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Gamma-ray spectrometric and semiquantitative spectrographic analytical data of the thorium and rare-earth disseminated deposits in the southern Bear Lodge Mountains, Wyoming.

by

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Introduction

The purpose of this report is to present analytical data on 343 samples taken in the thorium and rare-earth disseminated deposits in the southern Bear Lodge Mountains. The results obtained from some or all of these data have been used first in resource calculations made on these deposits (Staatz and others, 1979, p. 23-27) and second in an overall description of these deposits and their surrounding geology (Staatz, in press).

The southern Bear Lodge Mountains occupy an area of approximately 110 km^2 just north of the town of Sundance in Crook County, Wyoming. The Bear Lodge dome underlies most of this area. It consists of a core of Tertiary intrusive rocks that has domed up the surrounding sedimentary rocks of Paleozoic and Mesozoic age. The central core of Tertiary intrusive rocks, mainly trachyte and phonolite, was formed by multiple intrusions of alkalic igneous rocks, during a period of at least 20 million years. This alkalic igneous core has an oval outcrop pattern and is exposed over an area about 8.8 km long by 3.5 km wide. Separate, smaller intrusive bodies also intrude the sedimentary rocks along the flanks of the dome. In the southern half of the core, isolated bodies of granite of Precambrian age are surrounded by the Tertiary alkalic rocks. After most of the igneous rocks were intruded the rocks in the central and north-central parts of the core were fractured, altered, and many of the fractures filled with sanidine-rich vein material. The greater part of this material occurs in thin veinlets that, with their surrounding host rock, make up the disseminated deposits. Most of the veinlets range from fracture coatings to veins as much as 0.6 cm thick. The fractures and the emplaced veinlets are numerous, crisscrossing, and strike in many directions. Dips are variable. Some 26 veins, ranging in thickness from 5 cm to 1.7 m, are also found in the area, but they are not included in the disseminated deposits.

The resources of these veins are small, and their description and chemistry have been reported elsewhere (Staatz and others, 1979, p. 17-18; Staatz, in press). Data in table 1 are entirely on samples taken from the disseminated deposits.

The veinlets in the disseminated deposits are brown, black, or gray. The color generally depends on the abundance of various iron and manganese oxides. Goethite tends to color the veinlets shades of brown; the presence of pyrolusite, cryptomelane, or finely disseminated specular hematite gives the veinlets a black color. Only where these oxides are lacking, or present in only small amounts does a vein show the color of the other minerals present. The principal thorium and rare-earth minerals are brockite and monazite. In addition, rare earths also occur in bastnaesite and weinschenkite. Sanidine is the principal gangue mineral. Common accessory minerals include magnetite, barite, rutile, and brookite.

The size and boundaries of the deposits, may be sharp or gradational. Most of the alkalic rocks have been altered after their emplacement and neither the outline nor relative grade is visually determinable. The position and grade of the disseminated deposits can be determined by either chemical or radiometric analyses. In order to determine the general outline of the disseminated deposits, radiometric readings were taken over the entire igneous central core of the Bear Lodge dome, an area of approximately 30 km^2, with a Mount Sopris scintillation counter. A contour map made from some 537 readings was compiled. Individual readings in this survey ranged from 125 to 2,000 counts per second. The area of principal interest, however, lies within the 400 counts-per-second contour. This contour, shown on figure 1, was used to select the area to be sampled in detail.

Methods of present study

All samples analyzed were taken either of bed rock or of dump material that had been dug out of bed rock. The greater part of the alkalic intrusive rocks is covered by several centimeters to a few meters of overburden. Outcrops are common along ridges. Many bulldozer trenches were made in the area in the early 1950's during exploration for rare earth-veins. In addition, there are scattered hand-dug pits that were made in prospecting for other metals during the first part of the twentieth century. Our sampling was done principally in the bulldozer trenches, either along the sides of the trenches or from the dumps. In addition we also sampled outcrops exposed in small hand-dug pits, along ridges, and in road cuts. All samples were chip samples and were taken so as to represent the average disseminated deposit at the sample locality. Veins 5 cm or more thick are widely scattered, few in number, and were not included in sampling. Although these veins would undoubtedly be mined along with the smaller veinlets in any mining operation, their relatively small volume and much higher grade would disproportionatel y affect the grade of the disseminated deposits. Most of the samples lie within the 400 count-per-second contour. The locations of all the samples taken are shown on figure 1.

The samples weighed 2 to 3 kg, and were ground to -20 mesh. A 600-gm split was measured out of every sample and used by Bunker and Bush to analyze for thorium (Th), radium equivalent uranium (RaeU), and potassium (K) on a gamma-ray spectrometer. From a total of about 340 samples, 192 samples were chosen for semiquantitative spectrographic analyses by Conklin. These samples were selected to give a representative geographic coverage. A split of approximately 150 g was taken for this purpose and ground to -150 mesh. In addition, the various mineral components of some samples were separated by a heavy liquid and a magnetic separator. The various minerals were identified by X-ray diffraction, and the results of the mineralogic work are given in a separate report (Staatz, in press).

Chemical Analyses

The results of the chemical analyses are given in table 1. Thorium, uranium, and potassium were analyzed by a quantitative gamma-ray spectrometer that measures over 512 channels with a 12.7 cm diameter by 10.2 cm thick NaI crystal. This method has a precision of ±3 percent. Thorium content of the 343 samples ranges from 9.3 to 990 parts per million (ppm). Of these samples, 265 contained at least 50 ppm thorium. The uranium content of these same samples ranges from 1.8 to 346 ppm. Only five samples, however, contained as much as 80 ppm uranium and only one sample contained more than 120 ppm.

All other elements analyzed were done by semiquantitative spectrographic analyses. Results were grouped into several levels bracketed by 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, and so forth, and then reported as mid-values between these brackets. Thus, the numbers reported would be 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, and so forth. The precision of a reported value is approximately plus or minus one level. The lower limit of detection varies from element to element. This lower limit is generally a constant for any specific element, but in some samples large amounts of another element will produce interfering lines on the spectrographic plate and raise the limit of detection. This accounts for the variation in the lower limit of detection shown for some elements in table 1. The original semiquantitative spectrographic analyses furnished data on 57 elements. We have reported on 34 of these elements (table 1). We have eliminated a few like silicon and aluminum, which occur in all samples in amounts greater than 10 percent, as well as many elements, such as arsenic, boron, gold, antimony, and tungsten, which occur in insignificant amounts in all samples. In addition we give a value for total rare earths, which is the sum of all individual rare earths whose values lay above the limit of detection. Rare earths are probably the most economically significant metals in these deposits. The total rare earth content of the 192 samples ranges from 47 to 27,145 ppm. Of these samples, 171 contain in excess of 500 ppm total rare earths, and 54 contain in excess of 5,000 ppm.

Present work and acknowledgments

The first 38 samples listed in table 1 were collected by Staatz between 1974 and 1977, while he was making a geologic map of the area. The rest of the samples were taken during the summer of 1979 during a detailed study of the disseminated deposits. During the summer of 1979, Staatz was assisted in the sampling program for various periods by Russell F. Dubiel, Timothy E. Mower, and David F. Piske, Jr. Sample preparation was carried out by Isabelle K. Brownfield, Timothy E. Mower, and William F. Robinson IV.

References cited

Staatz, M. H., Armbrustmacher, T. J., Olson, J. C., Brownfield, I. K., Brock, M. R., Lemons, J. F., Jr., Coppa, L. V., and Clingan, B. V., 1979, Principal thorium resources in the United States: U.S. Geological Survey Circular 805, 42 p.

Staatz, M. H., in press, Geology and description of thorium and rare-earth deposits in the southern Bear Lodge Mountains, northeastern Wyoming: U.S. Geological Survey Professional Paper, in press.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains.
[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	25	26	27	28	29	30	31	32	33
Sample No.	MHS-30-77	MHS-29-77	MHS-31-77	MHS-110-75	MHS-81-75	MHS-45-77	MHS-32-77	MHS-33-77	MHS-52-77
Element	In parts per million								
Thorium[1]	104	156	220	93	128	46	79	113	175
Uranium[1]	7	12	16	14	10	47	52	36	14
Lanthanum[2]	N.D.	N.D.	N.D.	N.D.	300	N.D.	N.D.	1,500	1,000
Cerium[2]	N.D.	N.D.	N.D.	N.D.	700	N.D.	N.D.	1,500	1,500
Praesodymium[2]	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.	300	200
Neodymium[2]	N.D.	N.D.	N.D.	N.D.	700	N.D.	N.D.	1,500	700
Samarium[2]	N.D.	N.D.	N.D.	N.D.	200	N.D.	N.D.	150	150
Europium[2]	N.D.	N.D.	N.D.	N.D.	<100	N.D.	N.D.	<100	<100
Gadolinium[2]	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.	150	100
Terbium[2]	N.D.	N.D.	N.D.	N.D.	<300	N.D.	N.D.	<300	<300
Dysprosium[2]	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<500	<50
Holmium[2]	N.D.	N.D.	N.D.	N.D.	<20	N.D.	N.D.	30	<20
Erbium[2]	N.D.	N.D.	N.D.	N.D.	<50	N.D.	N.D.	<50	<50
Thulium[2]	N.D.	N.D.	N.D.	N.D.	<20	N.D.	N.D.	<20	<20
Ytterbium[2]	N.D.	N.D.	N.D.	N.D.	15	N.D.	N.D.	10	3
Lutetium[2]	N.D.	N.D.	N.D.	N.D.	<30	N.D.	N.D.	<30	<30
Yttrium[2]	N.D.	N.D.	N.D.	N.D.	200	N.D.	N.D.	300	150
Total rare earths	N.D.	N.D.	N.D.	N.D.	2,335	N.D.	N.D.	5,440	3,803
Barium[2]	N.D.	N.D.	N.D.	N.D.	2,000	N.D.	N.D.	3,000	1,500
Beryllium[2]	N.D.	N.D.	N.D.	N.D.	7	N.D.	N.D.	7	3
Bismuth[2]	N.D.	N.D.	N.D.	N.D.	10	N.D.	N.D.	10	<10
Copper[2]	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.	300	30
Lead[2]	N.D.	N.D.	N.D.	N.D.	300	N.D.	N.D.	300	70
Manganese[2]	N.D.	N.D.	N.D.	N.D.	3,000	N.D.	N.D.	700	700
Molybdenum[2]	N.D.	N.D.	N.D.	N.D.	30	N.D.	N.D.	50	30
Niobium[2]	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.	70	70
Strontium[2]	N.D.	N.D.	N.D.	N.D.	1,000	N.D.	N.D.	1,500	1,500
Tin[2]	N.D.	N.D.	N.D.	N.D.	<10	N.D.	N.D.	<10	<10
Vanadium[2]	N.D.	N.D.	N.D.	N.D.	200	N.D.	N.D.	700	200
Zinc[2]	N.D.	N.D.	N.D.	N.D.	500	N.D.	N.D.	700	<300
Zirconium[2]	N.D.	N.D.	N.D.	N.D.	300	N.D.	N.D.	200	200
	In percent								
Calcium[2]	N.D.	N.D.	N.D.	N.D.	.3	N.D.	N.D.	.15	.0
Iron[2]	N.D.	N.D.	N.D.	N.D.	7	N.D.	N.D.	>10	3
Magnesium[2]	N.D.	N.D.	N.D.	N.D.	.15	N.D.	N.D.	.7	.0
Phoaphorus[2]	N.D.	N.D.	N.D.	N.D.	<.2	N.D.	N.D.	<.2	<.2
Potassium[1]	11	9.8	11.3	11.2	11.7	9.3	8.6	8.2	11.7
Sodium[2]	N.D.	N.D.	N.D.	N.D.	1	N.D.	N.D.	.7	.7
Titanium[2]	N.D.	N.D.	N.D.	N.D.	.7	N.D.	N.D.	.3	.3

[1] Analyzed by gamma-ray spectrometer by C. M. Bunker and C. A. Bush.

[2] Analyzed by semi-quantitative six-step spectrographic method by N. M. Conklin.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	34	35	36	37	38	39	40	41	42
Sample No.	MHS-51-77	MHS-50-77	MHS-84-75	MHS-34-77	MHS-55-75	MHS-35-77	MHS-53-77	MHS-49-77	MHS-56-77
Element	In parts per million								
Thorium[1]	193	260	285	123	350	149	135	197	74
Uranium[1]	8	19	25	10	13	5	63	42	17
Lanthanum[2]	150	N.D.	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cerium	300	N.D.	2,000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Praesodymium[2]	<100	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Neodymium[2]	300	N.D.	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Samarium[2]	<100	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Europium[2]	<100	N.D.	<100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Gadolinium[2]	<50	N.D.	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Terbium[2]	<300	N.D.	<300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dysprosium[2]	<50	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Holmium[2]	<20	N.D.	<20	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Erbium[2]	<50	N.D.	<50	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Thulium[2]	<20	N.D.	<20	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ytterbium[2]	2	N.D.	30	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Lutetium[2]	<30	N.D.	<30	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Yttrium[2]	70	N.D.	700	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total rare earths	822	N.D.	6,480	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Barium[2]	1,500	N.D.	3,000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beryllium[2]	<1.5	N.D.	3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bismuth[2]	10	N.D.	<10	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Copper[2]	70	N.D.	200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Lead[2]	70	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Manganese[2]	1,000	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Molybdenum[2]	30	N.D.	200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Niobium[2]	70	N.D.	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Strontium[2]	1,500	N.D.	1,000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tin[2]	<10	N.D.	<10	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vanadium[2]	150	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zinc[2]	<300	N.D.	<300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zirconium[2]	150	N.D.	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	In percent								
Calcium[2]	.07	N.D.	.07	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Iron[2]	1.5	N.D.	<10	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Magnesium[2]	.3	N.D.	.07	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phosphorus[2]	<.2	N.D.	<.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Potassium[1]	11.3	10.9	10.9	11.6	9.8	9.1	9.6	9.9	11.2
Sodium[2]	1.5	N.D.	.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Titanium[2]	.15	N.D.	.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	43	44	45	46	47	48	49	50	51
Sample No.	MHS-47-77	MHS--48-77	MHS-54-77	MHS-36-77	MHS-37-77	MHS-57-75	MHS-59-77	MHS-58-77	MHS-39-77
Element	In parts per million								
Thorium[1]	132	74	102	116	68	990	202	470	120
Uranium[1]	16	11	40	9	11	90	8	34	13
Lanthanum[2]	N.D.	500	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cerium[2]	N.D.	1,000	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Praesodymium[2]	N.D.	150	200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Neodymium[2]	N.D.	700	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Samarium[2]	N.D.	150	200	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Europium[2]	N.D.	<100	<100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Gadolinium[2]	N.D.	70	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Terbium[2]	N.D.	<300	<300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dysprosium[2]	N.D.	<50	<500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Holmium[2]	N.D.	<20	<20	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Erbium[2]	N.D.	<50	<50	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Thulium[2]	N.D.	<20	<20	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ytterbium[2]	N.D.	3	3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Lutetium[2]	N.D.	<30	<30	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Yttrium[2]	N.D.	100	100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total rare earths	N.D.	2,673	5,153	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Barium[2]	N.D.	5,000	3,000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beryllium[2]	N.D.	3	7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bismuth[2]	N.D.	<10	15	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Copper[2]	N.D.	70	30	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Lead[2]	N.D.	30	700	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Manganese[2]	N.D.	3,000	7,000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Molybdenum[2]	N.D.	15	30	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Niobium[2]	N.D.	70	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Strontium[2]	N.D.	1,500	1,500	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tin[2]	N.D.	10	<10	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vanadium[2]	N.D.	200	150	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zinc[2]	N.D.	<300	700	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zirconium[2]	N.D.	150	100	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	In percent								
Calcium[2]	N.D.	.3	.07	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Iron[2]	N.D.	3	7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Magnesium[2]	N.D.	.7	.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phosphorus[2]	N.D.	<.2	<.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Potassium[1]	10.8	10.9	9.9	10.2	10.6	6	9.8	10.4	11.2
Sodium[2]	N.D.	.7	.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Titanium[2]	N.D.	.3	.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	52	53	54	55	56	57	58	59	60
Sample No.	MHS-40-77	MHS-38-77	BL-11-74	MHS-46-75	MHS-57-77	BL-4-74	MHS-41-75	MHS-42-77	MHS-41-77
Element	In parts per million								
Thorium[1]	74	135	133	345	335	225	292	110	49
Uranium[1]	27	11	346	117	69	29	24	10	10
Lanthanum[2]	1,500	700	7,000	N.D.	7,000	2,000	N.D.	1,500	N.D.
Cerium[2]	1,500	1,500	7,000	N.D.	10,000	7,000	N.D.	1,500	N.D.
Praesodymium[2]	500	150	700	N.D.	1,000	<100	N.D.	150	N.D.
Neodymium[2]	1,500	700	3,000	N.D.	7,000	1,500	N.D.	700	N.D.
Samarium[2]	300	150	500	N.D.	1,500	300	N.D.	100	N.D.
Europium[2]	<100	<100	150	N.D.	<100	<100	N.D.	<100	N.D.
Gadolinium[2]	150	70	150	N.D.	300	150	N.D.	70	N.D.
Terbium[2]	<300	<300	<300	N.D.	<300	<300	N.D.	<300	N.D.
Dysprosium[2]	<500	<50	<50	N.D.	<500	200	N.D.	<50	N.D.
Holmium[2]	<20	<20	<20	N.D.	30	<20	N.D.	<20	N.D.
Erbium[2]	<50	<50	<50	N.D.	<50	<50	N.D.	<50	N.D.
Thulium[2]	<20	<20	<20	N.D.	<20	<20	N.D.	<20	N.D.
Ytterbium[2]	7	2	15	N.D.	15	10	N.D.	3	N.D.
Lutetium[2]	<30	<30	<30	N.D.	<30	<30	N.D.	<30	N.D.
Yttrium[2]	150	70	150	N.D.	300	100	N.D.	100	N.D.
Total rare earths	5,457	3,342	18,665	N.D.	26,845	11,260	N.D.	4,123	N.D.
Barium[2]	3,000	2,000	7,000	N.D.	7,000	2,000	N.D.	3,000	N.D.
Beryllium[2]	2	3	5	N.D.	7	7	N.D.	7	N.D.
Bismuth[2]	<10	<10	15	N.D.	30	15	N.D.	15	N.D.
Copper[2]	150	50	70	N.D.	150	500	N.D.	70	N.D.
Lead[2]	150	150	300	N.D.	700	500	N.D.	300	N.D.
Manganese[2]	700	200	7,000	N.D.	150	500	N.D.	3,000	N.D.
Molybdenum[2]	70	30	100	N.D.	200	150	N.D.	30	N.D.
Niobium[2]	150	150	2,000	N.D.	200	200	N.D.	30	N.D.
Strontium[2]	2,000	1,500	3,000	N.D.	2,000	1,000	N.D.	3,000	N.D.
Tin[2]	<10	<10	15	N.D.	<10	<10	N.D.	<10	N.D.
Vanadium[2]	150	150	700	N.D.	700	300	N.D.	300	N.D.
Zinc[2]	<300	<300	<300	N.D.	<300	<300	N.D.	300	N.D.
Zirconium[2]	200	150	100	N.D.	200	200	N.D.	200	N.D.
	In percent								
Calcium[2]	.07	.03	.2	N.D.	.1	.03	N.D.	.07	N.D.
Iron[2]	3	2	>10	N.D.	7	>10	N.D.	7	N.D.
Magnesium[2]	.07	.07	.7	N.D.	.07	.05	N.D.	.015	N.D.
Phosphorus[2]	<.2	<.2	.2	N.D.	<.2	<.2	N.D.	<.2	N.D.
Potassium[1]	10.7	11.8	8.4	4.4	8.4	8.2	4.9	9.7	9.4
Sodium[2]	.7	.7	.5	N.D.	.7	.5	N.D.	.7	N.D.
Titanium[2]	.3	.3	.5	N.D.	.2	.2	N.D.	.15	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	61	62	63	64	65	66	67	68	69
Sample No.	MHS-33-75	MHS-28-75	MHS-2-79	MHS-3-79	MHS-4-79	MHS-5-79	MHS-1-79	MHS-6-79	MHS-7-79
Element	In parts per million								
Thorium[1]	26	17	23	62	22	21	22	33	72
Uranium[1]	8	8	10	6.7	10	5.2	4.7	7.4	4.4
Lanthanum[2]	150	N.D.	150	N.D.	N.D.	150	N.D.	N.D.	150
Cerium[2]	300	N.D.	150	N.D.	N.D.	150	N.D.	N.D.	150
Praesodymium[2]	<100	N.D.	<100	N.D.	N.D.	<100	N.D.	N.D.	<100
Neodymium[2]	300	N.D.	100	N.D.	N.D.	150	N.D.	N.D.	100
Samarium[2]	<100	N.D.	<100	N.D.	N.D.	<100	N.D.	N.D.	<100
Europium[2]	<100	N.D.	<100	N.D.	N.D.	<100	N.D.	N.D.	<100
Gadolinium[2]	<50	N.D.	<50	N.D.	N.D.	<50	N.D.	N.D.	<50
Terbium[2]	<300	N.D.	<300	N.D.	N.D.	<300	N.D.	N.D.	<300
Dysprosium[2]	<50	N.D.	<50	N.D.	N.D.	<50	N.D.	N.D.	<50
Holmium[2]	<20	N.D.	<20	N.D.	N.D.	<20	N.D.	N.D.	<20
Erbium[2]	<50	N.D.	<50	N.D.	N.D.	<50	N.D.	N.D.	<50
Thulium[2]	<20	N.D.	<20	N.D.	N.D.	<20	N.D.	N.D.	<20
Ytterbium[2]	7	N.D.	3	N.D.	N.D.	3	N.D.	N.D.	3
Lutetium[2]	<30	N.D.	<30	N.D.	N.D.	<30	N.D.	N.D.	<30
Yttrium[2]	70	N.D.	30	N.D.	N.D.	30	N.D.	N.D.	30
Total rare earths	827	N.D.	433	N.D.	N.D.	483	N.D.	N.D.	433
Barium[2]	700	N.D.	3,000	N.D.	N.D.	2,000	N.D.	N.D.	1,500
Beryllium[2]	5	N.D.	7	N.D.	N.D.	2	N.D.	N.D.	7
Bismuth[2]	<10	N.D.	<10	N.D.	N.D.	<10	N.D.	N.D.	<10
Copper[2]	30	N.D.	150	N.D.	N.D.	30	N.D.	N.D.	70
Lead[2]	50	N.D.	30	N.D.	N.D.	30	N.D.	N.D.	30
Manganese[2]	1,500	N.D.	300	N.D.	N.D.	150	N.D.	N.D.	300
Molybdenum[2]	<3	N.D.	20	N.D.	N.D.	30	N.D.	N.D.	7
Niobium[2]	50	N.D.	20	N.D.	N.D.	15	N.D.	N.D.	30
Strontium[2]	1,500	N.D.	7,000	N.D.	N.D.	5,000	N.D.	N.D.	3,000
Tin[2]	<10	N.D.	<10	N.D.	N.D.	<10	N.D.	N.D.	<10
Vanadium[2]	200	N.D.	700	N.D.	N.D.	300	N.D.	N.D.	700
Zinc[2]	<300	N.D.	<300	N.D.	N.D.	<300	N.D.	N.D.	<300
Zirconium[2]	700	N.D.	300	N.D.	N.D.	300	N.D.	N.D.	200
	In percent								
Calcium[2]	5	N.D.	.07	N.D.	N.D.	.15	N.D.	N.D.	.07
Iron[2]	7	N.D.	7	N.D.	N.D.	3	N.D.	N.D.	3
Magnesium[2]	1	N.D.	.3	N.D.	N.D.	1.5	N.D.	N.D.	.15
Phosphorus[2]	<.2	N.D.	<.2	N.D.	N.D.	<.2	N.D.	N.D.	<.2
Potassium[1]	4.4	3.1	11.1	11.2	10.3	9.7	11.1	11.1	11.6
Sodium[2]	7	N.D.	.7	N.D.	N.D.	3	N.D.	N.D.	1
Titanium[2]	.7	N.D.	.7	N.D.	N.D.	.7	N.D.	N.D.	.3

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater then value indicated]

Locality No.	70	71	72	73	74	75	76	77	78
Sample No.	MHS-8-79	MHS-9-79	MHS-10-79	MHS-11-79	MHS-12-79	MHS-14-79	MHS-15-79	MHS-16-79	MHS-17-79
Element					In parts per million				
Thorium[1]	74	22	51	25	22	42	69	141	94
Uranium[1]	14	11	16	6.8	6.1	13	8.2	24	8.7
Lanthanum[2]	N.D.	150	N.D.	N.D.	150	150	300	N.D.	300
Cerium[2]	N.D.	150	N.D.	N.D.	150	150	300	N.D.	300
Praesodymium[2]	N.D.	<100	N.D.	N.D.	<100	<100	<100	N.D.	<100
Neodymium[2]	N.D.	100	N.D.	N.D.	150	100	150	N.D.	300
Samarium[2]	N.D.	<100	N.D.	N.D.	<100	<100	<100	N.D.	<100
Europium[2]	N.D.	<100	N.D.	N.D.	<100	<100	<100	N.D.	<100
Gadolinium[2]	N.D.	<50	N.D.	N.D.	<50	<50	<50	N.D.	<50
Terbium[2]	N.D.	<300	N.D.	N.D.	<300	<300	<300	N.D.	<300
Dysprosium[2]	N.D.	<50	N.D.	N.D.	<50	<50	50	N.D.	<50
Holmium[2]	N.D.	<20	N.D.	N.D.	<20	<20	<20	N.D.	<20
Erbium[2]	N.D.	<50	N.D.	N.D.	<50	<50	<50	N.D.	<50
Thulium[2]	N.D.	<20	N.D.	N.D.	<20	<20	<20	N.D.	<20
Ytterbium[2]	N.D.	3	N.D.	N.D.	3	3	7	N.D.	7
Lutetium[2]	N.D.	<30	N.D.	N.D.	<30	<30	<30	N.D.	<30
Yttrium[2]	N.D.	30	N.D.	N.D.	30	30	150	N.D.	70
Total rare earths	N.D.	433	N.D.	N.D.	483	433	957	N.D.	977
Barium[2]	N.D.	3,000	N.D.	N.D.	1,500	1,500	3,000	N.D.	3,000
Beryllium[2]	N.D.	3	N.D.	N.D.	1	3	2	N.D.	7
Bismuth[2]	N.D.	<10	N.D.	N.D.	<10	15	10	N.D.	<10
Copper[2]	N.D.	150	N.D.	N.D.	30	70	500	N.D.	150
Lead[2]	N.D.	70	N.D.	N.D.	70	300	1,500	N.D.	700
Manganese[2]	N.D.	150	N.D.	N.D.	7	70	70	N.D.	70
Molybdenum[2]	N.D.	150	N.D.	N.D.	30	150	150	N.D.	70
Niobium[2]	N.D.	20	N.D.	N.D.	30	30	30	N.D.	50
Strontium[2]	N.D.	7,000	N.D.	N.D.	3,000	3,000	3,000	N.D.	3,000
Tin[2]	N.D.	<10	N.D.	N.D.	<10	<10	<10	N.D.	<10
Vanadium[2]	N.D.	500	N.D.	N.D.	300	300	700	N.D.	700
Zinc[2]	N.D.	<300	N.D.	N.D.	<200	<200	300	N.D.	<200
Zirconium[2]	N.D.	300	N.D.	N.D.	300	700	300	N.D.	300
					In percent				
Calcium[2]	N.D.	.07	N.D.	N.D.	.1	.15	.3	N.D.	.3
Iron[2]	N.D.	3	N.D.	N.D.	7	3	10	N.D.	7
Magnesium[2]	N.D.	.07	N.D.	N.D.	.15	.3	.15	N.D.	.07
Phosphorus[2]	N.D.	<.2	N.D.	N.D.	<.2	<.2	<.2	N.D.	<.2
Potassium[1]	11.5	11.8	11.3	6.5	6.3	10.4	9.8	9.4	11.5
Sodium[2]	N.D.	.7	N.D.	N.D.	5	3	.7	N.D.	.7
Titanium[2]	N.D.	.3	N.D.	N.D.	.7	.3	1.5	N.D.	.7

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	79	80	81	82	83	84	85	86	87
Sample No.	MHS-18-79	MHS-19-79	MHS-20-79	MHS-21-79	MHS-22-79	MHS-23-79	MHS-24-79	MHS-25-79	MHS-13-79
Element	In parts per million								
Thorium[1]	118	93	191	130	181	126	35	202	75
Uranium[1]	7.3	7.7	7.4	3.1	5.4	9.4	25	13	10
Lanthanum[2]	300	N.D.	150	N.D.	300	150	N.D.	N.D.	N.D.
Cerium[2]	300	N.D.	300	N.D.	300	200	N.D.	N.D.	N.D.
Praesodymium[2]	<100	N.D.	<100	N.D.	<100	<100	N.D.	N.D.	N.D.
Neodymium[2]	200	N.D.	100	N.D.	150	100	N.D.	N.D.	N.D.
Samarium[2]	<100	N.D.	<100	N.D.	<100	<100	N.D.	N.D.	N.D.
Europium[2]	<100	N.D.	<100	N.D.	<100	<100	N.D.	N.D.	N.D.
Gadolinium[2]	<50	N.D.	<50	N.D.	<50	<50	N.D.	N.D.	N.D.
Terbium[2]	<300	N.D.	<300	N.D.	<300	<300	N.D.	N.D.	N.D.
Dysprosium[2]	<70	N.D.	<50	N.D.	50	<50	N.D.	N.D.	N.D.
Holmium[2]	<20	N.D.	<20	N.D.	<20	<20	N.D.	N.D.	N.D.
Erbium[2]	<50	N.D.	<50	N.D.	<50	<50	N.D.	N.D.	N.D.
Thulium[2]	<20	N.D.	<20	N.D.	<20	<20	N.D.	N.D.	N.D.
Ytterbium[2]	7	N.D.	7	N.D.	7	7	N.D.	N.D.	N.D.
Lutetium[2]	<30	N.D.	<30	N.D.	<30	<30	N.D.	N.D.	N.D.
Yttrium[2]	150	N.D.	100	N.D.	100	70	N.D.	N.D.	N.D.
Total rare earths	957	N.D.	657	N.D.	907	527	N.D.	N.D.	N.D.
Barium[2]	3000	N.D.	2000	N.D.	3000	3000	N.D.	N.D.	N.D.
Beryllium[2]	7	N.D.	7	N.D.	10	30	N.D.	N.D.	N.D.
Bismuth[2]	<10	N.D.	<10	N.D.	<10	<10	N.D.	N.D.	N.D.
Copper[2]	150	N.D.	150	N.D.	300	70	N.D.	N.D.	N.D.
Lead[2]	70	N.D.	70	N.D.	70	30	N.D.	N.D.	N.D.
Manganese[2]	1500	N.D.	2000	N.D.	2000	1500	N.D.	N.D.	N.D.
Molybdenum[2]	70	N.D.	70	N.D.	70	70	N.D.	N.D.	N.D.
Niobium[2]	30	N.D.	30	N.D.	50	20	N.D.	N.D.	N.D.
Strontium[2]	2000	N.D.	2000	N.D.	7000	3000	N.D.	N.D.	N.D.
Tin[2]	<10	N.D.	<10	N.D.	<10	<10	N.D.	N.D.	N.D.
Vanadium[2]	700	N.D.	700	N.D.	700	300	N.D.	N.D.	N.D.
Zinc[2]	<200	N.D.	200	N.D.	300	<200	N.D.	N.D.	N.D.
Zirconium[2]	150	N.D.	150	N.D.	150	70	N.D.	N.D.	N.D.
	In percent								
Calcium[2]	.3	N.D.	.7	N.D.	.15	.3	N.D.	N.D.	N.D.
Iron[2]	7	N.D.	7	N.D.	7	5	N.D.	N.D.	N.D.
Magnesium[2]	.3	N.D.	.3	N.D.	.7	.07	N.D.	N.D.	N.D.
Phosphorus[2]	<.2	N.D.	<.2	N.D.	<.2	<.2	N.D.	N.D.	N.D.
Potassium[1]	11.0	11.1	11.0	11.1	11.0	11.0	11.2	11.4	10.2
Sodium[2]	.7	N.D.	.7	N.D.	.7	.7	N.D.	N.D.	N.D.
Titanium[2]	.7	N.D.	.5	N.D.	.7	.3	N.D.	N.D.	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive maes in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - lese than value indicated; > - greater than value indicated]

Locality No.	88	89	90	91	92	93	94	95	96
Sample No.	MHS-26-79	MHS-27-79	MHS-28-79	MHS-29-79	MHS-30-79	MHS-31-79	MHS-32-79	MHS-33-79	MHS-34-79
Element	In parts per million								
Thorium[1]	150	154	128	54	166	68	51	179	74
Uranium[1]	33	13	24	41	12	65	19	56	23
Lanthanum[2]	N.D.	300	3,000	N.D.	N.D.	5,000	150	5,000	700
Cerium[2]	N.D.	700	3,000	N.D.	N.D.	7,000	300	3,000	1,500
Praesodymium[2]	N.D.	100	300	N.D.	N.D.	1,500	<100	700	100
Neodymium[2]	N.D.	300	1,500	N.D.	N.D.	7,000	150	5,000	700
Samarium[2]	N.D.	150	300	N.D.	N.D.	1,500	<100	700	150
Europium[2]	N.D.	<100	<100	N.D.	N.D.	150	<100	<200	<100
Gadolinium[2]	N.D.	70	150	N.D.	N.D.	200	<50	300	70
Terbium[2]	N.D.	<300	<300	N.D.	N.D.	<300	<300	<300	<300
Dysprosium[2]	N.D.	50	70	N.D.	N.D.	300	<50	150	50
Holmium[2]	N.D.	<20	<20	N.D.	N.D.	<20	<20	<20	<20
Erbium[2]	N.D.	<50	<50	N.D.	N.D.	<50	<50	<50	<50
Thulium[2]	N.D.	<20	<20	N.D.	N.D.	<20	<20	<20	<20
Ytterbium[2]	N.D.	7	7	N.D.	N.D.	15	7	30	3
Lutetium[2]	N.D.	<30	<30	N.D.	N.D.	<30	<30	<30	<30
Yttrium[2]	N.D.	150	200	N.D.	N.D.	300	70	700	70
Total rsre earthe	N.D.	1,827	8,527	N.D.	N.D.	22,965	677	17,580	3,343
Barium[2]	N.D.	3,000	3,000	N.D.	N.D.	2,000	3,000	7,000	3,000
Beryllium[2]	N.D.	7	1.5	N.D.	N.D.	1.5	1.5	7	3
Bismuth[2]	N.D.	<10	<10	N.D.	N.D.	<10	<10	<10	<10
Copper[2]	N.D.	150	10,000	N.D.	N.D.	150	150	300	500
Lead[2]	N.D.	70	300	N.D.	N.D.	300	150	150	200
Manganese[2]	N.D.	10,000	150	N.D.	N.D.	300	150	10,000	150
Molybdenum[2]	N.D.	30	100	N.D.	N.D.	30	150	30	30
Niobium[2]	N.D.	30	150	N.D.	N.D.	15	15	50	50
Strontium[2]	N.D.	5,000	3,000	N.D.	N.D.	5,000	7,000	2,000	7,000
Tin[2]	N.D.	<10	<10	N.D.	N.D.	<10	<10	<10	<10
Vanadium[2]	N.D.	700	700	N.D.	N.D.	700	700	300	300
Zinc[2]	N.D.	300	<200	N.D.	N.D.	500	300	2,000	300
Zirconium[2]	N.D.	150	150	N.D.	N.D.	300	300	70	150
	In percent								
Calcium[2]	N.D.	.15	.07	N.D.	N.D.	.1	.07	.07	.07
Iron[2]	N.D.	7	7	N.D.	N.D.	3	7	>10	7
Magnesium[2]	N.D.	.7	.03	N.D.	N.D.	.07	.15	.015	.03
Phosphorue[2]	N.D.	<.2	<.2	N.D.	N.D.	<.2	<.2	<.2	<.2
Potassium[1]	8.1	10.4	9.0	8.3	8.1	9.2	11.6	7.2	11.0
Sodium[2]	N.D.	.7	.7	N.D.	N.D.	.7	.7	.3	.7
Titanium[2]	N.D.	.3	.7	N.D.	N.D.	1.5	.5	.3	.7

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	97	98	100	101	102	103	104	105	106
Sample No.	MHS-35-79	MHS-36-79	MHS-37-79	MHS-38-79	MHS-39-79	MHS-40-79	MHS-41-79	MHS-42-79	MHS-43-79
Element	In parts per million								
Thorium[1]	172	75	59	152	79	75	34	118	105
Uranium[1]	91	111	32	11	12	9.1	5.9	18	17
Lanthanum[2]	N.D.	3,000	N.D.	N.D.	N.D.	N.D.	150	N.D.	1,500
Cerium[2]	N.D.	5,000	N.D.	N.D.	N.D.	N.D.	300	N.D.	1,500
Praesodymium[2]	N.D.	700	N.D.	N.D.	N.D.	N.D.	<100	N.D.	150
Neodymium[2]	N.D.	3,000	N.D.	N.D.	N.D.	N.D.	150	N.D.	700
Samarium[2]	N.D.	700	N.D.	N.D.	N.D.	N.D.	<100	N.D.	150
Europium[2]	N.D.	150	N.D.	N.D.	N.D.	N.D.	<100	N.D.	<100
Gadolinium[2]	N.D.	300	N.D.	N.D.	N.D.	N.D.	<50	N.D.	70
Terbium[2]	N.D.	<300	N.D.	N.D.	N.D.	N.D.	<300	N.D.	<300
Dysprosium[2]	N.D.	150	N.D.	N.D.	N.D.	N.D.	<50	N.D.	<70
Holmium[2]	N.D.	50	N.D.	N.D.	N.D.	N.D.	<20	N.D.	<20
Erbium[2]	N.D.	<200	N.D.	N.D.	N.D.	N.D.	<50	N.D.	<50
Thulium[2]	N.D.	<20	N.D.	N.D.	N.D.	N.D.	<20	N.D.	<20
Ytterbium[2]	N.D.	70	N.D.	N.D.	N.D.	N.D.	5	N.D.	10
Lutetium[2]	N.D.	<30	N.D.	N.D.	N.D.	N.D.	<30	N.D.	<30
Yttrium[2]	N.D.	1,000	N.D.	N.D.	N.D.	N.D.	70	N.D.	150
Total rare earths	N.D.	14,120	N.D.	N.D.	N.D.	N.D.	670	N.D.	4,230
Barium[2]	N.D.	5,000	N.D.	N.D.	N.D.	N.D.	1,500	N.D.	3,000
Beryllium[2]	N.D.	7	N.D.	N.D.	N.D.	N.D.	7	N.D.	2
Bismuth[2]	N.D.	15	N.D.	N.D.	N.D.	N.D.	<10	N.D.	<10
Copper[2]	N.D.	7,000	N.D.	N.D.	N.D.	N.D.	150	N.D.	70
Lead[2]	N.D.	700	N.D.	N.D.	N.D.	N.D.	30	N.D.	150
Manganese[2]	N.D.	150	N.D.	N.D.	N.D.	N.D.	700	N.D.	3,000
Molybdenum[2]	N.D.	100	N.D.	N.D.	N.D.	N.D.	7	N.D.	70
Niobium[2]	N.D.	150	N.D.	N.D.	N.D.	N.D.	15	N.D.	70
Strontium[2]	N.D.	5,000	N.D.	N.D.	N.D.	N.D.	2,000	N.D.	3,000
Tin[2]	N.D.	15	N.D.	N.D.	N.D.	N.D.	<10	N.D.	<10
Vanadium[2]	N.D.	700	N.D.	N.D.	N.D.	N.D.	700	N.D.	300
Zinc[2]	N.D.	<200	N.D.	N.D.	N.D.	N.D.	<200	N.D.	300
Zirconium[2]	N.D.	300	N.D.	N.D.	N.D.	N.D.	300	N.D.	300
	In percent								
Calcium[2]	N.D.	.15	N.D.	N.D.	N.D.	N.D.	.3	N.D.	.3
Iron[2]	N.D.	5	N.D.	N.D.	N.D.	N.D.	5	N.D.	7
Magnesium[2]	N.D.	.15	N.D.	N.D.	N.D.	N.D.	.15	N.D.	.3
Phosphorus[2]	N.D.	<.2	N.D.	N.D.	N.D.	N.D.	<.2	N.D.	<.2
Potassium[1]	10.6	9.3	10.5	10.9	10.6	10.2	5.0	6.5	11.3
Sodium[2]	N.D.	.7	N.D.	N.D.	N.D.	N.D.	>10	N.D.	.7
Titanium[2]	N.D.	.7	N.D.	N.D.	N.D.	N.D.	.3	N.D.	.3

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	107	108	109	110	111	112	113	114	115
Sample No.	MHS-44-79	MHS-45-79	MHS-46-79	MHS-47-79	MHS-48-79	MHS-49-79	MHS-50-79	MHS-51-79	MHS-53-79
Element	In parts per million								
Thorium[1]	154	128	184	464	94	198	529	110	49
Uranium[1]	23	11	15	16	8.2	13	53	17	40
Lanthanum[2]	N.D.	1,000	1,500	N.D.	1,500	N.D.	3,000	2,000	5,000
Cerium[2]	N.D.	1,500	1,500	N.D.	1,500	N.D.	3,000	3,000	5,000
Praesodymium[2]	N.D.	150	300	N.D.	150	N.D.	700	300	700
Neodymium[2]	N.D.	1,500	1,500	N.D.	700	N.D.	3,000	1,500	5,000
Samarium[2]	N.D.	300	300	N.D.	150	N.D.	700	300	700
Europium[2]	N.D.	<100	100	N.D.	<100	N.D.	100	<100	100
Gadolinium[2]	N.D.	150	150	N.D.	70	N.D.	300	70	150
Terbium[2]	N.D.	<300	<300	N.D.	<300	N.D.	<300	<300	<300
Dysprosium[2]	N.D.	<70	70	N.D.	<70	N.D.	100	<70	<70
Holmium[2]	N.D.	<20	<20	N.D.	<20	N.D.	<20	<20	<20
Erbium[2]	N.D.	<50	<100	N.D.	<50	N.D.	<100	<50	<100
Thulium[2]	N.D.	<20	<20	N.D.	<20	N.D.	<20	<20	<20
Ytterbium[2]	N.D.	7	7	N.D.	7	N.D.	7	7	7
Lutetium[2]	N.D.	<30	<30	N.D.	<30	N.D.	<30	<30	<30
Yttrium[2]	N.D.	150	100	N.D.	150	N.D.	300	150	150
Total rare earths	N.D.	4,757	5,527	N.D.	4,227	N.D.	11,207	7,327	16,807
Barium[2]	N.D.	7,000	3,000	N.D.	5,000	N.D.	10,000	5,000	7,000
Beryllium[2]	N.D.	1.5	1.5	N.D.	1	N.D.	2	3	3
Bismuth[2]	N.D.	<10	<10	N.D.	<10	N.D.	15	<10	<10
Copper[2]	N.D.	70	50	N.D.	70	N.D.	70	70	150
Lead[2]	N.D.	150	150	N.D.	70	N.D.	700	150	150
Manganese[2]	N.D.	1,500	3,000	N.D.	1,500	N.D.	1,500	3,000	5,000
Molybdenum[2]	N.D.	50	20	N.D.	70	N.D.	100	30	15
Niobium[2]	N.D.	150	70	N.D.	50	N.D.	300	70	150
Strontium[2]	N.D.	2,000	3,000	N.D.	2,000	N.D.	1,500	2,000	2,000
Tin[2]	N.D.	10	<10	N.D.	<10	N.D.	15	<10	<10
Vanadium[2]	N.D.	700	150	N.D.	300	N.D.	300	300	300
Zinc[2]	N.D.	<200	300	N.D.	<200	N.D.	300	300	700
Zirconium[2]	N.D.	150	70	N.D.	300	N.D.	70	150	100
	In percent								
Calcium[2]	N.D.	.15	.07	N.D.	.1	N.D.	.07	.3	.3
Iron[2]	N.D.	7	3	N.D.	7	N.D.	7	7	7
Magnesium[2]	N.D.	.15	.07	N.D.	.7	N.D.	.07	.7	.7
Phosphorus[2]	N.D.	<.2	<.2	N.D.	<.2	N.D.	<.2	<.2	<.2
Potassium[1]	12.3	12.1	12.1	11.4	11.2	12.3	11.4	10.8	10.6
Sodium[2]	N.D.	.7	.7	N.D.	3	N.D.	.7	.7	.7
Titanium[2]	N.D.	.7	.15	N.D.	.3	N.D.	.7	.3	.7

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	116	117	118	119	120	121	122	123	124
Sample No.	MHS-52-79	MHS-54-79	MHS-55-79	MHS-56-79	MHS-57-79	MHS-58-79	MHS-59-79	MHS-60-79	MHS-61-79
Element	In parts per million								
Thorium[1]	225	85	299	435	111	93	137	65	210
Uranium[1]	19	14	14	30	9.6	8.2	9.5	44	16
Lanthanum[2]	2,000	N.D.	N.D.	3,000	N.D.	700	N.D.	N.D.	N.D.
Cerium[2]	3,000	N.D.	N.D.	5,000	N.D.	1,500	N.D.	N.D.	N.D.
Praesodymium[2]	300	N.D.	N.D.	700	N.D.	150	N.D.	N.D.	N.D.
Neodymium[2]	1,500	N.D.	N.D.	3,000	N.D.	1,000	N.D.	N.D.	N.D.
Samarium[2]	300	N.D.	N.D.	700	N.D.	200	N.D.	N.D.	N.D.
Europium[2]	<100	N.D.	N.D.	100	N.D.	<100	N.D.	N.D.	N.D.
Gadolinium[2]	150	N.D.	N.D.	300	N.D.	70	N.D.	N.D.	N.D.
Terbium[2]	<300	N.D.	N.D.	<300	N.D.	<300	N.D.	N.D.	N.D.
Dysprosium[2]	<50	N.D.	N.D.	150	N.D.	<70	N.D.	N.D.	N.D.
Holmium[2]	<20	N.D.	N.D.	<20	N.D.	<20	N.D.	N.D.	N.D.
Erbium[2]	<50	N.D.	N.D.	<100	N.D.	<50	N.D.	N.D.	N.D.
Thulium[2]	<20	N.D.	N.D.	<20	N.D.	<20	N.D.	N.D.	N.D.
Ytterbium[2]	5	N.D.	N.D.	30	N.D.	7	N.D.	N.D.	N.D.
Lutetium[2]	<30	N.D.	N.D.	<30	N.D.	<30	N.D.	N.D.	N.D.
Yttrium[2]	70	N.D.	N.D.	700	N.D.	150	N.D.	N.D.	N.D.
Total rare earths	7,325	N.D.	N.D.	13,680	N.D.	3,777	N.D.	N.D.	N.D.
Barium[2]	3,000	N.D.	N.D.	7,000	N.D.	3,000	N.D.	N.D.	N.D.
Beryllium[2]	3	N.D.	N.D.	7	N.D.	2	N.D.	N.D.	N.D.
Bismuth[2]	<10	N.D.	N.D.	<10	N.D.	<10	N.D.	N.D.	N.D.
Copper[2]	100	N.D.	N.D.	100	N.D.	70	N.D.	N.D.	N.D.
Lead[2]	200	N.D.	N.D.	300	N.D.	100	N.D.	N.D.	N.D.
Manganese[2]	700	N.D.	N.D.	10,000	N.D.	5,000	N.D.	N.D.	N.D.
Molybdenum[2]	30	N.D.	N.D.	150	N.D.	50	N.D.	N.D.	N.D.
Niobium[2]	70	N.D.	N.D.	150	N.D.	70	N.D.	N.D.	N.D.
Strontium[2]	1,500	N.D.	N.D.	3,000	N.D.	1,000	N.D.	N.D.	N.D.
Tin[2]	<15	N.D.	N.D.	10	N.D.	<10	N.D.	N.D.	N.D.
Vanadium[2]	300	N.D.	N.D.	700	N.D.	500	N.D.	N.D.	N.D.
Zinc[2]	300	N.D.	N.D.	500	N.D.	<200	N.D.	N.D.	N.D.
Zirconium[2]	150	N.D.	N.D.	150	N.D.	300	N.D.	N.D.	N.D.
	In percent								
Calcium[2]	.07	N.D.	N.D.	.3	N.D.	.3	N.D.	N.D.	N.D.
Iron[2]	>10	N.D.	N.D.	7	N.D.	7	N.D.	N.D.	N.D.
Magnesium[2]	.3	N.D.	N.D.	.7	N.D.	.7	N.D.	N.D.	N.D.
Phosphorus[2]	<.2	N.D.	N.D.	.3	N.D.	<.2	N.D.	N.D.	N.D.
Potassium[1]	10.4	10.0	11.2	11.0	11.2	11.2	11.3	9.1	9.9
Sodium[2]	.7	N.D.	N.D.	.7	N.D.	1.5	N.D.	N.D.	N.D.
Titanium[2]	.3	N.D.	N.D.	.7	N.D.	.7	N.D.	N.D.	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued
[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	125	126	127	128	129	130	131	132	133
Sample No.	MHS-62-79	MHS-63-79	MHS-64-79	MHS-65-79	MHS-66-79	MHS-67-79	MHS-68-79	MHS-69-79	MHS-70-79
Element	In parts per million								
Thorium[1]	107	242	210	191	252	699	168	170	775
Uranium[1]	42	14	28	7.4	23	29	9.5	8.6	63
Lanthanum[2]	5,000	3,000	N.D.	N.D.	2,000	5,000	N.D.	N.D.	5,000
Cerium[2]	7,000	3,000	N.D.	N.D.	2,000	7,000	N.D.	N.D.	7,000
Praesodymium[2]	700	700	N.D.	N.D.	200	700	N.D.	N.D.	700
Neodymium[2]	3,000	3,000	N.D.	N.D.	1,500	3,000	N.D.	N.D.	7,000
Samarium[2]	700	300	N.D.	N.D.	200	700	N.D.	N.D.	1,000
Europium[2]	100	100	N.D.	N.D.	<100	100	N.D.	N.D.	150
Gadolinium[2]	150	150	N.D.	N.D.	70	150	N.D.	N.D.	300
Terbium[2]	<300	<300	N.D.	N.D.	<300	<300	N.D.	N.D.	<300
Dysprosium[2]	50	150	N.D.	N.D.	70	150	N.D.	N.D.	150
Holmium[2]	<20	<20	N.D.	N.D.	<20	30	N.D.	N.D.	<20
Erbium[2]	<100	<50	N.D.	N.D.	<50	<100	N.D.	N.D.	<100
Thulium[2]	<20	<20	N.D.	N.D.	<20	<20	N.D.	N.D.	<20
Ytterbium[2]	15	15	N.D.	N.D.	15	30	N.D.	N.D.	15
Lutetium[2]	<30	<30	N.D.	N.D.	<30	<30	N.D.	N.D.	<30
Yttrium[2]	300	700	N.D.	N.D.	500	1,000	N.D.	N.D.	700
Total rare earths	17,015	11,115	N.D.	N.D.	6,555	17,860	N.D.	N.D.	22,015
Barium[2]	3,000	7,000	N.D.	N.D.	3,000	7,000	N.D.	N.D.	7,000
Beryllium[2]	3	1.5	N.D.	N.D.	15	7	N.D.	N.D.	3
Bismuth[2]	<10	<10	N.D.	N.D.	<10	<15	N.D.	N.D.	50
Copper[2]	300	70	N.D.	N.D.	70	100	N.D.	N.D.	150
Lead[2]	300	150	N.D.	N.D.	150	300	N.D.	N.D.	1,500
Manganese[2]	100,000	2,000	N.D.	N.D.	70	70	N.D.	N.D.	30,000
Molybdenum[2]	50	300	N.D.	N.D.	300	500	N.D.	N.D.	100
Niobium[2]	70	150	N.D.	N.D.	70	150	N.D.	N.D.	300
Strontium[2]	2,000	2,000	N.D.	N.D.	1,500	2,000	N.D.	N.D.	2,000
Tin[2]	<15	<15	N.D.	N.D.	<15	10	N.D.	N.D.	<15
Vanadium[2]	300	700	N.D.	N.D.	700	700	N.D.	N.D.	300
Zinc[2]	1,500	<300	N.D.	N.D.	<300	<200	N.D.	N.D.	1,500
Zirconium[2]	300	300	N.D.	N.D.	300	300	N.D.	N.D.	70
	In percent								
Calcium[2]	.07	.07	N.D.	N.D.	.07	.07	N.D.	N.D.	5
Iron[2]	>10	7	N.D.	N.D.	7	7	N.D.	N.D.	>10
Magnesium[2]	.7	.3	N.D.	N.D.	.15	.03	N.D.	N.D.	.7
Phosphorus[2]	<.2	<.2	N.D.	N.D.	<.2	<.2	N.D.	N.D.	<.2
Potassium[1]	7.8	11.6	10.3	12.1	10.6	10.0	10.9	8.7	8.6
Sodium[2]	.7	.7	N.D.	N.D.	.7	.7	N.D.	N.D.	.7
Titanium[2]	.7	.7	N.D.	N.D.	.7	.7	N.D.	N.D.	.7

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	134	135	136	138	139	140	141	142	143
Sample No.	MHS-71-79	MHS-72-79	MHS-73-79	MHS-75-79	MHS-76-79	MHS-77-79	MHS-78-79	MHS-79-79	MHS-80-79
Element	In parts per million								
Thorium[1]	525	238	123	26	71	266	642	273	361
Uranium[1]	42	11	15	9.4	6.6	9.1	18.9	15.7	14.7
Lanthanum[2]	3,000	3,000	N.D.	300	N.D.	N.D.	3,000	1,500	3,000
Cerium[2]	7,000	3,000	N.D.	700	N.D.	N.D.	5,000	2,000	3,000
Praesodymium[2]	700	300	N.D.	<100	N.D.	N.D.	700	300	300
Neodymium[2]	3,000	1,500	N.D.	300	N.D.	N.D.	3,000	1,500	3,000
Samarium[2]	700	300	N.D.	100	N.D.	N.D.	700	300	300
Europium[2]	100	<100	N.D.	<100	N.D.	N.D.	100	<100	100
Gadolinium[2]	200	150	N.D.	<50	N.D.	N.D.	300	150	150
Terbium[2]	<300	<300	N.D.	<300	N.D.	N.D.	<300	<300	<300
Dysprosium[2]	150	70	N.D.	<50	N.D.	N.D.	150	70	70
Holmium[2]	<20	<20	N.D.	<20	N.D.	N.D.	30	<20	<20
Erbium[2]	<100	<100	N.D.	<100	N.D.	N.D.	<100	<50	<50
Thulium[2]	<20	<20	N.D.	<20	N.D.	N.D.	<20	<20	<20
Ytterbium[2]	15	7	N.D.	3	N.D.	N.D.	20	10	15
Lutetium[2]	<30	<30	N.D.	<30	N.D.	N.D.	<30	<30	<30
Yttrium[2]	300	200	N.D.	30	N.D.	N.D.	1,000	300	500
Total rare earths	15,165	8,527	N.D.	1,433	N.D.	N.D.	14,000	6,130	10,435
Barium[2]	7,000	7,000	N.D.	3,000	N.D.	N.D.	10,000	7,000	7,000
Beryllium[2]	3	1.5	N.D.	7	N.D.	N.D.	7	7	7
Bismuth[2]	20	<10	N.D.	<10	N.D.	N.D.	<15	<10	<15
Copper[2]	150	150	N.D.	100	N.D.	N.D.	100	70	100
Lead[2]	700	150	N.D.	50	N.D.	N.D.	700	150	150
Manganese[2]	30,000	3,000	N.D.	2,000	N.D.	N.D.	10,000	10,000	15,000
Molybdenum[2]	300	150	N.D.	30	N.D.	N.D.	150	150	150
Niobium[2]	300	100	N.D.	30	N.D.	N.D.	500	300	150
Strontium[2]	2,000	2,000	N.D.	5,000	N.D.	N.D.	2,000	1,000	2,000
Tin[2]	<15	<15	N.D.	<10	N.D.	N.D.	20	15	10
Vanadium[2]	300	300	N.D.	700	N.D.	N.D.	700	700	700
Zinc[2]	700	<200	N.D.	<200	N.D.	N.D.	700	300	300
Zirconium[2]	150	150	N.D.	300	N.D.	N.D.	150	150	150
	In percent								
Calcium[2]	.07	.2	N.D.	.15	N.D.	N.D.	1.5	.7	.3
Iron[2]	>10	7	N.D.	7	N.D.	N.D.	7	7	7
Magnesium[2]	.15	.7	N.D.	.7	N.D.	N.D.	.15	.3	.3
Phosphorus[2]	<.2	<.2	N.D.	<.2	N.D.	N.D.	.3	<.2	<.2
Potassium[1]	10.3	11.7	8.2	11.6	6.0	11.2	10.8	11.5	10.8
Sodium[2]	.7	.7	N.D.	.7	N.D.	N.D.	.7	.7	1.5
Titanium[2]	.7	.3	N.D.	.7	N.D.	N.D.	.7	.7	.5

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	144	145	146	147	148	149	150	151	152
Sample No.	MHS-81-79	MHS-82-79	MHS-83-79	MHS-84-79	MHS-85-79	MHS-86-79	MHS-87-79	MHS-88-79	MHS-89-79
Element	In parts per million								
Thorium[1]	430	216	188	163	126	171	181	127	52
Uranium[1]	10.2	2.9	5.5	4.6	9.9	20	19	20	12
Lanthanum[2]	700	N.D.	300	N.D.	N.D.	N.D.	N.D.	1,500	N.D.
Cerium[2]	1,500	N.D.	700	N.D.	N.D.	N.D.	N.D.	2,000	N.D.
Praesodymium[2]	200	N.D.	<100	N.D.	N.D.	N.D.	N.D.	200	N.D.
Neodymium[2]	1,500	N.D.	300	N.D.	N.D.	N.D.	N.D.	1,500	N.D.
Samarium[2]	300	N.D.	150	N.D.	N.D.	N.D.	N.D.	300	N.D.
Europium[2]	<100	N.D.	<100	N.D.	N.D.	N.D.	N.D.	<100	N.D.
Gadolinium[2]	150	N.D.	70	N.D.	N.D.	N.D.	N.D.	100	N.D.
Terbium[2]	<300	N.D.	<300	N.D.	N.D.	N.D.	N.D.	<300	N.D.
Dysprosium[2]	70	N.D.	<50	N.D.	N.D.	N.D.	N.D.	70	N.D.
Holmium[2]	<20	N.D.	<20	N.D.	N.D.	N.D.	N.D.	<20	N.D.
Erbium[2]	<50	N.D.	<50	N.D.	N.D.	N.D.	N.D.	<50	N.D.
Thulium[2]	<20	N.D.	<20	N.D.	N.D.	N.D.	N.D.	<20	N.D.
Ytterbium[2]	7	N.D.	7	N.D.	N.D.	N.D.	N.D.	10	N.D.
Lutetium[2]	<30	N.D.	<30	N.D.	N.D.	N.D.	N.D.	<30	N.D.
Yttrium[2]	300	N.D.	150	N.D.	N.D.	N.D.	N.D.	150	N.D.
Total rare earths	4,727	N.D.	1,677	N.D.	N.D.	N.D.	N.D.	5,830	N.D.
Barium[2]	7,000	N.D.	3,000	N.D.	N.D.	N.D.	N.D.	7,000	N.D.
Beryllium[2]	7	N.D.	7	N.D.	N.D.	N.D.	N.D.	3	N.D.
Bismuth[2]	20	N.D.	<10	N.D.	N.D.	N.D.	N.D.	10	N.D.
Copper[2]	100	N.D.	100	N.D.	N.D.	N.D.	N.D.	150	N.D.
Lead[2]	700	N.D.	150	N.D.	N.D.	N.D.	N.D.	300	N.D.
Manganese[2]	5,000	N.D.	3,000	N.D.	N.D.	N.D.	N.D.	300	N.D.
Molybdenum[2]	700	N.D.	70	N.D.	N.D.	N.D.	N.D.	150	N.D.
Niobium[2]	200	N.D.	70	N.D.	N.D.	N.D.	N.D.	70	N.D.
Strontium[2]	2,000	N.D.	1,500	N.D.	N.D.	N.D.	N.D.	2,000	N.D.
Tin[2]	15	N.D.	<10	N.D.	N.D.	N.D.	N.D.	<15	N.D.
Vanadium[2]	700	N.D.	700	N.D.	N.D.	N.D.	N.D.	700	N.D.
Zinc[2]	<200	N.D.	<200	N.D.	N.D.	N.D.	N.D.	300	N.D.
Zirconium[2]	150	N.D.	300	N.D.	N.D.	N.D.	N.D.	300	N.D.
	In percent								
Calcium[2]	.3	N.D.	.3	N.D.	N.D.	N.D.	N.D.	.07	N.D.
Iron[2]	7	N.D.	7	N.D.	N.D.	N.D.	N.D.	>10	N.D.
Magnesium[2]	.3	N.D.	.7	N.D.	N.D.	N.D.	N.D.	.15	N.D.
Phosphorus[2]	<.2	N.D.	<.2	N.D.	N.D.	N.D.	N.D.	<.2	N.D.
Potassium[1]	10.8	8.8	10.5	8.9	10.4	10.4	10.4	9.9	10.4
Sodium[2]	1.5	N.D.	3	N.D.	N.D.	N.D.	N.D.	.7	N.D.
Titanium[2]	.7	N.D.	.7	N.D.	N.D.	N.D.	N.D.	.7	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	153	154	155	156	157	158	159	160	161
Sample No.	MHS-90-79	MHS-91-79	MHS-92-79	MHS-93-79	MHS-94-79	MHS-95-79	MHS-96-79	MHS-97-79	MHS-98-79
Element	In parts per million								
Thorium[1]	191	208	115	528	450	59	84	102	226
Uranium[1]	25	14	40	13	3.3	6.0	13	8.8	10
Lanthanum[2]	700	700	N.D.	700	300	N.D.	200	N.D.	150
Cerium[2]	1,500	700	N.D.	1,500	700	N.D.	300	N.D.	300
Praesodymium[2]	150	150	N.D.	200	<100	N.D.	<100	N.D.	<100
Neodymium[2]	700	500	N.D.	1,500	300	N.D.	150	N.D.	150
Samarium[2]	150	300	N.D.	300	150	N.D.	<100	N.D.	100
Europium[2]	<100	<100	N.D.	<100	<100	N.D.	<100	N.D.	<100
Gadolinium[2]	70	150	N.D.	300	70	N.D.	<50	N.D.	70
Terbium[2]	<300	<300	N.D.	<300	<300	N.D.	<300	N.D.	<300
Dysprosium[2]	<70	<70	N.D.	150	70	N.D.	<70	N.D.	<70
Holmium[2]	<20	<20	N.D.	30	<20	N.D.	<20	N.D.	<20
Erbium[2]	<50	<50	N.D.	<50	<50	N.D.	<50	N.D.	<50
Thulium[2]	<20	<20	N.D.	<20	<20	N.D.	<20	N.D.	<20
Ytterbium[2]	7	7	N.D.	30	15	N.D.	7	N.D.	10
Lutetium[2]	<50	<30	N.D.	<30	<30	N.D.	<30	N.D.	<30
Yttrium[2]	70	200	N.D.	1,000	300	N.D.	150	N.D.	150
Total rare earths	3,347	2,707	N.D.	5,710	1,905	N.D.	807	N.D.	930
Barium[2]	5,000	7,000	N.D.	5,000	3,000	N.D.	1,500	N.D.	3,000
Beryllium[2]	3	10	N.D.	7	3	N.D.	3	N.D.	10
Bismuth[2]	<10	<10	N.D.	<15	<10	N.D.	<10	N.D.	<10
Copper[2]	100	100	N.D.	70	100	N.D.	70	N.D.	30
Lead[2]	300	70	N.D.	150	150	N.D.	30	N.D.	70
Manganese[2]	150	2,000	N.D.	30,000	5,000	N.D.	1,500	N.D.	2,000
Molybdenum[2]	150	200	N.D.	500	150	N.D.	15	N.D.	100
Niobium[2]	150	70	N.D.	150	150	N.D.	15	N.D.	50
Strontium[2]	2,000	5,000	N.D.	2,000	1,500	N.D.	1,500	N.D.	2,000
Tin[2]	<15	10	N.D.	15	15	N.D.	<10	N.D.	<15
Vanadium[2]	500	700	N.D.	700	700	N.D.	700	N.D.	700
Zinc[2]	<200	<200	N.D.	500	<200	N.D.	<200	N.D.	<200
Zirconium[2]	300	200	N.D.	300	150	N.D.	300	N.D.	300
	In percent								
Calcium[2]	.07	5	N.D.	3	.15	N.D.	.7	N.D.	.7
Iron[2]	>10	7	N.D.	7	7	N.D.	7	N.D.	5
Magnesium[2]	.15	3	N.D.	.15	.15	N.D.	.15	N.D.	.3
Phosphorus[2]	<.2	<.2	N.D.	<.2	<.2	N.D.	<.2	N.D.	<.2
Potassium[1]	9.7	9.6	9.4	11.0	12.1	5.7	10.3	9.7	10.9
Sodium[2]	.7	.7	N.D.	.7	.7	N.D.	3	N.D.	1.5
Titanium[2]	.3	.7	N.D.	.5	1	N.D.	.7	N.D.	.3

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	162	163	164	165	166	167	168	169	170
Sample No.	MHS-99-79	MHS-100-79	MHS-101-79	MHS-102-79	MHS-103-79	MHS-104-79	MHS-105-79	MHS-106-79	MHS-107-79
Element	In parts per million								
Thorium[1]	466	212	175	203	311	234	161	123	291
Uranium[1]	6.2	3.8	9.0	6.1	4.6	9.0	4.0	11	23
Lanthanum[2]	150	150	150	150	300	700	N.D.	300	1,500
Cerium[2]	300	200	300	300	500	1,500	N.D.	700	1,500
Praesodymium[2]	<100	<100	<100	<100	100	200	N.D.	<70	200
Neodymium[2]	300	150	300	300	500	1,500	N.D.	300	1,000
Samarium[2]	150	150	150	150	150	300	N.D.	<100	200
Europium[2]	<100	<100	<100	<100	<100	<100	N.D.	<100	<100
Gadolinium[2]	150	150	70	70	150	100	N.D.	<50	150
Terbium[2]	<300	<300	<300	<300	<300	<300	N.D.	<300	<300
Dysprosium[2]	70	<70	<70	70	70	<70	N.D.	<50	70
Holmium[2]	<20	<20	<20	<20	<20	<20	N.D.	<20	<20
Erbium[2]	<50	<50	<50	<50	<50	<50	N.D.	<50	<50
Thulium[2]	<20	<20	<20	<20	<20	<20	N.D.	<20	<20
Ytterbium[2]	10	15	10	15	15	7	N.D.	3	15
Lutetium[2]	<30	<30	<30	<30	<30	<30	N.D.	<30	<30
Yttrium[2]	200	150	150	300	300	150	N.D.	70	300
Total rare earths	1,330	965	1,130	1,355	2,085	4,457	N.D.	1,373	4,935
Barium[2]	3,000	3,000	3,000	3,000	3,000	3,000	N.D.	3,000	3,000
Beryllium[2]	7	7	7	7	7	7	N.D.	10	5
Bismuth[2]	<15	<10	<10	<10	<10	<10	N.D.	<10	<10
Copper[2]	70	70	150	30	70	100	N.D.	30	50
Lead[2]	70	30	30	70	50	70	N.D.	70	200
Manganese[2]	3,000	1,500	7,000	3,000	3,000	15,000	N.D.	3,000	7,000
Molybdenum[2]	150	30	70	150	150	70	N.D.	15	70
Niobium[2]	150	30	70	70	70	150	N.D.	70	70
Strontium[2]	1,000	1,000	1,500	1,500	3,000	3,000	N.D.	7,000	1,500
Tin[2]	15	<15	15	<10	10	15	N.D.	<10	<10
Vanadium[2]	700	700	700	700	700	700	N.D.	500	300
Zinc[2]	<200	<200	<200	<200	<200	<200	N.D.	<200	300
Zirconium[2]	100	300	300	300	150	150	N.D.	300	200
	In percent								
Calcium[2]	1.5	.7	.7	1	.5	.7	N.D.	1.5	.15
Iron[2]	7	7	7	7	7	7	N.D.	7	7
Magnesium[2]	.2	.15	.7	.7	.15	.15	N.D.	.7	.5
Phosphorus[2]	<.2	<.2	<.2	<.2	<.2	<.2	N.D.	<.2	<.2
Potassium[1]	11.8	11.0	11.1	9.8	11.1	12.0	9.4	9.6	10.5
Sodium[2]	.7	3	1.5	3	2	.7	N.D.	3	.7
Titanium[2]	.7	.7	1	.7	.7	.7	N.D.	.3	.3

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	171	172	173	174	175	176	177	178	179
Sample No.	MHS-108-79	MHS-109-79	MHS-110-79	MHS-111-79	MHS-112-79	MHS-113-79	MHS-114-79	MHS-116-79	MHS-117-79
Element	In parts per million								
Thorium[1]	290	96	205	296	70	83	502	343	327
Uranium[1]	21	18	12	3.9	10	11	75	37	22
Lanthanum[2]	3,000	1,500	300	N.D.	300	1,500	3,000	N.D.	3,000
Cerium[2]	3,000	2,000	700	N.D.	300	1,000	7,000	N.D.	3,000
Praesodymium[2]	500	200	100	N.D.	<100	100	700	N.D.	300
Neodymium[2]	3,000	1,500	700	N.D.	300	500	7,000	N.D.	2,000
Samarium[2]	300	200	150	N.D.	150	150	1,500	N.D.	300
Europium[2]	100	<100	<100	N.D.	<100	<100	150	N.D.	<100
Gadolinium[2]	300	70	70	N.D.	<70	<70	300	N.D.	150
Terbium[2]	<300	<300	<300	N.D.	<300	<300	<300	N.D.	<300
Dysprosium[2]	70	<50	<50	N.D.	<50	<50	100	N.D.	70
Holmium[2]	<20	<20	<20	N.D.	<20	<20	30	N.D.	<20
Erbium[2]	<50	<50	<50	N.D.	<50	<50	<100	N.D.	<100
Thulium[2]	<20	<20	<20	N.D.	<20	<20	<20	N.D.	<20
Ytterbium[2]	15	7	7	N.D.	7	5	15	N.D.	10
Lutetium[2]	<30	<30	<30	N.D.	<30	<30	<30	N.D.	<30
Yttrium[2]	300	70	70	N.D.	70	70	300	N.D.	200
Total rare earths	10,585	5,547	2,097	N.D.	1,127	3,325	20,095	N.D.	9,030
Barium[2]	3,000	3,000	5,000	N.D.	3,000	3,000	7,000	N.D.	5,000
Beryllium[2]	7	7	7	N.D.	7	1.5	7	N.D.	7
Bismuth[2]	<10	15	<10	N.D.	<10	<10	150	N.D.	15
Copper[2]	70	150	70	N.D.	100	300	150	N.D.	70
Lead[2]	200	700	150	N.D.	70	200	5,000	N.D.	1,500
Manganese[2]	5,000	3,000	3,000	N.D.	3,000	150	70	N.D.	70
Molybdenum[2]	150	70	300	N.D.	20	30	150	N.D.	70
Niobium[2]	150	70	300	N.D.	50	30	1,000	N.D.	150
Strontium[2]	1,500	700	1,500	N.D.	1,500	3,000	3,000	N.D.	2,000
Tin[2]	<10	<15	30	N.D.	<10	<10	15	N.D.	<10
Vanadium[2]	700	700	1,500	N.D.	300	700	700	N.D.	700
Zinc[2]	700	300	<200	N.D.	300	<200	<200	N.D.	<200
Zirconium[2]	150	150	300	N.D.	200	300	150	N.D.	300
	In percent								
Calcium[2]	.15	.3	.3	N.D.	.3	.07	.15	N.D.	.07
Iron[2]	7	7	7	N.D.	7	7	7	N.D.	7
Magnesium[2]	.7	1.5	.7	N.D.	1.5	.03	.07	N.D.	.07
Phosphorus[2]	<.2	<.2	<.2	N.D.	<.2	<.2	<.2	N.D.	<.2
Potassium[1]	10.4	10.8	10.9	9.5	9.9	9.2	9.9	10.7	11.1
Sodium[2]	1	.7	3	N.D.	3	1.5	.7	N.D.	.7
Titanium[2]	.7	.7	.7	N.D.	.3	.3	1	N.D.	.7

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	180	181	182	183	184	185	186	187	188
Sample No.	MHS-115-79	MHS-118-79	MHS-119-79	MHS-120-79	MHS-121-79	MHS-122-79	MHS-123-79	MHS-124-79	MHS-125-79
Element	In parts per million								
Thorium[2]	144	103	103	118	112	53	377	176	141
Uranium[1]	19	7.0	14	23	38	20	42	14	18
Lanthanum[2]	N.D.	500	N.D.	1,500	700	3,000	3,000	2,000	N.D.
Cerium[2]	N.D.	700	N.D.	1,500	1,000	3,000	3,000	3,000	N.D.
Praesodymium[2]	N.D.	<100	N.D.	150	150	500	500	150	N.D
Neodymium[2]	N.D.	300	N.D.	1,000	700	3,000	3,000	1,500	N.D.
Samarium[2]	N.D.	150	N.D.	200	150	300	300	200	N.D.
Europium[2]	N.D.	<100	N.D.	<100	<100	<100	<100	<100	N.D.
Gadolinium[2]	N.D.	70	N.D.	70	70	150	150	70	N.D.
Terbium[2]	N.D.	<300	N.D.	<300	<300	<300	<300	<300	N.D.
Dysprosium[2]	N.D.	<70	N.D.	<70	<50	<70	70	<50	N.D.
Holmium[2]	N.D.	<20	N.D.	<20	<20	<20	<20	<20	N.D.
Erbium[2]	N.D.	<50	N.D.	<50	<50	<50	<100	<50	N.D.
Thulium[2]	N.D.	<20	N.D.	<20	<20	<20	<20	<20	N.D.
Ytterbium[2]	N.D.	7	N.D.	7	5	7	10	3	N.D.
Lutetium[2]	N.D.	<30	N.D.	<30	<30	<30	<30	<30	N.D.
Yttrium[2]	N.D.	150	N.D.	150	70	150	300	70	N.D.
Total rare earths	N.D.	1,877	N.D.	4,577	2,845	10,107	10,330	6,993	N.D.
Barium[2]	N.D.	3,000	N.D.	3,000	1,500	1,500	7,000	3,000	N.D.
Beryllium[2]	N.D.	15	N.D.	5	7	5	7	7	N.D.
Bismuth[2]	N.D.	<10	N.D.	<10	<10	<10	50	10	N.D.
Copper[2]	N.D.	70	N.D.	70	70	30	150	70	N.D.
Lead[2]	N.D.	100	N.D.	70	150	150	3,000	300	N.D.
Manganese[2]	N.D.	7,000	N.D.	700	300	150	150	150	N.D.
Molybdenum[2]	N.D.	30	N.D.	70	70	150	700	150	N.D.
Niobium[2]	N.D.	70	N.D.	150	70	70	500	150	N.D.
Strontium[2]	N.D.	3,000	N.D.	3,000	2,000	3,000	3,000	3,000	N.D.
Tin[2]	N.D.	<10	N.D.	<10	<10	<10	<10	<15	N.D.
Vanadium[2]	N.D.	700	N.D.	300	300	700	700	700	N.D.
Zinc[2]	N.D.	300	N.D.	<200	<200	<200	<200	<200	N.D.
Zirconium[2]	N.D.	300	N.D.	200	700	700	200	150	N.D.
	In percent								
Calcium[2]	N.D.	.07	N.D.	.07	.07	.07	.07	.07	N.D.
Iron[2]	N.D.	7	N.D.	7	3	7	7	7	N.D.
Magnesium[2]	N.D.	.15	N.D.	.07	.07	.3	.07	.03	N.D.
Phosphorus[2]	N.D.	<.2	N.D.	<.2	<.2	<.2	<.2	<.2	N.D.
Potassium[1]	10.3	10.9	10.8	10.7	7.9	8.5	8.4	9.8	11.2
Sodium[2]	N.D.	.7	N.D.	.7	.7	.5	.7	.7	N.D.
Titanium[2]	N.D.	.7	N.D.	.7	.3	.7	.3	.7	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	189	190	191	192	193	194	196	197	198
Sample No.	MHS-126-79	MHS-127-79	MHS-128-79	MHS-129-79	MHS-130-79	MHS-131-79	MHS-132-79	MHS-133-79	MHS-134-79
Element					In parts per million				
Thorium[1]	183	78	79	114	123	272	116	83	55
Uranium[1]	15	22	11	13	13	21	27	33	11
Lanthanum[2]	1,500	N.D.	N.D.	N.D.	150	2,000	N.D.	N.D.	150
Cerium[2]	2,000	N.D.	N.D.	N.D.	1,500	3,000	N.D.	N.D.	150
Praesodymium[2]	200	N.D.	N.D.	N.D.	150	300	N.D.	N.D.	<100
Neodymium[2]	1,500	N.D.	N.D.	N.D.	700	3,000	N.D.	N.D.	150
Samarium[2]	300	N.D.	N.D.	N.D.	150	700	N.D.	N.D.	<100
Europium[2]	<100	N.D.	N.D.	N.D.	<100	150	N.D.	N.D.	<100
Gadolinium[2]	150	N.D.	N.D.	N.D.	100	700	N.D.	N.D.	<50
Terbium[2]	<300	N.D.	N.D.	N.D.	<300	<300	N.D.	N.D.	<300
Dysprosium[2]	70	N.D.	N.D.	N.D.	<70	150	N.D.	N.D.	<50
Holmium[2]	<20	N.D.	N.D.	N.D.	<20	20	N.D.	N.D.	<20
Erbium[2]	<100	N.D.	N.D.	N.D.	<50	<50	N.D.	N.D.	<50
Thulium[2]	<20	N.D.	N.D.	N.D.	<20	<20	N.D.	N.D.	<20
Ytterbium[2]	7	N.D.	N.D.	N.D.	7	15	N.D.	N.D.	7
Lutetium[2]	<30	N.D.	N.D.	N.D.	<30	<30	N.D.	N.D.	<30
Yttrium[2]	150	N.D.	N.D.	N.D.	150	300	N.D.	N.D.	70
Total rare earths	5,877	N.D.	N.D.	N.D.	4,257	10,335	N.D.	N.D.	527
Barium[2]	3,000	N.D.	N.D.	N.D.	3,000	7,000	N.D.	N.D.	1,500
Beryllium[2]	15	N.D.	N.D.	N.D.	<1.5	2	N.D.	N.D.	7
Bismuth[2]	<10	N.D.	N.D.	N.D.	<10	<10	N.D.	N.D.	<10
Copper[2]	70	N.D.	N.D.	N.D.	70	70	N.D.	N.D.	70
Lead[2]	150	N.D.	N.D.	N.D.	300	300	N.D.	N.D.	30
Manganese[2]	150	N.D.	N.D.	N.D.	150	3,000	N.D.	N.D.	150
Molybdenum[2]	30	N.D.	N.D.	N.D.	70	150	N.D.	N.D.	<3
Niobium[2]	300	N.D.	N.D.	N.D.	150	70	N.D.	N.D.	10
Strontium[2]	1,500	N.D.	N.D.	N.D.	1,500	1,500	N.D.	N.D.	1,500
Tin[2]	<10	N.D.	N.D.	N.D.	<10	15	N.D.	N.D.	<10
Vanadium[2]	700	N.D.	N.D.	N.D.	300	300	N.D.	N.D.	300
Zinc[2]	300	N.D.	N.D.	N.D.	<200	300	N.D.	N.D.	<200
Zirconium[2]	150	N.D.	N.D.	N.D.	500	150	N.D.	N.D.	300
					In percent				
Calcium[2]	.07	N.D.	N.D.	N.D.	.07	.15	N.D.	N.D.	.15
Iron[2]	7	N.D.	N.D.	N.D.	7	7	N.D.	N.D.	3
Magnesium[2]	.07	N.D.	N.D.	N.D.	.07	.3	N.D.	N.D.	.07
Phosphorus[2]	<.2	N.D.	N.D.	N.D.	<.2	<.2	N.D.	N.D.	<.2
Potassium[1]	10.8	10.0	11.6	11.1	10.0	11.3	9.9	6.4	8.2
Sodium[2]	.3	N.D.	N.D.	N.D.	.7	.7	N.D.	N.D.	10
Titanium[2]	.3	N.D.	N.D.	N.D.	.7	.7	N.D.	N.D.	.3

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - lese than value indicated; > - greater than value indicated]

Locality No.	199	200	201	202	203	204	205	207	208
Sample No.	MHS-135-79	MHS-136-79	MHS-137-79	MHS-138-79	MHS-139-79	MHS-140-79	MHS-141-79	MHS-142-79	MHS-143-79
Element	In parts per million								
Thorium[1]	52	84	309	109	148	115	79	31	40
Uranium[1]	12	24	7.5	8.3	6.7	12	15	7.1	15
Lanthanum[2]	N.D.	100	300	150	N.D.	300	150	N.D.	200
Cerium[2]	N.D.	150	300	200	N.D.	300	200	N.D.	300
Praesodymium[2]	N.D.	<100	<70	<100	N.D.	<100	<100	N.D.	<100
Neodymium[2]	N.D.	70	150	150	N.D.	150	100	N.D.	300
Samarium[2]	N.D.	<100	<100	<100	N.D.	<100	<100	N.D.	<100
Europium[2]	N.D.	<100	<100	<100	N.D.	<100	<100	N.D.	<100
Gadolinium[2]	N.D.	<50	<50	<50	N.D.	<50	<50	N.D.	<50
Terbium[2]	N.D.	<300	<300	<300	N.D.	<300	<300	N.D.	<300
Dysprosium[2]	N.D.	<50	<50	<50	N.D.	<50	<50	N.D.	<50
Holmium[2]	N.D.	<20	<20	<20	N.D.	<20	<20	N.D.	<20
Erbium[2]	N.D.	<50	<50	<50	N.D.	<50	<50	N.D.	<50
Thulium[2]	N.D.	<20	<20	<20	N.D.	<20	<20	N.D.	<20
Ytterbium[2]	N.D.	7	7	7	N.D.	3	3	N.D.	3
Lutetium[2]	N.D.	<30	<30	<30	N.D.	<30	<30	N.D.	<30
Yttrium[2]	N.D.	50	100	100	N.D.	30	30	N.D.	50
Total rare earths	N.D.	377	857	607	N.D.	783	483	N.D.	853
Barium[2]	N.D.	500	2,000	3,000	N.D.	3,000	3,000	N.D.	3,000
Beryllium[2]	N.D.	15	1.5	1.5	N.D.	7	1.5	N.D.	7
Bismuth[2]	N.D.	<10	<10	<10	N.D.	<10	<10	N.D.	<10
Copper[2]	N.D.	30	70	100	N.D.	150	70	N.D.	150
Lead[2]	N.D.	150	30	70	N.D.	150	50	N.D.	30
Mangenese[2]	N.D.	200	1,500	700	N.D.	3,000	1,500	N.D.	3,000
Molybdenum[2]	N.D.	7	30	100	N.D.	7	30	N.D.	50
Niobium[2]	N.D.	50	30	50	N.D.	20	20	N.D.	30
Strontium[2]	N.D.	300	1,500	3,000	N.D.	3,000	3,000	N.D.	3,000
Tin[2]	N.D.	<10	<10	<10	N.D.	<10	<10	N.D.	<10
Vanadium[2]	N.D.	150	300	700	N.D.	700	700	N.D.	700
Zinc[2]	N.D.	<200	<200	<200	N.D.	<200	<200	N.D.	<200
Zirconium[2]	N.D.	1,000	150	500	N.D.	300	300	N.D.	300
	In percent								
Calcium[2]	N.D.	.07	.07	1.5	N.D.	.15	.15	N.D.	.15
Iron[2]	N.D.	3	7	7	N.D.	7	7	N.D.	7
Magnesium[2]	N.D.	.03	.07	.07	N.D.	.7	.3	N.D.	.7
Phosphorus[2]	N.D.	<.2	<.2	<.2	N.D.	<.2	<.2	N.D.	<.2
Potassium[1]	6.2	6.2	11.1	11.1	11.2	11.5	11.9	10.0	10.9
Sodium[2]	N.D.	3	.3	.7	N.D.	.7	.7	N.D.	1.5
Titanium[2]	N.D.	.15	.7	.7	N.D.	.7	.5	N.D.	.7

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	209	214	215	216	217	218	219	220	221
Sample No.	MHS-144-79	MHS-145-79	MHS-146-79	MHS-147-79	MHS-148-79	MHS-149-79	MHS-150-79	MHS-151-79	MHS-152-79
Element	In parts per million								
Thorium[1]	21	118	90	154	64	106	85	137	84
Uranium[1]	5.8	22	13	6.8	13	49	14	39	36
Lanthanium[2]	150	N.D.	1,500	500	300	N.D.	N.D.	1,500	N.D.
Cerium[2]	300	N.D.	1,500	700	300	N.D.	N.D.	2,000	N.D.
Praesodymium[2]	<100	N.D.	200	150	<100	N.D.	N.D.	300	N.D.
Neodymium[2]	150	N.D.	1,500	700	300	N.D.	N.D.	2,000	N.D.
Samarium[2]	<100	N.D.	300	150	150	N.D.	N.D.	700	N.D.
Europium[2]	<100	N.D.	<200	100	<100	N.D.	N.D.	150	N.D.
Gadolinium[2]	<50	N.D.	150	70	70	N.D.	N.D.	150	N.D.
Terbium[2]	<300	N.D.	<300	<300	<300	N.D.	N.D.	<300	N.D.
Dysprosium[2]	<50	N.D.	70	<50	<50	N.D.	N.D.	70	N.D.
Holmium[2]	<20	N.D.	<20	<20	<20	N.D.	N.D.	<20	N.D
Erbium[2]	<50	N.D.	<100	<50	<50	N.D.	N.D.	<100	N.D.
Thulium[2]	<20	N.D.	<20	<20	<20	N.D.	N.D.	<20	N.D.
Ytterbium[2]	3	N.D.	15	7	7	N.D.	N.D.	7	N.D.
Lutetium[2]	<30	N.D.	<30	<30	<30	N.D.	N.D.	<30	N.D.
Yttrium[2]	30	N.D.	150	70	70	N.D.	N.D.	150	N.D.
Total rare earths	633	N.D.	5,385	2,447	1,197	N.D.	N.D.	7,027	N.D.
Barium[2]	1,500	N.D.	3,000	5,000	3,000	N.D.	N.D.	7,000	N.D.
Beryllium[2]	2	N.D.	7	10	5	N.D.	N.D.	7	N.D.
Bismuth[2]	<10	N.D.	10	<10	<10	N.D.	N.D.	20	N.D.
Copper[2]	150	N.D.	70	30	70	N.D.	N.D.	150	N.D.
Lead[2]	30	N.D.	200	70	150	N.D.	N.D.	1,000	N.D.
Manganese[2]	70	N.D.	7,000	3,000	3,000	N.D.	N.D.	3,000	N.D.
Molybdenum[2]	7	N.D.	150	30	20	N.D.	N.D.	30	N.D.
Niobium[2]	15	N.D.	70	70	70	N.D.	N.D.	100	N.D.
Strontium[2]	1,500	N.D.	1,500	3,000	3,000	N.D.	N.D.	1,500	N.D.
Tin[2]	<10	N.D.	<15	<10	<10	N.D.	N.D.	15	N.D.
Vanadium[2]	700	N.D.	300	700	500	N.D.	N.D.	700	N.D.
Zinc[2]	<200	N.D.	700	<200	300	N.D.	N.D.	700	N.D.
Zirconium[2]	300	N.D.	300	200	150	N.D.	N.D.	70	N.D.
	In percent								
Calcium[2]	.1	N.D.	.3	.3	.3	N.D.	N.D.	.15	N.D.
Iron[2]	7	N.D.	10	7	7	N.D.	N.D.	>10	N.D.
Magnesium[2]	.07	N.D.	.7	.7	.7	N.D.	N.D.	.15	N.D.
Phosphorus[2]	<.2	N.D.	<.2	<.2	<.2	N.D.	N.D.	<.2	N.D.
Potassium[1]	10.6	10.6	10.3	10.6	10.8	10.4	11.3	11.1	11.2
Sodium[2]	1.5	N.D.	1	.7	.7	N.D.	N.D.	.3	N.D.
Titanium[2]	.7	N.D.	.3	.3	.3	N.D.	N.D.	.3	N.D.

Table 1.--Chemical analyses of samplss from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	222	223	224	225	227	228	229	230	231
Sample No.	MHS-153-79	MHS-154-79	MHS-155-79	MHS-156-79	MHS-157-79	MHS-158-79	MHS-159-79	MHS-160-79	MHS-161-79
Element	In parts per million								
Thorium[1]	72	40	208	112	96	36	34	44	185
Uranium[1]	19	10	23	44	9.4	5.3	2.9	6.8	21
Lanthanum[2]	700	N.D.	3,000	1,500	N.D.	N.D.	150	N.D.	3,000
Cerium[2]	1,500	N.D.	3,000	1,500	N.D.	N.D.	300	N.D.	3,000
Praesodymium[2]	150	N.D.	300	200	N.D.	N.D.	<100	N.D.	700
Neodymium[2]	700	N.D.	2,000	1,500	N.D.	N.D.	150	N.D.	3,000
Samarium[2]	150	N.D.	300	300	N.D.	N.D.	<100	N.D.	300
Europium[2]	<100	N.D.	<200	<200	N.D.	N.D.	<100	N.D.	150
Gadolinium[2]	70	N.D.	150	70	N.D.	N.D.	<70	N.D.	150
Terbium[2]	<300	N.D.	<300	<300	N.D.	N.D.	<300	N.D.	<300
Dysproeium[2]	<50	N.D.	70	<50	N.D.	N.D.	<50	N.D.	70
Holmium[2]	<20	N.D.	<20	<20	N.D.	N.D.	<20	N.D.	<20
Erbium[2]	<50	N.D.	<100	<100	N.D.	N.D.	<50	N.D.	<100
Thulium[2]	<20	N.D.	<20	<20	N.D.	N.D.	<20	N.D.	<20
Ytterbium[2]	7	N.D.	15	7	N.D.	N.D.	3	N.D.	15
Lutetium[2]	<30	N.D.	<30	<30	N.D.	N.D.	<30	N.D.	<30
Yttrium[2]	100	N.D.	300	150	N.D.	N.D.	70	N.D.	200
Total rare earths	3,377	N.D.	9,135	5,227	N.D.	N.D.	673	N.D.	10,585
Barium[2]	7,000	N.D.	3,000	7,000	N.D.	N.D.	3,000	N.D.	15,000
Beryllium[2]	3	N.D.	3	3	N.D.	N.D.	1.5	N.D.	30
Bismuth[2]	<10	N.D.	10	15	N.D.	N.D.	<10	N.D.	15
Copper[2]	70	N.D.	150	150	N.D.	N.D.	70	N.D.	100
Lead[2]	70	N.D.	1,000	700	N.D.	N.D.	15	N.D.	1,000
Manganese[2]	2,000	N.D.	15,000	15,000	N.D.	N.D.	1,500	N.D.	3,000
Molybdenum[2]	5	N.D.	30	70	N.D.	N.D.	<3	N.D.	300
Niobium[2]	150	N.D.	100	70	N.D.	N.D.	15	N.D.	300
Strontium[2]	1,500	N.D.	1,500	3,000	N.D.	N.D.	1,500	N.D.	1,500
Tin[2]	<10	N.D.	<10	<10	N.D.	N.D.	<10	N.D.	30
Vanadium[2]	300	N.D.	700	300	N.D.	N.D.	300	N.D.	1,500
Zinc[2]	300	N.D.	700	700	N.D.	N.D.	<200	N.D.	300
Zirconium[2]	70	N.D.	70	70	N.D.	N.D.	70	N.D.	700
	In percent								
Calcium[2]	.07	N.D.	.3	.3	N.D.	N.D.	.7	N.D.	.3
Iron[2]	7	N.D.	10	7	N.D.	N.D.	5	N.D.	10
Magnesium[2]	.3	N.D.	.7	.7	N.D.	N.D.	1.5	N.D.	1
Phosphorus[2]	<.2	N.D.	<.2	<.2	N.D.	N.D.	<.2	N.D.	<.2
Potassium[1]	11.2	11.3	10.6	10.3	10.0	11.8	12.0	10.0	9.9
Sodium[2]	.3	N.D.	.3	.7	N.D.	N.D.	.7	N.D.	.7
Titanium[2]	.3	N.D.	.3	.3	N.D.	N.D.	.3	N.D.	.7

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued
[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	232	233	234	235	236	237	238	239	240
Sample No.	MHS-162-79	MHS-163-79	MHS-164-79	MHS-165-79	MHS-166-79	MHS-167-79	MHS-168-79	MHS-169-79	MHS-170-79
Element	In parts per million								
Thorium[1]	53	145	99	158	86	231	319	154	100
Uranium[1]	6.7	14	27	9.1	14	7.1	14	12	21
Lanthanum[2]	150	200	N.D.	150	150	150	150	150	150
Cerium[2]	150	300	N.D.	200	200	200	200	200	200
Praesodymium[2]	<100	<100	N.D.	<100	<100	<100	<100	<100	<100
Neodymium[2]	150	200	N.D.	150	150	100	150	150	70
Samarium[2]	<100	100	N.D.	<100	<100	<100	<100	<100	<100
Europium[2]	<100	<100	N.D.	<100	<100	<100	<100	<100	<100
Gadolinium[2]	<50	<70	N.D.	<70	<50	<70	<70	<50	<70
Terbium[2]	<300	<300	N.D.	<300	<300	<300	<300	<300	<300
Dysprosium[2]	<50	<50	N.D.	<50	<50	<50	70	<50	<50
Holmium[2]	<20	<20	N.D.	<20	<20	<20	<20	<20	<20
Erbium[2]	<50	<50	N.D.	<50	<50	<50	<50	<50	<50
Thulium[2]	<20	<20	N.D.	<20	<20	<20	<20	<20	<20
Ytterbium[2]	7	10	N.D.	15	3	7	30	7	7
Lutetium[2]	<30	<30	N.D.	<30	<30	<30	<30	<30	<30
Yttrium[2]	70	150	N.D.	150	30	100	300	150	70
Total rare earths	527	960	N.D.	665	533	557	900	657	497
Barium[2]	1,500	1,500	N.D.	1,500	1,500	1,500	1,500	1,500	700
Beryllium[2]	3	7	N.D.	10	7	7	15	7	20
Bismuth[2]	<10	<10	N.D.	<10	<10	<10	<10	<10	<10
Copper[2]	30	70	N.D.	70	70	70	70	70	15
Lead[2]	30	30	N.D.	30	15	30	30	50	150
Manganese[2]	1,500	1,500	N.D.	1,500	1,500	1,500	700	3,000	300
Molybdenum[2]	30	30	N.D.	5	<3	15	7	30	7
Niobium[2]	20	30	N.D.	30	30	30	15	30	30
Strontium[2]	1,000	700	N.D.	1,500	1,500	1,500	1,500	3,000	150
Tin[2]	<10	<10	N.D.	<10	<10	<10	<10	<10	<10
Vanadium[2]	150	300	N.D.	700	700	300	700	300	150
Zinc[2]	<200	<200	N.D.	<200	<200	<200	<200	<200	<200
Zirconium[2]	150	150	N.D.	300	150	100	150	150	700
	In percent								
Calcium[2]	.3	.3	N.D.	1.5	.5	1	1.5	.7	.05
Iron[2]	7	7	N.D.	7	5	7	7	7	3
Magnesium[2]	.7	.3	N.D.	.05	.7	.05	.07	.07	.1
Phosphorus[2]	<.2	<.2	N.D.	<.2	<.2	<.2	<.2	<.2	<.2
Potassium[1]	11.0	12.2	7.1	11.3	9.6	11.7	11.0	7.6	5.9
Sodium[2]	1.5	.3	N.D.	.7	3	.7	1.5	3	3
Titanium[2]	.7	.7	N.D.	.7	.3	.3	.3	.3	.07

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	241	242	243	244	245	246	247	248	249
Sample No.	MHS-171-79	MHS-172-79	MHS-173-79	MHS-174-79	MHS-175-79	MHS-176-79	MHS-177-79	MHS-178-79	MHS-179-79
Element	In parts per million								
Thorium[1]	36	51	92	103	136	136	28	108	83
Uranium[1]	5.0	6.1	26	17	45	5.9	8.5	20	37
Lanthanum[2]	N.D.	N.D.	150	700	5,000	700	N.D.	3,000	3,000
Cerium[2]	N.D.	N.D.	200	1,500	7,000	700	N.D.	3,000	3,000
Praesodymium[2]	N.D.	N.D.	<100	150	1,000	<100	N.D.	700	700
Neodymium[2]	N.D.	N.D.	70	700	5,000	300	N.D.	3,000	3,000
Samarium[2]	N.D.	N.D.	<100	150	700	150	N.D.	300	300
Europium[2]	N.D.	N.D.	<100	<100	150	<200	N.D.	150	100
Gadolinium[2]	N.D.	N.D.	<50	70	300	100	N.D.	150	300
Terbium[2]	N.D.	N.D.	<300	<300	<300	<300	N.D.	<300	<300
Dysprosium[2]	N.D.	N.D.	<50	<70	100	50	N.D.	70	70
Holmium[2]	N.D.	N.D.	<20	<20	<20	<20	N.D.	<20	<20
Erbium[2]	N.D.	N.D.	<50	<50	<100	<50	N.D.	<100	<100
Thulium[2]	N.D.	N.D.	<20	<20	<20	<20	N.D.	<20	<20
Yttsrbium[2]	N.D.	N.D.	7	7	15	7	N.D.	10	10
Lutetium[2]	N.D.	N.D.	<30	<30	<30	<30	N.D.	<30	<30
Yttrium[2]	N.D.	N.D.	50	150	300	150	N.D.	150	150
Total rare earths	N.D.	N.D.	477	3,427	19,565	2,157	N.D.	10,530	10,630
Barium[2]	N.D.	N.D.	700	3,000	5,000	3,000	N.D.	7,000	5,000
Beryllium[2]	N.D.	N.D.	15	1.5	1.5	7	N.D.	7	7
Bismuth[2]	N.D.	N.D.	<10	<10	20	<10	N.D.	20	15
Copper[2]	N.D.	N.D.	15	150	300	30	N.D.	150	100
Lead[2]	N.D.	N.D.	150	70	100	70	N.D.	1,000	1,000
Manganese[2]	N.D.	N.D.	300	3,000	7,000	7,000	N.D.	3,000	3,000
Molybdenum[2]	N.D.	N.D.	7	150	70	30	N.D.	30	30
Niobium[2]	N.D.	N.D.	30	70	150	70	N.D.	70	150
Strontium[2]	N.D.	N.D.	300	3,000	500	1,500	N.D.	1,000	3,000
Tin[2]	N.D.	N.D.	<10	<10	<10	<10	N.D.	<20	<20
Vanadium[2]	N.D.	N.D.	150	300	700	300	N.D.	200	300
Zinc[2]	N.D.	N.D.	<200	300	300	<200	N.D.	1,500	300
Zirconium[2]	N.D.	N.D.	700	150	150	300	N.D.	70	150
	In percent								
Calcium[2]	N.D.	N.D.	.3	.3	.3	.15	N.D.	.3	.1
Iron[2]	N.D.	N.D.	3	7	7	7	N.D.	>10	>10
Magnesium[2]	N.D.	N.D.	.15	.7	.7	.7	N.D.	.7	.7
Phosphorus[2]	N.D.	N.D.	<.2	<.2	<.2	<.2	N.D.	<.2	<.2
Potassium[1]	5.8	7.4	7.5	11.2	10.4	11.1	11.9	8.3	9.9
Sodium[2]	N.D.	N.D.	3	.7	.7	.7	N.D.	.3	.7
Titanium[2]	N.D.	N.D.	.07	.3	.7	.3	N.D.	.3	.7

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greeter then value indicated]

Locality No.	250	251	252	253	254	255	256	257	258
Sample No.	MHS-180-79	MHS-181-79	MHS-182-79	MHS-183-79	MHS-184-79	MHS-185-79	MHS-186-79	MHS-187-79	MHS-188-79
Element					In parts per million				
Thorium[1]	59	54	686	139	147	151	64	261	216
Uranium[1]	9.2	8.2	42	26	26	30	13	28	8.1
Lanthanum[2]	300	300	3,000	N.D.	3,000	1,500	300	300	300
Cerium[2]	500	700	3,000	N.D.	5,000	2,000	7,000	500	300
Praesodymium[2]	<100	100	700	N.D.	700	300	150	<100	<100
Neodymium[2]	300	300	3,000	N.D.	3,000	2,000	700	500	200
Samarium[2]	100	100	700	N.D.	300	300	150	300	100
Europium[2]	<100	<100	150	N.D.	<200	<200	<200	<200	<100
Gadolinium[2]	70	50	500	N.D.	300	300	70	150	70
Terbium[2]	<300	<300	<300	N.D.	<300	<300	<300	<300	<300
Dysprosium[2]	<50	<50	150	N.D.	70	50	<50	150	70
Holmium[2]	<20	<20	30	N.D.	<20	<20	<20	<20	<20
Erbium[2]	<50	<50	<100	N.D.	<100	<100	<50	<100	<50
Thulium[2]	<20	<20	<20	N.D.	<20	<20	<20	<20	<20
Ytterbium[2]	3	3	30	N.D.	15	10	7	15	7
Lutetium[2]	<30	<30	<30	N.D.	<30	<30	<30	<30	<30
Yttrium[2]	70	50	500	N.D.	200	150	70	300	150
Total rare earths	1,343	1,603	11,760	N.D.	12,585	6,610	2,147	2,215	1,197
Barium[2]	3,000	3,000	7,000	N.D.	7,000	7,000	5,000	3,000	3,000
Beryllium[2]	1.5	1.5	7	N.D.	10	5	7	7	2
Bismuth[2]	<10	<10	70	N.D.	<10	<10	<10	<10	15
Copper[2]	70	30	70	N.D.	150	150	100	300	150
Lead[2]	30	30	3,000	N.D.	700	500	100	50	300
Manganese[2]	7,000	3,000	15,000	N.D.	30,000	30,000	7,000	15,000	3,000
Molybdenum[2]	150	5	30	N.D.	70	70	50	150	70
Niobium[2]	70	30	70	N.D.	150	150	70	100	30
Strontium[2]	3,000	2,000	3,000	N.D.	3,000	3,000	3,000	2,000	2,000
Tin[2]	<10	<10	15	N.D.	<20	<20	10	10	<10
Vanadium[2]	150	150	300	N.D.	500	300	300	700	300
Zinc[2]	200	<200	1,500	N.D.	700	700	<200	300	200
Zirconium[2]	150	150	50	N.D.	150	150	150	200	150
					In percent				
Calcium[2]	.15	.3	>10	N.D.	.15	.15	.2	.5	.3
Iron[2]	7	3	7	N.D.	>10	7	7	7	5
Magnesium[2]	.3	.7	.3	N.D.	.3	.7	.7	.5	.15
Phosphorus[2]	<.2	<.2	<.2	N.D.	<.2	<.2	<.2	<.2	<.2
Potassium[1]	11.6	10.9	4.2	10.0	9.2	10.7	11.2	10.3	11.3
Sodium[2]	.7	.7	.3	N.D.	.3	.5	.7	.7	3
Titanium[2]	.3	.3	.3	N.D.	.7	.3	.3	.3	.3

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued
[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	259	260	261	262	263	264	265	266	267
Sample No.	MHS-189-79	MHS-190-79	MHS-191-79	MHS-192-79	MHS-193-79	MHS-194-79	MHS-195-79	MHS-196-79	MHS-197-79
Element	In parts per million								
Thorium[1]	593	201	86	90	91	105	961	36	63
Uranium[1]	24	14	23	31	9.2	25	44	7.8	7.4
Lanthanum[2]	1,500	N.D.	N.D.	1,000	1,500	N.D.	N.D.	N.D.	150
Cerium[2]	1,500	N.D.	N.D.	1,500	1,500	N.D.	N.D.	N.D.	300
Praesodymium[2]	300	N.D.	N.D.	300	300	N.D.	N.D.	N.D.	<100
Neodymium[2]	1,500	N.D.	N.D.	1,500	1,500	N.D.	N.D.	N.D.	150
Samarium[2]	500	N.D.	N.D.	300	300	N.D.	N.D.	N.D.	<100
Europium[2]	<200	N.D.	N.D.	<100	<100	N.D.	N.D.	N.D.	<100
Gadolinium[2]	150	N.D.	N.D.	150	100	N.D.	N.D.	N.D.	<70
Terbium[2]	<300	N.D.	N.D.	<300	<300	N.D.	N.D.	N.D.	<300
Dysprosium[2]	150	N.D.	N.D.	70	70	N.D.	N.D.	N.D.	<50
Holmium[2]	<20	N.D.	N.D.	<20	<20	N.D.	N.D.	N.D.	<20
Erbium[2]	<100	N.D.	N.D.	<100	<100	N.D.	N.D.	N.D.	<50
Thulium[2]	<20	N.D.	N.D.	<20	<20	N.D.	N.D.	N.D.	<20
Ytterbium[2]	30	N.D.	N.D.	7	7	N.D.	N.D.	N.D.	7
Lutetium[2]	<30	N.D.	N.D.	<30	<30	N.D.	N.D.	N.D.	<30
Yttrium[2]	300	N.D.	N.D.	150	70	N.D.	N.D.	N.D.	70
Total rare earths	5,930	N.D.	N.D.	4,977	5,347	N.D.	N.D.	N.D.	607
Barium[2]	7,000	N.D.	N.D.	5,000	5,000	N.D.	N.D.	N.D.	1,500
Beryllium[2]	7	N.D.	N.D.	1.5	2	N.D.	N.D.	N.D.	10
Bismuth[2]	<10	N.D.	N.D.	<10	<10	N.D.	N.D.	N.D.	<10
Copper[2]	150	N.D.	N.D.	150	30	N.D.	N.D.	N.D.	70
Lead[2]	200	N.D.	N.D.	150	200	N.D.	N.D.	N.D.	50
Manganese[2]	30,000	N.D.	N.D.	1,500	70	N.D.	N.D.	N.D.	1,000
Molybdenum[2]	100	N.D.	N.D.	30	70	N.D.	N.D.	N.D.	<3
Niobium[2]	150	N.D.	N.D.	70	70	N.D.	N.D.	N.D.	15
Strontium[2]	7,000	N.D.	N.D.	1,500	2,000	N.D.	N.D.	N.D.	3,000
Tin[2]	15	N.D.	N.D.	<10	<10	N.D.	N.D.	N.D.	<10
Vanadium[2]	700	N.D.	N.D.	300	300	N.D.	N.D.	N.D.	700
Zinc[2]	300	N.D.	N.D.	300	<200	N.D.	N.D.	N.D.	<200
Zirconium[2]	150	N.D.	N.D.	150	150	N.D.	N.D.	N.D.	300
	In percent								
Calcium[2]	.3	N.D.	N.D.	.07	.07	N.D.	N.D.	N.D.	2
Iron[2]	7	N.D.	N.D.	7	3	N.D.	N.D.	N.D.	3
Magnesium[2]	.3	N.D.	N.D.	.15	.05	N.D.	N.D.	N.D.	.7
Phosphorus[2]	<.2	N.D.	N.D.	<.2	<.2	N.D.	N.D.	N.D.	<.2
Potassium[1]	10.7	10.9	11.3	10.6	12.0	10.2	6.8	8.7	9.4
Sodium[2]	.7	N.D.	N.D.	.3	.3	N.D.	N.D.	N.D.	1.5
Titanium[2]	.3	N.D.	N.D.	.3	.3	N.D.	N.D.	N.D.	.3

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	269	270	271	272	273	274	275	276	277
Sample No.	MHS-198-79	MHS-199-79	MHS-200-79	MHS-201-79	MHS-202-79	MHS-203-79	MHS-204-79	MHS-205-79	MHS-206-79
Element	In parts per million								
Thorium[1]	65	86	87	44	86	109	147	84	60
Uranium[1]	5.7	6.1	3.7	5.2	5.7	5.3	10	8.7	9.4
Lanthanum[2]	150	N.D.	700	N.D.	150	N.D.	700	500	N.D.
Cerium[2]	200	N.D.	700	N.D.	300	N.D.	1,500	700	N.D.
Praesodymium[2]	<100	N.D.	150	N.D.	<100	N.D.	150	150	N.D.
Neodymium[2]	150	N.D.	700	N.D.	150	N.D.	700	300	N.D.
Samarium[2]	<100	N.D.	150	N.D.	<100	N.D.	150	150	N.D.
Europium[2]	<100	N.D.	<100	N.D.	<100	N.D.	<100	<100	N.D.
Gadolinium[2]	<50	N.D.	70	N.D.	<70	N.D.	70	<70	N.D.
Terbium[2]	<300	N.D.	<300	N.D.	<300	N.D.	<300	<300	N.D.
Dysprosium[2]	<50	N.D.	<50	N.D.	<50	N.D.	<50	<50	N.D.
Holmium[2]	<20	N.D.	<20	N.D.	<20	N.D.	<20	<20	N.D.
Erbium[2]	<50	N.D.	<50	N.D.	<50	N.D.	<50	<50	N.D.
Thulium[2]	<20	N.D.	<20	N.D.	<20	N.D.	<20	<20	N.D.
Ytterbium[2]	3	N.D.	5	N.D.	7	N.D.	7	3	N.D.
Lutetium[2]	<30	N.D.	<30	N.D.	<30	N.D.	<30	<30	N.D.
Yttrium[2]	30	N.D.	70	N.D.	70	N.D.	150	70	N.D.
Total rare earths	533	N.D.	2,545	N.D.	677	N.D.	3,427	1,873	N.D.
Barium[2]	2,000	N.D.	2,000	N.D.	2,000	N.D.	2,000	3,000	N.D.
Beryllium[2]	3	N.D.	10	N.D.	7	N.D.	7	1.5	N.D.
Bismuth[2]	<10	N.D.	<10	N.D.	<10	N.D.	<10	<10	N.D.
Copper[2]	300	N.D.	150	N.D.	50	N.D.	300	100	N.D.
Lead[2]	30	N.D.	70	N.D.	70	N.D.	150	70	N.D.
Manganese[2]	700	N.D.	1,000	N.D.	1,500	N.D.	3,000	150	N.D.
Molybdenum[2]	5	N.D.	7	N.D.	10	N.D.	30	70	N.D.
Niobium[2]	15	N.D.	30	N.D.	30	N.D.	70	70	N.D.
Strontium[2]	3,000	N.D.	1,500	N.D.	3,000	N.D.	2,000	3,000	N.D.
Tin[2]	<10	N.D.	15	N.D.	<10	N.D.	<10	<10	N.D.
Vanadium[2]	500	N.D.	700	N.D.	300	N.D.	700	300	N.D.
Zinc[2]	<200	N.D.	<200	N.D.	<200	N.D.	300	<200	N.D.
Zirconium[2]	150	N.D.	150	N.D.	200	N.D.	300	200	N.D.
	In percent								
Calcium[2]	.7	N.D.	.3	N.D.	.7	N.D.	.7	.15	N.D.
Iron[2]	7	N.D.	3	N.D.	7	N.D.	7	3	N.D.
Magnesium[2]	1	N.D.	.3	N.D.	.7	N.D.	.7	.15	N.D.
Phosphorus[2]	<.2	N.D.	<.2	N.D.	<.2	N.D.	<.2	<.2	N.D.
Potassium[1]	8.1	10.2	9.0	6.0	6.8	7.1	8.2	11.1	9.5
Sodium[2]	3	N.D.	3	N.D.	7	N.D.	3	1.5	N.D.
Titanium[2]	.3	N.D.	.3	N.D.	.3	N.D.	.7	.3	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	278	279	280	281	282	283	284	285	286
Sample No.	MHS-207-79	MHS-208-79	MHS-209-79	MHS-210-79	MHS-211-79	MHS-212-79	MHS-213-79	MHS-214-79	MHS-215-79
Element	In parts per million								
Thorium[1]	231	179	58	131	69	123	73	45	42
Uranium[1]	17	34	28	21	6.2	14	4.6	6.1	5.8
Lanthanum[2]	700	2,000	N.D.	2,000	N.D.	700	150	150	N.D.
Cerium[2]	1,000	3,000	N.D.	3,000	N.D.	1,500	150	300	N.D.
Praesodymium[2]	150	300	N.D.	500	N.D.	150	<100	<100	N.D.
Neodymium[2]	700	1,500	N.D.	3,000	N.D.	700	150	150	N.D.
Samarium[2]	200	300	N.D.	300	N.D.	200	<100	<100	N.D.
Europium[2]	<100	<100	N.D.	<100	N.D.	<100	<100	<100	N.D.
Gadolinium[2]	100	100	N.D.	150	N.D.	70	<50	<70	N.D.
Terbium[2]	<300	<300	N.D.	<300	N.D.	<300	<300	<300	N.D.
Dysprosium[2]	50	70	N.D.	70	N.D.	<50	<50	<50	N.D.
Holmium[2]	<20	<20	N.D.	<20	N.D.	<20	<20	<20	N.D.
Erbium[2]	<100	<100	N.D.	<100	N.D.	<50	<50	<50	N.D.
Thulium[2]	<20	<20	N.D.	<20	N.D.	<20	<20	<20	N.D.
Ytterbium[2]	7	7	N.D.	7	N.D.	5	7	5	N.D.
Lutetium[2]	<30	<30	N.D.	<30	N.D.	<30	<30	<30	N.D.
Yttrium[2]	150	150	N.D.	150	N.D.	70	150	70	N.D.
Total rare earths	3,057	7,427	N.D.	9,177	N.D.	3,395	607	675	N.D.
Barium[2]	3,000	3,000	N.D.	1,500	N.D.	3,000	700	1,500	N.D.
Beryllium[2]	7	7	N.D.	3	N.D.	3	15	10	N.D.
Bismuth[2]	<10	20	N.D.	20	N.D.	<10	<10	<10	N.D.
Copper[2]	30	150	N.D.	150	N.D.	150	70	50	N.D.
Lead[2]	150	700	N.D.	700	N.D.	200	70	30	N.D.
Manganese[2]	150	2,000	N.D.	70	N.D.	70	1,500	700	N.D.
Molybdenum[2]	70	150	N.D.	100	N.D.	150	30	15	N.D.
Niobium[2]	150	150	N.D.	70	N.D.	70	30	15	N.D.
Strontium[2]	3,000	3,000	N.D.	3,000	N.D.	1,500	700	3,000	N.D.
Tin[2]	<10	<10	N.D.	<10	N.D.	<10	<10	<10	N.D.
Vanadium[2]	700	700	N.D.	700	N.D.	700	700	300	N.D.
Zinc[2]	<200	<200	N.D.	<200	N.D.	<200	<200	<200	N.D.
Zirconium[2]	150	200	N.D.	300	N.D.	150	300	200	N.D.
	In percent								
Calcium[2]	.07	.15	N.D.	.15	N.D.	.07	.7	.3	N.D.
Iron[2]	3	7	N.D.	3	N.D.	7	7	5	N.D.
Magnesium[2]	.07	.07	N.D.	.3	N.D.	.07	.7	.3	N.D.
Phosphorus[2]	<.2	<.2	N.D.	<.2	N.D.	<.2	<.2	<.2	N.D.
Potassium[1]	10.5	9.7	8.9	8.2	10.8	11.7	6.3	6.8	7.9
Sodium[2]	.3	.7	N.D.	2	N.D.	.7	.7	3	N.D.
Titanium[2]	.3	.3	N.D.	.3	N.D.	.3	.3	.3	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	287	288	289	290	292	293	294	295	297
Sample No.	MHS-216-79	MHS-217-79	MHS-218-79	MHS-219-79	MHS-220-79	MHS-221-79	MHS-222-79	MHS-223-79	MHS-225-79
Element	In parts per million								
Thorium[1]	87	40	49	158	117	69	177	178	146
Uranium[1]	7.0	9.0	5.6	3.5	11.3	9.0	7.1	8.2	5.2
Lanthanum[2]	150	N.D.	150	N.D.	1,500	N.D.	700	700	150
Cerium[2]	150	N.D.	200	N.D.	3,000	N.D.	1,500	700	200
Praesodymium[2]	<100	N.D.	<100	N.D.	150	N.D.	150	100	<100
Neodymium[2]	100	N.D.	150	N.D.	700	N.D.	700	700	150
Samarium[2]	<100	N.D.	<100	N.D.	150	N.D.	200	150	<100
Europium[2]	<100	N.D.	<100	N.D.	<100	N.D.	<100	<100	<100
Gadolinium[2]	70	N.D.	<50	N.D.	70	N.D.	100	70	70
Terbium[2]	<300	N.D.	<300	N.D.	<300	N.D.	<300	<300	<300
Dysprosium[2]	<50	N.D.	<50	N.D.	<50	N.D.	70	<50	<50
Holmium[2]	<20	N.D.	<20	N.D.	<20	N.D.	<20	<20	<20
Erbium[2]	<50	N.D.	<50	N.D.	<50	N.D.	<50	<50	<50
Thulium[2]	<20	N.D.	<20	N.D.	<20	N.D.	<20	<20	<20
Ytterbium[2]	3	N.D.	7	N.D.	7	N.D.	10	3	7
Lutetium[2]	<30	N.D.	<30	N.D.	<30	N.D.	<30	<30	<30
Yttrium[2]	70	N.D.	70	N.D.	70	N.D.	200	70	70
Total rare earths	540	N.D.	577	N.D.	5,647	N.D.	3,630	2,493	647
Barium[2]	1,500	N.D.	1,500	N.D.	3,000	N.D.	3,000	3,000	2,000
Beryllium[2]	7	N.D.	7	N.D.	10	N.D.	15	7	7
Bismuth[2]	<10	N.D.	<10	N.D.	<10	N.D.	<10	<10	<10
Copper[2]	100	N.D.	70	N.D.	150	N.D.	70	70	70
Leed[2]	150	N.D.	30	N.D.	300	N.D.	150	100	30
Manganese[2]	3,000	N.D.	1,500	N.D.	7,000	N.D.	3,000	7,000	3,000
Molybdenum[2]	30	N.D.	7	N.D.	30	N.D.	20	30	30
Niobium[2]	10	N.D.	15	N.D.	70	N.D.	70	70	50
Strontium[2]	1,500	N.D.	3,000	N.D.	3,000	N.D.	3,000	2,000	1,500
Tin[2]	<10	N.D.	<10	N.D.	<10	N.D.	<10	<10	<10
Vanadium[2]	300	N.D.	300	N.D.	700	N.D.	700	500	700
Zinc[2]	300	N.D.	<200	N.D.	300	N.D.	<200	<200	<200
Zirconium[2]	150	N.D.	200	N.D.	150	N.D.	150	70	300
	In percent								
Calcium[2]	.15	N.D.	1	N.D.	.15	N.D.	.07	.07	.5
Iron[2]	3	N.D.	7	N.D.	7	N.D.	7	7	7
Magnesium[2]	.15	N.D.	.7	N.D.	.3	N.D.	.07	.07	.7
Phosphorus[2]	<.2	N.D.	<.2	N.D.	<.2	N.D.	<.2	<.2	<.2
Potassium[1]	8.3	8.8	6.1	7.9	10.2	10.8	11.1	11.1	9.5
Sodium[2]	3	N.D.	5	N.D.	1	N.D.	.7	.7	3
Titanium[2]	.3	N.D.	.5	N.D.	.3	N.D.	.3	.5	.5

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued
[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	298	299	300	301	302	303	304	305	306
Sample No.	MHS-226-79	MHS-227-79	MHS-228-79	MHS-229-79	MHS-230-79	MHS-231-79	MHS-232-79	MHS-233-79	MHS-234-79
Element	In parts per million								
Thorium[1]	116	23	45	60	119	149	296	51	50
Uranium[1]	6.4	5.5	5.9	6.5	4.7	10	5.0	5.6	4.2
Lanthanum[2]	150	150	N.D.	N.D.	N.D.	N.D.	200	N.D.	N.D.
Cerium[2]	200	150	N.D.	N.D.	N.D.	N.D.	300	N.D.	N.D.
Praesodymium[2]	<100	<100	N.D.	N.D.	N.D.	N.D.	<100	N.D.	N.D.
Neodymium[2]	150	100	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.
Samarium[2]	<100	<100	N.D.	N.D.	N.D.	N.D.	<100	N.D.	N.D.
Europium[2]	<100	<100	N.D.	N.D.	N.D.	N.D.	<100	N.D.	N.D.
Gadolinium[2]	<50	<50	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.
Terbium[2]	<300	<300	N.D.	N.D.	N.D.	N.D.	<300	N.D.	N.D.
Dysprosium[2]	<50	<50	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.
Holmium[2]	<20	<20	N.D.	N.D.	N.D.	N.D.	<20	N.D.	N.D.
Erbium[2]	<50	<50	N.D.	N.D.	N.D.	N.D.	<50	N.D.	N.D.
Thulium[2]	<20	<20	N.D.	N.D.	N.D.	N.D.	<20	N.D.	N.D.
Ytterbium[2]	7	3	N.D.	N.D.	N.D.	N.D.	7	N.D.	N.D.
Lutetium[2]	<30	<30	N.D.	N.D.	N.D.	N.D.	<30	N.D.	N.D.
Yttrium[2]	100	30	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.
Total rare earths	607	433	N.D.	N.D.	N.D.	N.D.	947	N.D.	N.D.
Barium[2]	1,500	1,500	N.D.	N.D.	N.D.	N.D.	1,000	N.D.	N.D.
Beryllium[2]	7	7	N.D.	N.D.	N.D.	N.D.	15	N.D.	N.D.
Bismuth[2]	<10	<10	N.D.	N.D.	N.D.	N.D.	<10	N.D.	N.D.
Copper[2]	100	150	N.D.	N.D.	N.D.	N.D.	30	N.D.	N.D.
Lead[2]	50	30	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.
Manganese[2]	1,500	1,000	N.D.	N.D.	N.D.	N.D.	2,000	N.D.	N.D.
Molybdenum[2]	30	7	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.
Niobium[2]	20	15	N.D.	N.D.	N.D.	N.D.	30	N.D.	N.D.
Strontium[2]	3,000	3,000	N.D.	N.D.	N.D.	N.D.	1,500	N.D.	N.D.
Tin[2]	<10	<10	N.D.	N.D.	N.D.	N.D.	<10	N.D.	N.D.
Vanadium[2]	300	700	N.D.	N.D.	N.D.	N.D.	700	N.D.	N.D.
Zinc[2]	<200	<200	N.D.	N.D.	N.D.	N.D.	<200	N.D.	N.D.
Zirconium[2]	150	200	N.D.	N.D.	N.D.	N.D.	70	N.D.	N.D.
	In percent								
Calcium[2]	.3	.7	N.D.	N.D.	N.D.	N.D.	.15	N.D.	N.D.
Iron[2]	7	7	N.D.	N.D.	N.D.	N.D.	7	N.D.	N.D.
Magnesium[2]	.15	.3	N.D.	N.D.	N.D.	N.D.	.2	N.D.	N.D.
Phosphorus[2]	<.2	<.2	N.D.	N.D.	N.D.	N.D.	<.2	N.D.	N.D.
Potassium[1]	8.6	8.2	5.5	6.6	9.2	9.6	11.6	6.7	5.3
Sodium[2]	3	3	N.D.	N.D.	N.D.	N.D.	.7	N.D.	N.D.
Titanium[2]	.3	.5	N.D.	N.D.	N.D.	N.D.	.3	N.D.	N.D.

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	307	308	309	310	311	312	313	314	315
Sample No.	MHS-235-79	MHS-236-79	MHS-237-79	MHS-238-79	MHS-239-79	MHS-240-79	MHS-241-79	MHS-242-79	MHS-243-79
Element	In parts per million								
Thorium[1]	182	102	33	61	57	128	34	57	34
Uranium[1]	8.0	6.2	1.8	6.0	6.3	10.6	5.7	6.4	5.0
Lanthanum[2]	N.D.	150	70	150	N.D.	700	N.D.	N.D.	150
Cerium[2]	N.D.	200	150	200	N.D.	1,000	N.D.	N.D.	300
Praesodymium[2]	N.D.	<100	<100	<100	N.D.	150	N.D.	N.D.	<100
Neodymium[2]	N.D.	150	70	100	N.D.	700	N.D.	N.D.	100
Samarium[2]	N.D.	<100	<100	<100	N.D.	150	N.D.	N.D.	<100
Europium[2]	N.D.	<100	<100	<100	N.D.	<100	N.D.	N.D.	<100
Gadolinium[2]	N.D.	<50	<50	<50	N.D.	<50	N.D.	N.D.	<50
Terbium[2]	N.D.	<300	<300	<300	N.D.	<300	N.D.	N.D.	<300
Dysprosium[2]	N.D.	<70	<50	<50	N.D.	<70	N.D.	N.D.	<50
Holmium[2]	N.D.	<20	<20	<20	N.D.	<20	N.D.	N.D.	<20
Erbium[2]	N.D.	<50	<50	<50	N.D.	<50	N.D.	N.D.	<50
Thulium[2]	N.D.	<20	<20	<20	N.D.	<20	N.D.	N.D.	<20
Ytterbium[2]	N.D.	7	1.5	5	N.D.	7	N.D.	N.D.	3
Lutetium[2]	N.D.	<30	<30	<30	N.D.	<30	N.D.	N.D.	<30
Yttrium[2]	N.D.	150	30	70	N.D.	150	N.D.	N.D.	30
Total rare earths	N.D.	657	321.5	525	N.D.	2,857	N.D.	N.D.	583
Barium[2]	N.D.	1,500	1,500	1,500	N.D.	700	N.D.	N.D.	1,500
Beryllium[2]	N.D.	7	7	10	N.D.	7	N.D.	N.D.	7
Bismuth[2]	N.D.	<10	<10	<10	N.D.	<10	N.D.	N.D.	<10
Copper[2]	N.D.	50	30	30	N.D.	70	N.D.	N.D.	30
Lead[2]	N.D.	30	20	30	N.D.	70	N.D.	N.D.	30
Manganese[2]	N.D.	700	300	1,500	N.D.	700	N.D.	N.D.	1,500
Molybdenum[2]	N.D.	7	7	30	N.D.	30	N.D.	N.D.	<3
Niobium[2]	N.D.	15	10	20	N.D.	200	N.D.	N.D.	15
Strontium[2]	N.D.	1,500	700	700	N.D.	700	N.D.	N.D.	5,000
Tin[2]	N.D.	<10	<10	<10	N.D.	30	N.D.	N.D.	<10
Vanadium[2]	N.D.	300	150	300	N.D.	1,500	N.D.	N.D.	300
Zinc[2]	N.D.	<200	<200	<200	N.D.	<200	N.D.	N.D.	<200
Zirconium[2]	N.D.	150	150	300	N.D.	150	N.D.	N.D.	300
	In percent								
Calcium[2]	N.D.	.3	.3	.3	N.D.	.3	N.D.	N.D.	.7
Iron[2]	N.D.	7	1.5	3	N.D.	3	N.D.	N.D.	3
Magnesium[2]	N.D.	.15	.2	.15	N.D.	.3	N.D.	N.D.	.3
Phosphorus[2]	N.D.	<.2	<.2	<.2	N.D.	<.2	N.D.	N.D.	<.2
Potassium[1]	10.3	8.3	5.5	9.2	7.5	8.4	5.8	7.2	6.4
Sodium[2]	N.D.	3	3	3	N.D.	1.5	N.D.	N.D.	5
Titanium[2]	N.D.	.3	.15	.3	N.D.	.7	N.D.	N.D.	.3

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	316	317	318	319	320	321	322	323	324
Sample No.	MHS-244-79	MHS-245-79	MHS-246-79	MHS-247-79	MHS-248-79	MHS-249-79	MHS-250-79	MHS-251-79	MHS-252-79
Element	In parts per million								
Thorium[1]	45	49	116	36	37	106	203	65	39
Uranium[1]	6.3	7.9	8.3	6.6	7.1	9.0	7.2	5.6	5.
Lanthanum[2]	150	N.D.	150	N.D.	150	N.D.	N.D.	150	N.D.
Cerium[2]	200	N.D.	200	N.D.	200	N.D.	N.D.	150	N.D.
Praesodymium[2]	<100	N.D.	<100	N.D.	<100	N.D.	N.D.	<100	N.D.
Neodymium[2]	150	N.D.	150	N.D.	150	N.D.	N.D.	100	N.D.
Samarium[2]	<100	N.D.	<100	N.D.	<100	N.D.	N.D.	<100	N.D.
Europium[2]	<100	N.D.	<100	N.D.	<100	N.D.	N.D.	<100	N.D.
Gadolinium[2]	<50	N.D.	70	N.D.	<50	N.D.	N.D.	<50	N.D.
Terbium[2]	<300	N.D.	<300	N.D.	<300	N.D.	N.D.	<300	N.D.
Dysprosium[2]	<50	N.D.	70	N.D.	<70	N.D.	N.D.	<50	N.D.
Holmium[2]	<20	N.D.	<20	N.D.	<20	N.D.	N.D.	<20	N.D.
Erbium[2]	<50	N.D.	<50	N.D.	<50	N.D.	N.D.	<50	N.D.
Thulium[2]	<20	N.D.	<20	N.D.	<20	N.D.	N.D.	<20	N.D.
Ytterbium[2]	7	N.D.	7	N.D.	7	N.D.	N.D.	7	N.D.
Lutetium[2]	<30	N.D.	<30	N.D.	<30	N.D.	N.D.	<30	N.D.
Yttrium[2]	70	N.D.	150	N.D.	150	N.D.	N.D.	70	N.D.
Total rare earths	577	N.D.	797	N.D.	657	N.D.	N.D.	477	N.D.
Barium[2]	1,500	N.D.	1,500	N.D.	1,500	N.D.	N.D.	1,500	N.D.
Beryllium[2]	7	N.D.	10	N.D.	7	N.D.	N.D.	7	N.D.
Bismuth[2]	<10	N.D.	<10	N.D.	<10	N.D.	N.D.	<10	N.D.
Copper[2]	150	N.D.	70	N.D.	150	N.D.	N.D.	70	N.D.
Lead[2]	150	N.D.	30	N.D.	30	N.D.	N.D.	30	N.D.
Manganese[2]	1,500	N.D.	700	N.D.	1,500	N.D.	N.D.	700	N.D.
Molybdenum[2]	<3	N.D.	15	N.D.	7	N.D.	N.D.	5	N.D.
Niobium[2]	15	N.D.	30	N.D.	15	N.D.	N.D.	30	N.D.
Strontium[2]	2,000	N.D.	1,500	N.D.	1,500	N.D.	N.D.	300	N.D.
Tin[2]	<10	N.D.	<10	N.D.	<10	N.D.	N.D.	<10	N.D.
Vanadium[2]	300	N.D.	700	N.D.	700	N.D.	N.D.	300	N.D.
Zinc[2]	300	N.D.	<200	N.D.	<200	N.D.	N.D.	300	N.D.
Zirconium[2]	200	N.D.	150	N.D.	150	N.D.	N.D.	300	N.D.
	In percent								
Calcium[2]	.5	N.D.	.7	N.D.	.5	N.D.	N.D.	.3	N.D.
Iron[2]	7	N.D.	3	N.D.	7	N.D.	N.D.	3	N.D.
Magnesium[2]	.3	N.D.	.3	N.D.	.3	N.D.	N.D.	.15	N.D.
Phosphorus[2]	<.2	N.D.	<.2	N.D.	<.2	N.D.	N.D.	<.2	N.D.
Potassium[1]	6.4	8.7	9.7	7.3	7.5	8.1	8.8	7.0	5
Sodium[2]	3	N.D.	3	N.D.	3	N.D.	N.D.	3	N.D.
Titanium[2]	.5	N.D.	.3	N.D.	.7	N.D.	N.D.	.3	N.D.

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	325	326	329	330	331	332	333	335	336
Sample No.	MHS-253-79	MHS-254-79	MHS-257-79	MHS-258-79	MHS-259-79	MHS-260-79	MHS-261-79	MHS-262-79	MHS-263-79
Element	In parts per million								
Thorium[1]	61	269	49	152	121	45	62	46	36
Uranium[1]	5.5	27	11	9.4	6.6	3.7	7.5	6.7	5.3
Lanthanum[2]	150	300	N.D.	150	150	150	N.D.	N.D.	150
Cerium[2]	150	500	N.D.	300	200	150	N.D.	N.D.	200
Praesodymium[2]	<100	<100	N.D.	<100	<100	<100	N.D.	N.D.	<100
Neodymium[2]	150	150	N.D.	150	150	100	N.D.	N.D.	150
Samarium[2]	<100	<100	N.D.	<100	<100	<100	N.D.	N.D.	<100
Europium[2]	<100	<100	N.D.	<100	<100	<100	N.D.	N.D.	<100
Gadolinium[2]	<50	70	N.D.	<50	<50	<50	N.D.	N.D.	<50
Terbium[2]	<300	<300	N.D.	<300	<300	<300	N.D.	N.D.	<300
Dysprosium[2]	<50	70	N.D.	<50	<50	<50	N.D.	N.D.	<50
Holmium[2]	<20	<20	N.D.	<20	<20	<20	N.D.	N.D.	<20
Erbium[2]	<50	<50	N.D.	<50	<50	<50	N.D.	N.D.	<50
Thulium[2]	<20	<20	N.D.	<20	<20	<20	N.D.	N.D.	<20
Ytterbium[2]	7	10	N.D.	7	15	2	N.D.	N.D.	7
Lutetium[2]	<30	<30	N.D.	<30	<30	<30	N.D.	N.D.	<30
Yttrium[2]	70	200	N.D.	100	150	30	N.D.	N.D.	70
Total rare earths	527	1,300	N.D.	707	665	432	N.D.	N.D.	577
Barium[2]	1,500	1,500	N.D.	1,000	2,000	1,500	N.D.	N.D.	1,500
Beryllium[2]	7	10	N.D.	5	7	3	N.D.	N.D.	7
Bismuth[2]	<10	<10	N.D.	<10	<10	<10	N.D.	N.D.	<10
Copper[2]	100	150	N.D.	70	70	15	N.D.	N.D.	70
Lead[2]	30	30	N.D.	30	30	50	N.D.	N.D.	30
Manganese[2]	700	15,000	N.D.	700	700	300	N.D.	N.D.	1,500
Molybdenum[2]	7	20	N.D.	10	7	3	N.D.	N.D.	<3
Niobium[2]	15	30	N.D.	30	70	10	N.D.	N.D.	15
Strontium[2]	1,000	2,000	N.D.	1,500	1,500	500	N.D.	N.D.	1,500
Tin[2]	<10	<10	N.D.	<10	<10	<10	N.D.	N.D.	<10
Vanadium[2]	500	700	N.D.	300	700	150	N.D.	N.D.	700
Zinc[2]	<200	300	N.D.	<200	<200	<200	N.D.	N.D.	<200
Zirconium[2]	150	100	N.D.	150	700	150	N.D.	N.D.	200
	In percent								
Calcium[2]	.3	3	N.D.	.7	3	.7	N.D.	N.D.	1.5
Iron[2]	7	7	N.D.	7	7	3	N.D.	N.D.	7
Magnesium[2]	.15	.07	N.D.	.15	.15	.15	N.D.	N.D.	.15
Phosphorus[2]	<.2	<.2	N.D.	<.2	<.2	<.2	N.D.	N.D.	<.2
Potassium[1]	8.3	10.3	7.6	8.6	7.7	5.3	7.9	7.1	7.2
Sodium[2]	3	.7	N.D.	3	5	3	N.D.	N.D.	5
Titanium[2]	.3	.3	N.D.	.3	.7	.2	N.D.	N.D.	.3

Table 1.—Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	337	338	339	340	341	342	343	344	345
Sample No.	MHS-264-79	MHS-265-79	MHS-266-79	MHS-267-79	MHS-268-79	MHS-269-79	MHS-270-79	MHS-271-79	MHS-272-79
Element	In parts per million								
Thorium[1]	56	23	10	143	65	70	58	32	48
Uranium[1]	5.6	4.8	2.8	7.5	6.6	7.0	6.8	5.2	6.8
Lanthanum[2]	N.D.	300	30	150	N.D.	N.D.	150	N.D.	150
Cerium[2]	N.D.	300	<150	200	N.D.	N.D.	150	N.D.	200
Praesodymium[2]	N.D.	<100	<100	<100	N.D.	N.D.	<100	N.D.	<100
Neodymium[2]	N.D.	150	<70	150	N.D.	N.D.	70	N.D.	150
Samarium[2]	N.D.	<100	<100	<100	N.D.	N.D.	<100	N.D.	<100
Europium[2]	N.D.	<100	<100	<100	N.D.	N.D.	<100	N.D.	<100
Gadolinium[2]	N.D.	<50	<50	<50	N.D.	N.D.	<50	N.D.	<50
Terbium[2]	N.D.	<300	<300	<300	N.D.	N.D.	<300	N.D.	<300
Dysprosium[2]	N.D.	<50	<50	<50	N.D.	N.D.	<50	N.D.	<50
Holmium[2]	N.D.	<20	<20	<20	N.D.	N.D.	<20	N.D.	<20
Erbium[2]	N.D.	<50	<50	<50	N.D.	N.D.	<50	N.D.	<50
Thulium[2]	N.D.	<20	<20	<20	N.D.	N.D.	<20	N.D.	<20
Ytterbium[2]	N.D.	5	2	10	N.D.	N.D.	7	N.D.	7
Lutetium[2]	N.D.	<30	<30	<30	N.D.	N.D.	<30	N.D.	<30
Yttrium[2]	N.D.	50	15	150	N.D.	N.D.	100	N.D.	100
Total rare earths	N.D.	805	47	660	N.D.	N.D.	477	N.D.	607
Barium[2]	N.D.	700	1,000	1,500	N.D.	N.D.	700	N.D.	1,500
Beryllium[2]	N.D.	15	1.5	10	N.D.	N.D.	7	N.D.	7
Bismuth[2]	N.D.	<10	<10	<10	N.D.	N.D.	<10	N.D.	<10
Copper[2]	N.D.	300	100	100	N.D.	N.D.	150	N.D.	70
Leed[2]	N.D.	100	30	30	N.D.	N.D.	30	N.D.	30
Manganese[2]	N.D.	700	300	1,500	N.D.	N.D.	300	N.D.	1,500
Molybdenum[2]	N.D.	30	7	5	N.D.	N.D.	7	N.D.	<3
Niobium[2]	N.D.	70	10	30	N.D.	N.D.	30	N.D.	20
Strontium[2]	N.D.	700	700	1,500	N.D.	N.D.	1,500	N.D.	3,000
Tin[2]	N.D.	<10	<10	<10	N.D.	N.D.	<10	N.D.	<10
Vanadium[2]	N.D.	1,500	150	500	N.D.	N.D.	500	N.D.	500
Zinc[2]	N.D.	<200	<200	<200	N.D.	N.D.	<200	N.D.	<200
Zirconium[2]	N.D.	300	150	300	N.D.	N.D.	300	N.D.	300
	In percent								
Calcium[2]	N.D.	.15	.7	.3	N.D.	N.D.	.15	N.D.	.7
Iron[2]	N.D.	7	2	7	N.D.	N.D.	3	N.D.	7
Magnesium[2]	N.D.	.07	.07	.07	N.D.	N.D.	.15	N.D.	.3
Phosphorus[2]	N.D.	<.2	<.2	<.2	N.D.	N.D.	<.2	N.D.	<.2
Potassium[1]	7.8	11.4	5.4	10.9	9.0	10.4	11.1	5.2	6.8
Sodium[2]	N.D.	1	3	3	N.D.	N.D.	3	N.D.	5
Titanium[2]	N.D.	.7	.15	.3	N.D.	N.D.	.3	N.D.	.7

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	346	347	348	349	350	351	352	353	354
Sample No.	MHS-273-79	MHS-274-79	MHS-275-79	MHS-276-79	MHS-277-79	MHS-278-79	MHS-279-79	MHS-280-79	MHS-281-79
Element	In parts per million								
Thorium[1]	9.3	45	25	67	32	54	46	21	24
Uranium[1]	1.8	5.6	3.8	3.4	5.8	7.4	5.7	6.8	5.5
Lanthanum[2]	N.D.	N.D.	150	100	N.D.	N.D.	150	N.D.	150
Cerium[2]	N.D.	N.D.	200	150	N.D.	N.D.	150	N.D.	300
Praesodymium[2]	N.D.	N.D.	<100	<100	N.D.	N.D.	<100	N.D.	<100
Neodymium[2]	N.D.	N.D.	100	70	N.D.	N.D.	100	N.D.	150
Samarium[2]	N.D.	N.D.	<100	<100	N.D.	N.D.	<100	N.D.	<100
Europium[2]	N.D.	N.D.	<100	<100	N.D.	N.D.	<100	N.D.	<100
Gadolinium[2]	N.D.	N.D.	<50	<50	N.D.	N.D.	<50	N.D.	<50
Terbium[2]	N.D.	N.D.	<300	<300	N.D.	N.D.	<300	N.D.	<300
Dysprosium[2]	N.D.	N.D.	<50	<50	N.D.	N.D.	<50	N.D.	<50
Holmium[2]	N.D.	N.D.	<20	<20	N.D.	N.D.	<20	N.D.	<20
Erbium[2]	N.D.	N.D.	<50	<50	N.D.	N.D.	<50	N.D.	<50
Thulium[2]	N.D.	N.D.	<20	<20	N.D.	N.D.	<20	N.D.	<20
Ytterbium[2]	N.D.	N.D.	7	3	N.D.	N.D.	7	N.D.	5
Lutetium[2]	N.D.	N.D.	<30	<30	N.D.	N.D.	<30	N.D.	<30
Yttrium[2]	N.D.	N.D.	70	30	N.D.	N.D.	50	N.D.	50
Total rare earths	N.D.	N.D.	527	353	N.D.	N.D.	457	N.D.	655
Barium[2]	N.D.	N.D.	1,500	1,500	N.D.	N.D.	700	N.D.	1,000
Beryllium[2]	N.D.	N.D.	1.5	1.5	N.D.	N.D.	7	N.D.	7
Bismuth[2]	N.D.	N.D.	<10	<10	N.D.	N.D.	<10	N.D.	<10
Copper[2]	N.D.	N.D.	70	15	N.D.	N.D.	70	N.D.	70
Lead[2]	N.D.	N.D.	70	30	N.D.	N.D.	30	N.D.	30
Manganese[2]	N.D.	N.D.	700	300	N.D.	N.D.	700	N.D.	1,500
Molybdenum[2]	N.D.	N.D.	7	<3	N.D.	N.D.	<3	N.D.	5
Niobium[2]	N.D.	N.D.	30	<10	N.D.	N.D.	15	N.D.	30
Strontium[2]	N.D.	N.D.	300	300	N.D.	N.D.	1,500	N.D.	2,000
Tin[2]	N.D.	N.D.	<10	<10	N.D.	N.D.	<10	N.D.	<10
Vanadium[2]	N.D.	N.D.	70	70	N.D.	N.D.	200	N.D.	300
Zinc[2]	N.D.	N.D.	<200	<200	N.D.	N.D.	<200	N.D.	<200
Zirconium[2]	N.D.	N.D.	700	150	N.D.	N.D.	150	N.D.	300
	In percent								
Calcium[2]	N.D.	N.D.	.3	.7	N.D.	N.D.	.7	N.D.	3
Iron[2]	N.D.	N.D.	3	3	N.D.	N.D.	7	N.D.	7
Magnesium[2]	N.D.	N.D.	.07	.15	N.D.	N.D.	.15	N.D.	.3
Phosphorus[2]	N.D.	N.D.	<.2	<.2	N.D.	N.D.	<.2	N.D.	<.2
Potassium[1]	1.8	5.6	5.9	5.2	6.0	7.1	7.9	5.6	4.6
Sodium[2]	N.D.	N.D.	3	3	N.D.	N.D.	3	N.D.	7
Titanium[2]	N.D.	N.D.	.3	.15	N.D.	N.D.	.3	N.D.	.5

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	355	356	357	358	359	360	361	362	372
Sample No.	MHS-282-79	MHS-283-79	MHS-284-79	MHS-285-79	MHS-286-79	MHS-287-79	MHS-288-79	MHS-289-79	MHS-299-79
Element	In parts per million								
Thorium[1]	25	87	32	38	44	58	46	60	64
Uranium[1]	5.6	7.9	8.3	7.3	7.6	14	7.2	5.0	4.4
Lanthanum[2]	N.D.	150	150	150	N.D.	150	N.D.	150	150
Cerium[2]	N.D.	200	300	200	N.D.	200	N.D.	200	200
Praesodymium[2]	N.D.	<100	<100	<100	N.D.	<100	N.D.	<100	<100
Neodymium[2]	N.D.	150	150	150	N.D.	70	N.D.	100	150
Samarium[2]	N.D.	<100	<100	<100	N.D.	<100	N.D.	<100	<100
Europium[2]	N.D.	<100	<100	<100	N.D.	<100	N.D.	<100	<100
Gadolinium[2]	N.D.	<50	<50	<50	N.D.	<50	N.D.	<50	<50
Terbium[2]	N.D.	<300	<300	<300	N.D.	<300	N.D.	<300	<300
Dysprosium[2]	N.D.	<50	<50	<50	N.D.	<50	N.D.	<50	<50
Holmium[2]	N.D.	<20	<20	<20	N.D.	<20	N.D.	<20	<20
Erbium[2]	N.D.	<50	<50	<50	N.D.	<50	N.D.	<50	<50
Thulium[2]	N.D.	<20	<20	<20	N.D.	<20	N.D.	<20	<20
Ytterbium[2]	N.D.	7	5	7	N.D.	7	N.D.	3	3
Lutetium[2]	N.D.	<30	<30	<30	N.D.	<30	N.D.	<30	<30
Yttrium[2]	N.D.	70	70	70	N.D.	100	N.D.	70	70
Total rare earths	N.D.	577	675	577	N.D.	527	N.D.	523	573
Barium[2]	N.D.	1,500	1,500	1,500	N.D.	2,000	N.D.	3,000	1,500
Beryllium[2]	N.D.	10	7	5	N.D.	7	N.D.	7	7
Bismuth[2]	N.D.	<10	<10	<10	N.D.	<10	N.D.	<10	<10
Copper[2]	N.D.	70	300	300	N.D.	70	N.D.	150	50
Lead[2]	N.D.	50	30	50	N.D.	30	N.D.	70	150
Manganese[2]	N.D.	700	700	700	N.D.	700	N.D.	1,500	2,000
Molybdenum[2]	N.D.	30	30	70	N.D.	30	N.D.	15	10
Niobium[2]	N.D.	70	30	20	N.D.	15	N.D.	15	15
Strontium[2]	N.D.	3,000	7,000	3,000	N.D.	1,500	N.D.	1,500	2,000
Tin[2]	N.D.	<10	<10	<10	N.D.	<10	N.D.	<10	<10
Vanadium[2]	N.D.	500	700	700	N.D.	700	N.D.	700	700
Zinc[2]	N.D.	<200	<200	<200	N.D.	300	N.D.	<200	300
Zirconium[2]	N.D.	300	300	200	N.D.	150	N.D.	300	150
	In percent								
Calcium[2]	N.D.	1.5	3	.7	N.D.	7	N.D.	.7	.3
Iron[2]	N.D.	3	3	7	N.D.	3	N.D.	7	3
Magnesium[2]	N.D.	.7	.7	.15	N.D.	.15	N.D.	.3	.3
Phosphorus[2]	N.D.	<.2	<.2	<.2	N.D.	<.2	N.D.	<.2	<.2
Potassium[1]	3.8	7.2	8.0	9.5	8.3	8.0	8.4	6.5	6.5
Sodium[2]	N.D.	7	7	3	N.D.	1.5	N.D.	3	3
Titanium[2]	N.D.	.3	.3	.7	N.D.	.3	N.D.	.3	.3

Table 1.--Chemical analysee of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols : N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	373	374	375	376	377	378	379	380	382
Sample No.	MHS-300-79	MHS-301-79	MHS-302-79	MHS-303-79	MHS-304-79	MHS-305-79	MHS-306-79	MHS-307-79	MHS-308-79
Element	In parts per million								
Thorium[1]	70	67	55	228	20	33	27	28	35
Uranium[1]	9.2	11	5.5	12	5.7	7.6	6.5	5.9	6.4
Lanthanum[2]	N.D.	100	N.D.	150	150	N.D.	150	N.D.	150
Cerium[2]	N.D.	150	N.D.	150	200	N.D.	200	N.D.	200
Praesodymium[2]	N.D.	<100	N.D.	<100	<100	N.D.	<100	N.D.	<100
Neodymium[2]	N.D.	<70	N.D.	150	150	N.D.	150	N.D.	150
Samarium[2]	N.D.	<100	N.D.	<100	<100	N.D.	<100	N.D.	<100
Europium[2]	N.D.	<100	N.D.	<100	<100	N.D.	<100	N.D.	<100
Gadolinium[2]	N.D.	<50	N.D.	<50	<50	N.D.	<50	N.D.	<50
Terbium[2]	N.D.	<300	N.D.	<300	<300	N.D.	<300	N.D.	<300
Dysprosium[2]	N.D.	<50	N.D.	<50	<50	N.D.	<50	N.D.	<50
Holmium[2]	N.D.	<20	N.D.	<20	<20	N.D.	<20	N.D.	<20
Erbium[2]	N.D.	<50	N.D.	<50	<50	N.D.	<50	N.D.	<50
Thulium[2]	N.D.	<20	N.D.	<20	<20	N.D.	<20	N.D.	<20
Ytterbium[2]	N.D.	3	N.D.	3	3	N.D.	7	N.D.	3
Lutetium[2]	N.D.	<30	N.D.	<30	<30	N.D.	<30	N.D.	<30
Yttrium[2]	N.D.	30	N.D.	30	50	N.D.	70	N.D.	30
Total rare earths	N.D.	283	N.D.	483	553	N.D.	577	N.D.	533
Barium[2]	N.D.	1,000	N.D.	1,500	1,500	N.D.	1,500	N.D.	1,000
Beryllium[2]	N.D.	7	N.D.	7	2	N.D.	5	N.D.	5
Bismuth[2]	N.D.	<10	N.D.	<10	<10	N.D.	<10	N.D.	<10
Copper[2]	N.D.	70	N.D.	30	150	N.D.	100	N.D.	70
Lead[2]	N.D.	150	N.D.	70	30	N.D.	30	N.D.	30
Manganese[2]	N.D.	150	N.D.	1,000	1,500	N.D.	1,500	N.D.	300
Molybdenum[2]	N.D.	30	N.D.	7	15	N.D.	7	N.D.	<3
Niobium[2]	N.D.	30	N.D.	30	15	N.D.	15	N.D.	15
Strontium[2]	N.D.	1,500	N.D.	1,500	3,000	N.D.	1,000	N.D.	2,000
Tin[2]	N.D.	<10	N.D.	<10	<10	N.D.	<10	N.D.	<10
Vanadium[2]	N.D.	500	N.D.	300	700	N.D.	700	N.D.	500
Zinc[2]	N.D.	<200	N.D.	300	<200	N.D.	<200	N.D.	<200
Zirconium[2]	N.D.	300	N.D.	300	300	N.D.	300	N.D.	150
	In percent								
Calcium[2]	N.D.	.07	N.D.	.3	.7	N.D.	.3	N.D.	.7
Iron[2]	N.D.	3	N.D.	3	7	N.D.	5	N.D.	5
Magnesium[2]	N.D.	.15	N.D.	.7	.3	N.D.	.15	N.D.	.15
Phosphorus[2]	N.D.	<.2	N.D.	<.2	<.2	N.D.	<.2	N.D.	<.2
Potassium[1]	8.8	7.4	7.4	10.8	5.1	5.6	4.9	7.3	5.0
Sodium[2]	N.D.	1.5	N.D.	3	7	N.D.	7	N.D.	5
Titanium[2]	N.D.	.3	N.D.	.7	.3	N.D.	.7	N.D.	.3

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	383	384	385	386	387	388	389	390	391
Sample No.	MHS-309-79	MHS-310-79	MHS-311-79	MHS-312-79	MHS-313-79	MHS-314-79	MHS-315-79	MHS-316-79	MHS-317-79
Element	In parts per million								
Thorium[1]	43	35	25	42	31	48	45	39	33
Uranium[1]	5.5	5.7	5.3	5.7	5.4	5.0	5.5	4.6	5.7
Lanthanum[2]	150	150	N.D.	150	N.D.	150	N.D.	150	N.D.
Cerium[2]	200	150	N.D.	200	N.D.	200	N.D.	200	N.D.
Praesodymium[2]	<100	<100	N.D.	<100	N.D.	<100	N.D.	<100	N.D.
Neodymium[2]	150	150	N.D.	150	N.D.	150	N.D.	150	N.D.
Samarium[2]	<100	<100	N.D.	<100	N.D.	<100	N.D.	<100	N.D.
Europium[2]	<100	<100	N.D.	<100	N.D.	<100	N.D.	<100	N.D.
Gadolinium[2]	<50	<50	N.D.	<50	N.D.	<50	N.D.	<50	N.D.
Terbium[2]	<300	<300	N.D.	<300	N.D.	<300	N.D.	<300	N.D.
Dysprosium[2]	<50	<50	N.D.	<50	N.D.	<50	N.D.	<50	N.D.
Holmium[2]	<20	<20	N.D.	<20	N.D.	<20	N.D.	<20	N.D.
Erbium[2]	<50	<50	N.D.	<50	N.D.	<50	N.D.	<50	N.D.
Thulium[2]	<20	<20	N.D.	<20	N.D.	<20	N.D.	<20	N.D.
Ytterbium[2]	3	3	N.D.	3	N.D.	5	N.D.	15	N.D.
Lutetium[2]	<30	<30	N.D.	<30	N.D.	<30	N.D.	<30	N.D.
Yttrium[2]	70	50	N.D.	30	N.D.	70	N.D.	150	N.D.
Total rare earths	573	503	N.D.	533	N.D.	575	N.D.	665	N.D.
Barium[2]	1,500	1,500	N.D.	1,000	N.D.	1,500	N.D.	1,500	N.D.
Beryllium[2]	5	5	N.D.	3	N.D.	5	N.D.	5	N.D.
Bismuth[2]	<10	<10	N.D.	<10	N.D.	<10	N.D.	<10	N.D.
Copper[2]	70	150	N.D.	150	N.D.	150	N.D.	70	N.D.
Lead[2]	15	15	N.D.	70	N.D.	30	N.D.	30	N.D.
Manganese[2]	1,500	1,500	N.D.	1,500	N.D.	1,500	N.D.	1,500	N.D.
Molybdenum[2]	5	<3	N.D.	5	N.D.	5	N.D.	3	N.D.
Niobium[2]	20	30	N.D.	20	N.D.	30	N.D.	30	N.D.
Strontium[2]	1,500	3,000	N.D.	1,500	N.D.	2,000	N.D.	1,500	N.D.
Tin[2]	<10	<10	N.D.	<10	N.D.	<10	N.D.	<10	N.D.
Vanadium[2]	300	700	N.D.	300	N.D.	700	N.D.	700	N.D.
Zinc[2]	<200	<200	N.D.	<200	N.D.	<200	N.D.	<200	N.D.
Zirconium[2]	300	300	N.D.	150	N.D.	300	N.D.	300	N.D.
	In percent								
Calcium[2]	.7	.7	N.D.	1	N.D.	.7	N.D.	.3	N.D.
Iron[2]	7	7	N.D.	7	N.D.	7	N.D.	3	N.D.
Magnesium[2]	.3	.7	N.D.	.15	N.D.	.7	N.D.	.07	N.D.
Phosphorus[2]	<.2	<.2	N.D.	<.2	N.D.	<.2	N.D.	<.2	N.D.
Potassium[1]	6.9	7.6	5.6	5.7	5.4	6.2	6.8	7.3	6.1
Sodium[2]	7	5	N.D.	7	N.D.	3	N.D.	7	N.D.
Titanium[2]	.5	.7	N.D.	.3	N.D.	.7	N.D.	.3	N.D.

Table 1.--Chemical analyses of samples from the principal Tertiary intrusive mass in the southern Bear Lodge Mountains. - Continued

[Symbols: N.D. - not determined; < - less than value indicated; > - greater than value indicated]

Locality No.	392								
Sample No.	MHS-318-79	MHS-	MHS-	MHS-	MHS-	MHS-	MHS-	MHS-	MHS-
Element	In parts per million								
Thorium[1]	42								
Uranium[1]	5.5								
Lanthanum[2]	150								
Cerium[2]	200								
Praesodymium[2]	<100								
Neodymium[2]	150								
Samarium[2]	<100								
Europium[2]	<100								
Gadolinium[2]	<50								
Terbium[2]	<300								
Dysprosium[2]	<50								
Holmium[2]	<20								
Erbium[2]	<50								
Thulium[2]	<20								
Ytterbium[2]	7								
Lutetium[2]	<30								
Yttrium[2]	70								
Total rare earths	577								
Barium[2]	1,500								
Beryllium[2]	7								
Bismuth[2]	<10								
Copper[2]	70								
Lead[2]	30								
Manganese[2]	1,500								
Molybdenum[2]	2								
Niobium[2]	30								
Strontium[2]	1,500								
Tin[2]	<10								
Vanadium[2]	700								
Zinc[2]	<200								
Zirconium[2]	500								
	In percent								
Calcium[2]	.1								
Iron[2]	5								
Magnesium[2]	.3								
Phosphorus[2]	<.2								
Potassium[1]	7.9								
Sodium[2]	3								
Titanium[2]	.2								