Exploration for Uranium Deposits in the Spring Creek Mesa Area, Montrose County, Colorado

By C. H. Roach

Trace Elements Investigations Report 343

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geology and Mineralogy

This document consists of 55 pages,
plus 2 figures.
Series A

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

EXPLORATION FOR URANIUM DEPOSITS IN THE SPRING CREEK MESA AREA, MONTROSE COUNTY, COLORADO*

By

C. H. Roach

December 1954

Trace Elements Investigations Report 343

This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

GEOLOGY AND MINERALOGY

Distribution (Series A)	No. of copies
Argonne National Laboratory	1
Atomic Energy Commission, Washington	1
Division of Raw Materials, Albuquerque	1
Division of Raw Materials, Butte	1
Division of Raw Materials, Casper	1
Division of Raw Materials, Denver	1
Division of Raw Materials, Hot Springs	1
Division of Raw Materials, Ishpeming	1
Division of Raw Materials, Phoenix	1
Division of Raw Materials, Richfield	1
Division of Raw Materials, Salt Lake City	1
Division of Raw Materials, Washington	3
Exploration Division, Grand Junction Operations Office	6
Grand Junction Operations Office	1
Technical Information Service, Oak Ridge	6
Tennessee Valley Authority, Wilson Dam	1
U. S. Geological Survey:	
Fuels Branch, Washington	1
Geochemistry and Petrology Branch, Washington	1
Geophysics Branch, Washington	1
Mineral Deposits Branch, Washington	2
E. H. Bailey, Menlo Park	1
A. L. Brokaw, Grand Junction	2
N. M. Denson, Denver	1
C. E. Dutton, Madison	1
W. L. Emerick, Plant City	1
M. R. Klepper, Spokane	1
A. H. Koschmann, Denver	1
R. A. Laurence, Knoxville	1
J. D. Love, Laramie	1
L. R. Page, Washington	1
P. C. Patton, Denver	1
J. F. Powers, Salt Lake City	1
C. B. Read, Albuquerque	1
Q. D. Singewald, Beltsville	1
A. E. Weissenborn, Spokane	1
TEPCO, Denver	2
TEPCO, RPS, Washington, (Including master)	2
	53

CONTENTS

	Page
Abstract and summary	4
Introduction	5
Geology	7
Stratigraphy	7
Morrison formation	7
Burro Canyon formation	9
Dakota sandstone	10
Structural geology	10
Ore deposits	11
Guides to ore	13
Literature cited	15
Unpublished reports	15

ILLUSTRATIONS

Figure 1. Index map of part of the Colorado Plateau showing the location of the Spring Creek Mesa area, Montrose County, Colorado	6
2. Geologic map and sections of the Spring Creek Mesa area, Montrose County, Colorado	In envelope
3. Geologic map and sections of the western part of Spring Creek Mesa, Montrose County, Colorado	In envelope

EXPLORATION FOR URANIUM DEPOSITS IN THE SPRING CREEK MESA AREA, MONTROSE COUNTY, COLORADO

By C. H. Roach

ABSTRACT AND SUMMARY

The U. S. Geological Survey explored the Spring Creek Mesa area from July 11, 1951, to August 14, 1953. During that period, 280 diamond-drill holes were completed for a total of 180,287 feet.

Sedimentary rocks of Mesozoic age are exposed in and adjacent to the Spring Creek Mesa area. These rocks consist of, from oldest to youngest: the Upper Jurassic Morrison formation, the Lower Cretaceous Burro Canyon formation, and the Upper Cretaceous Dakota formation.

The Morrison formation consists of two members in the Spring Creek Mesa area: the lower is the Salt Wash member and the upper is the Brushy Basin member. All of the large uranium-bearing deposits discovered by Geological Survey drilling in the Spring Creek Mesa area are in a series of coalescing sandstone lenses in the uppermost part of the Salt Wash member of the Morrison formation. Most of the ore deposits are believed to be irregular tabular or lens-shaped masses and probably lie parallel to the bedding, although in detail, they may crosscut the bedding. Also, ore deposits that take the form of narrow elongate concretionary-like structures, locally called "rolls", may be present in the Spring Creek Mesa area. The mineralized material consists mostly of sandstone which has been selectively impregnated and in part replaced by uranium and vanadium minerals. Also, rich concentrations of uranium and vanadium are commonly associated with thin mudstone seams, beds of mudstone pebbles, and carbonaceous material of various types. Two suites of ore minerals are present in the ore deposits--an oxidized suite of secondary uranium and vanadium minerals and a relatively unoxidized suite of "primary" uranium and vanadium minerals.

The following geologic criteria are useful as guides to ore in the Spring Creek Mesa area:

1. Large ore deposits generally occur where the "ore-bearing sandstone" is more than 40 feet thick.

2. The color of the mudstone associated with the "ore-bearing sandstone" in the vicinity of large ore deposits is commonly gray instead of the usual red.

3. The "ore-bearing sandstone" is normally a light red, but in the vicinity of oxidized ore deposits it is light brown and in the vicinity of relatively unoxidized ore deposits it is gray.

4. The "ore-bearing sandstone" in the vicinity of relatively unoxidized ore deposits commonly contains sparse to abundant disseminated pyrite. In the vicinity of oxidized deposits it commonly contains abundant limonite spots and widespread limonite staining.

INTRODUCTION

The U. S. Geological Survey explored the Spring Creek Mesa area (fig. 1) from July 11, 1951, to August 14, 1953. During the period, 280 diamond-drill holes were completed for a total of 180,287 feet. The purposes of the exploration were to find uranium-bearing deposits which would make new mines and to estimate the potential reserves of uranium and vanadium in the area. The exploration drilling tested ore-bearing zones that were too deep or too far removed from known mines or deposits to encourage private exploration.

The Spring Creek Mesa area is about 2 miles northeast of Uravan, Montrose County, Colo., and includes the topographic features known as Atkinson Breaks, Hog Point, Blue Springs Point, and Spring Creek Mesa (fig. 2). The area is bounded by the San Miguel bench along the western and southern sides, the Atkinson Creek drainage system to the north, and the Spring Creek drainage system and Uncompahgre Plateau to the east. The explored part of the area includes parts of secs. 1, 2, 10-14, 22-28, 35, and 36, T. 48 N., R. 17 W., New Mexico principal meridian.

The altitude of the area ranges from about 5,600 feet in the central part of the area to about 6,400 feet in the northeastern part of the area. The surface relief ranges from slight to moderate; but, locally, deep washes and abrupt cliffs make access difficult. The vegetation of the Spring Creek Mesa area is the Upper Sonoran type and is predominantly pinon and juniper on rock outcrops, and sagebrush, cacti, and numerous grasses on alluvial flats. The climate of the area is semiarid.

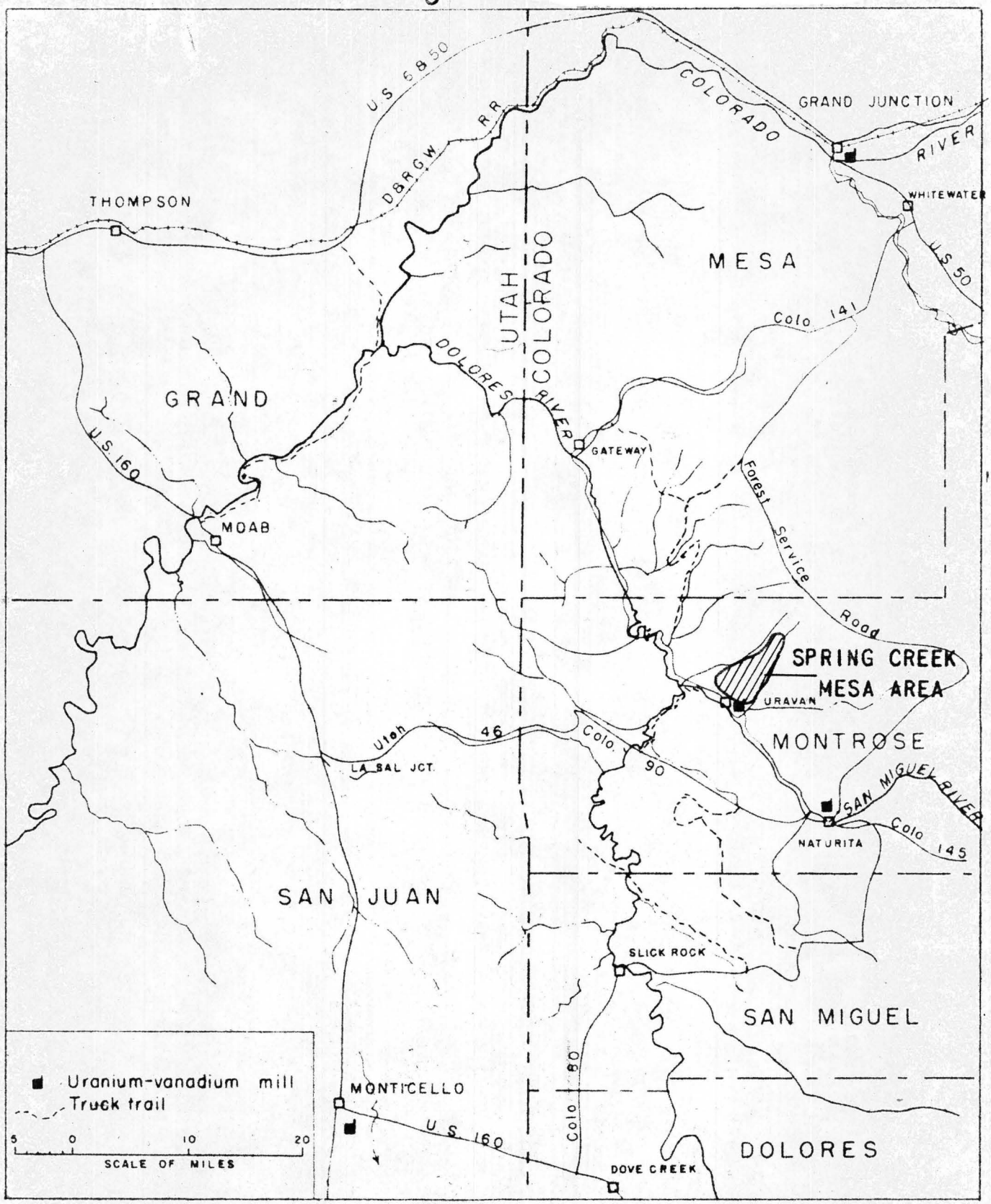

Figure 1. INDEX MAP OF PART OF THE COLORADO PLATEAU SHOWING THE LOCATION OF THE SPRING CREEK MESA AREA, MONTROSE COUNTY, COLORADO

The Spring Creek Mesa area is accessable by two unimproved roads which connect with Colorado Highway 141 at points half a mile north and 2 miles northwest of Uravan, Colo. In addition, numerous truck roads connect drill sites with the main roads in the area.

This report summarizes the results of the exploration by the Geological Survey and contains a brief description of the geology and ore deposits of the Spring Creek Mesa area. The exploration was done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

GEOLOGY

Stratigraphy

Sedimentary rocks of Mesozoic age are exposed in and adjacent to the Spring Creek Mesa area. These rocks are, from oldest to youngest: the Upper Jurassic Morrison formation, the Lower Cretaceous Burro Canyon formation, and the Upper Cretaceous Dakota formation. Older Mesozoic sedimentary rocks and pre-Cambrian rocks consisting of gneiss, schist, granite, and pegmatite are exposed along the southwestern flank of the Uncompahgre Plateau uplift which is about 4 miles northwest of the explored part of the Spring Creek Mesa area. The character of these older igneous, metamorphic, and sedimentary rocks has been discussed previously (McKay, 1953).

Morrison formation

The Morrison formation is late Jurassic in age and consists of two members in the Spring Creek Mesa area; the lower is the Salt Wash member and the upper is the Brushy Basin member. In this area, the Morrison formation ranges in thickness from 700 to 800 feet, and the thickness of the Brushy Basin member is slightly more than half of the total thickness of the formation.

The Salt Wash member is about 300 feet thick, and its topographic expression consists of a series of thick resistant sandstone ledges and benches. It consists predominantly of sandstones which vary in color from white to gray, light brown, and light red. The sandstones occur as strata that are traceable as

ledges for as much as several thousand feet along the outcrop. However, within each stratum individual sandstone beds are highly lenticular and discontinuous. Each sandstone lens is commonly surrounded by mudstone and contains mudstone seams. In places, however, sandstone lenses intersect without intervening mudstone seams.

Most of the known uranium-vanadium deposits in the Spring Creek Mesa area are in the uppermost series of sandstone lenses of the Salt Wash member of the Morrison formation. This series of sandstone lenses is called the "ore-bearing sandstone" and ranges in total thickness from a few feet to slightly more than 100 feet. Normally, the "ore-bearing sandstone" is light brown, light gray, or light red. However, in the vicinity of large ore deposits it is either light brown or light gray. In the vicinity of oxidized ore deposits the "ore-bearing sandstone" is light brown and commonly is spotted with limonite. In the vicinity of relatively unoxidized ore deposits the "ore-bearing sandstone" is light gray and commonly contains disseminated pyrite.

Normally, the mudstone which overlies, underlies, or is within the "ore-bearing sandstone" is predominantly red. However, the mudstone associated with the "ore-bearing sandstone" in the vicinity of large masses of mineralized rock is usually gray. The cause of the change in color of the mudstone from red to gray is not completely understood. Weeks (1951) studied the red and gray clays that underlie the "ore-bearing sandstone" of the Morrison formation in western Colorado and states that "the only significant difference that has been found between the red and gray clays, other than color, is the difference in total iron and state of oxidation of the iron." Many geologists believe that the red mudstone has been "altered" to gray mudstone. This change in color may represent an alteration phase of the mineralization process, or it may represent a post-mineralization reaction between the clays and ground-water that has reacted with the emplaced mineralized material. Regardless of the origin of the gray clays, there does seem to be some correlation between the amount of "altered" mudstone associated with the "ore-bearing sandstone" and the known ore deposits in the area. The gray mudstone usually extends for some distance beyond the limits of ore deposits and therefore, represents a good target for diamond-drill exploration.

The "ore-bearing sandstone" in the Spring Creek Mesa area commonly contains carbonaceous material of various types. A relationship between uranium-vanadium ore deposits and carbonaceous material has long been recognized, and it is common to find carbonaceous material that has been richly mineralized. This relationship was substantiated by the exploration on Spring Creek Mesa.

The Brushy Basin member contrasts greatly with the underlying Salt Wash member and consists predominantly of varicolored bentonitic shale and mudstone with interbedded lenses of conglomerate and sandstone and a few thin discontinuous layers of limestone. The contact with the underlying Salt Wash is gradational and no consistent marker bed exists that can be mapped as a contact between the two members. Because of the great amount of easily eroded bentonitic shale and mudstone, the Brushy Basin shale member usually forms smooth slopes covered with boulders and blocks weathered from the more resistant layers of the member and from the overlying formations. The shales and mudstones are thin-bedded and range in color from white to pastel tints of red, purple, blue, and green. Erratically scattered throughout the Brushy Basin member are thin beds of fine-grained very hard silicified rock that breaks with a conchoidal fracture. This type or rock probably originated as a fine-grained sandstone which later was recemented with silica derived probably from devitrification of the volcanic debris contained in adjacent mudstone beds. Silicification seems to be more intense where the Brushy Basin member is traversed by faults or shear zones.

Throughout the area, the Brushy Basin member ranges from 400 to 500 feet in thickness, but local variations in thickness of as much as 30 feet are common.

Burro Canyon formation

The Burro Canyon formation is Lower Cretaceous in age and has an indistinct contact with the underlying Morrison formation. In many places, the Burro Canyon formation appears to interfinger with the upper part of the Brushy Basin member. The formation consists essentially of white, gray, and red sandstone and conglomerate that form beds up to 100 feet thick, and bright green mudstone and shale that locally is more common than the sandstone and conglomerate. Thin, discontinuous beds of dense gray

limestone are present in a few scattered localities. The Burro Canyon formation is usually exposed as a cliff or a series of thick resistant ledges that cap most of the high mesas adjacent to the Uncompahgre Plateau. In the Spring Creek Mesa area the Burro Canyon formation is 100 to 120 feet thick.

Dakota sandstone

The Dakota sandstone is Upper Cretaceous in age and caps Spring Creek and Atkinson Mesas. It consists predominantly of thin-bedded gray, yellow, and brown sandstones with subordinate amounts of conglomerate, carbonaceous shale with numerous plant impressions, and impure coal. The contact of the Dakota sandstone with the underlying Burro Canyon formation is an erosional surface of regional extent. The entire thickness of the Dakota sandstone is not present in the Spring Creek Mesa area. The upper portion of the formation has been removed by erosion and a maximum thickness of about 80 feet remains.

Structural geology

The Spring Creek Mesa area straddles the axis of the San Miguel syncline. This syncline lies between the Uncompahgre Plateau uplift to the northeast and the Paradox Valley anticline to the southwest. Dips of the rock formations on the flanks of the syncline are commonly less than 5° and within a mile of the synclinal axis the dips do not exceed 2°. However, on the flank of the Uncompahgre Plateau uplift dips as much as 25° have been observed. The syncline plunges gently to the northwest.

A conjugate set of joints related to the Uncompahgre Plateau uplift is prominent in the Spring Creek Mesa area. The most prominent system of joints is parallel to the trend of the uplift and strikes about N. 45° W. A second system of joints is normal to the trend of the uplift and strikes about N. 45° E.

Along the southwestern flank of the Uncompahgre Plateau uplift the sedimentary rocks have been faulted and monoclinally folded by the upward movement of the pre-Cambrian basement complex. Locally, the sedimentary rocks are intensively folded and cut by reverse faults. The only known fault in the Spring Creek Mesa area has been observed on the northwestern side of the mesa. Information obtained from drill holes suggests that the fault probably extends through the mesa and into the area to the southeast.

Because of the great distance between drill holes in the southern part of the mesa, extension of the fault can only be inferred. The fault has a maximum vertical throw of about 50 feet. The significance of this fault is not known at the present time, although some interesting relations appear to exist between the fault, the San Miguel synclinal axis, and the mineralized ground in the Spring Creek Mesa area. All ore deposits, all areas of favorable ground and nearly all areas of mineralized ground found in the Spring Creek Mesa area are southwest of the fault and the synclinal axis (fig. 2). The fault extends northwest of Spring Creek Mesa and traverses San Miguel bench, Dolores bench, and extends under Atkinson Mesa for an undetermined distance. The Geological Survey has conducted diamond-drill exploration in all three of these areas (Alvord in preparation, Brew 1954, and Jobin 1953). The ore deposits and the areas of mineralized ground found in these areas are southwest of the fault.

A "belt" of favorable ground trends northward through the western part of Spring Creek Mesa. This belt, known as "Uravan mineral belt", is an elongate area in which the uranium-vanadium deposits generally have closer spacing, larger size, and higher grade than those in the adjoining areas and in the region as a whole. The geology of this "mineral belt" has been described by Fischer and Hilpert (1952). All the ore deposits discovered in the Spring Creek Mesa area are within its boundaries. A general description of the geology and habits of the uranium and vanadium deposits in southwestern Colorado is given by Fischer (1942).

ORE DEPOSITS

The ore deposits in the Spring Creek Mesa area consists mostly of sandstone which has been selectively impregnated and in part replaced by uranium and vanadium minerals. Also, rich concentrations of uranium and vanadium are commonly associated with thin mudstone seams, beds of mudstone pebbles, and carbonaceous material of various types. The ore bodies are irregular, tabular or lens-shaped masses and generally lie parallel to the bedding, although they may be cross-cutting in detail. Ore deposits in the form of narrow elongate concretionary structures, locally called "rolls" may be present. Fossil logs and trees that have been richly mineralized have been discovered in various deposits in adjacent areas and may be present

in the Spring Creek Mesa area. The margins of the ore bodies may be either vaguely or sharply defined. Usually the margins of the irregular tabular type of deposit are vaguely defined and commonly the mineralized material extends well beyond the limits of commercial ore and therefore presents a good drilling target. However, in the "roll" type of deposit, the margins are commonly sharply defined and mark the limits of both mineralized material and commercial ore. "Rolls" are poor drilling targets and a knowledge of their common orientation, if one exists in the area, is needed to guide drill-hole exploration for this type of deposit.

Two suites of ore minerals are present in the ore deposits in the Spring Creek Mesa area: the "blue-black" type and the "carnotite" type. The blue-black suite is characteristic of the relatively unoxidized ore deposits. The principal uranium minerals in this suite are pitchblende (a massive variety of uraninite, with specific gravity lower than 8.5 and thorium absent or less than 1 percent) and a new uranium mineral tentatively called "coffinite," the chemical composition of which is unknown at present, but whose x-ray powder pattern is very similar to that of thorite ($ThSiO_4$) (Weeks and Thompson, 1953). The vanadium minerals that characterize the blue-black suite are montroseite--VO(OH) or (V,Fe)O(OH)--, and a new vanadium oxide. The uranium and vanadium minerals of the blue-black suite commonly are associated with pyrite, high rank coalified wood, and traces of copper, lead, cobalt, nickel, molybdenum, and silver. Melanovanadite, corvusite, and probably fernandinite are present and may represent a transition to the oxidized type of ore deposit. These uranium and vanadium minerals are characteristic of the blue-black type of deposits. No complete mineral identification work has been done on the Spring Creek Mesa ores, and the relative abundance of the various minerals is unknown.

The carnotite type of ore is characteristic of highly oxidized ore deposits and occurs in the Spring Creek Mesa area along the rims in shallow areas, and other areas that have undergone oxidation. The main uranium minerals of this suite is carnotite--$K_2(UO_2)_2(VO_4)_2 \cdot 1\text{-}3H_2O$ and tyuyamunite--$Ca(UO_2)_2(VO_4)_2 \cdot nH_2O$ where n=9-12. The most abundant vanadium minerals (excepting the uranyl vanadates) are vanadium hydromica and/or roscoelite--$(Al, V)_2(AlSi_3)(K, Na)O_{10}(OH, F)_2$--and corvusite--$V_2O_4 \cdot 6V_2O_5 \cdot nH_2O(?)$. Certain general relations between the two types of mineral suites are evident as

a result of the exploration in the Spring Creek Mesa area. In general, the blue-black ore deposits are smaller in size and richer in grade than the carnotite ore deposits. On Spring Creek Mesa there is a gradual transition from blue-black ore deposits in the eastern portion of the area to the carnotite ore deposits to the west.

The ore deposits in the Spring Creek Mesa area range in size from small irregular masses containing only a few tons of ore to large tabular masses containing many thousands of tons of ore. No consistent regional orientation or trends of the ore deposits in the Spring Creek Mesa area can be recognized from the results of Geological Survey exploration. The average ratio of uranium to vanadium in the carnotite ore deposits in the Colorado Plateau district is about 1 to 6. However, assays of drill-hole samples in the ore deposits discovered in the Spring Creek Mesa area indicate the ratio may approach 1 to 4.

GUIDES TO ORE

Numerous geologic features are known to be associated with bodies of mineralized rock and are useful in evaluating the data obtained from diamond-drill exploration. The importance of these features as guides to ore has been studied by Weir (1952). The geologic features used to guide the exploration for ore deposits in the Spring Creek Mesa area are similar to those suggested by Weir.

The following geologic criteria are useful as guides to ore in the Spring Creek Mesa area:

1. The ore deposits generally occur where the "ore-bearing sandstone" is greater than 40 feet thick. A few deposits seem to be restricted to narrow sinuous belts of sandstone which have a thickness much greater than the normal thickness of the ore-bearing sandstone. Subsurface studies indicate that these thick sinuous belts probably represent the location of major stream channels, where a stratigraphically higher sandstone unit has channeled into the top of the ore-bearing sandstone. Some of these sandstone channels are more than 100 feet thick. However, the size of the ore deposits does not have a direct relationship to the thickness of the sandstone unit.

2. The mudstone associated with the ore-bearing sandstone in the vicinity of large ore deposits is predominantly gray instead of the common red color. This "alteration" usually extends for a few hundred feet beyond the limits of the mineralized rock and provides a more extensive target for diamond-drill exploration than do the deposits themselves.

3. The ore-bearing sandstone is generally light red and has red mudstone associated with it. However, the ore-bearing sandstone in the vicinity of oxidized ore deposits is light brown and little or no red mudstone is associated with it. In the vicinity of relatively unoxidized ore deposits, the ore-bearing sandstone is gray and most of the mudstone associated with it is gray.

4. The ore-bearing sandstone in the vicinity of relatively unoxidized ore deposits commonly contains sparse to abundant disseminated pyrite. In the vicinity of oxidized ore deposits, the ore-bearing sandstone commonly contains abundant limonite spots and widespread limonite staining, both of which probably originated from the oxidation of originally contained pyrite.

In addition to these guides, several other features were evaluated in an effort to develop new guides to exploration. These were: gamma-ray anomalies at the contact of the ore-bearing sandstone and the underlying mudstone, maximum gamma-ray anomalies in drill holes, structural contours at the top and bottom of the ore-bearing sandstone, variations in thickness of the ore-bearing sandstone, and trends of major stream channels. Structure contour and isopachous maps helped to delineate the trends of the major stream channels which may have influenced the location of some deposits. The isorad line showing 150 counts per minute at the contact between the ore-bearing sandstone and the underlying mudstone correlated roughly with the outer limits of favorable ground as determined by use of the features discussed previously.

LITERATURE CITED

Fischer, R. P., 1942, Vanadium deposits of Colorado and Utah, a preliminary report: U. S. Geol. Survey Bull. 936-P, p. 363-394.

Fischer, R. P., and Hilpert, L. S., 1952, Geology of the Uravan mineral belt: U. S. Geol. Survey Bull. 988-A, p. 1-13.

Weir, D. B., 1952, Geologic guides to prospecting for carnotite deposits on the Colorado Plateau: U. S. Geol. Survey Bull. 988-B, p. 15-27.

UNPUBLISHED REPORTS

Alvord, D. C., in preparation, Carnotite resources of San Miguel bench, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Inv. Rept. 289.

Brew, D. A., 1954, Exploration for uranium deposits in the Atkinson Mesa area, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Inv. Rept. 290.

Jobin, D. A., 1953, Carnotite resources of the Dolores bench, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Inv. Rept. 214.

McKay, E. J., 1953, Geology of the Atkinson Creek quadrangle, Colorado: U. S. Geol. Survey Trace Elements Memo. Rept. 691.

Weeks, A. D., 1951, Red and gray clay underlying ore-bearing sandstone of the Morrison formation in Western Colorado: U. S. Geol. Survey Trace Elements Memo. Rept. 251.

Weeks, A. D., and Thompson, M. E., 1953, Identification and occurrence of uranium and vanadium minerals from the Colorado Plateaus: U. S. Geol. Survey Trace Elements Inv. Rept. 334.

CONTENTS

	Page
Abstract and summary	17
Introduction	18
Geological Survey exploration	18
Reserves	19
Indicated and inferred reserves	21
Definitions	21
Thickness cutoffs	21
Grade cutoffs	22
Calculation of tonnage	22
Calculation of grade	54
Reserve blocks	54
Potential reserves	55
Plans and recommendations	55
Unpublished reports	55

TABLES

Table 1.	Summary of indicated and inferred reserves 1 foot or more thick	17
2.	Indicated and inferred reserves 1 foot or more thick in the Spring Creek Mesa area, Montrose County, Colorado	20
3.	Assay data, Spring Creek Mesa area, Montrose County, Colorado	23

EXPLORATION FOR URANIUM DEPOSITS IN THE SPRING CREEK MESA AREA, MONTROSE COUNTY, COLORADO

PART II

ABSTRACT AND SUMMARY

From July 11, 1951, through August 14, 1953, the U. S. Geological Survey conducted diamond-drill exploration in the Spring Creek Mesa area. During that period, 280 drill holes were completed for a total of 180,287 feet.

Indicated and inferred reserves of Class I material discovered by this drilling totalled 49,700 short tons averaging 0.26 percent U_3O_8 and 1.16 percent V_2O_5 (table 1). Potential reserves totalling 15,000 short tons averaging about 0.25 percent U_3O_8 and 1.15 percent V_2O_5 are estimated for the Spring Creek Mesa area.

No additional exploration is planned for the Spring Creek Mesa area by the Geological Survey. Because of the depth of the ore-bearing horizon, underground drilling and drifting by lessees is probably the most economical way of developing additonal reserves in ground adjacent to the known reserve blocks.

Table 1.--Summary of indicated and inferred reserves 1 foot or more thick

Reserves	Grade cutoff	Short tons	Percent		Pounds _/	
			U_3O_8	V_2O_5	U_3O_8	V_2O_5
Indicated	0.10% U_3O_8 or 1.0% V_2O_5	20,900	0.27	1.18	113,000	493,000
	0.05% U_3O_8 or 0.50% V_2O_5	44,250	0.19	0.95	168,000	841,000
Inferred	0.10% U_3O_8 or 1.0% V_2O_5	28,800	0.25	1.15	144,000	662,500
	0.05% U_3O_8 or 0.50% V_2O_5	44,750	0.18	0.85	161,000	761,000

_/ Figures rounded to nearest 500 pounds

INTRODUCTION

The exploration drilling conducted by the Geological Survey in The Spring Creek Mesa area tested ore-bearing zones that were too deep or too far removed from known mines or deposits to encourage private exploration. No previous production of uranium ore has come from the Spring Creek Mesa area, and all the explored ground is in public land except for six private claims (fig. 2). Preliminary results of the earlier stages of Geological Survey exploration in the area have been reported previously (Eicher, 1953; and Roach, 1953).

The deposits discovered by Geological Survey drilling are in public land in the western part of Spring Creek Mesa (fig. 2). Some of the deposits near the rim either connect with or overlap deposits that were discovered by Geological Survey exploration on the adjacent San Miguel bench (Alvord, in preparation). The deposits on Spring Creek Mesa range in size from a few tons to about 20,000 tons. The average grade of the mineralized material in the four deposits that are economically significant ranges between 0.12 percent and 0.51 percent U_3O_8 and between 0.72 percent and 1.35 percent V_2O_5.

GEOLOGICAL SURVEY EXPLORATION

Geological Survey exploration in the Spring Creek Mesa area started on July 11, 1951, and continued through August 14, 1953. During that period, 280 diamond-drill holes were completed on two separate contracts for a total of 180,287 feet. The average depth of the holes was about 645 feet.

Of the 280 holes drilled, 129 penetrated mineralized rock (material containing 0.020 percent or more U_3O_8 or 0.10 percent or more V_2O_5), and 26 of the 129 holes penetrated mineralized rock that is in the highest reserve class used in this report (material 1 foot or more thick containing 0.10 percent or more U_3O_8 or 1.0 percent or more V_2O_5). All but three of the total number of holes drilled are in public land, and these three are barren holes in the Spring Creek Nos. 2, 3, and 5 claims (fig. 2).

The exploration drilling in the Spring Creek Mesa area consisted of three phases. The first phase of drilling consisted of drilling holes on 1,500-to 2,000-foot centers along parallel lines that were approximately

perpendicular to the strike of the rocks. The purpose of this stage of drilling was to delineate roughly the ground considered to be favorable for the occurrence of ore deposits. This phase of drilling was accomplished with the completion of 88 drill holes, and indicated that the western part of Spring Creek Mesa was the area most favorable for the occurrence of ore deposits.

The second phase of drilling consisted of drilling moderate-spaced (200-750 feet) holes in the favorable area indicated by the first phase of drilling. The purpose of the second phase of drilling was to discover ore deposits. This phase of drilling was completed with 60 drill holes.

The third phase of drilling consisted of 100- to 200-foot offset drilling for the purpose of delineating approximately the extent of the deposits that were discovered by the first and second phases of drilling. This phase of drilling was completed with 132 drill holes.

RESERVES

The terms "indicated" and "inferred" reserves are applied to the uranium- and vanadium-bearing material in the deposits that are known from drill holes. These reserves are subdivided by thickness and grade cutoffs, and the method used in calculating them is explained below. Figures, expressing the calculated tonnage and grade of the indicated and inferred reserves for each reserve block and for each grade cutoff, are given in table 2. The ground containing the reserve blocks and several geologic sections showing the position of the mineralized rock in the ground are shown on figures 2 and 3.

In addition to the known deposits, other deposits are probably present which have not yet been found. These deposits are predicted solely on interpretation of geologic evidence, for there is no physical proof of their existence. The term "potential" reserves is applied to the material in these deposits. Potential reserves are described on page 55.

Although reserves are not classified in this report according to their availability for mining, consideration was given to the 1953 mining and milling practices in selecting the higher grade and thickness cutoffs. This was done to obtain figures for a category of reserves that would express as nearly as possible the tonnage and grade of the material that might actually be mined from these deposits under 1953 conditions. A summary of indicated and inferred reserves in this category, and in a lower-grade category, is given in table 1 (page 17).

Table 2. Indicated and inferred reserves 1 foot or more thick in the Spring Creek Mesa area, Montrose County, Colorado (based on Geological Survey drilling, 1951-53)

Block No.	Location (claims)	INDICATED						INFERRED					
		Grade cutoff 0.10% U_3O_8 or 1.0% V_2O_5			Grade cutoff 0.05% U_3O_8 or 0.50% V_2O_5			Grade cutoff 0.10% U_3O_8 or 1.0% V_2O_5			Grade cutoff 0.05% U_3O_8 or 0.50% V_2O_5		
		Short tons	Percent U_3O_8	Percent V_2O_5	Short tons	Percent U_3O_8	Percent V_2O_5	Short tons	Percent U_3O_8	Percent V_2O_5	Short tons	Percent U_3O_8	Percent V_2O_5
A	Public Land	3,500	0.12	1.15	5,450	0.10	0.85	4,000	0.12	1.15	4,850	0.10	0.85
B	Public Land	2,300	0.22	0.72	3,600	0.18	0.59	1,800	0.22	0.72	2,700	0.18	0.59
C	Public Land	6,600	0.51	1.15	9,800	0.36	0.81	6,300	0.51	1.15	9,250	0.36	0.81
D	Public Land	8,500	0.15	1.35	13,450	0.09	1.17	11,000	0.15	1.35	15,800	0.09	1.17
E	Public Land	--	--	--	1,250	0.09	0.41	--	--	--	2,650	0.09	0.41
F	Public Land	--	--	--	9,300	0.13	0.74	3,400	0.24	1.45	4,500	0.13	0.74
G	Public Land	--	--	--	--	--	--	--	--	--	700	0.06	--
H	Public Land	--	--	--	1,400	0.80	3.11	1,000	0.23	0.12	600	0.80	3.11
I	Public Land	--	--	--	--	--	--	800	0.47	--	2,500	0.19	--
J	Public Land	--	--	--	--	--	--	1,200	0.32	--	1,200	0.32	--
Totals		20,900	0.27	1.18	44,250	0.19	0.95	29,500	0.25	1.15	44,750	0.18	0.85

Indicated and inferred reserves

Definitions

Known reserves are classed as indicated and inferred. Owing to the erratic variations in thickness and grade of uranium- and vanadium-bearing ore within short distances, and the general lack of abundant sample data for individual reserve blocks, the amount of reserves that can be calculated within a small limit of error, and thus can be classed as "measured", is so small as to be nearly negligible. Therefore, reserves that might be classed as measured are included with indicated reserves.

Indicated reserves _/ are those for which the grade is computed from drill-hole samples, and for which the tonnage is computed by projections for a reasonable distance on geologic evidence from drill holes. Inferred reserves are those for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposits and for which there are few, if any, samples or measurements.

Because of the variations in thickness and grade of ore and the scarcity of sample data, the indicated reserves in any single reserve block might actually amount to as much as twice the calculated tonnage or as little as one-half the calculated tonnage. The limit of error of the total tonnage for several blocks, however, is apt to be considerably lower, perhaps not more than 25 percent of the calculated tonnage. For this reason indicated reserves are not computed for single holes in reserve-grade material that have not been offset or cannot be connected with known deposits or mine workings. The limit of error in the tonnage figures for inferred reserves, of course, is apt to be higher than for indicated reserves. The possible limit of error in the calculated or estimated grade for both indicated and inferred reserves probably is somewhat smaller than the possible limit of error in the tonnage figures.

Thickness cutoffs

Although mining practices vary throughout the region as well as with individual operators, under 1953 mining conditions most ore bodies of average grade are being mined to where they pinch to a layer about

_/ The definitions used here for indicated and inferred reserves are abstracted from the definitions adopted by the Bureau of Mines and the Geological Survey in April 1943.

1 foot thick. Layers of material less than 1 foot thick are mined in places if the grade is high. The tonnage of minable material less than 1 foot thick is small with respect to the total reserves and for that reason reserves less than 1 foot thick are not calculated.

Grade cutoffs

The deposits contain two metals of economic importance, uranium and vanadium. The oxides of these metals, U_3O_8 and V_2O_5, occur in an average ratio of about 1:4 as estimated from the assays of the Geological Survey drill core from the Spring Creek Mesa area (table 3). Within the deposits, however, the two metals are so erratically distributed that a single sample obtained from a drill hole, is not necessarily representative of the metal ratio or grade of the material near the point sampled. Knowing this by experience, the miner will drive toward a drill hole that shows a good value in vanadium, even though the uranium content of the sample might be negligible. Thus the material in the vicinity of this sample must be classed as a reserve, even though the sample shows a value for only one metal. Furthermore, with the 1951 price schedules (Atomic Energy Commission, 1951) for ore, the vanadium content of ore with the expected metal ratio (1:4) constitutes about one-fifth of the market value of the ore. Thus both metals must be considered in reserve appraisals and in selecting grade cutoffs.

Reserves 1 foot or more thick are classified by two grade cutoffs. The higher cutoff--0.10 percent U_3O_8 or 1.00 percent V_2O_5--corresponds to the Atomic Energy Commission purchase cutoff for uranium and the commonly used mill cutoff for vanadium. Reserves are figured also on a lower cutoff--0.05 percent U_3O_8 or 0.50 percent V_2O_5--on the possibility that conditions in the future might demand or permit the mills to accept lower-grade ore.

Calculation of tonnage

The method used for calculating the volume, and hence the tonnage, of a reserve unit 1 foot or more thick is based upon the premise that the reserve unit is a uniformly tapered mass. The average thickness of the drill-hole samples that can be combined within the specified grade class is assumed to be the average thickness of the reserve unit. (Text is continued on page 54.)

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado

Geological Survey exploration, 1951-53. Assays by the Geological Survey. Samples in sandstone.

Rock units containing less than 0.020% U_3O_8, less than 0.020% equivalent U_3O_8, and less than 0.10% V_2O_5, as determined by assay of drill core, are considered to be barren. Barren holes and rock units are omitted from this table.

Assay data listed under blocks A, B, C, D, E, F, G, H, I, and J are within the block of calculated reserves discussed in this report.

Assay data under "other holes" are within areas from which no reserves were calculated because the samples recovered are too thin or too weakly mineralized to qualify for the selected grade and thickness cutoffs.

Gamma-ray data obtained by probing drill holes with radiometric logging unit. Radioactivity expressed as percent equivalent U_3O_8. Values less than 0.020% eU_3O_8 are omitted from this table. These data are of doubtful reliability.

Most collar elevations and hole locations obtained by plane-table survey methods; others by less accurate methods shown with asterisk (*).

Undet Undetermined

e Equivalent

< Less than

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block A										
116 (5882)	534.7	535.1	0.4	<0.020e	0.45	Undet	0.024	530.6	531.6	1.0
	535.1	535.4	0.3	0.15	1.50	1.8				
	535.4	535.6	0.2	0.033	1.11	1.9	1.0	533.0	533.9	0.9
	535.6	535.9	0.3	0.23	0.61	3.9	0.026	533.9	535.5	1.6
	535.9	536.0	0.1	0.86	2.95	0.7	0.63	535.5	536.7	1.2
	536.0	536.1	0.1	<0.020	0.44	0.3	0.043	536.7	537.3	0.6
							0.37	537.3	538.1	0.8
	536.7	538.9	2.2	0.030	0.22	3.9	0.082	538.1	539.4	1.3
	538.9	540.0	1.1	0.15	1.05	1.7				
	540.0	540.6	0.6	0.14	0.48	3.9	0.30	540.6	541.4	0.8
	540.6	541.2	0.6	0.077	0.49	1.8	0.11	541.4	542.5	1.1
	541.2	541.5	0.3	0.13	0.66	0.4	0.080	542.5	544.1	1.6
	541.5	543.0	1.5	0.042	0.37	2.4	0.071	544.1	545.0	0.9
	543.0	544.3	1.3	0.037	0.20	3.0				
	544.3	544.7	0.4	0.10	0.76	1.8				
	544.7	546.2	1.5	0.066	0.29	2.0				
	546.2	547.3	1.1	0.048	0.13	4.1				
	547.6	548.3	0.7	0.035	0.13	0.5				
	553.9	554.2	0.3	0.029	< 0.1	2.8				
134 (5863)	521.1	521.8	0.7	0.029e	0.24	Undet	0.024	522.6	524.2	1.6
156-A (5876)	534.6	535.5	0.9	0.046	0.28	4.4	0.32	630.5	631.5	1.0
	535.5	536.1	0.6	0.23	1.89	3.6				
	536.1	536.6	0.5	0.11	2.13	2.8				
158 (5886)	552.7	553.6	0.9	0.023e	0.13	Undet	Barren			
	556.5	557.4	0.9	0.028e	0.18	Undet				

Table 3. Assay data, Spring Creek Mesa area, Montrose County Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block A--Continued										
159 (5855)	510.7	511.6	0.9	0.045	0.21	2.2	0.050	512.1	513.4	1.3
	512.2	513.7	1.5	0.044	0.21	4.1	0.12	514.2	515.5	1.3
	513.7	515.2	1.5	0.031	0.20	5.0	0.038	515.5	516.7	1.2
							0.072	516.7	517.5	0.9
	515.5	515.8	0.3	0.035	0.22	0.5				
							0.075	518.6	520.6	2.0
	516.7	518.2	1.5	0.056	0.25	2.4				
	518.2	519.4	1.2	0.040	0.15	2.1	0.11	522.6	523.5	0.9
	519.7	520.9	1.2	0.031	< 0.1	4.0				
	520.9	521.9	1.0	0.045	0.34	3.5				
160 (5864)	515.3	516.5	1.2	0.053	1.11	0.6	0.030	513.7	514.3	0.6
	516.5	517.3	0.8	0.16	2.51	0.4	0.42	514.3	515.2	0.9
	517.3	517.4	0.1	0.023	1.01	0.2				
	517.4	518.0	0.6	0.026e	0.42	Undet	0.28	516.6	517.6	1.0
							0.084	517.6	519.2	1.6
	519.0	519.3	0.3	0.29	3.24	0.2	0.057	519.2	519.9	0.7
	519.3	519.5	0.2	0.032	1.96	0.2	0.167	519.9	521.2	1.3
	519.5	520.9	1.4	0.13	0.84	0.3				
	520.9	521.5	0.6	0.073	0.64	0.5	0.11	531.3	532.4	0.9
	521.5	521.8	0.3	0.12	0.84	1.0				
	521.8	522.6	0.8	0.086	0.70	1.3	0.30	536.8	537.7	0.9
	522.6	522.9	0.3	0.16	0.31	1.7				
	522.9	523.1	0.2	0.094	0.22	1.8				
	523.1	524.1	1.0	0.043	0.48	3.8				
	524.4	524.7	0.3	0.027e	< 0.1	Undet				
	531.0	531.3	0.3	0.025e	< 0.1	Undet				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block A--Continued										
160--Continued	531.6	531.9	0.3	0.025e	< 0.1	Undet				
	532.2	533.1	0.9	0.020e	< 0.1	Undet				
	533.4	534.6	1.2	0.044	0.15	6.6				
	534.6	535.2	0.6	0.038	0.11	2.9				
199 (5794)	445.7	446.0	0.3	0.030e	0.29	Undet	0.14	445.5	446.9	1.4
	446.0	446.3	0.3	0.15	0.83	4.7				
	446.3	447.5	1.2	0.042	0.16	2.4	0.023	461.0	462.3	1.3
							0.048	464.1	465.0	0.9
							0.022	480.0	480.9	0.9
	465.3	466.2	0.9	0.042	0.32	2.3				
214 (5839)	493.3	493.9	0.6	0.033e	0.12	Undet	0.026	494.4	495.3	0.9
	507.4	508.9	1.5	0.031e	0.21	Undet	0.037	508.1	510.4	2.3
	508.9	509.2	0.3	0.032e	0.19	Undet				
	509.2	509.3	0.1	< 0.020e	0.14	Undet				
226 (5779)	460.9	461.5	0.6	0.058	< 0.1	11.5	0.024	435.8	437.3	1.5
227 (5800)	444.6	445.2	0.6	0.14	0.99	0.2	0.27	444.8	445.7	0.9
	445.2	445.4	0.2	0.029	0.68	< 0.1	0.036	445.7	447.1	1.4
	445.4	446.9	1.5	0.045	< 0.1	0.4				
							0.022	459.6	460.7	1.1
	462.3	462.6	0.3	0.030e	0.19	Undet				
							0.092	463.2	464.0	0.8

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block A--Continued										
227--Continued	463.2	463.5	0.3	0.036	0.19	0.2				
	463.5	464.1	0.6	0.038	0.19	4.3				
Block B										
194 (5903)	607.1	607.7	0.6	0.022e	0.15	Undet	0.028	596.8	597.7	0.9
	607.7	608.0	0.3	< 0.020e	0.28	Undet				
	608.0	608.3	0.3	0.027e	0.27	Undet	0.086	605.2	606.1	0.9
	608.3	608.4	0.1	0.028e	0.32	Undet				
	608.4	608.7	0.3	0.14	0.64	0.2	0.046	616.8	618.0	1.2
	608.7	608.9	0.2	< 0.020e	0.15	Undet				
							0.033	623.4	624.4	1.0
	623.7	624.0	0.3	< 0.020e	0.12	Undet				
	624.0	624.3	0.3	0.052	0.12	0.2				
	624.3	624.5	0.2	0.027e	< 0.1	Undet				
	628.8	629.1	0.3	0.084	0.42	0.5				
216 (5906)	604.0	604.3	0.3	< 0.020e	0.12	Undet	0.034	606.7	609.7	3.0
	605.2	605.5	0.3	0.021e	0.12	Undet	0.029	624.3	626.2	1.9
	607.3	608.8	1.5	0.033e	0.19	Undet				
	609.4	609.7	0.3	0.027e	0.12	Undet				
217 (5902)	606.7	607.0	0.3	0.024e	0.12	Undet	0.021	583.6	584.4	0.8
							0.031	603.9	605.0	1.1

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	V_2O_5	$CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block B--Continued										
224 (5904)	623.2	623.4	0.2	0.10	0.12	0.3	0.023	595.6	596.3	0.7
							0.027	602.5	603.4	0.9
							0.024	606.0	607.2	1.2
							0.033	622.9	623.9	1.0
230 (5911)	604.7	605.3	0.6	0.058	0.19	0.6	0.024	580.4	581.7	1.3
	605.3	605.9	0.6	0.069	0.19	0.8				
	605.9	606.5	0.6	0.12	0.84	0.2	0.18	602.0	602.8	0.8
	606.5	607.1	0.6	0.11	0.34	< 0.1	0.24	602.8	603.9	1.1
	607.1	608.6	1.5	0.16	0.74	0.1	0.16	603.9	604.8	0.9
	608.6	610.0	1.4	0.067	0.25	0.3	0.27	604.8	605.8	1.0
	610.0	611.2	1.2	0.048	0.25	0.7	0.12	605.8	606.2	0.4
	611.2	611.9	0.7	0.22	0.18	0.4	0.30	606.2	607.1	0.9
							0.12	607.1	607.6	0.5
							0.26	607.6	608.9	1.3
							0.032	626.2	627.1	0.9
245 (5914)	610.6	610.9	0.3	0.037	0.15	0.3	0.022	617.1	618.0	0.9
247 (5910)	585.7	586.0	0.3	0.046	0.27	< 0.1	0.028	583.1	584.3	1.2
	599.2	600.8	1.6	0.033e	0.15	Undet	0.025	598.0	601.7	3.7
	600.8	602.1	1.3	0.026e	0.15	Undet	0.15	601.7	603.4	1.7
	602.1	602.7	0.6	0.027e	0.14	Undet	1.6	603.4	604.3	0.9

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block B--Continued										
247--Continued	602.8	603.4	0.6	0.10	0.24	1.5				
	603.4	604.4	1.0	0.15	1.04	0.1				
	604.4	605.0	0.6	0.11	0.67	< 0.1				
	605.0	605.6	0.6	1.14	1.92	< 0.1				
	605.6	606.6	1.0	0.16	0.46	0.1				
	608.5	608.8	0.3	0.022e	< 0.1	Undet				
249 (5914)	604.1	604.7	0.6	0.030e	0.15	Undet	0.020	600.5	603.1	2.6
							0.065	603.1	604.1	1.0
	604.8	605.1	0.3	< 0.020e	0.30	Undet	0.029	604.1	604.9	0.8
	605.1	606.9	1.8	0.037	0.28	0.7	0.30	604.9	606.1	1.2
	606.9	608.4	1.5	0.18	0.49	1.5	0.033	606.1	607.7	1.6
	608.4	608.6	0.2	0.067	0.28	2.8				
	608.6	608.9	0.3	0.034e	0.30	Undet				
	609.2	609.5	0.3	0.028e	< 0.1	Undet				
	609.5	610.1	0.6	< 0.020e	0.25	Undet				
256 (5910)	605.7	606.0	0.3	0.033e	0.24	Undet	0.021	604.0	605.6	1.6
260 (5918)*	No sample						0.022	606.2	607.7	1.5
263 (5914)	604.7	605.0	0.3	0.043	0.37	< 0.1	0.026	603.9	605.3	1.4
	616.4	616.7	0.3	0.031	0.21	0.5				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block B--Continued										
264 (5918)	582.8	584.0	1.2	0.031	0.15	10.5	0.050	577.9	579.2	1.3
	584.0	584.1	0.1	0.63	1.59	7.1	0.30	579.2	580.1	0.9
	584.1	584.4	0.3	0.097	0.34	0.3				
							0.028	615.7	616.6	0.9
	605.6	605.7	0.1	0.026e	2.29	< 0.1				
							0.037	629.6	631.5	1.9
	617.0	617.3	0.3	0.048	0.30	0.8				
	624.1	624.4	0.3	< 0.020e	0.15	Undet				
	631.3	631.6	0.3	0.034e	< 0.1	Undet				
Block C										
259 (5866)	554.1	554.4	0.3	0.020e	< 0.1	Undet	0.027	496.4	497.9	1.9
	558.4	559.8	1.4	0.030e	0.12	Undet	0.020	536.4	540.7	4.3
	559.8	561.0	1.2	0.045	< 0.1	0.2				
	561.0	561.6	0.6	0.030e	< 0.1	Undet	0.021	550.8	556.8	6.0
	561.6	563.1	1.5	0.12	0.27	0.2	0.052	556.8	558.2	1.4
	563.1	564.5	1.4	0.19	0.46	0.1	0.049	558.2	559.1	0.9
	564.5	564.6	0.1	0.13	0.30	< 0.1	0.21	559.1	560.4	1.3
	564.6	565.5	0.9	0.25	0.82	0.2	0.14	560.4	562.1	1.7
	565.5	565.7	0.2	0.16	0.40	< 0.1	0.40	562.1	563.2	1.1
	565.7	566.0	0.3	0.22	0.85	0.1	0.14	563.2	564.5	1.3
	566.0	567.7	1.7	0.039	0.15	0.5	0.060	564.5	567.0	2.5
							0.039	567.0	569.0	2.0
	568.1	569.2	1.1	0.027e	0.27	Undet				
							0.030	572.4	573.6	1.2
	569.5	569.8	0.3	0.023e	< 0.1	Undet				
	574.2	574.5	0.3	< 0.020e	0.11	Undet				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block C--Continued										
271 (5861)	560.2	561.1	0.9	0.10	0.29	4.0	0.024	548.3	551.5	3.2
	561.4	561.7	0.3	0.021e	0.20	Undet	0.022	552.3	553.1	0.8
272 (5881)	575.0	575.9	0.9	0.065	0.29	0.9	2.45	574.3	575.0	0.7
	575.9	576.1	0.2	7.9	7.42	0.6	0.21	575.0	576.3	1.3
	576.1	577.4	1.3	0.12	0.40	0.3				
							0.025	580.1	581.5	1.4
274 (5868)	552.3	552.9	0.6	0.028e	< 0.1	Undet	0.22	567.5	569.8	2.3
							0.054	569.8	571.2	1.4
	554.6	555.5	0.9	0.21	1.02	0.3	0.37	571.2	572.9	1.7
	555.5	556.4	0.9	0.15	0.99	0.3	0.38	572.9	573.5	0.6
	556.4	557.8	1.4	0.079	0.26	0.9	0.40	573.5	575.1	1.6
	557.8	558.4	0.6	0.47	1.89	0.3	0.12	575.1	576.7	1.6
	558.4	559.1	0.7	2.64	4.25	0.2				
	559.1	559.5	0.4	0.77	2.39	0.5				
	559.5	560.4	0.9	0.25	0.90	0.1				
	560.4	561.3	0.9	0.15	0.82	< 0.1				
	561.3	561.7	0.4	0.69	1.80	< 0.1				
	561.7	562.6	0.9	0.07e	0.20	0.8				
	562.6	563.7	1.1	0.09e	0.20	0.7				
	563.7	564.1	0.4	0.033	0.13	1.0				
	564.7	565.3	0.6	< 0.020e	0.13	Undet				
	565.3	565.6	0.3	0.11	0.17	0.4				
Block D										
258 (5900)	521.2	521.5	0.3	0.033e	< 0.1	Undet	0.030	521.4	522.5	1.1

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block D--Continued										
258--Continued	540.6	541.2	0.6	0.021e	< 0.1	Undet	0.027	531.3	533.8	2.5
	542.1	542.7	0.6	0.24	1.16	0.1	0.11	541.5	543.3	1.8
	542.7	543.0	0.3	0.072	0.24	< 0.1	2.8	543.3	544.1	0.8
	543.0	543.6	0.6	0.088	0.43	< 0.1	0.092	544.1	545.3	1.2
	543.6	544.0	0.4	0.94	1.77	< 0.1	0.21	545.3	546.9	1.6
	544.0	544.1	0.1	0.10	0.40	< 0.1	0.072	546.9	547.5	0.6
	544.1	545.3	1.2	0.10	1.10	< 0.1	0.070	547.5	548.9	1.4
	545.3	546.2	0.9	0.15	2.01	< 0.1				
	546.2	546.5	0.3	0.070	1.59	< 0.1	0.033	549.6	551.2	1.6
	546.5	546.8	0.3	0.11	2.47	< 0.1				
	546.8	547.3	0.5	0.040	1.65	< 0.1	0.13	555.8	556.6	0.8
	547.3	548.4	1.1	0.055	1.53	0.4				
	548.4	549.3	0.9	0.034e	0.88	< 0.1	0.23	559.5	560.2	0.7
	549.3	549.6	0.3	< 0.020e	0.73	< 0.1	0.020	560.2	562.5	2.3
	549.6	550.8	1.2	0.031e	1.07	< 0.1				
	550.8	551.0	0.2	< 0.020e	1.50	0.4				
	554.9	555.2	0.3	0.090	1.89	< 0.1				
	555.2	555.5	0.3	0.029e	0.21	Undet				
	558.8	559.1	0.3	0.032	0.21	0.2				
	559.1	559.4	0.3	0.13	1.86	0.5				
	559.4	559.7	0.3	0.028e	0.24	Undet				
	559.7	560.0	0.3	< 0.020e	0.18	Undet				
	560.0	560.9	0.9	0.027e	0.30	Undet				
	561.2	561.5	0.3	0.021e	0.24	Undet				
265 (5904)	549.8	550.4	0.6	0.021e	< 0.1	Undet	Barren			

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block D--Continued										
268 (5873)	509.4	510.0	0.6	0.11	0.74	0.2	Not logged			
	510.0	510.6	0.6	0.26	0.71	0.6				
	510.6	510.8	0.2	0.13	1.66	< 0.1				
	510.8	511.5	0.7	0.25	0.48	0.6				
	511.5	512.1	0.6	0.55	1.33	< 0.1				
	512.1	512.7	0.6	0.17	0.65	1.0				
	512.7	513.3	0.6	0.43	0.60	0.1				
	513.3	514.5	1.2	0.15	0.92	0.1				
	514.5	515.7	1.2	0.034	0.98	< 0.1				
	515.7	516.0	0.3	0.025e	0.62	< 0.1				
	516.0	516.3	0.3	0.023e	1.66	< 0.1				
	516.3	517.7	1.4	0.027e	2.29	< 0.1				
	517.7	519.0	1.3	< 0.020e	0.89	0.5				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block D--Continued										
270	535.8	537.1	1.3	0.051	0.18	0.9	Not logged			
(5898)	537.1	537.7	0.6	0.038	0.32	0.4				
	537.7	538.0	0.3	< 0.020e	0.44	Undet				
	538.0	539.4	1.4	0.030e	0.44	Undet				
	539.4	540.0	0.6	0.063	1.53	< 0.1				
	540.0	540.9	0.9	0.23	1.94	0.2				
	540.9	541.1	0.2	0.13	1.32	< 0.1				
	541.1	542.7	1.6	0.040	0.68	1.1				
	542.7	543.0	0.3	0.027e	1.09	0.1				
	543.0	544.0	1.0	0.033e	0.79	0.4				
	544.0	544.6	0.6	0.044	1.32	< 0.1				
	544.6	545.8	1.2	< 0.020e	1.56	0.3				
	545.8	546.1	0.3	< 0.020e	1.09	0.9				
	546.1	546.5	0.4	< 0.020e	1.24	0.8				
	546.5	547.4	0.9	0.042	2.15	< 0.1				
	547.4	547.7	0.3	0.16	1.71	< 0.1				
	547.7	547.9	0.2	0.031	0.76	< 0.1				
	547.9	548.2	0.3	0.15	1.35	0.2				
	548.2	548.6	0.4	0.11	1.38	0.1				
	548.6	548.9	0.3	0.033	1.30	< 0.1				
	548.9	550.1	1.2	< 0.020e	0.76	0.2				
275	477.2	477.8	0.6	0.048	0.27	< 0.1	Not logged			
(5845)	477.8	479.6	1.8	< 0.020e	1.17	< 0.1				
	479.6	480.8	1.2	0.045	1.99	< 0.1				
	480.8	481.4	0.6	< 0.020e	0.92	< 0.1				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block E										
154 (5902)	587.6	587.9	0.3	0.043	< 0.1	4.8	0.022	585.0	585.9	0.9
	592.5	592.8	0.3	0.033e	0.36	Undet	0.10	589.4	590.1	0.7
	592.8	593.4	0.6	0.032e	< 0.1	Undet				
185 (5895)	585.9	586.5	0.6	0.058	0.27	3.8	0.044	584.2	585.4	1.2
187 (5907)*	599.5	599.6	0.1	0.13	0.42	0.3	0.026	592.0	593.0	1.0
	603.8	604.1	0.3	0.14	0.83	0.2	0.021	597.5	598.5	1.0
	604.1	604.2	0.1	0.043	1.11	0.1				
							0.13	602.0	602.7	0.7
189 (5907)	600.0	601.5	1.5	0.028e	0.14	Undet	0.18	600.8	601.7	0.9
	601.5	603.0	1.5	0.057	0.25	0.5				
	603.0	604.3	1.3	0.090	0.42	0.2	0.30	602.1	603.1	1.0
	604.3	604.7	0.4	0.34	1.62	0.2	0.024	603.1	604.5	1.4
	604.7	605.9	1.2	0.062	0.18	2.6				
237 (5916)	No sample						0.024	510.3	511.1	0.8
Block F										
153 (5910)*	625.0	625.3	0.3	< 0.020e	0.14	Undet	0.036	593.2	595.0	1.8
	625.3	625.6	0.3	0.029e	0.14	Undet				
	625.6	625.8	0.2	0.023e	0.20	Undet	0.020	617.1	618.3	1.2
	632.7	633.1	0.4	0.038	0.22	0.2	0.065	620.7	621.4	0.7
	633.4	634.0	0.6	0.034	0.11	0.9	0.045	629.3	630.8	1.5

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
153--Continued	635.2	635.5	0.3	0.028e	< 0.1	Undet	0.031	632.6	635.5	2.9
							0.18	635.5	636.6	1.1
	635.8	637.0	1.2	0.034e	< 0.1	Undet				
	637.2	638.4	1.2	0.034	0.12	0.8				
	638.4	639.6	1.2	0.078	0.23	0.4				
	639.6	639.9	0.3	0.036	0.15	0.2				
	639.9	640.2	0.3	0.028e	< 0.1	Undet				
174 (5907)	No sample						0.032	606.8	607.7	0.9
							0.043	608.1	609.0	0.9
							0.030	624.6	625.2	0.6
175 (5891)	587.1	587.7	0.6	0.023e	0.37	Undet	0.035	591.4	592.5	1.1
	592.6	592.9	0.3	0.034e	< 0.1	Undet	0.19	598.9	600.2	1.3
	594.1	594.4	0.3	0.034e	0.22	Undet	0.048	601.5	602.3	0.8
	594.6	595.2	0.6	0.070	0.27	0.3	0.035	603.3	604.2	0.9
	595.2	595.8	0.6	0.14	0.66	0.2				
	595.8	596.6	0.8	0.057	0.13	0.2	0.028	604.8	606.0	1.2
	596.6	597.2	0.6	0.031	< 0.1	0.9				
							0.091	609.3	610.5	1.2
	597.5	598.1	0.6	0.022e	< 0.1	Undet	0.032	610.5	611.6	1.1
							0.039	616.1	617.2	1.1
							0.030	617.2	617.8	0.6
	601.5	602.1	0.6	0.031e	< 0.1	Undet	0.11	617.8	619.0	1.2

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
175--Continued							0.36	636.4	637.6	1.2
	605.7	606.9	1.2	0.041	0.17	0.8				
	611.4	611.8	0.4	0.029e	0.31	Undet				
	612.6	614.6	2.0	0.032	0.81	0.4				
	631.5	631.8	0.3	0.021e	< 0.1	Undet				
	632.1	632.7	0.6	0.023	0.15	0.9				
	632.7	633.0	0.3	0.17	0.31	0.3				
	633.0	633.9	0.9	0.073	0.28	0.8				
176 (5907)	608.0	609.5	1.5	0.084	0.57	5.1	Not logged			
177 (5901)	601.4	601.7	0.3	0.037	0.18	0.2	0.028	599.1	600.0	0.9
	608.5	609.1	0.6	0.034	0.61	0.3	0.038	605.7	607.0	1.3
	610.5	610.9	0.4	0.054	0.24	0.4	0.032	607.5	608.7	1.2
	624.8	625.1	0.3	0.026e	< 0.1	Undet				
	629.5	629.8	0.3	0.021e	< 0.1	Undet				
190 (5893)	592.7	593.3	0.6	0.029e	< 0.1	Undet	0.036	590.2	591.4	1.2
	601.7	602.0	0.3	0.024	< 0.1	Undet	0.022	598.0	599.9	1.9

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	V_2O_5	$CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
190--Continued	605.4	605.6	0.2	0.064	0.19	0.3	0.035	603.2	604.7	1.5
	605.6	605.9	0.3	0.028e	< 0.1	Undet				
							0.039	650.0	651.1	1.1
	606.5	607.4	0.9	0.027e	0.1	Undet				
	608.0	608.4	0.4	0.032e	0.15	Undet				
	610.9	611.5	0.6	0.023e	< 0.1	Undet				
	612.1	612.4	0.3	0.031e	< 0.1	Undet				
	652.0	652.6	0.6	0.063	< 0.1	0.3				
193 (5881)	590.2	591.0	0.8	0.034e	0.24	Undet	0.037	587.1	589.5	2.4
	591.3	591.9	0.6	0.029e	0.20	Undet	0.037	590.4	594.7	4.3
							0.025	594.7	595.8	1.1
	593.4	594.3	0.9	0.027e	0.12	Undet				
	594.9	595.5	0.6	0.055	0.15	2.4	0.052	598.9	599.8	0.9
	595.8	597.6	1.8	0.032e	0.17	Undet	0.029	629.5	630.7	1.2
	597.9	598.5	0.6	0.024e	0.12	Undet				
	602.3	602.6	0.3	0.029e	0.42	Undet				
	633.5	633.8	0.3	0.039	< 0.1	1.5				
196 (5886)	601.3	601.9	0.6	0.024e	< 0.1	Undet	0.072	596.8	597.7	0.9

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
196--Continued	602.2	603.1	0.9	0.069	0.34	2.9	0.26	614.7	615.6	0.9
	612.9	613.7	0.8	< 0.020e	0.12	Undet	0.021	635.3	636.1	0.8
	615.3	616.2	0.9	0.078	0.17	0.4				
	616.2	616.5	0.3	0.12	0.34	0.2				
	616.5	616.8	0.3	0.16	0.88	0.1				
	616.8	617.7	0.9	0.10	0.44	0.1				
	617.7	618.3	0.6	0.026e	< 0.1	Undet				
202 (5900)	No sample						0.040	613.3	614.9	1.6
							0.024	621.5	622.3	0.8
206 (5904)	607.[illegible]	608.9	1.2	0.055	0.83	1.6	0.16	609.7	610.6	0.9
	616.4	616.7	0.3	0.020e	0.32	Undet				
	617.0	617.3	0.3	0.031e	0.56	0.2				
	617.6	617.8	0.2	< 0.020e	0.12	Undet				
207 (5880)	584.1	584.7	0.6	0.023e	< 0.1	Undet	0.084	583.1	584.0	0.9
	584.9	585.2	0.3	0.024e	< 0.1	Undet	0.025	592.9	593.9	1.0
	585.2	585.7	0.5	0.049	< 0.1	0.7				
	585.7	585.8	0.1	0.027e	< 0.1	Undet	0.028	596.7	598.5	1.8
	600.7	601.0	0.3	0.042	< 0.1	4.3	0.042	599.0	600.2	1.2
							0.025	621.8	623.0	1.2

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
207--Continued	602.0	602.6	0.6	0.056	< 0.1	1.9				
	603.2	603.5	0.3	< 0.020e	0.12	Undet				
	616.9	617.2	0.3	0.024e	< 0.1	Undet				
211 (5875)	588.4	590.2	1.8	0.049	0.17	4.2	0.096	587.6	588.7	1.1
	590.2	591.7	1.5	0.055	0.22	2.2	0.025	588.7	589.3	0.6
	591.7	593.0	1.3	0.025e	0.24	Undet	0.068	589.3	591.4	2.1
	595.7	596.0	0.3	0.032	0.17	0.8	0.021	593.5	594.8	1.3
233 (5874)	588.0	589.2	1.2	0.031e	0.19	Undet	0.022	586.3	589.6	3.3
	589.2	590.1	0.9	< 0.020e	0.19	Undet				
	590.4	590.7	0.3	0.024e	< 0.1	Undet				
	591.9	592.2	0.3	0.020e	< 0.1	Undet				
235 (5857)	612.9	613.3	0.4	0.035	< 0.1	1.0	0.022	611.7	613.3	1.6
236 (5873)	621.2	621.6	0.4	0.024e	< 0.1	Undet	0.020	616.4	618.1	1.7
238 (5866)	583.8	584.7	0.9	0.024e	0.15	Undet	0.029	569.1	570.2	1.1
	586.5	586.8	0.3	0.023e	0.19	Undet	0.025	582.3	584.2	1.9
							0.027	585.5	586.8	1.3
							0.021	617.7	620.2	2.5

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block F--Continued										
242 (5908)	605.5	606.9	1.4	0.030e	0.19	Undet	0.020	603.8	605.1	1.3
	606.9	608.1	1.2	0.043	0.25	0.8				
	608.1	609.6	1.5	0.095	1.52	< 0.1	0.042	606.9	608.5	1.6
	609.6	611.1	1.5	0.14	1.02	< 0.1				
	611.1	612.1	1.0	0.82	3.74	0.2	0.33	609.3	610.9	1.6
	612.1	612.8	0.7	0.18	0.90	1.7	0.13	610.9	612.1	1.2
	612.8	613.1	0.3	< 0.020e	0.15	Undet	1.5	612.1	613.2	1.1
	613.4	613.7	0.3	0.032e	0.28	Undet				
243 (5888)*	613.3	613.9	0.6	0.028e	< 0.1	Undet	0.12	612.3	613.3	1.0
	613.9	615.1	1.2	0.053	0.24	0.5				
	615.1	615.7	0.6	0.034e	< 0.1	Undet				
244 (5902)	600.1	600.4	0.3	0.023e	< 0.1	Undet	0.026	600.9	603.2	2.1
257 (5901)	587.5	587.8	0.3	0.025e	0.15	Undet	0.028	585.6	586.6	1.0
Block G										
277A (5832)	548.3	548.5	0.2	0.051	< 0.1	0.4	0.057	545.6	546.6	1.0
	556.9	558.1	1.2	0.062	< 0.1	1.0	0.094	554.9	555.9	1.0
	559.0	559.3	0.3	0.028e	< 0.1	Undet	0.035	563.4	564.4	1.0
							0.038	577.6	578.6	1.0
Block H										
13 (5887)	652.2	652.7	0.5	0.047	0.15	0.8	0.038	648.9	651.1	2.2
	653.2	653.7	0.5	0.031e	0.51	1.1	0.53	652.2	653.1	0.9

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block H--Continued										
13--Continued	655.2	655.3	0.1	0.033e	0.15	Undet	0.038	662.6	663.2	0.6
	655.3	656.3	1.0	0.23	0.12	2.1				
	665.6	665.9	0.3	0.031e	< 0.1	Undet				
102 (5873)	No sample						0.038	502.5	503.7	1.2
							0.034	504.3	506.1	1.8
							0.023	634.7	635.7	1.0
							0.043	642.8	643.7	0.9
103 (5880)	No sample						0.026	567.3	567.8	0.5
							0.033	659.0	660.0	1.0
105 (5881)	652.5	653.1	0.6	1.70	6.17	0.4	3.0	651.9	652.7	0.8
	653.1	653.3	0.2	0.35	2.58	0.2				
	653.3	653.9	0.6	0.047	0.22	0.3				
114 (5890)	638.0	638.5	0.5	0.027e	< 0.1	Undet	0.045	635.4	637.1	1.7
							0.041	637.1	638.2	1.1
	639.0	639.3	0.3	0.031e	0.46	Undet				
	639.3	639.6	0.3	0.026e	0.11	Undet	0.032	652.5	653.6	1.1
	639.6	640.2	0.6	0.030	< 0.1	4.1				
	656.0	656.3	0.3	0.033e	0.13	Undet				
117 (5876)	No sample						0.020	488.8	489.8	1.0

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block H--Continued										
161 (5882)	655.3	655.5	0.2	0.066	0.33	0.3	0.18	652.0	652.9	0.9
	656.1	656.4	0.3	< 0.020e	0.11	Undet				
162 (5879)	No sample						0.048	662.6	663.3	0.7
163 (5878)	No sample						0.020	636.7	637.5	0.8
							0.027	645.0	645.8	0.8
164 (5885)	No sample						0.025	636.2	637.0	0.8
165 (5892)	No sample						0.039	635.7	636.6	0.9
							0.12	636.9	637.5	0.6
							0.022	639.0	639.9	0.9
166 (5890)	No sample						0.036	648.3	649.9	1.6
							0.011	656.1	657.6	1.5
167 (5877)	No sample						0.34	517.1	517.7	0.6
							0.020	651.3	652.5	1.2
222 (5878)	No sample						0.024	650.9	651.8	0.9
223 (5878)*	No sample						0.025	620.6	622.3	1.7

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	V_2O_5	$CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block I										
129 (5864)	606.0	606.3	0.3	0.023e	< 0.1	Undet	0.022	600.0	601.1	1.1
	619.5	619.8	0.3	0.052	< 0.1	13.2	0.021	602.3	604.0	1.7
	619.8	620.4	0.6	0.14	< 0.1	13.6				
	620.4	621.0	0.6	0.030	< 0.1	0.6	0.28	614.4	615.3	0.9
195 (5868)	619.0	619.6	0.6	0.041	< 0.1	4.8	0.56	615.8	616.7	0.9
	619.6	620.2	0.6	1.04	< 0.1	6.2				
200A (5866)	599.8	601.0	1.2	0.074	< 0.1	2.1	0.18	601.8	602.6	0.8
	603.6	604.8	1.2	0.028e	< 0.1	Undet	0.10	605.1	606.1	1.0
	606.6	607.2	0.6	0.024e	< 0.1	Undet	0.17	608.6	609.8	1.2
	607.2	607.5	0.3	0.022	< 0.1	5.1	0.040	609.8	610.5	0.7
	607.5	607.8	0.3	0.026	< 0.1	5.9	0.37	610.5	611.7	1.2
	607.8	608.4	0.6	0.046	< 0.1	6.3	0.085	611.7	612.7	1.0
	608.4	608.7	0.3	0.021	< 0.1	6.8				
	608.7	609.3	0.6	0.027	< 0.1	7.3				
	609.3	610.5	1.2	0.47	< 0.1	1.5				
	610.5	610.9	0.4	0.056	< 0.1	6.5				
	610.9	611.8	0.9	0.036	< 0.1	3.6				
203A (5815)	No sample						0.024	510.6	511.8	1.2
							0.029	528.5	529.2	0.7

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block I--Continued										
234 (5866)	624.4	625.3	0.9	0.026e	< 0.1	Undet	0.58	623.5	624.3	0.8
	625.3	625.9	0.6	0.71	< 0.1	0.7				
	625.9	626.2	0.3	0.025e	< 0.1	Undet				
251 (5866)	616.5	618.0	1.5	0.052	< 0.1	1.3	0.039	601.0	602.1	1.1
	624.7	625.9	1.2	0.031e	< 0.1	Undet	0.051	613.5	614.3	0.8
	626.5	628.0	1.5	0.039	< 0.1	2.3	0.18	615.4	616.3	0.9
	628.0	629.8	1.8	0.034e	< 0.1	Undet				
							0.020	622.2	624.7	2.5
							0.062	624.7	626.8	2.1
							0.028	629.6	630.8	1.2
							0.032	631.4	632.2	0.8
252 (5855)*	621.1	622.0	0.9	0.030e	< 0.1	Undet	0.041	617.9	619.3	1.4
							0.025	619.3	619.9	0.6
	623.2	623.5	0.3	0.59	0.3	2.3	0.36	619.9	620.6	0.7
	623.5	623.8	0.3	0.022e	< 0.1	Undet				
							0.026	634.7	635.7	1.0
	638.4	639.3	0.9	0.026e	< 0.1	Undet				
							0.031	637.0	639.7	2.7
	640.9	641.8	0.9	0.026e	< 0.1	Undet				
	641.8	643.0	1.2	0.032e	< 0.1	Undet				
	643.6	644.8	1.2	0.026e	< 0.1	Undet				
255 (5861)	No sample						0.47	617.2	617.8	0.6

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Block J										
20 (5828)	591.0	591.2	0.2	0.032	< 0.05	8.3	0.029	579.0	580.3	1.3
	591.2	591.9	0.7	0.45	< 0.1	8.5				
	591.9	592.4	0.5	0.10	< 0.1	10.5	0.34	589.3	590.5	1.2
59 (5843)	595.0	595.1	0.1	< 0.020e	0.35	Undet	0.10	601.0	601.7	0.7
110 (5793)	546.3	547.1	0.8	0.023	< 0.1	2.2	0.024	536.5	537.8	1.3
	582.3	582.6	0.3	0.064	< 0.1	10.9	0.35	543.0	543.9	0.9
	583.5	583.8	0.3	0.031e	< 0.1	Undet	0.024	576.8	578.0	1.2
	586.2	586.5	0.3	0.028e	< 0.1	Undet	0.060	578.7	579.5	0.8
							0.097	579.9	580.9	1.0
							0.035	582.0	583.0	1.0
178 (5792)	No sample						0.021	542.1	543.0	0.9
179 (5784)	527.3	527.6	0.3	0.048	< 0.1	0.1	0.032	524.0	526.6	2.6
	529.1	529.4	0.3	0.029e	< 0.1	Undet				
188 (5813)	592.4	592.7	0.3	0.024e	< 0.1	Undet	0.11	591.7	592.3	0.6

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	V_2O_5	$CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes										
1 (5798)*	590.9	591.1	0.2	0.12	0.18	0.6	0.055	590.0	590.8	0.8
							0.030	592.2	593.3	1.1
6 (5949)	712.2	712.5	0.3	< 0.020e	0.21	Undet	Barren			
11 (5837)	551.3	551.7	0.4	0.045	0.42	0.3	0.042	548.7	550.0	1.3
	551.7	552.2	0.5	0.025e	0.22	Undet				
	552.2	552.9	0.7	0.020e	0.11	Undet	0.029	550.3	551.3	1.0
	552.9	553.3	0.4	0.021e	0.17	Undet				
	553.3	553.8	0.5	0.023e	0.15	Undet	0.022	552.5	555.8	3.3
	558.2	558.4	0.2	0.030e	0.10	Undet	0.026	558.6	559.6	1.0
							0.043	588.9	589.8	0.9
15 (5782)	573.1	573.9	0.8	0.053	0.04	1.7	3.7	571.0	571.7	0.7
	573.9	574.1	0.2	< 0.020e	< 0.05	Undet				
							0.023	579.1	579.9	0.8
24 (5738)	No sample						0.022	394.4	395.6	1.2
							0.024	457.7	458.7	1.0
38 (5835)*	No sample						0.025	663.3	664.3	1.0
40 (5460)*	No sample						0.046	384.8	385.5	0.7
41	No sample						0.027	597.1	597.6	0.5

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
46 (5906)*	No sample						0.020	532.1	534.6	2.5
50 (5847)*	503.7	504.1	0.4	0.029e	0.17	Undet	0.022	477.3	478.0	0.7
							0.10	502.1	503.0	0.9
62 (5902)	No sample						0.032	661.1	661.9	0.8
64 (5867)	546.5	547.1	0.6	0.020e	0.16	Undet	0.030	545.2	546.2	1.0
96 (5815)	No sample						0.021	550.1	551.0	0.9
							0.024	558.9	559.8	0.9
101 (5850)	No sample						0.028	467.9	469.2	1.3
							0.026	470.7	472.5	1.8
							0.080	605.0	606.0	1.0
							0.042	607.6	608.4	0.8
							0.10	608.7	610.3	1.6
							0.041	611.7	613.0	1.3
							0.020	613.0	614.3	1.3
104 (5785)	473.8	474.1	0.3	0.034	< 0.1	8.0	0.033	385.1	386.7	1.6

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
104--Continued										
	475.1	475.4	0.3	0.033e	< 0.1	Undet	0.031	441.2	443.0	1.8
	499.8	500.1	0.3	0.031e	< 0.1	Undet	0.022	464.4	465.6	1.2
							0.052	465.6	466.7	1.1
	500.4	500.8	0.4	0.042	< 0.1	2.0				
							0.041	467.1	468.3	1.2
	501.4	501.7	0.3	0.035	< 0.1	7.8				
							0.026	492.6	495.1	2.5
111 (5880)	No sample						0.023	652.6	653.9	1.3
112 (5891)	556.9	557.2	0.3	0.027e	< 0.1	Undet	0.030	482.3	483.7	1.4
122 (5887)	666.5	666.7	0.2	0.037	< 0.1	0.4	0.032	663.5	664.2	0.7
124 (5872)	No sample						0.028	565.7	566.8	1.1
125A (5847)	No sample						0.023	600.2	600.9	0.7
128 (5874)	No sample						0.087	592.6	594.1	1.5
130 (5898)	600.9	601.5	0.6	0.033e	< 0.1	Undet	0.033	572.2	573.8	1.6

OFFICIAL USE ONLY

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
136 (5936)	615.2	616.1	0.9	0.021e	0.12	Undet	0.027	577.1	578.4	1.3
							0.064	614.5	615.4	0.9
142 (5835)*	No sample						0.023	535.6	537.4	1.8
							0.026	564.7	566.0	1.3
143 (5943)*	No sample						0.029	597.2	598.6	1.4
144 (5928)	574.4	575.6	1.2	0.036	< 0.1	12.8	0.086	488.5	489.2	0.7
	575.9	576.5	0.6	0.020e	< 0.1	Undet	0.079	577.8	578.7	0.9
145 (5935)*	No sample						0.029	484.6	485.8	1.2
146 (5880)	No sample						0.035	602.2	603.2	1.0
147 (5896)	No sample						0.029	574.4	575.2	0.8
157B (5849)	597.4	597.7	0.3	0.023e	Undet	Undet	Barren			
	597.9	598.2	0.3	0.022e	Undet	Undet				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
169 (5841)	No sample						0.021	454.9	455.9	1.0
							0.037	590.0	591.2	1.2
							0.027	604.8	605.7	0.9
170A (5861)	No sample						0.027	489.1	490.2	1.1
171 (5860)	629.1	629.8	0.7	0.057	< 0.1	0.2	0.037	620.7	621.5	0.8
172 (5857)	No sample						0.039	404.5	405.3	0.8
181 (5803)	498.7	499.0	0.3	0.033e	< 0.1	Undet	0.044	498.0	498.8	0.8
	533.3	533.6	0.3	0.034	< 0.1	0.4	0.025	530.9	534.9	4.0
	534.5	535.2	0.7	0.042	0.1	0.7	0.030	574.6	575.6	1.0
	567.5	567.8	0.3	0.034e	< 0.1	Undet				
198 (5812)*	No sample						0.053	517.2	518.1	0.9
201 (5796)	No sample						0.022	462.7	463.6	0.9

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
205 (5786)*	579.7	580.3	0.6	0.022e	< 0.1	Undet	0.028	576.6	577.4	0.8
	580.3	580.6	0.3	0.16	< 0.1	2.9				
							0.11	580.2	581.2	1.0
208 (5828)	572.2	573.1	0.9	0.033e	0.12	Undet	0.024	524.8	526.2	1.4
							0.026	543.3	544.3	1.0
							0.041	572.4	573.4	1.0
209 (5787)*	No sample						0.029	521.8	522.8	1.0
							0.041	524.7	526.2	1.5
210 (5907)	561.5	562.4	0.9	0.034e	< 0.1	Undet	0.029	560.4	563.2	2.8
	564.0	564.6	0.6	0.030e	< 0.1	Undet	0.030	566.4	567.6	1.2
	568.0	568.2	0.2	0.056	0.16	0.6				
	568.8	569.1	0.3	0.024e	0.12	Undet				
215 (5818)*	No sample						0.043	547.8	549.3	1.5
218 (5819)	567.7	568.0	0.3	0.030e	< 0.1	Undet	0.025	564.2	566.7	2.5
	568.3	568.9	0.6	0.024e	< 0.1	Undet	0.038	568.4	569.7	1.3
	572.5	572.8	0.3	0.028e	< 0.1	Undet	0.039	575.1	576.2	1.1
	578.8	579.3	0.5	0.030e	< 0.1	Undet				

Table 3. Assay data, Spring Creek Mesa area, Montrose County, Colorado--Continued

Hole No. and collar elev. (feet)	Assay data: Depth in feet From	To	Thickness (feet)	Percent U_3O_8	Percent V_2O_5	Percent $CaCO_3$	Gamma-ray data: Percent eU_3O_8	Depth in feet From	To	Thickness (feet)
Other holes--Continued										
220 (5760)*	No sample						0.026	505.1	507.0	1.9
243 (5888)*	613.3	613.9	0.6	0.028e	< 0.1	Undet	0.12	612.3	613 3	1.0
	613.9	615.1	1.2	0.053	0.24	0.5				
	615.1	615.7	0.6	0.034e	< 0.1	Undet				
276 (5874)	570.7	571.0	0.3	0.028e	< 0.1	Undet	0.043	571.0	572.4	1.4
	571.7	572.3	0.6	< 0.020e	0.23	Undet				
	572.3	573.4	1.1	0.030e	0.17	Undet				
281 (5816)	No sample						0.030	531.9	533.0	1.1

By definition, the tonnage of the indicated reserves ". . . is computed by projection for a reasonable distance on geologic evidence." Throughout the Spring Creek Mesa area, indicated reserves are projected where correlation of samples is good between drill holes that are not more than 150 feet apart. On the other hand, indicated reserves are not projected more than 30 feet beyond sample points, where the edge of the deposit has not been located or where correlation of data between sample points is lacking. Reserves are classed as inferred rather than indicated if the projection exceeds these lengths. Inferred reserves are projected to the assumed limits of the deposits, as determined by geologic evidence and interpretation.

A constant of 14 cubic feet per ton is used to calculate tonnage.

Calculation of grade

The average grade of the indicated reserves is calculated by weighting the assay values of all samples that qualify as reserves within the grade and thickness limits. As strict grade cutoffs are used, it is generally expected that the average grade assigned to the reserve blocks will be somewhat higher than the average grade of the ore that will be eventually mined from them, owing to the unavoidable dilution of the ore with waste and low-grade material during mining. On the other hand, the tonnage assigned to these blocks should be somewhat lower than the tonnage mined from them, owing to the increment of waste and low-grade material.

Reserve blocks

Masses or units of mineralized rock that constitute an indicated or inferred reserve, as defined by the thickness and grade cutoffs, are called reserve blocks. The geometric limits of reserve blocks are determined by the rules used in calculating reserves. (See above.) The exact positions of the blocks are not shown on figure 3 though the mineralized ground that contains the blocks is designated by block numbers. Where mineralized layers overlap, even though they contain two or more masses of reserves, a single block number is assigned, and the total tonnage of these masses, as well as their weighted grade, is shown on table 2.

Potential reserves

Potential reserves are estimates of the amount of reserve material that is probably present in deposits that have not been discovered to date, but whose presence is predicted on the basis of geologic reasoning. About 15,000 tons of potential reserves are predicted for the Spring Creek Mesa area. These reserve masses are 1 foot or more thick and probably contain about 0.25 percent U_3O_8 and about 1.15 percent V_2O_5. Most of these potential reserves are probably contained in small deposits of less than 1,000 tons in the western part of Spring Creek Mesa. Blocks H, I, and J are typical examples of these small reserve masses (fig. 3 and table 2).

PLANS AND RECOMMENDATIONS

No additional exploration is planned by the Geological Survey for the Spring Creek Mesa area. Because of the depth to the ore-bearing zones, most of the ore deposits of economic significance probably have already been found by drilling. However, smaller deposits probably exist near the larger deposits and could probably be explored less expensively by underground drifting and drilling methods after the larger deposits have been mined. Additional reserves may be developed by this method in the vicinity of blocks A, B, C, and D (fig. 3).

UNPUBLISHED REPORTS

Atomic Energy Commission, June 1951, Domestic uranium program, Circ. 6.

Alvord, D. C., in preparation, Carnotite resources of the San Miguel bench, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Inv. Rept. 289.

Eicher, L. J., 1953, Interim report on exploration of the Spring Creek Mesa area, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Memo. Rept. 488.

Roach, C. H., 1953, Preliminary report on exploration of the Spring Creek Mesa area, Montrose County, Colorado: U. S. Geol. Survey Trace Elements Memo. Rept 688.