	.2	.2	.2	.2	10
Mn	.007	.03	.005	.02	.01	.01	.005	.005	.01	.007	.02
Mo	.005	<.0007	.003	.0015	---	.0015	.003	.0015	.002	---	.002
Nb	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	---
Nd	.015		.015	.015		<.015	.02	.015	<.01		
Ni	.015	.005	.01	.015	.007	.015	.015	.015	.015	.003	.01
P	5	---	3	3	---	3	5	5	5	---	---
Pb	.002	---	---	.007	---	<.002	.002	.002	<.002	---	---
Sc	.0015	---	.0015	.0015	---	.001	.0015	.0015	.0015	---	---
Sr	.03	.03	.02	.015	.005	.02	.02	.02	.03	.015	.015
Ti	.2	.07	.3	.3	.05	.3	.3	.3	.3	.02	.07
V	.015	.01	.015	.015	.005	.015	.05	.015	.1	.003	.01
Y	.01	.003	.01	.007	<.002	.007	.03	.015	.01	.002	---
Yb	.0007	.0002	.0007	.0005	<.0002	.0005	.002	.001	.0007	<.0002	---
Zn	.07	---	---	.07	---	---	.07	.07	.15	---	.1
Zr	.015	.005	.03	.03	.005	.03	.02	.03	.03	.003	.005

Table 3.--Analytical data, values reported in percent (continued)

Place	Middle Piney Lake (continued)										
Sample No.	14B	14C	14D	14E	14F	14G	14H	14J	14K	14L	14M
Thickness in metres	0.3	1.4	4.0	1.4	0.5	1.2	3.0	1.0	2.9	2.4	1.8
Carbon, total	12.6	8.12	8.38	6.32	10.8	8.30	8.09	8.75	8.90	6.97	4.08
as carbonate	12.3	6.26	3.22	4.97	10.5	2.99	5.95	3.10	7.96	4.60	3.65
as organic	.3	1.9	5.2	1.4	.3	5.3	2.1	5.6	.9	2.4	.4
Ag	---	.0005	.001	.0007	---	.001	.001	.001	.0007	.0007	.0003
Al	.3	2	3	3	1	3	2	3	2	3	3
B	---	.005	.007	.005	---	.005	.005	.007	.005	.007	.005
Ba	.0015	.015	.02	.02	.007	.03	.015	.02	.015	.02	.02
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	>10	>10	>10	10	>10	>10	>10	>10	>10	>10	10
Cd	---	.01	.015	---	---	.015	.01	.015	.01	.01	---
Ce											
Co	---	---	---	---	---	---	---	.001	---	---	---
Cr	.007	.07	.3	.05	.007	.3	.15	.3	.03	.1	.01
Cu	.0007	.01	.02	.005	.0007	.02	.01	.02	.002	.01	.002
Fe	.15	1.5	2	1.5	.5	1.5	1.5	2	1	1	1
Ga	---	.001	.001	---	---	.001	.001	.0015	---	.0015	.001
K	---	1.5	2	2	---	1.5	1.5	2	1.5	1.5	2
La	---	.015	.015	---	---	.02	.01	.02	---	.007	---
Mg	>10	7	5	7	>10	5	7	5	10	7	2
Mn	.02	.01	.007	.015	.02	.01	.015	.015	.015	.015	.015
Mo	.0007	.002	.01	.01	.003	.015	.007	.01	.005	.005	.001
Nb	---	---	---	---	---	---	---	---	---	---	---
Nd		.015	.015			.015	.015	.015		.015	
Ni	.005	.015	.02	.01	.003	.015	.01	.03	.007	.01	.003
P	---	7	3	---	---	7	1.5	3	---	3	---
Pb	---	.002	<.002	---	---	.002	<.002	<.002	<.002	.002	<.002
Sc	---	<.001	.001	---	---	<.001	<.001	.0015	---	.001	<.001
Sr	.015	.07	.05	.01	.015	.07	.02	.05	.015	.03	.02
Ti	.007	.07	.2	.2	.07	.2	.2	.2	.15	.15	.15
V	.007	.05	.15	.03	.015	.2	.07	.2	.05	.15	.015
Y	---	.015	.015	.003	.002	.02	.007	.015	.003	.01	.003
Yb	---	.0007	.001	.0003	---	.0015	.0005	.0015	.0002	.0007	.0003
Zn	---	.15	.15	.07	---	.15	.15	.15	<.07	.07	---
Zr	---	.007	.01	.015	.007	.01	.01	.01	.01	.01	.02

Table 3.--Analytical data, values reported in percent (continued)

Place	Middle Piney Lake (continued)				Paris Canyon					
Sample No.	14N	14P	14Q	14R	15A	15B	15C	15D	15E	15F
Thickness in metres	2.9	1.9	2.5	2.0		2.4	0.1	1.1	1.0	1.0
Carbon, total	2.84	4.44	1.88	2.03	6.38	10.8	1.14	1.26	.86	1.04
as carbonate	.21	4.14	.22	2.07	6.24	10.8	.38	.14	---	.75
as organic	2.6	.3	1.7	.1	.1	<.1	.8	1.1	---	.3
Ag	.0007	.0003	.0007	---	---	---	.0007	.0002	.0003	---
Al	5	5	5	2	.5	.7	1	7	2	1.5
B	.007	.005	.007	.005	---	---	---	.02	.005	<.005
Ba	.03	.03	.05	.015	.003	.003	.01	.03	.02	.015
Be	---	---	---	---	---	---	---	---	---	---
Ca	7	10	7	10	>10	>10	>10	1.5	>10	>10
Cd	.01	---	---	---	---	---	---	---	< .01	< .01
Ce							---			
Co	---	---	<.001	---	---	---	---	<.001	---	---
Cr	.15	.015	.1	.015	.002	.02	.07	.05	.1	.15
Cu	.01	.0015	.01	.001	.0003	.0005	.001	.007	.0015	.002
Fe	1.5	1	2	1	.15	.3	.3	1.5	.3	.3
Ga	.0015	---	.0015	---	---	---	---	.0015	---	---
K	3	2	3	---	---	---	---	3	---	---
La	.015	---	.015	.007	---	---	.05	.007	.015	.02
Mg	.7	5	.7	2	7	10	.15	.7	.3	.2
Mn	.007	.02	.015	.01	.01	.01	.0015	.02	.01	.0015
Mo	.007	.001	.01	.0007	---	---	---	.001	---	---
Nb	---	---	---	---	---	---	---	<.002	---	---
Nd	.015		.015	---			.03	.015		
Ni	.01	.005	.01	.003	<.001	.003	.003	.015	.007	.005
P	2	---	1.5	1.5	---	---	>10	---	>10	>10
Pb	<.002	<.002	<.002	<.002	---	---	---	<.002	---	---
Sc	.0015	.001	.0015	<.001	---	---	---	.0015	---	---
Sr	.015	.01	.015	.015	.005	.015	.1	.015	.1	.15
Ti	.3	.3	.15	.15	.05	.03	.05	.5	.1	.05
V	.15	.015	.15	.015	<.0015	.007	.015	.05	.1	.15
Y	.015	.003	.01	.007	.002	.002	.05	.005	.015	.02
Yb	.001	.0003	.0007	.0003	---	.0002	.002	.0005	.001	.0015
Zn	.1	---	.1	---	---	---	---	.07	---	---
Zr	.02	.03	.03	.015	.007	---	.005	.03	.01	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Paris Canyon (continued)										
Sample No.	15G	15H	15J	15K	15L	15M	15N	15P	15Q	15R	15S
Thickness in metres	1.0	3.0	3.0	3.0	2.0	2.0	5.0	2.0	1.5	3.5	2.0
Carbon, total	1.08	.77	1.52	1.23	1.52	1.06	.55	2.84	1.37	.71	.14
as carbonate	.59	---	.24	.26	.48	.26	---	.15	<.01	---	---
as organic	.5	---	1.3	1.0	1.0	.8	---	2.7	1.4	---	---
Ag	.0007	.0007	.0005	.0007	.0003	---	---	.001	.0005	.0003	---
Al	3	2	3	3	3	3	3	3	2	2	.5
B	.007	.007	.007	.007	.01	.007	.007	.01	.005	<.005	<.005
Ba	.02	.02	.03	.03	.05	.03	.03	.03	.02	.015	.007
Be	---	---	---	---	---	---	---	.0003	.0003	---	---
Ca	>10	>10	>10	>10	>10	>10	1.5	10	>10	>10	.2
Cd	.015	.01	---	.01	---	---	---	.02	.02	.01	---
Ce							---	---			---
Co	---	---	---	---	---	---	.001	---	---	---	---
Cr	.15	.07	.1	.15	.2	.07	.05	.2	.15	.1	.003
Cu	.01	.005	.007	.01	.01	.005	.007	.02	.01	.005	.0005
Fe	.7	1.5	1.5	1	1.5	2	2	1.5	1	.7	.15
Ga	.001	.001	.0015	.001	.0015	.0015	.001	.001	---	---	---
K	1.5	---	2	2	2	1.5	1.5	1.5	---	---	---
La	.015	.01	.02	.02	.015	.03	.007	.015	.015	.02	---
Mg	.2	.2	.3	.3	.3	.3	.2	.3	.2	.15	.05
Mn	.007	.01	.003	.005	.007	.007	.02	.005	.03	.01	---
Mo	.002	.003	.0015	.002	.0015	.002	.007	.0007	.01	..007	---
Nb	---	---	---	<.002	---	---	<.002	<.002	---	---	<.002
Nd	---	---	.015	.015	---	.02	---	---	---		
Ni	.015	.015	.015	.015	.015	.01	.02	.02	.015	.01	.007
P	10	7	7	7	3	10	.5	3	>10	>10	---
Pb	---	<.002	---	---	---	---	---	<.002	<.002	---	---
Sc	.001	<.001	.0015	.0015	.0015	.0015	.001	.0015	<.001	<.001	---
Sr	.07	.05	.05	.05	.05	.1	.01	.05	.15	.2	.0015
Ti	.15	.15	.2	.2	.2	.2	.3	.3	.15	.1	.007
V	.07	.05	.02	.03	.015	.015	.015	.2	.2	.15	.005
Y	.02	.01	.015	.02	.01	.02	.007	.015	.015	.02	---
Yb	.0015	.0007	.001	.0015	.0007	.0015	.0005	.0015	.0015	.002	---
Zn	.07	.07	.07	.07	.07	<.07	.1	.15	.15	.1	---
Zr	.01	.015	.01	.015	.015	.015	.02	.02	.015	.015	---

Table 3.--Analytical data, values reported in percent (continued)

Place	Paris Canyon (continued)	Hublett Reservoir								
Sample No.	15T	16A	16B	16C	16D	16E	16F	16G	16H	16J	16K
Thickness in metres		4.4	4.4	4.4	4.4	4.4	6.5	6.5	30.0	3.4	3.4
Carbon, total	13.1	1.57	1.22	2.03	1.88	.01	.41	.44	.82	.64	1.02
as carbonate	1.69	1.22	.07	.16	.13	.01	---	---	---	---	.83
as organic	11.4	.4	1.2	1.9	1.8	1.0	---	---	---	---	.2
Ag	.0007	.0001	<.0001	.0015	.0001	.0015	<.0001	<.0001	---	---	---
Al	3	7	5	2	3	3	1	1.5	.7	3	2
B	.005	.01	.007	.005	.005	.007	<.005	<.005	.005	.005	.005
Ba	.015	.03	.03	.03	.02	.02	.015	.015	.05	.03	.03
Be	---	<.0003	---	---	---	---	---	---	---	---	---
Ca	>10	2	7	>10	>10	.7	10	>10	3	2	5
Cd	.03	---	---	---	---	---	---	---	---	---	---
Ce		<.05	<.05	<.05	<.05	---	---	<.05	---	<.05	<.05
Co	---	.0015	.001	<.001	<.001	<.001	<.001	---	---	<.001	<.001
Cr	.15	.007	.015	.07	.1	.07	.015	.02	.007	.03	.02
Cu	.01	.007	.01	.007	.005	.007	.0015	.0015	.0005	.002	.0015
Fe	1	3	3	3	1.5	1.5	.7	.7	.5	1.5	1
Ga	.001	.002	.0015	.001	<.001	.001	<.001	<.001	---	<.001	<.001
K	---	5	3	---	---	1.5	---	---	---	1.5	---
La	.007	<.01	<.01	.015	.02	<.01	.015	.03	---	<.01	<.01
Mg	3	1.5	.7	.5	.5	.5	.1	.15	.5	1.5	1
Mn	.0007	.1	.1	.03	.03	.015	.01	.007	.015	.15	.1
Mo	.015	.0007	.0007	.0007	.0007	.001	<.0007	.0007	---	---	---
Nb	---	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Nd	---	---	<.015	<.015	.03	---	.015	.015		---	---
Ni	.02	.003	.007	.007	.01	.015	.005	.003	.0013	.005	.003
P	7	---	3	7	5	.7	5	5	1	.7	.7
Pb	<.002	.003	.003	.003	.002	---	---	---	---	---	---
Sc	<.001	.0015	.0015	<.001	<.001	<.001	---	<.001	---	<.001	<.001
Sr	.07	.015	.05	.03	.05	.015	.015	.03	.015	.015	.015
Ti	.2	.3	.3	.1	.1	.2	.02	.05	.03	2.0	.15
V	.5	.015	.015	.015	.015	.01	.003	.007	.0015	.007	.007
Y	.01	.003	.005	.01	.02	.005	.015	.02	.002	.007	.005
Yb	.0015	.0003	.0003	.0007	.0015	.0003	.0007	.0015	<.0002	.0005	.0003
Zn	.3	---	---	---	---	.07	---	---	---	---	---
Zr	.015	.01	.015	.007	.007	.015	.007	.007	.005	.015	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Benjamin Mine										
Sample No.	17A	17B	17C	17D	17E	17F	17G	17H	17J	17K	17L
Thickness in metres	4.0	5.0	3.0	2.0	2.0	2.0	2.0	2.0	3.0	1.8	2.4
Carbon, total	3.18	5.35	4.28	3.82	5.63	5.78	3.85	6.91	6.52	3.17	3.85
as carbonate	2.12	4.87	3.44	1.29	3.62	3.24	2.37	4.94	3.02	2.72	3.74
as organic	1.1	.5	.8	2.5	1.0	2.5	1.5	2.2	3.5	.4	.1
Ag	.0005	---	.0003	.0005	.0007	.0007	.0003	.0003	.0007	---	---
Al	3	2	5	3	5	3	5	5	3	5	1
B	.005	.005	.01	.005	.01	.01	.01	.01	.01	.005	---
Ba	.03	.01	.015	.02	.02	.02	.02	.02	.02	.02	.01
Be	---	---	---	---	---	---	.0003	---	---	---	---
Ca	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10
Cd	<.01	---	---	---	---	---	---	---	---	---	---
Ce											
Co	---	---	---	---	---	---	---	---	---	---	---
Cr	.05	.02	.03	.1	.15	.15	.15	.1	.2	.02	.02
Cu	.005	.001	.002	.007	.007	.01	.007	.007	.01	.002	.001
Fe	.7	.7	1	1	1.5	1.5	1.5	1.5	1.5	1.5	.7
Ga	---	---	.001	---	.001	.001	.0015	.0015	.0015	.0015	---
K	---	---	2	---	2	2	2	2	1.5	2	---
La	.01	.007	.007	.03	.015	.02	.03	.01	.03	.01	.01
Mg	.7	1.5	3	1.5	5	.7	.5	1	1.5	3	3
Mn	.007	.007	.01	.005	.01	.007	.01	.01	.015	.015	.007
Mo	.0015	---	---	---	.002	.003	.0015	.003	.007	.001	---
Nb	---	---	---	---	---	---	---	---	---	---	---
Nd	---	---	---	.015	---	---	.015	---	.02	---	---
Ni	.007	.003	.005	.01	.015	.015	.01	.01	.02	.007	.003
P	>10	1	1.5	>10	5	7	7	.7	7	1.5	7
Pb	---	---	---	---	---	---	---	<.002	<.002	<.002	---
Sc	.001	---	.001	---	.0015	.0015	.0015	.001	.0015	.001	---
Sr	.1	.015	.02	.1	.07	.1	.07	.03	.1	.03	.07
Ti	.15	.07	.2	.07	.2	.2	.2	.2	.15	.3	.07
V	.05	.003	.007	.01	.02	.03	.015	.05	.05	.015	.007
Y	.01	.003	.007	.02	.02	.02	.02	.01	.03	.007	.01
Yb	.0007	.0002	.0007	.001	.001	.001	.001	.0007	.0015	.0007	.0007
Zn	.1	---	---	.07	<.07	.07	---	<.07	.07	<.07	---
Zr	.015	.007	.01	.007	.007	.01	.02	.007	.01	.02	.005

Table 3.--Analytical data, values reported in percent (continued)

Place	Benjamin M'ne (continued)							Devils Slide			
Sample No.	17M	17N	17P	17Q	17R	17S	17T	18A	18B	18C	18D
Thickness in metres	0.8	0.7	1.4	1.2	2.0	5.5	3.4	5.8	0.5	0.8	1.0
Carbon, total	1.13	6.09	3.14	2.97	3.03	4.07	5.40	7.48	1.96	.76	2.34
as carbonate	.34	5.69	.47	1.45	2.83	3.85	5.12	7.24	1.63	---	1.70
as organic	.8	.4	2.7	1.5	.2	.2	.3	.2	3	---	.6
Ag	.0005	.0003	.0007	.0003	---	---	---	---	.00015	.0003	.0002
Al	3	2	3	3	5	3	3	1.5	.7	2	1.5
B	<.005	.005	.005	.005	.015	.01	.007	<.005	<.005	.005	.007
Ba	.02	.01	.02	.02	.02	.015	.015	.007	.007	.03	.01
Be	---	---	.0003	---	---	---	---	---	---	---	---
Ca	>10	10	>10	>10	10	10	>10	>10	>10	>10	5
Cd	---	---	.015	---	---	---	---	---	---	---	---
Ce		---			---	---	---	---	---	---	---
Co	---	---	---	---	---	---	---	<.001	---	---	<.001
Cr	.1	.02	.15	.05	.02	.015	.015	.015	.03	.03	.02
Cu	.005	.005	.01	.002	.002	.001	.0007	.0007	.001	.0015	.001
Fe	1.5	1	1	1	2	1.5	1	.5	.3	.5	.5
Ga	.001	.001	.001	---	.0015	.001	---	<.001	---	<.001	<.001
K	1.5	2	---	---	3	2	1.5	---	---	---	---
La	.03	---	.015	.015	---	---	---	---	.015	.015	---
Mg	.2	7	.5	1.5	5	5	3	7	.07	.1	1
Mn	.005	.015	.003	.01	.015	.015	.015	.007	.003	.002	.005
Mo	.002	<.0007	.007	.001	---	---	---	---	---	.0007	---
Nb	---	---	---	---	---	---	---	<.002	<.002	<.002	<.002
Nd	.02	---	---	---	---	---	---		<.015	<.015	
Ni	.01	.007	.01	.005	.003	.003	.002	.0015	.002	.0015	.002
P	>10	.7	>10	>10	---	---	---	1.5	10	10	1
Pb	<.002	---	.002	<.002	---	---	---	---	<.002	<.002	<.002
Sc	.001	---	---	---	001	---	---	---	---	<.001	----
Sr	.2	.015	.15	.1	.015	.007	.015	.015	.03	.03	.015
Ti	.15	.15	.1	.1	.2	.15	.1	.05	.05	.1	.1
V	.03	.015	.15	.02	.007	.005	.003	.003	.002	.007	.005
Y	.05	.002	.02	.02	.003	.002	.002	.003	.007	.015	.003
Yb	.002	.0002	.001	.0007	.0003	.0002	.0002	<.0002	.0003	.0007	.0002
Zn	.07	.07	.15	---	---	---	---	---	---	---	---
Zr	.015	.01	.01	.015	.015	.015	.015	.003	.007	.015	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Devils Slide (continued)										
Sample No.	18E	18F	18G	18H	18J	18K	18L	18M	18N	18P	18Q
Thickness in metres	6.3	0.5	2.0	0.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Carbon, total	5.02	3.78	5.94	1.96	5.73	4.99	3.72	4.41	5.21	5.79	3.19
as carbonate	4.71	3.66	5.61	1.27	4.61	4.25	3.41	3.36	4.90	5.10	2.77
as organic	.3	.1	.3	.7	1.1	.6	.3	1.0	.3	.7	.4
Ag	.001	---	.00015	.00015	.0003	.0003	.00015	.0003	.00015	.0005	.00015
Al	1	.7	1	.7	2	3	5	5	1	3	2
B	.005	<.005	<.005	<.005	.007	.01	.015	.015	.007	.015	.015
Ba	.005	.007	.007	.005	.015	.015	.015	.02	.005	.01	.01
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	7	>10	>10	>10	>10	7	7	7	7	7	5
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---	---
Co	<.001	---	---	<.001	---	<.001	<.001	<.001	---	<.001	<.001
Cr	.015	.015	.02	.03	.1	.05	.03	.1	.015	.1	.07
Cu	.0007	.001	.0015	002	.005	.002	.0015	.003	.0007	.0015	.0007
Fe	.5	.3	.5	.3	1	1.5	2	1.5	.5	1	1
Ga	<.001	<.001	<.001	<.001	.001	.001	.001	.0015	---	.0015	<.001
K	---	---	---	---	<1.5	2	2	3	---	.7	1.5
La	---	<.01	<.01	.03	.015	<.01	<.01	.01	---	<.01	<.01
Mg	3	1	5	.1	5	5	3	5	5	5	2
Mn	.007	.005	.007	.003	.01	.01	.01	.015	.007	.01	.005
Mo	---	---	.0007	.0007	.001	.001	.0007	.0015	---	.0007	---
Nb	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Nd		<.05	<.05	<.05	.015	---	---	.015		---	---
Ni	.002	.0015	.003	.003	.007	.005	.003	.007	.0015	.007	.003
P	1.5	3	3	>10	3	---	---	.7	.7	1	.5
Pb	---	---	---	---	---	<.002	<.002	<.002	---	<.002	<.002
Sc	---	---	---	---	<.001	<.001	.001	.0015	---	.001	.001
Sr	.015	.03	.03	.07	.03	.015	.015	.015	.015	.02	.0.5
Ti	.05	.05	.05	.015	.15	.3	.3	.3	.07	.15	.1
V	.002	.002	.005	.007	.01	.01	.007	.03	.003	.01	.007
Y	.003	.005	.003	.02	.015	.003	.003	.007	<.002	.005	.003
Yb	<.0002	.0003	.0003	.001	.0005	.0002	.0003	.0005	---	.0003	.0002
Zn	---	---	---	---	---	---	---	<.07	---	---	---
Zr	.007	.007	.007	.005	---	---	---	---	---	---	.005

Table 3.--Analytical data, values reported in percent (continued)

Place	Devils Slide (continued)	Mill Creek Canyon									
Sample No.	18R	19A	19B	19C	19D	19E	19F	19G	19H	19J	19K
Thickness in metres	10.0	10.0	4.0	10.0	10.0	6.0	2.0	10.0	10.0	10.0	10.0
Carbon, total	3.40	5.58	9.11	9.15	6.92	7.03	6.56	4.39	9.62	8.65	4.97
as carbonate	2.98	5.55	8.94	9.35	6.80	6.94	6.44	4.28	9.45	8.52	4.92
as organic	.4	<.1	.2	<.1	.1	<.1	.1	.1	.2	.1	<.1
Ag	.0001	.0007	---	---	---	---	---	---	---	---	---
Al	5	.5	.7	.7	1	.7	1	1.5	.15	.7	.7
B	.005	---	---	---	---	---	---	.005	---	---	---
Ba	.01	.005	.002	.003	.005	.003	.007	.01	.0015	.003	.005
Be	---	.0007	---	---	---	---	---	---	---	---	---
Ca	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---	---
Co	---	---	---	---	---	---	---	---	---	---	---
Cr	.03	.007	.01	.01	.007	.01	.015	.015	.007	.01	.02
Cu	.0007	.0015	.0005	.0003	.0005	.0007	.001	.0007	.0002	.0003	.0005
Fe	.5	.15	.15	.2	.3	.3	.5	.5	.15	.5	.5
G	<.001	.001	---	---	---	---	---	---	---	---	---
K	---	---	---	---	---	---	---	---	---	---	---
La	<.01	---	---	---	---	---	.007	---	---	---	.01
Mg	1.5	5	7	10	7	7	7	7	10	7	5
Mn	.01	.005	.005	.005	.005	.005	.01	.007	.003	.007	.003
Mo	.0007	.0007	---	---	.007	---	.0007	---	---	---	.0007
Nb	<.002	---	---	---	---	---	---	---	---	---	---
Nd	---						---				---
Ni	.0015	.0015	.0015	.002	.0015	.0015	.002	.001	---	.001	.001
P	3	---	.5	.5	---	.7	.5	---	---	---	3
Pb	---	---	---	---	---	---	---	---	---	---	---
Sc	---	.0015	---	---	---	---	---	---	---	---	---
Sr	.02	.02	.015	.015	.015	.01	.015	.01	.007	.007	.03
Ti	.07	.02	.02	.05	.05	.5	.7	.7	.007	.03	.03
V	.003	.0015	.0015	.002	.002	.0015	.003	.003	.0015	.002	.0015
Y	.007	.002	---	---	---	---	.002	---	---	---	.005
Yb	.0005	.0005	.0002	---	---	---	.0002	---	---	---	.0003
Zn	---	---	---	---	---	---	---	---	---	---	---
Zr	.01	.003	.003	.003	.007	.005	.007	.007	.005	.005	.015

Table 3.--Analytical data, values reported in percent (continued)

Place	Mill Creek Canyon (continued)										
Sample No.	19L	19M	19N	19P	19Q	19R	19S	19T	19U	19V	19W
Thickness in metres	5.0	15.0	45.0	45.0	35.0	30.0	20.0	23.0	20.0	20.0	10.0
Carbon, total	1.80	4.61	5.58	5.89	11.3	10.7	11.0	4.31	1.23	11.0	2.86
as carbonate	1.68	4.62	5.61	5.82	11.2	10.6	10.6	3.94	1.11	11.1	2.86
as organic	.1	<.1	<.1	<.1	.1	.1	.5	.4	.1	<.1	<.1
Ag	---	---	---	---	---	---	---	---	---	---	---
Al	2	2	2	3	.15	.5	.7	2	2	.15	3
B	.005	---	---	---	---	---	---	.005	.005	---	.005
Ba	.02	.01	.01	.0015	.0007	.002	.002	.015	.015	.0007	.03
Be	---	---	---	---	---	---	---	---	---	---	---
Ca	7	>10	>10	>10	10	>10	>10	10	10	>10	10
Cd	---	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---			---	---		---
Co	---	---	---	---	---	---	---	---	---	---	---
Cr	.015	.015	.005	.003	.0015	.01	.01	.02	.05	.007	.01
Cu	.0007	.0005	.001	.0003	.0002	.0003	.0005	.001	.0003	.0002	.002
Fe	.7	.5	1	1	.3	.3	.7	1	.7	.2	1
Ga	.001	---	---	.001	---	---	---	.0015	---	---	.001
K	---	---	---	1.5	---	---	---	1.5	---	---	1.5
La	---	---	---	---	---	---	---	---	0.15	---	.007
Mg	1.5	7	7	5	.7	10	>10	5	2	7	2
Mn	.007	.01	.07	.05	.007	.05		.01	.005	.007	.015
Mo	---	.0007	---	---	---	---	---	.0007	---	---	---
Nb	---	---	---	---	---	---	---	---	---	---	---
Nd									---		---
Ni	.0015	.001	.001	.001	---	---	.001	.003	.001	---	.002
P	.7	.5	---	---	---	---	---	.5	3	---	---
Pb	---	<.002	---	---	---	<.002	---	<.002	---	---	<.002
Sc	---	---	---	---	---	---	---	---	---	---	---
Sr	.005	.007	.005	.015	.007	.01	.015	.007	.015	.01	.007
Ti	.15	.1	.05	.15	.003	.02	.03	.15	.2	.007	.2
V	.002	.002	.002	.003	---	.002	.003	.005	.0015	.0015	.005
Y	.003	.003	.002	---	---	.002	.002	.003	.007	---	.002
Yb	.0002	.0002	.0002	.0002	---	---	.0002	.0003	---	---	.0003
Zn	---	---	---	---	---	---	---	---	---	---	---
Zr	.02	.015	.007	.01	---	.005	.007	.01	.03	---	.02

Table 3.--Analytical data, values reported in percent (continued)

Place	Mill Creek Canyon (continued)				Franson (Pi ion) Canyon					
Sample No.	19X	19Y	19Z	19ZZ	20A	20B	20C	20X	20D	20E
Thickness in metres	1.0	1.0	1.0	1.0	5.0	1.0	0.1	6.0	1.0	1.0
Carbon, total	7.66	10.0	7.74	7.20	3.09	2.15	1.79	7.38	4.01	4.68
as carbonate	7.73	9.26	7.38	4.83	2.94	2.01	.98	4.40	1.33	2.73
as organic	<.1	.8	.4	2.4	.2	.1	.8	3.0	2.7	2.0
Ag	---	---	---	---	---	---	.0002	.0003	.0005	.0007
Al	1.5	1	1.5	2	.7	.5	.5	3	7	3
B	.005	---	.007	.005	<.005	<.005	.005	.007	.01	.01
Ba	.01	.005	.007	.01	.01	.005	.01	.015	.03	.02
Be	---	---	---	---	---	---	---	---	---	---
Ca	>10	>10	>10	>10	7	5	>10	>10	7	10
Cd	---	---	---	---	---	---	---	---	---	---
Ce					---	---	< .07	---	---	---
Co	---	---	---	---	---	---	---	---	<.001	<.001
Cr	.02	.015	.03	.05	.0015	.0015	.05	.1	.15	.15
Cu	.0007	.0005	.001	.003	.0002	<.0002	.003	.007	.007	.007
Fe	.5	.5	1	1.5	.15	.1	.3	1	1.5	1.5
Ga	---	---	.001	.001	---	---	---	<.001	.0015	.0015
K	1.5	---	2	1.5	---	---	---	1.5	3	3
La	.007	---	---	.007	---	---	.03	.015	.015	.01
Mg	.7	2	5	3	2	1.5	.5	5	1.5	2
Mn	.005	.007	.01	.007	.005	.005	.001	.007	.015	.015
Mo	.0007	---	---	---	---	---	---	.0015	.0015	.0015
Nb	---	---	---	---	<.002	<.002	<.002	<.002	<.002	<.002
Nd	---			---			.03	<.05	<.05	<.05
Ni	.0015	.0015	.002	.003	.001	<.001	.003	.01	.015	.015
F	1.5	---	.7	1.5	---	---	>10	5	2	1.5
Pb	---	---	<.002	---	---	---	---	---	---	.007
Sc	---	---	---	---	---	---	---	<.0007	.0015	.001
Sr	.07	.05	.03	.05	.003	.003	.07	.02	.015	.01
Ti	.05	.05	.07	.07	.015	.003	.015	.1	.3	.2
V	.003	.002	.003	.003	<.0015	<.0015	.01	.015	015	.015
Y	.003	.002	.003	.005	---	---	.03	.015	.007	.007
Yb	.0002	---	.0002	.0003	---	---	0015	.0007	.0005	.0003
Zn	---	---	---	---	---	---	.07	.07	.07	.07
Zr	.005	.003	.003	.003	.003(82)	---	.007	.007	.01	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Frawson (Pinon) Canyon (continued)									
Sample No.	20F	20G	20H	20J	20K	20L	20M	20N	20P	20Q
Thickness in metres	0.3	1.0	1.3	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Carbon, total	7.98	2.94	2.58	10.3	6.74	6.00	5.04	6.03	5.79	8.13
as carbonate	7.35	1.40	1.73	9.60	4.90	4.05	3.82	4.86	4.93	6.69
as organic	.6	1.5	.8	.7	1.8	2.0	1.2	1.2	.9	1.4
Ag	---	.00011	---	---	.0002	.0003	.0003	.0003	.0005	.0002
Al	3	5	5	2	3	1.5	2	3	3	3
B	<.005	.01	.01	<.005	.007	.007	.007	.007	.007	.005
Ba	.015	.03	.03	.007	.02	.01	.01	.015	.015	.015
Be	---	---	---	---	---	---	---	---	---	---
Ca	>10	7	5	>10	>10	7	10	>10	>10	>10
Cd	---	---	---	---	>.01	.01	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---
Co	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	---	---
Cr	.01	.07	.02	.015	.07	.04	.03	.05	.05	.05
Cu	.001	.007	.002	.001	.007	.007	.003	.002	.002	.015
Fe	1.5	2	3	.7	1.5	1	1.5	1.5	1.5	1.5
Ga	.001	.0015	.0015	<.001	.001	.001	.001	.001	.001	<.001
K	1.5	3	3	---	3	1.5	1.5	3	3	1.5
La	---	.01	---	---	---	---	---	---	---	---
Mg	7	1.5	2	10	3	3	3	5	5	7
Mn	.03	.015	.015	.02	.01	.007	.007	.01	.007	.007
Mo	<.0007	.0015	.001	<.0007	.003	.003	.0015	.0015	.0015	.0015
Nb	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Nd		<.015								
Ni	.003	.007	.007	.003	.015	.007	.005	.005	.005	.005
P	---	2	---	---	1	.7	.7	1	1	.7
Pb	---	-	---	---	---	---	.002	.002	.002	<.002
Sc	<.001	.0015	.001	---	<.001	---	---	<.001	<.001	<.001
Sr	.015	.015	.015	.05	.02	.015	.015	.015	.015	.015
Ti	.2	.3	.3	.07	.2	.07	.07	.15	.15	.15
V	.007	.015	.01	.007	.02	.015	.01	.01	.007	.007
Y	<.002	.005	.003	<.002	.003	<.002	.003	.003	.003	002
Yb	<.0002	.0003	.0003	<.0002	.0002	<.0002	.0002	.0003	.0002	.0002
Zn	---	.07	<.07	---	.15	.15	.1	---	---	---
Zr	.01	.015	.02	.005	.007	.005	.007	.007	.007	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Prunoon (Pinon) Canyon						Strawberry Valley			
Sample No.	20R	20S	20T	20U	20V	20W	21A	21B	21C	21D
Thickness in metres	0.2	0.5	1.0	6.0	1.0	n.m.	2.5	2.5	3.0	3.0
Carbon, total	10.9	9.48	1.17	9.66	1.82	7.12	8.02	6.48	6.08	3.67
as carbonate	10.5	8.65	.37	8.79	1.68	7.08	1.10	.62	5.71	3.38
as organic	.4	.8	.8	.9	.1	<.1	6.9	5.9	.4	.3
Ag	.0001	.0003	.00015	---	---	---	.0007	.0007	---	---
Al	.7	.3	3	1.5	1.5	.7	5	5	.7	.7
B	<.005	.007	.015	<.005	.015	.005	.007	.01	.002	.003
Ba	.003	.01	.02	.005	.03	.003	.015	.015	.002	.002
Be	---	---	---	---	---	---	.002	.002	---	---
Ca	>10	>10	5	>10	5	>10	>10	10	7	3.
Cd	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	.02	<.02	---	---
Co	---	<.001	<.001	---	---	---	<.0005	.0005	---	---
Cr	.02	.05	.07	.03	.02	.01	.2	.15	.015	.007
Cu	.0007	.0015	.003	.0005	.001	.0002	.007	.01	.002	.002
Fe	.7	1	1.5	.7	.5	.3	1	1	.3	.1
Ga	---	.001	.0015	<.001	<.001	---	.0015	.0015	<.0005	<.0005
K	---	1.5	2	---	---	---	3	3	---	---
La	---	---	---	---	---	---	.015	.015	---	---
Mg	10	7	1	10	1.5	7	.7	.7	3	2
Mn	.015	.007	.007	.015	.005	.01	.007	.007	.005	.005
Mo	.0007	.0015	.0007	---	.0007	---	.0015	.0015	---	---
Nb	<.002	<.002	<.002	<.002	<.002	<.002	<.001	<.001	<.001	<.001
Nd							.01	.007		
Ni	.015	.007	.007	.001	.015	<.001	.007	.007	.0015	.002
P	---	.5	1	---	.7	.5	5	5	.3	.3
Pb	---	---	---	---	---	---	.0015	.0015	---	---
Sc	---	<.001	<.001	---	---	---	.0015	.0015	---	---
Sr	.015	.015	.007	.015	.005	.007	.03	.02	.007	.003
Ti	.03	.07	.2	.07	.07	.02	.15	.15	.02	.015
V	.007	.007	.01	.005	.002	.0015	.03	.02	.003	.002
Y	---	.002	.003	<.002	.003	<.002	.01	.01	.001	<001
Yb	---	<.0002	.0003	<.0002	<.0002	<.0002	.0007	.0007	<.0001	<.0001
Zn	---	---	---	---	---	---	.03	.05	---	---
Zr	---	.003	.01	.005	.005	.005	.007	.007	.0015	.0015

Table 3.--Analytical data, values reported in percent (continued)

Place	Strawberry Valley (continued)						MacKintire Draw			
Sample No.	21E	21F	21G	21H	21J	21K	22A	22B	22C	22D
Thickness in metres	3.0	3.0	3.0	3.0	15.0	10.0	10.0	2.0	4.0	3.5
Carbon, total	8.26	8.33	8.27	3.82	5.57	5.24	9.05	11.39	11.89	11.27
as carbonate	8.03	8.08	7.78	3.32	4.10	4.42	9.06	11.19	11.49	11.23
as organic	.2	.2	.5	.5	1.5	.8	<.1	.2	.4	<.1
Ag	---	---	---	.00005	.00015	.00005	---	---	---	---
Al	.3	.5	.5	.5	3	3	.7	.3	.5	.3
B	<.002	<.002	<.002	.003	.007	.005	---	---	---	---
Ba	.001	.0015	.003	.002	.01	.01	.005	.002	.0015	.0015
Be	---	---	---	---	<.00015	<.00015	---	---	---	---
Ca	10	7	>10	3	7	7	>10	>10	>10	>10
Cd	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---
Co	---	---	---	---	<.0005	<.0005	---	---	---	---
Cr	.007	.01	.01	.007	.07	.07	.0015	.0015	.0015	.007
Cu	.001	.001	.0015	.0015	.001	.0015	.0007	.0007	.0005	.0007
Fe	.15	.2	.15	.5	1	1	.15	.15	.15	.1
Ga	<.0005	<.0005	<.0005	<.0005	.001	.001	---	---	---	---
K	---	---	---	---	3	3	---	---	---	---
La	---	---	---	---	.005	<.005	---	---	---	<.005
Mg	5	5	5	1.5	3	3	3	7	7	7
Mn	.007	.005	.005	.002	.007	.007	.01	.007	.005	.005
Mo	---	---	---	.001	.0003	<.0003	---	---	---	---
Nb	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Nd					---	---				
Ni	.001	.0015	.0015	.0015	.002	.002	.0005	.0007	<.0005	.0007
P	.2	.2	.3	.5	.7	.7	---	---	---	---
Pb	---	---	---	---	.001	.001	.001	---	---	---
Sc	---	---	---	---	.0007	.0007	---	---	---	---
Sr	.005	.007	.007	.005	.015	.015	.007	.01	.015	.01
Ti	.007	.01	.01	.01	.1	.15	.02	.02	.015	.007
V	.0015	.002	.0015	.002	.01	.007	.002	.015	.015	.01
Y	<.001	.001	<.001	.001	.002	.002	---	---	---	<.001
Yb	<.0001	<.0001	<.0001	<.0001	.00015	.0002	---	---	---	---
Zn	---	---	---	---	---	---	---	---	---	---
Zr	.0015	.0015	.0015	.0015	.005	.007	.005	.007	.0015	.003

Table 3.--Analytical data, values reported in percent (continued)

Place	Mackintire Draw (continued)									
Sample No.	22E	22F	22G	22H	22I	22J	22K	22L	22M	22N
Thickness in metres	3.5	0.7	1.0	2.0	3.2	2.4	3.2	3.2	3.8	3.2
Carbon, total	1.86	7.81	.88	2.12	6.90	5.36	6.91	6.18	8.80	7.31
as carbonate	1.55	7.72	.36	.46	6.32	4.38	5.10	4.93	5.29	3.85
as organic	.3	<.1	.5	1.7	.6	1.0	1.8	1.2	3.5	3.5
Ag	---	---	.00015	.0003	.00015	.0007	.00015	.00015	.0005	.0007
Al	.5	.7	1	1.5	1.5	1	1	2	2	1.5
B	.005	<.002	.003	.002	.002	.002	.002	.003	.003	.003
Ba	.003	.003	.007	.01	.007	.01	.007	.02	.007	.007
Be	---	---	<.00015	<.00015	---	---	---	---	<.00015	---
Ca	3	>10	>10	>10	>10	7	10	>10	>10	7
Cd	---	---	---	<.005	---	---	---	---	---	---
Ce	---	---	<.02	.03	---	---	---	---	---	---
Co	---	---	<.0005		---	---	<.0005	<.0005	<.0005	<.0005
Cr	.003	.007	.02	.07	.05	.03	.02	.03	.07	.07
Cu	.0007	.0007	.002	.003	.002	.0015	.0015	.001	.003	.003
Fe	.15	.1	.2	.3	.3	.3	.3	.7	.7	.7
Ga	---	---	<.0005	<.0005	.0007	.0007	.0005	.0007	.001	.001
K	---	---	---	---	1.5	1.5	1	2	2	2
La	---	---	.02	.05	.005	---	---	---	.005	<.015
Mg	1	5	.1	.2	5	3	3	3	5	3
Mn	.005	.01	.003	.002	.007	.005	.005	.005	.005	.003
Mo	---	.0003	.0003	.0003	.0007	<.0003	.0003	.0005	.0007	.0007
Nb	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Nd			.015	.03	---				---	---
Ni	.0007	.0015	.003	.003	.003	.0015	.002	.002	.003	.005
P	---	---	---	---	---	---	---	---	---	---
Pb	---	.0015	.007	.005	---	---	---	.001	.0015	.0015
Sc	---	---	<.0005	.0007	<.0005	---	---	.0005	.0007	<.0005
Sr	.002	.01	.015	.02	.015	.007	.007	.015	.015	.015
Ti	.01	.015	.02	.02	.02	.02	.02	.05	.1	.07
V	.0007	.003	.007	.007	.007	.003	.003	.005	.007	.007
Y	<.001	.001	.02	.05	.003	.0015	.0015	.0015	.003	.0015
Yb	<.0001	.0001	.001	.0015	.00015	.0001	<.0001	.00015	.00015	.00015
Zn	---	---	.05	.07	---	---	---	<.03	.07	---
	.002	.003	.005	.005	.002	.003	.0015	.003	.003	.003

Table 3.--Analytical data, values reported in percent (continued)

Place	MacKintire Draw (continued)		Sheep Creek Bay							Little Brush Creek
Sample No.	22P	22Q	23A	23B	23C	23D	23E	23F	23G	24A
Thickness in metres	5.0	3.0	1.0	0.9	1.2	1.3	0.3	3.9	n.m.	0.9
Carbon, total	2.25	1.74	.80	.73	1.86	3.68	1.91	3.68	3.82	1.19
as carbonate	2.25	1.71	---	---	1.66	3.49	1.28	3.19	3.46	.89
as organic	<.1	<.1	---	---	.2	.1	.6	.5	.4	.3
Ag	---	---	---	---	---	---	---	---	---	---
Al	.7	1	3	3	1.5	5	1	3	1.5	2
B	.005	.005	.005	.01	---	.01	---	.007	.007	.005
Ba	.02	.007	.015	.05	.007	.02	.005	.015	.015	.015
Be	---	---	.0003	.0003	---	.0003	---	---	---	---
Ca	5	3	>10	10	>10	>10	>10	>10	10	>10
Cd	---	---	---	---	---	---	---	---	---	---
Ce	---	---		---						---
Co	---	---	---	---	---	---	---	---	---	
Cr	.015	.015	.2	.15	.1	.1	.1	.07	.03	.15
Cu	.003	.001	.005	.007	.0015	.0015	.007	.003	.0007	.0015
Fe	.3	.3	.7	1	.7	1	.5	.7	.5	1
Ga	<.0005	<.0005	.001	.0015	---	.0015	---	.001	---	.001
K	---	---	1.5	3	---	3	---	1.5	---	1.5
La	---	---	.03	.007	.02	.007	.02	.007	---	.02
Mg	1	.7	.3	.7	1.5	7	.2	2	3	.7
Mn	.003	.003	.0007	.003	.007	.005	.007	.007	.01	.015
Mo	<.0003	---	.002	.001	.0015	.0007	.0007	.0007	---	.0007
Nb	<.001	<.001	---	---	---	---	---	---	---	---
Nd			.015	---	.015	---	.015	---		.015
Ni	.001	.0007	.002	.007	.005	.005	.0015	.002	.0015	.003
P	---	---	>10	3	>10.	2	>10	5.	3	>10
Pb	---	---	.002	<.002	.002	---	.002	---	---	<.002
Sc	---	---	.0015	.0015	.001	.0015	.001	.001	---	.0015
Sr	.007	.007	.1	.03	.05	.03	.05	.02	.02	.07
Ti	.03	.02	.1	.2	.05	.2	.02	.15	.7	.07
V	.002	.001	.03	.015	.01	.01	.007	.007	.003	.015
Y	.001	.001	.05	.007	.02	.005	.03	.005	.002	.02
Yb	<.0001	<.0001	.002	.0003	.0015	.0003	.001	.0003	---	.0007
Zn	---	---	---	---	---	---	---	---	---	---
Zr	.002	.0015	.01	.01	.007	.015	.005	.01	.003	.007

Table 3.--Analytical data, values reported in percent (continued)

Place	Little Brush Creek (continued)					W. Fork Duchesne River			Right Fork Hobble Creek	
Sample No.	24B	24C	24D	24E	24F	25CE	25GH	25JK	26AD	26FH
Thickness in metres	0.8	0.2	.10	1.4	0.8	4.8	4.5	5.0	33.3	1.52
Carbon, total	2.79	2.09	3.17	2.08	4.70	6.10	3.57	4.02	4.04	2.87
as carbonate	1.37	.63	1.26	1.89	4.43	2.92	2.58	2.98	2.34	1.37
as organic	1.4	1.5	1.9	0.2	.3	3.2	1.0	1.0	1.7	1.5
Ag	---	---	---	---	---	.00015	.0005	.0001	.0001	---
Al	3.	1.5	1.5	3.	.7	3.	1.5	3.	2.	1.5
B	.007	.01	.005	.007	---	.01	.007	.015	.01	.01
Ba	.02	.1	.03	.015	.02	.02	.007	.015	.01	.01
Be	---	---	---	---	---	.00015	---	---	---	---
Ca	>10.	7.	>10.	>10.	>10.	7.	5.	10.	10.	7.
Cd	---	---	---	---	---	---	---	---	---	---
Ce	---	---	---	---	---	---	---	---	---	---
Co		---		---		---	---	<.0005	<.0005	---
Cr	.2	.03	.15	.1	.05	.1	.03	.1	.07	.07
Cu	.0015	.0007	.001	.0007	.0007	.002	.001	.015	.002	.0015
Fe	1.5	1.	.7	1.	1.	1.5	.7	1.5	1.	.7
Ga	.0015	.001	---	.001	---	.0015	.0007	.0015	.0015	.007
K	1.5	---	---	1.5	---	3.	2.	3.	2.	1.5
La	.015	---	.015	.01	.01	.003	---	.003	.003	.003
Mg	1.	.7	.5	2.	.15	2.	2.	3.	1.5	.5
Mn	.015	.015	.015	.015	.05	.007	.007	.007	.007	.005
Mo	.0007	.0007	.0007	.0007	.0007	.0005	.0007	.0003	.0003	---
Nb	---	---	---	---	---	---	---	---	---	---
Nd	.015		---	.015	.015	---		---	---	---
Ni	.003	.005	.003	.003	.003	.005	.0015	.003	.003	.002
P	10.	3.	>10.	7.	7.	1.	.7	2.	1.5	1.
Pb	<.002	---	---	---	---	.003	.002	.007	---	---
Sc	.0015	---	.0015	.001	.0015	.0007	---	.0007	.0007	<.0005
Sr	.07	.015	.07	.05	.05	.02	.01	.03	.02	.015
Ti	.15	.05	.07	.1	.02	.15	.05	.15	.1	.1
V	.01	.005	.007	.007	.005	.015	.005	.01	.007	.005
Y	.015	.003	.015	.007	.007	.003	.0015	.003	.005	.003
Yb	.0007	.0002	.0007	.0003	.0003	.0003	.0001	.0003	.0003	.0003
Zn	---	---	---	---	---	.03	.03	---	<.03	---
Zr	.007	.005	.007	.007	---	.005	.002	.007	.005	.005

Table 3.--Analytical data, values reported in percent (continued)

Place	Red Butte Creek		Baldwin Creek			Anchor dam		Sappington Canyon	Retort Mountains	
Sample No.	27FJ	27LQ	28CD	28EF	28GJ	29AD	29EG	31BE	35BE	35FI
Thickness in metres	23.0	22.5	11.0	6.0	5.2	8.0	3.5	4.3	7.5	9.5
Carbon, total	4.18	4.01	2.61	3.09	3.05	2.69	9.01	2.78	1.64	11.9
C as carbonate	3.34	3.49	1.87	2.39	2.42	2.63	8.87	1.44	.03	.02
C as organic	.8	.5	.7	.7	.6	<.1	.1	1.3	1.6	11.9
Ag	---	---	---	---	---	---	---	.0003	.001	.0005
Al	1.5	1	10	5	1.5	3	1	2	2	3
B	.007	.01	.01	.007	.007	.01	---	.007	.01	.007
Ba	.01	.007	.03	.02	.01	.03	.007	.02	.02	.02
Be	---	---	.0002	.00015	---	---	---	.00015	.0002	.0002
Ca	10	3	5	10	7	3	>10	10	3	7
Cd	---	---	---	---	---	---	---	.01	.007	---
Ce	---	---	---	---	---	---				
Co	---	---	.0007	.0005	---	.0007	---	---	---	---
Cr	.05	.05	.05	.05	.05	.007	.03	.05	.07	.07
Cu	.0015	.0015	.002	.0015	.001	.0015	.0007	.003	.01	.01
Fe	.7	.7	3	2	1.5	1.5	1	1.5	1.5	1.5
Ga	.0007	.001	.003	.002	.001	.002	<.0005	.001	.0015	.0015
K	1.5	2	7	3	3	3	---	1	2	2
La	.003	---	.003	.003	.003	---	.003	.015	.01	.02
Mg	5	5	5	5	3	3	2	1.5	.2	.3
Mn	.007	.003	.015	.015	.007	.01	.007	.02	.003	.003
Mo	.0003	---	.0003	.0005	.0005	---	---	.002	.007	.005
Nb	---	---	.001	<.001	<.001	.001	---	---	<.001	<.001
Nd	---		---	---	---		---	.007	.01	.015
Ni	.0015	.0015	.002	.002	.0015	.001	.0007	.003	.002	.005
P	1.5	.3	.5	1	1.5	---	.7	5	3	3
Pb	---	---	.0015	.002	.0015	.0015	.001	.003	.0015	.0015
Sc	<.0005	---	.001	.0007	<.0005	.0007	---	.0007	.0007	.001
Sr	.02	.005	.015	.03	.015	.01	.015	.05	.02	.03
Ti	.15	.07	.2	.15	.1	.15	.02	.1	.15	.15
V	.07	.07	.01	.007	.007	.007	.005	.03	.07	.03
Y	.003	.0015	.003	.003	.003	.002	.003	.01	.01	.015
Yb	.0002	.00015	.0003	.0003	.0002	.0002	.00015	.0007	.0007	.001
Zn	---	---	<.03	<.03	---	---	---	.1	---	---
Zr	.01	.003	.01	.007	.005	.015	.003	.007	.015	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Retort Mountain (continued)	Anaconda Warm Springa Creek			W. Fork Blacktail Deer Creek					
Sample No.	35JL	36A	36C	36D	37BD	37E	37F	37G	37HK	37LM
Thickness in metres	11.3	2.1	1.7	3.0	5.0	1.0	2.0	0.6	15.0	3.0
Carbon, total	13.3	2.20	8.54	1.94	12.8	12.4	13.5	4.26	8.82	5.60
as carbonate	< .01	.05	.75	.75	7.44	10.2	.08	.26	.52	.13
as organic	13.3	2.2	8.5	1.2	5.4	2.2	13.4	4.0	8.3	5.5
Ag	.002	.0003	.0003	---	.0003	---	.0015	.0007	.001	.0015
Al	3	1	5	10	2	.7	3	1	3	1.5
B	.007	---	---	.005	.002	---	.007	---	.01	.002
Ba	.02	.02	.15	.05	.01	.003	.02	.01	.02	.015
Be	.0002	---	---	---	.00015	---	.0002	.00015	.00015	.0002
Ca	1.5	>10	>10	5	10	10	10	>10	3	>10
Cd	---	---	---	---	---	---	.01	.015	.01	.01
Ce	---	.05		---					---	---
Co	---	---	---	.0015	---	---	---	---	---	---
Cr	.07	.07	.15	.01	.05	.015	.1	.07	.07	.1
Cu	.015	.01	.007	.005	.003	.002	.015	.002	.007	.007
Fe	1.5	5	1.5	3	.7	.3	1.5	.7	1.5	1.5
Ge	.0015	---	.001	.002	.001	.0005	.0015	< .0005	.0015	.0007
K	3	---	---	5	3	.7	5	---	3	.7
La	.007	.07	.05	.007	.003	---	.015	.07	.007	.02
Mg	.3	.1	.3	1	7	7	.5	.15	1	.3
Mn	.003	.003	.007	.1	.03	.01	.005	.007	.007	.003
Mo	.003	.003	.005	---	.0007	.0003	.003	.0015	.002	.003
Nb	---	---	.002	.002	---	---	.001	---	.001	---
Nd	.007	.05	.03	---	---		.007	.07	.007	.015
Ni	.003	.003	.003	.003	.005	.003	.007	.003	.005	.003
P	1.5	>10	>10	---	.7	.3	3	>10	2	10
Pb	.0015	---	.002	.003	---	---	.002	.0015	.0015	.0015
Sc	.0007	---	.0015	.0015	.0005	---	.0007	.001	.0007	.001
Sr	.02	.07	.07	.0015	.05	.02	.05	.15	.03	.05
Ti	.1	.07	.2	.5	.07	.015	.15	.03	.15	.07
V	.05	.03	.07	.015	.01	.007	.07	.05	.05	.07
Y	.005	.1	.07	.002	.005	.0015	.015	.1	.01	.03
Yb	.0007	.007	.005	.0002	.0003	.00015	.001	.005	.0005	.0015
Zn	.03	---	---	---	.03	.03	.03	.03	.03	.03

Table 3.--Analytical data, values reported in percent (continued)

Place	Hawley Creek			Snakey Canyon	Taylor Creek		
Sample No.	38AE	38F	38GK	39AP	40G	40HK	40LP
Thickness in metres	6.4	1.0	6.2	10.8	0.014	3.0	10.0
Carbon, total	5.70	6.29	7.32	1.72	11.8	3.32	2.97
as carbonate	3.68	.81	4.08	<.01	.03	.25	.87
as organic	2.0	5.5	3.2	1.7	11.8	3.1	2.1
Ag	.001	.0015	.007	---	.0015	.00015	---
Al	.7	1.5	2	5	3	5	3
B	---	.002	.002	.015	.007	.01	.007
Ba	.01	.01	.015	.05	.02	.03	.02
Be	---	.00015	---	.0002	.0002	.0002	.0015
Ca	>10	>10	>10	.5	1.5	.7	1.5
Cd	---	.007	---	---	---	---	---
Ce	---	---	---	---	.01	---	.007
Co	---	---	---	---	---	.0007	.0005
Cr	.07	.2	.15	.07	.07	.03	.02
Cu	.003	.015	.007	.01	.015	.003	.002
Fe	.15	.5	1	3	3	3	1
Ga	<.0005	.005	.001	.002	.0015	.002	.0015
K	.7	.7	3	3	5	3	3
La	.02	.02	.02	.003	.007	.003	.003
Mg	5	.5	7	.7	.5	.7	1.5
Mn	.007	.003	.007	.005	.005	.01	.01
Mo	.0015	.005	.003	.0015	.002	.003	.005
Nb	---	---	---	.001	<.001	.001	<.001
Nd	.015	.015	.01	.007	.007	.007	---
Ni	.007	.015	.01	.01	.007	.005	.003
P	7	10	3	---	1.5	.3	.3
Pb	---	.001	.0015	.001	.0015	.0015	.0015
Sc	.0007	.001	.0007	.001	.0007	.001	.0007
Sr	.1	.3	.07	.015	.015	.015	.007
Ti	.05	.07	.1	.2	.15	.2	.15
V	.02	.07	.03	.015	.05	.015	.015
Y	.02	.02	.015	.003	.007	.003	.003
Yb	.001	.001	.0007	.0003	.0007	.0003	.0003
Zn	.03	.05	.05	.05	.07	---	.05
Zr	.007	.01	.01	.01	.007	.015	.01

Table 3.--Analytical data, values reported in percent (continued)

Place	Red Mountain	Cokeville Hydroelec. Plant	Cokeville Butte			
Sample No.	42CJ	43BE	44AD	44EF	44GJ	44KP
Thickness in metres	9.3	5.4	16.2	12.5	2.5	8.7
Carbon, total	5.36	2.74	5.39	4.50	3.77	6.99
as carbonate	2.53	1.77	2.85	3.59	2.78	6.51
as organic	2.8	1.0	2.5	.9	1.0	.5
Ag	.001	---	.0007	.0003	.00015	---
Al	2	3	2	2	3	2
B	.003	.01	.005	.002	.003	.005
Ba	.015	.03	.015	.015	.02	.01
Be	.00015	.00015	---	.00015	---	---
Ca	>10	10	10	>10	>10	>10
Cd	.015	---	.005	---	<.005	---
Ce						
Co	<.0005	<.0005	---	---	---	---
Cr	.1	.07	.05	.07	.05	.02
Cu	.015	.002	.005	.003	.002	.001
Fe	1	1.5	1.5	.7	1	.7
Ga	.001	.0015	.001	.0007	.001	.001
K	2	3	3	1	2	2
La	.01	.007	.007	.03	.01	.003
Mg	3	1.5	3	.5	.7	2
Mn	.015	.007	.007	.007	.01	.01
Mo	.002	.0003	.003	.0005	.0015	.0003
Nb	---	<.001	---	---	---	---
Nd	---	---	---	.03	---	---
Ni	.01	.003	.01	.003	.007	.002
P	5	1.5	2	7	7	---
Pb	.002	.003	.001	.001	.0015	---
Sc	.0007	.001	.0007	.0007	.0007	.0005
Sr	.07	.02	.05	.15	.1	.02
Ti	.1	.15	.15	.1	.15	.1
V	.07	.015	.05	.015	.05	.005
Y	.01	.007	.007	.03	.01	.002
Yb	.0007	.0005	.0005	.0015	.0007	.00015
Zn	.1	<.03	.1	<.03	.07	---
Zr	.01	.007	.01	.01	.015	.005