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GUNNISON GORGE AREA

GEOLOGICAL RESOURCE AREA (GRA) 5

FINAL REPORT

PHASE 1: GEM

(GEOLOGICAL, ENERGY and MINERALS)

RESOURCE ASSESSMENT FOR REGION 4, COLORADO PLATEAU

SUBMITTED TO:

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DENVER SERVICE CENTER
DENVER, COLORADO 80225

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MSME/WALLABY ENTERPRISES
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MOUNTAIN STATES MINERAL ENTERPRISES, INC.
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MINES, PROSPECTS
AND MINERAL OCCURENCES

OVERLAY A
PATENTED AND UNPATENTED
CLAIMS AND WSA BOUNDARIES

FOREWORD

This report is one of a series of eleven reports addressing the Wilderness Study Areas (WSA's) located in what has been designated as the Colorado Plateau, Region 4, by the Bureau of Land Management (BLM), Denver Federal Center. The study was under the direction of Mr. Robert J. Coker, the Contracting Officer's Authorized Representative (COAR).

The WSA's have been segregated into eleven G-E-M (Geology, Energy, Minerals) Resources Areas (GRA's). Each designated GRA constitutes one report. The purpose of these reports is to assess the potential for geology, energy and mineral (GEM) resources existing within a WSA and GRA. This information will then be used by BLM geologists in completing the assessment for GEM resources potential within the WSA's, and for the integration with other resource data for the decision on suitability for recommendation of the respective WSA.

The reports were developed and prepared by the Joint Venture team of MSME/Wallaby Enterprises, Tucson, Arizona, by Patricia J. Popp (Geologist), and Barbara J. Howie (Geologist) under the direction of Eric A. Nordhausen (Project Manager) and Richard Lundin (Principal Investigator), under BLM Contract No. YA-553-CT2-1041.

Consulting support was provided by a highly specialized geological team composed of: Ted Eyde, Dr. Paul Gilmour, Dr. Robert Carpenter, Dr. Donald Gentry, Dr. Edger Heylmun, Dr. Larry Lepley, Annon Cook, Walter Heinrichs, Jr., and Charles Campbell. Their contribution is both acknowledged and appreciated. The work of Dr. Gilmour, Dr. Gentry, Mr. Eyde, and Dr. Lepley should receive special acknowledgement. It was from the work of these consultants that this report on the Gunnison Gorge GRA was able to be completed.

EXECUTIVE SUMMARY

The BLM has adopted a two-phase procedure for the integration of geological, energy and minerals (GEM) resources data for suitable/nonsuitable decision for wilderness study areas (WSA's). The two-phased approach permits termination of a GEM resources data gathering effort at the end of Phase One. The objective of this Phase One GEM resources assessment is the evaluation of existing data (both published and available unpublished data) and their interpretation for the GEM resources potential of the WSA's included in each region. Phase Two is designed to generate new data needed to support GEM resources recommendations.

Over 10 million acres of WSA's require GEM resources data input. These WSA's are unequally distributed in the eleven western states of the coterminous United States. The WSA's are grouped in six large regional areas. The WSA's within the western part of Colorado, and a few crossing into Utah, were included as Region 4, also known as the Colorado Plateau Region. Except for one small area at the southwest extreme of the region and another at the north extreme, the region is within the northern half of the known Colorado Plateau physiographic province.

The 32 WSA's within Region 4 encompass 474,620 acres. These have been geographically segregated within 11 designated GEM Resource Areas (GRA's). This report addresses the Gunnison Gorge area, GRA 5. Contained in the GRA is the Gunnison Gorge WSA (CO-030-388).

The physiography in the GRA includes valley, canyon, and plateau areas along the course of the Gunnison and Uncompahgre River systems. Metamorphic rocks of Precambrian age crop out in the GRA. Base and precious metal mineralization is sometimes associated with these lithologies in other areas of western Colorado. The majority of the remaining rock formations are sedimentary. In addition, associated fault and joint systems may have produced mineralized areas.

Energy and mineral resources in the GRA include coal, precious and base metals, clays, and sand and gravel. The Grand Mesa and Tongue Mesa Coal Fields are partly included in the GRA. [Information on formations containing base metal deposits was not available.] Precious metal occurs as placers near Cedar Creek. Clays are derived from sedimentary formations. Sand and gravel occurs along the Gunnison River and its tributaries.

Gunnison Gorge WSA contains no known mineral deposits, with only a few mineralized areas. The classification for the leasable minerals, locatable and salable resources varies. Locatable resources show a high favorability in the WSA in the form of gypsum. There is a low favorability for locatable resources or base and precious metals within the WSA. There is high favorability for salable resource in the form of dimension stone.

Overall, it is recommended that each WSA in the GRA receive additional work to determine the full economic potential of each area. This work should include further research in the unpublished and proprietary literature, a detailed program of geologic mapping and sampling, and additional geochemical and stratigraphic studies to confirm the occurrence or lack of occurrence of geology, energy or mineralized commodities.

SECTION I

INTRODUCTION

The Gunnison Gorge GRA (Figure I-1) is located in Delta and Montrose Counties, Colorado. The GRA encompasses a single Wilderness Study Area (WSA) (CO-030-388).

The GRA area is located approximately 40 miles southeast of Grand Junction, Colorado. Located within the boundaries are a number of settlements that are local supply centers for agriculture, ranching and mining activities. Montrose, Colorado, one such regional supply center, is located in the southwest portion of the GRA. The small settlements that are distributed throughout the GRA are supplied by road and rail networks from Montrose and Grand Junction, and act as local supply centers for the mining activities in the area.

The GRA encompasses portions of Townships 14-15 South, Ranges 91-95 West; and Townships 47-51 North, Ranges 6-10 West. The entire area is bounded by west Longitudes 107° 30' 00" and 107° 58' 54" and north Latitudes 38° 20' 17" and 38° 51' 09". It contains approximately 849 square miles (2,287 square kilometers or 543,360 acres) of Federal, state and private lands. The Bureau of Land Management portion of these holdings are under the jurisdiction of the Montrose District, Uncompahgre Resource Area and Gunnison Basin Resource Area Offices.

Gunnison Gorge, the sole WSA within the GRA, has a total of 19,560 acres of Federal land. The WSA is located in the north central portion of the GRA, and is approximately 10 miles north of Montrose, Colorado. The unit is directly adjacent to Black Canyon of the Gunnison National Monument.

Due to the lack of available data on the WSA, emphasis was placed on gaining an understanding of the mineral potential of the WSA within the GRA. Information on the mineral resources of the GRA was utilized to extrapolate and estimate the potential of the WSA from the existing data that in most cases, referred only indirectly to the WSA. The known areas of mineralization and claims have been plotted as overlays to Figure I-1.

The information contained in this report was obtained from published literature, computerized data base sources, Bureau of Land Management file data, company files and returned data sheets. The information was compiled into a series of files on each WSA and a series of maps that covered the entire western portion of Colorado. After a thorough review of the existing data, a program of field checking was carried out by MSDME/Wallaby's team of experts. Field investigations in the GRA were carried out by Dr. Paul Gilmour, Dr. Donald Gentry and Mr. Ted Eyde during the period of August 31 - September 1, 1982.

All of these individuals are registered professional geologists and associates of MSDME/Wallaby. Further analysis and study was provided through the photographic interpretation services of BLM 1:24,000 aerial photos by Dr. Larry Lepley, registered professional geologist and remote sensing specialist. The aerial photos used are included in Appendix A.

CHAPTER 10

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OVERLAY D
SAND, GRAVEL AND
INDUSTRIAL MINERALS

OVERLAY C
COAL, OIL AND GAS

OVERLAY B
MINES, PROSPECTS
AND MINERAL OCCURENCES

OVERLAY A
PATENTED AND UNPATENTED
CLAIMS AND WSA BOUNDARIES

94W

93W

92W

91W

14S

15S

51N

50N

49N

48N

47N

(After Rowley et al, 1979)

GUNNISON GORGE GRA

SCALE 1:250,000

FIGURE I-1
GEOLOGIC MAP

EXPLANATION

Quaternary (Approximately 2 million years before present (mybp) to present)	Qa Ql Qg Qgo	Alluvium Landslide deposits Unconsolidated deposits, young gravels Unconsolidated deposits, old gravels and alluvium
Tertiary (Approximately 62-2 mybp)	Tm1 Tpl Tktc	Middle Tertiary Intrusive Rocks Pre-ash Flow Andesitic Lavas and Breccias Telluride Conglomerate and Cimarron Ridge Formation
Cretaceous (Approximately 135-62 mybp)	Km Km Kd Kdb	Mesaverde Formation Mancos Shale Dakota Sandstone Dakota Sandstone and Burro Canyon Formation
Jurassic (Approximately 195-135 mybp)	Jm Jmw Jmwe Jme	Morrison Formation Morrison and Wanakah Formations Morrison & Wanakah Formations, & Entrada Sandstone Morrison and Entrada Formations
Cambrian (Approximately 600-500 mybp)	Cam	Cambrian alkaline and mafic intrusive rocks Dike
Precambrian (Approximately 3400-600 mybp)	Yg Xg Xb	Granitic rocks (1400 m.y.) Granitic rocks (1700 m.y.) Biotitic gneisses and migmatite

LEGEND

-O OIL FIELD		MINERAL OREBODY
-G GAS FIELD		MINERAL DEPOSIT
-Os OIL SHALE		MINERAL OCCURRENCE
-C COAL REGION		PROSPECT
OIL WELL		ACCESSIBLE ADIT
OIL & GAS WELL		INACCESSIBLE ADIT
GAS WELL		VERTICAL SHAFT
SHOW OF GAS		INCLINED SHAFT
SHOW OF OIL		MINE TYPE UNKNOWN
SHOW OF OIL & GAS		ACTIVE OPEN PIT, OR QUARRY
-C COAL DEPOSIT		INACTIVE OPEN PIT, OR QUARRY
-C COAL OCCURRENCE		ACTIVE GRAVEL OR CLAY (CI) PIT
SHUT-IN WELL		INACTIVE GRAVEL OR CLAY (CI) PIT
CO ₂ OR H _e =HELIUM -RICH WELL		EXPLORATION HOLE WITH DATA AVAILABLE
DRY WELL-ABANDONED		EXPLORATION HOLE WITHOUT DATA AVAILABLE
MILL		UNPATENTED MINING CLAIM
PLANT		PATENTED MINING CLAIM
NATURAL GAS PROCESSING PLANT		MINERAL OR OIL & GAS LEASE
REFINERY		

O OIL
G GAS
Os OIL SHALE
Ot TAR SANDS
Gi GILSONITE
C COAL

Cb LIGNITE
Cp PEAT
Ag SILVER
Au GOLD
Cu COPPER
Cl CLAY

Ds DIMENSION STONE
Fe IRON
Mn MANGANESE
Pb LEAD
U URANIUM
V VANADIUM
Zn ZINC

SECTION II

GEOLOGY

PHYSIOGRAPHY

The GRA boundary includes valley, canyon and plateau areas along the course of the Gunnison and Uncompahgre River systems. The areas north and east of the Gunnison River can be characterized as a series of nearly flat-topped mesas and ridges that have been deeply cut by tributaries of the Gunnison. These mesas and ridge form prominent physiographic features, and are extensively used for agricultural and ranching activities (Fruitland, Scenic and Rogers Mesas are extensively utilized for these purposes). Vertical relief on the mesa tops is generally less than 1,000 feet but can increase to 1,500-2,000 feet as one approaches the eastern rim of the Black Canyon of the Gunnison. To the east of the ridge and mesa top area are a series of high peaks and ridges that rise up to approximately 10,000 feet in elevation.

The canyon areas along the course of the Gunnison River and into Black Canyon of the Gunnison National Monument are the dominant physiographic feature of the GRA. The Gunnison River cuts through 3,000 feet of Precambrian and Mesozoic stratigraphy. The canyon is narrow and steep-walled with deeply cut tributary canyons. Vertical cliff faces are common along the walls of the canyon and the Gunnison River twists through a narrow gorge in the fractured Precambrian units.

To the west and southwest of the canyon are a series of high ridges and mesas that are Cretaceous erosion remnants that have been deeply cut by the western tributaries of the Gunnison River and the eastern drainages of the Uncompahgre River. These ridges and mesa tops have relatively flat tops and have a vertical relief of less than 1,000 feet. They border the valley and mesa areas of the valley of the Uncompahgre, north and west of Montrose, Colorado. Directly south of the Gunnison River Canyon in the southeastern portion of the GRA are a series of high peaks, Waterdog Peak and Coal Hill, that rise up to nearly 10,000 feet in elevation. These features are erosion remnants of resistant Cretaceous units. The valley areas in the southwest portion of the GRA and the areas on the western drainage of the Uncompahgre River have a vertical relief of generally less than 1,000 feet. The Cretaceous units west of the Uncompahgre River drainage slopes gently to the northeast and has less than 1,500 feet of vertical relief.

GUNNISON GORGE WSA (CO-030-388)

The single WSA within this GRA is located along the steep-walled canyon of the Gunnison River directly north of Black Canyon of the Gunnison National Monument. Vertical relief in the canyon and in the tributary drainages is approximately 3,000 feet. The upper canyon areas that are within the WSA consist of deeply sculptured remnants of resistant Mesozoic units. Vertical relief within these areas is in the order of 1,000 - 2,000 feet.

ROCK UNITS

Within the Gunnison Gorge GRA is found a variety of rock units that represent a large portion of Precambrian, Mesozoic and Cenozoic time. The Precambrian section is represented by a complex of gneisses and schists that indicate periods of volcanic, volcanoclastic and sedimentary deposition (Gilmour, Personal Communication, 1982; Williams, 1964). These units have been moderately deformed and intruded by a series of felsic through mafic bodies. The Precambrian sequence is relatively unstudied in this area and has not been extensively dated, mapped or correlated to other sections of Colorado (Gilmour, Personal Communication, 1982; Schwochow, 1978; Williams, 1964). Base and precious metal deposits have been found associated with Precambrian units in the nearby Copper City - Unaweep Canyon District area. These deposits were worked intermittently during the period from 1870-1900 (Schwochow, 1978; Gilmour, Personal Communication, 1982; Eyde, Personal Communication, 1982). Mineralization consisted of copper oxides and carbonates with minor amounts of pyrite and chalcopyrite in association with fluorite and amethyst bearing quartz veins and pegmatites (Schwochow, 1978; Gilmour, Personal Communication, 1982). In other areas of Colorado and western United States and Canada, primary, syngenetic mineralization has been found associated with Precambrian felsic and sedimentary sequences (Gilmour, Personal Communication, 1982).

The Paleozoic section does not crop out within the GRA and is thought to be missing. It is thought that it was never deposited on the flanks of the Uncompahgre Uplift and may have never been deposited within the GRA. Where the Precambrian is exposed in Gunnison Gorge, the Jurassic section lies directly upon the Precambrian erosion surface (Schwochow, 1978; Gilmour, Personal Communication, 1982). In the Gorge area, the Jurassic Morrison Formation lies directly upon the basement Precambrian complex (Tweto et al, 1978), a further indication that there was a topographic high throughout most of the GRA during much of Paleozoic and Mesozoic time (Baars et al, 1981).

The Mesozoic section consists of the Jurassic Entrada Sandstone, Wanakah, and Morrison Formations.

The Jurassic Entrada Formation is found to directly overlie the Precambrian stratigraphy. Within the GRA this is thought to represent a conformable situation with the Triassic units being uplifted and forming a topographic high during Late Triassic time (Carter et al, 1965). This situation continued until the beginning of the Jurassic when the Entrada Sandstone Formation was deposited in a terrestrial eolian environment (Tweto et al, 1976). In other areas of Colorado, the Entrada contains uranium-vanadium deposits associated with a basal siltstone-sandstone unit that is described in other areas as the Carmel Formation (Tweto et al, 1976).

Directly overlying the Entrada is the Jurassic Wanakah Formation, which consists of a series of mudstone, sandstone, shale, and limestone units with chert and algal limestone beds. The units are thought to be of terrestrial - marine origin and do not have associated uranium-vanadium deposits within the GRA. Throughout most of the GRA, the Jurassic Morrison Formation overlies the Wanakah. The Morrison units that crop out within the GRA represent a series of mudstone, shale, conglomerate, fluvial sandstone and limestone beds (Tweto et al, 1976). Uranium-vanadium mineralization is normally associated with conglomeratic units within the upper or

Brushy Basin Member of the Morrison (Tweto et al, 1976, Vanderwilt, 1947). The Morrison Formation units that outcrop within the GRA are not known to contain ore-grade uranium-vanadium mineralization and are thought to have been deposited in a terrestrial fluvial environment (Carter et al, 1965; Vanderwilt, 1947, Williams, 1964). The Morrison Formation is known to contain uranium-vanadium deposits in other areas of western Colorado (Williams, 1964; Schwochow, 1968; Vanderwilt, 1947).

The Cretaceous section is represented within the GRA by the Burro Canyon Formation, Dakota Sandstone Formation, Mancos Shale Formation and the Mesaverde Formation (Tweto et al, 1976). These units can be described as a series of shales, sandstones, mudstones, and conglomerates with interbedded coal seams (Tweto et al, 1976). The Burro Canyon Formation consists of a sequence of fluvial sandstone, conglomerate, siltstone, shale, and mudstone units with thin beds of impure limestone (Tweto et al, 1976). The overlying Dakota Formation is a group of sandstone and conglomerate units with interbedded carbonaceous non-marine shale and coal units. Plant fossils are usually associated with this unit and minable coal seams have been identified within the GRA (Speltz, 1976), and mined in other areas of Colorado (Vanderwilt, 1947; Speltz, 1976; Gentry, Personal Communication, 1982; Tweto et al, 1976).

The Mancos Shale Formation consists of black fissile shale units with thin sandstone beds. The Mesaverde Formation units that outcrop within the GRA include a series of nonmarine sandstone, shale, and coal units with a massive, crossbedded sandstone unit (Rollins Sandstone Member). Coal beds within the Mesaverde are thought to be thin and discontinuous within the GRA (Gentry, Personal Communication, 1982; Speltz, 1976). The Mesaverde produces major quantities of coal in other areas of Colorado, and is considered a coal resource within the GRA (USGS & CGS, 1977). Past mining operations within the GRA have delineated coal bearing units with the Mesaverde that could be mined if economic condition warranted (Gentry, Personal Communication, 1982; Speltz, 1976; USGS & CGS, 1977).

The Cenozoic stratigraphy is represented by sandstone, shale and siltstone units of the Tertiary Wasatch Formation. This unit unconformably overlies the Cretaceous section and is thought to represent a period of shallow water deposition in a marine or neritic environment (Young, 1959; Tweto et al, 1976; Carter et al, 1965).

Quaternary alluvial, fluvial, and terrace deposits are found along the Gunnison River Valley and on the gently sloping outcrops of the Cretaceous section south and west of Grand Mesa (Tweto et al, 1976). Alluvial material directly north of Delta, Colorado and at various locations along the Gunnison River has been exploited in recent times as a source of sand, gravel and clays (Tweto et al, 1976; Eyde, Personal Communication, 1982).

GUNNISON GORGE WSA (CO-030-388)

Rock units cropping out within the Gunnison Gorge WSA include a series of Precambrian, Jurassic and Cretaceous units that have been deeply cut by the fluvial action of the Gunnison River. The Precambrian section consists of a complex series of schists, gneisses, and felsic intrusives that have been strongly deformed and intruded by a series of felsic-mafic bodies (Tweto et al, 1976). The Precambrian

units that outcrop within the WSA are not known to contain significant mineral deposits as are found in nearby areas of Colorado (Unaweep Canyon District, Dominguez District). A single prospect was noted in the field examination and verification effort, and it may be that it represents an area of base or precious metal mineralization within the Precambrian units (Gilmour, Personal Communication, 1982).

Directly overlying the Precambrian basement complex is the Jurassic Entrada Formation. Within the WSA, this unit consists of a single eolian cross-bedded sandstone unit. Directly above the Entrada is the Wanakah Formation, which consists of a series of mudstone, sandstone, gypsiferous sandstone, mudstone, and limestone with interbedded cherty limestone and gypsum beds. The gypsum units of this formation have been worked in the past and represent an industrial mineral resource for the Delta, Colorado area (Eyde, Personal Communication). The Entrada Formation is known to contain uranium-vanadium deposits in other areas of Colorado and in areas of the GRA adjacent to the WSA (Gilmour, Personal Communication, 1982; Williams, 1964, Vanderwilt, 1947). From the information at hand, there are no reported occurrences of uranium-vanadium mineralization from the areas within the WSA where the Jurassic section is exposed. Directly overlying the Wanakah Formation and sometimes mapped with it is the Brushy Basin Member of the Morrison Formation. In this area, the Brushy Basin member consists of a series of variegated mudstone, shale and sandstone members. The normally underlying Salt Wash Member of the Morrison is not thought to be present within the WSA and was probably never deposited this far east (Tweto et al, 1976; Carpenter, Personal Communication, 1982).

The Cretaceous section directly overlies the outcrops of the Morrison and consists of the Burro Canyon and Dakota Formations (Tweto et al, 1976). The Burro Canyon Formation crops out in the Gunnison Canyon as a series of sandstone, claystone and conglomerate units. The Dakota Formation overlies the Burro Canyon and is described as a resistant sandstone unit with carbonaceous shale, conglomerate and local coal beds. Outcrops of the Dakota and the overlying Mancos Shale Formation were investigated by the field examination and verification party who failed to find any commercially exploitable coal within the boundaries of the WSA (Gilmour, Personal Communication, 1982; Gentry, Personal Communication, 1982). The Dakota Formation is known to contain significant coal reserves in other areas of Colorado, and therefore the outcrop of the Dakota within the WSA have been designated as an energy resource by the United States Geological Survey (USGS & CGS, 1977; Speltz, 1979 Gentry, Personal Communication, 1982).

Quaternary alluvium is found to directly overlie exposed Precambrian and Mesozoic units in the Gunnison River Canyon and within it's tributary system within the WSA.

STRUCTURAL GEOLOGY AND TECTONICS

Tectonic features found within the GRA include northeast, north-south and northwest striking high angle faults, shear zones and joint systems. These structures are best exposed in the canyon areas of the Gunnison River Drainage. The Gunnison River Canyon is oriented along two major structures that cut through the Precambrian, Jurassic and Cretaceous sections. A major north-south fault and joint system that cuts through the Gunnison Gorge WSA is thought to have localized gold-silver-copper mineralization (Gilmour, Personal Communication, 1982; BLM/MRI File Data).

Other north-south and northeast striking fault and joint systems have acted as pathways for non-mineral quartz veins and hydrothermal solutions with minor amounts of copper and uranium (BLM/MRI File Data, 1982; Carpenter, Personal Communication, 1982). Crystal Creek Canyon and Smith Fork of the Gunnison Canyon, both of which trend east-west, have numerous tributary canyons cut by fluvial processes along existing northeast and north-south zones of weakness. In the southeast portion of the GRA, the Canyon of the Gunnison is aligned along the northwest striking Red Rock fault. This fault is a major structural feature that cuts across the GRA and coalesces with the paralleling Cimarron Fault System (Tweto et al, 1976).

In the western and southwestern portions of the GRA, the observed fracture pattern is parallel to the dominant northwest and northeast fault and joint systems. No major fold structures have been identified within the GRA (Tweto et al, 1976; Lepley, Personal Communication, 1982).

Throughout the GRA, various periods of erosion or non-deposition have occurred in the Precambrian and Mesozoic sections. In addition, the entire Paleozoic section is missing within the GRA. The oldest Precambrian rocks exposed within the GRA are thought to be 1700 million years old, and have been intensively deformed and intruded by younger Precambrian mafic and felsic bodies. This mass of highly deformed biotite, gneiss, and pegmatite was subsequently intruded by younger Precambrian granitic bodies and Cambrian mafic dikes. The early stages of Uncompahgre Event uplifting formed a topographic highland throughout much of western Colorado that persisted until the beginning of the Triassic. Within the GRA, the area received no Paleozoic and Triassic sediments and remained a prominent topographic high until upper Jurassic times, when the Morrison, Wanakah and Entrada Formations were deposited directly upon the Precambrian paleosurface (Tweto et al, 1976; Baars et al, 1981). Tertiary volcanic units have been directly deposited on the Cretaceous Mesaverde and Mancos Formations. Quaternary landslide and alluvial deposits were directly deposited on the Precambrian and Mesozoic outcrops (Tweto et al, 1976).

Deformation has obscured the true stratigraphic sequence in the basement Precambrian rocks. In other areas of Colorado, the younger sedimentary units of the Uncompahgre Formation (1400 million years before present) have been found cropping out. The lack of such units within the GRA may represent a period of non-deposition or erosion (Tweto et al, 1976).

GUNNISON GORGE WSA (CO-030-388)

Structural features found within the WSA include north-south striking, high angle, faults, shear zones and joint systems. These features cut through the WSA and have determined the course of the Gunnison River in this area. These features, and possibly some others, have localized gold-silver-copper mineralization (Gilmour, Personal Communication, 1982, BLM/MRI File Data). Northeast and northwest striking joint systems have caused many of the tributary canyons within the WSA.

Within the WSA, the Paleozoic and most of the Mesozoic section is absent, and probably was never deposited upon the deformed and uplifted Uncompahgre upland (a highland area in western Colorado that rises 3,000 to 5,000 feet higher than the surrounding terrain). The Jurassic Morrison, Wanakah, and Entrada Formations lie

unconformably upon the Precambrian crystalline basement complex (Tweto et al, 1976; Baars et al, 1981). Quaternary alluvial and fluvial deposits lie directly upon the Cretaceous, Jurassic and Precambrian rocks that are exposed within the study area (Tweto et al, 1976).

PALEONTOLOGY

Paleontological deposits in the GRA are not well known. Reconnaissance mapping of the Mesozoic units cropping out within the area has not been of sufficient detail to identify fossil localities. The Jurassic Wanakah and Entrada Formations are not known to be fossiliferous within the area of the GRA (Craig et al, 1955; NPS File Data, 1982). Cretaceous units that crop out throughout the GRA are thought to contain fossil plant remains, and may contain marine fishes and mollusks (Wanek, 1959; NPS File Data, 1982).

Reconnaissance of the Cretaceous Dakota Formation failed to delineate any coal seams within the unit (Gilmour, Personal Communication, 1982).

In other areas of Colorado, both the Cretaceous Mancos Formation and the underlying Dakota Formation are known to contain fossil plant material (Wanek, 1959; Speltz, 1976; Weeks, 1925; NPS File Data, 1982).

GUNNISON GORGE WSA (CO-030-388)

Within the WSA, no fossil localities or occurrences have been reported. The potential for paleontological resources in the Jurassic and Cretaceous stratigraphy remains unknown until further detailed studies are carried out in the area (NPS File Data, 1982).

HISTORICAL GEOLOGY

During Precambrian time the entire GRA was receiving sediments from both cratonic and island arc sources (Gilmour, Personal Communication). It appears that this was a time of persistent volcanism and tectonic activity. Marine deposition of eugeosynclinal sediments was interrupted by the ebb and flow of cratonic and island arc volcanism, and a period of extreme deformation was caused by plate collisions and regional uplifting. These older Precambrian units were metamorphosed, deformed, and intruded by a series of younger Precambrian mafic and felsic bodies. In this study area, the exposed older Precambrian rocks are mainly intrusive masses of granite that have partially absorbed the earlier gneiss and schist material.

Some of these intrusives contained anomalous amounts of metals, and have mineral deposits associated with them in other parts of Colorado and western United States (Vanderwilt, 1947). Other base and precious metal deposit types, called exhalative deposits, are commonly found in Precambrian lithologies. These exhalative deposits, found in association with marine basins and rhyolitic volcanic systems, are commonly associated with the older Precambrian lithologies. Younger Precambrian or Paleozoic intrusives have intruded the older, highly metamorphosed and deformed complex of granite, gneiss, schist, pegmatite, aplite and lamprophyre lithologies. This later granitic unit appears to have altered the units it intruded, and may be partially responsible for vein deposits of base and precious metals, beryl, and

fluorspar that are found in nearby areas to the west of the GRA. The Precambrian sequence is relatively well studied in this area and has been partially correlated with other areas of Colorado (Schwochow, 1979). In other parts of northwestern Colorado, the younger Precambrian is partially preserved, and consists of a thick section of clastic sediments. These lithologies represent a period of clastic deposition in a marine environment. The only area within the boundaries of the GRA where such an environment may have existed is along southern and western boundaries of the GRA, west of the Uncompahgre Uplift. From the seismic and drilling information that is currently available, it appears that the younger Precambrian units of this area were deposited in a deep, marine basin that persisted through Paleozoic time (Baars et al, 1981).

Approximately 1,700 million years before present in the Precambrian, there was a period of uplift and rift formation that set the stage for all subsequent events in southwestern Colorado (Baars et al, 1981). This event which caused the formation of a large and deep rift basin adjacent to the uplifted Uncompahgre Highland, and was caused by deep north-south compressional crustal forces (Baars, et al, 1981). With the formation of this deep basin, all sedimentation was restricted to the distant basin area, and the deformed and intruded Precambrian basement complex was subjected to erosion. Within the GRA, it is thought that this situation continued through Lower Jurassic time. It is thought that the Gunnison River Canyon area was the core of a topographic high that was finally eroded during the Lower Jurassic. During this entire period, the Precambrian units were shedding sediments to the southwest and east (Schwochow, 1979). Directly overlying the Precambrian are the Jurassic Summerville and Morrison Formations which were being deposited in near-shore lagoonal environments, or shallow water marine and fluvial systems. Some fresh water lacustrine and fresh water fluvial deposits have also been identified from these rocks. As in the Triassic section, mineral deposits are commonly found associated with limey sandstones, shales, and siltstones, deposited in shallow, neritic basins that have fluvial channels meandering through them. Copper-silver-uranium-vanadium mineralization occurs in these units as "roll-front" and organically precipitated "stream channel" deposits. "Roll-front" deposits are elongate concretionary structures encompassed by rich vein-like concentrations of uranium-vanadium bearing clay minerals. "Stream channel" deposits occur where uranium-vanadium waters encountered structural traps and clastic organic accumulations, depositing minerals in a reducing environment. Such mineral deposits are very important economically, and are known to occur throughout the GRA. These deposits are thought to have been emplaced in an environment similar to that of the present Lower Mississippi Basin. Fossil plant material from this period is indicative of a tropical environment that was adjacent to an active fluvial or lacustrine system.

During Cretaceous time, the area was the site of shallow water deposition in a lagoonal or swamp environment. The Lower Cretaceous Burro Canyon Formation appears to have been deposited in a series of meandering river systems with adjacent terrestrial lakes. The terrestrial, clastic nature of this formation is thought to be characteristic of a beach or littoral environment (Young, 1955). The Upper Cretaceous Dakota Sandstone unconformably overlies the Burro Canyon Formation, and was probably deposited on an irregular surface of Burro Canyon outcrops rather than a true erosion surface (Carter et al, 1965). Clastic portions of the Dakota are found as channel fillings in the Burro Canyon paleosurface. From fossil evidence, it appears that the lower sections of the Dakota were deposited in shallow basins

or stream channels with the source of the material being eroded masses of Pennsylvanian and Permian rocks (Carter et al, 1965). The carbonaceous shales of the Dakota are known to contain abundant plant remains, and were probably deposited in a near-shore swamp or lacustrine environment. Thin coal seams are known to exist within the Dakota and may have economic potential.

Units of the Cretaceous Mancos Shale have been described as being sandstone and shale units deposited in a near-shore environment. Thin coal beds may have some local economic significance. In the GRA proper, these units are represented by the carbonaceous units of the Mancos upper shale unit. The Mesaverde Group Cretaceous units crop out throughout the eastern portion of the GRA and represent a period of cyclical deposition of shale, coal, limestone and sandstone units in a near-shore marine environment adjacent to the deep-water basins where the bulk of the Mancos Shale unit was deposited (Richardson, 1909).

The Mesaverde Group units are unconformably overlain by the Tertiary Wasatch Formation. This unconformity may represent a period of uplift and erosion prior to the formation of the Uinta sedimentary basin.

GUNNISON GORGE WSA (CO-030-388)

Precambrian gneisses, schists and intrusive rocks are unconformably overlain by the Mesozoic section. The Younger Precambrian - Jurassic units were never deposited in the WSA, as the area is thought to have been a topographic high. Within the WSA there are no known occurrences of base or precious metal exhalite deposits. The Jurassic section directly overlies the Precambrian basement complex and is represented by the Summerville and Morrison Formations. These rocks are thought to represent near-shore lagoonal and shallow water marine conditions with periods of transgressive and regressive marine and lacustrine shorelines. Fluvial terrestrial and delta-floodplain deposits have also been identified from these rocks. The characteristic sandstone hosted roll-front copper-silver-uranium-vanadium deposits which occur in these lithologies and in other parts of Colorado have not been identified within these units in the WSA. An occurrence of uranium-vanadium mineralization has been reported in an area adjacent to the WSA, but has not been positively correlated to these lithologies.

The Cretaceous Burro Canyon Formation and Dakota Sandstone directly overlie the Jurassic section and represent periods of shallow water deposition in the lagoonal or swamp environment. In other areas of Colorado and Utah, the Lower Cretaceous section has produced oil and gas (Brainard, et al, 1962). The rest of the Cretaceous and Tertiary section has been eroded. Quaternary fluvial deposits are found along Gunnison Gorge and along the canyons that cut through the area.

Figures II-1 through II-6 illustrate the geology and physiography of the GRA.

FIGURE II-1

Looking at western flank of the WSA. Cretaceous Dakota overlying Jurassic Morrison and Precambrian.

BLACK CANYON

FIGURE II-2

Looking NW on western flank of Black Canyon of the Gunnison.

BLACK CANYON

FIGURE II-3
View of canyon
looking north.

BLACK CANYON

FIGURE II-4
Looking NW of Black
Canyon of the
Gunnison.

BLACK CANYON

FIGURE II-5
Prospect shaft within northern portion
of the WSA.

BLACK CANYON

FIGURE II-6
Mine workings west
of WSA. Light colored
sediments (?), uranium
(?). Validation cuts
for claims.

BLACK CANYON

SECTION III

ENERGY AND MINERAL RESOURCES

KNOWN MINERAL DEPOSITS

The known mineral deposits within the Gunnison Gorge GRA can be classified into three different categories: 1) coal, oil, and gas; 2) precious and base metals; and 3) sand, gravel, and industrial minerals.

In the first category, the coal, oil, and gas deposits consist of two coal mines, seventeen dry wells or abandoned locations, and two power plants. The MacGruder Mines and Tomahawk coal mines are located in T13S, R94W, sec. 15; and T49N, R9W, respectively (Overlay C and Appendix B). Both mines are active, however, no production statistics are available. In addition, the GRA contains the Tongue Mesa Field in the southern portion (Overlay C). The two power plants, the Nucla and Bullock Power Plants, are located in the town of Montrose, Colorado, and in T49N, R9W, section 23, respectively (Overlay C and Appendix B).

The base and precious metal deposits comprise the second category. The Iron Cap Mine, a past productive iron mine is located in the northwestern portion of the GRA (Overlay B). Although it is not a deposit, the Poughkeepsie Mill at T49N, R9W, section 28, is included here, as it is a copper-lead-zinc mill. Three past producers of gold are located in the GRA. These include the Dolores Placer, Red Canon, and placer deposits (T49N, R9W, sec. 28; T49N, R9W, T49N, R9W, sec. 28; respectively). The production statistics for all the previously mentioned deposits are unavailable.

The third category includes sand, gravel, and industrial minerals. The GRA includes eighteen inactive gravel or clay pits. There are two active gravel or clay pits, the Bingham Pit, and the North Fork Sand and Gravel and plant. These are located at T14S, R92W, sections 11 and 15, respectively. Most of these past and currently productive sand and gravel operations are located along the Gunnison River and its tributaries. The production statistics for the prior mentioned deposits are unknown. Though it is not a deposit, the Montrose Concrete Products plant, located in the town of Montrose, Colorado, is included since it is an active plant that uses the sand and gravel products. The industrial mineral deposit is the Dotty Mine, a past producer of gypsum at T15S, R93W, section 19 (Overlay D and Appendix B).

The following addresses the known mineral deposits within the Gunnison Gorge WSA.

GUNNISON GORGE WSA (CO-030-388)

There are no known mineral deposits in the Gunnison Gorge WSA.

KNOWN PROSPECTS, MINERAL OCCURRENCES, AND MINERALIZED AREAS

The prospects, occurrences, and mineralized areas in the Gunnison Gorge GRA are few. Approximately three-fourths of the GRA contains bituminous coal fields with

THE HISTORY OF THE
CITY OF BOSTON

From its first settlement in 1630 to the present time. By SAMUEL JOHNSON, Esq. of the Middle Temple, Barrister at Law. In three volumes. VOL. II.

THE first settlement of the English in Boston was made in 1630, by a company of Puritans, who had fled from the persecution of the Church of England in England. They were led by John Winthrop, who gave them the name of the City of Boston. The city was founded on a small island, and was at first a small village. It grew rapidly, and by 1680 it was one of the largest cities in New England. The city was the center of the Puritan movement, and it was here that the first American Revolution was fought. The city was the birthplace of many of the great men of the American Republic, and it was here that the first American Constitution was written. The city was the center of the American Revolution, and it was here that the first American Republic was founded. The city was the birthplace of many of the great men of the American Republic, and it was here that the first American Constitution was written. The city was the center of the American Revolution, and it was here that the first American Republic was founded.

less than 3000 feet of overburden (Overlay C and Appendix B). Six prospects of unknown commodities are indicated on the Black Ridge Quadrant topographic map (Appendix A) in T15S, R93W. In the western section of the GRA is mineralization which may contain uranium (Aerial photo 1-12n-6, Appendix A). In addition, two mineral prospects are indicated on Overlay D.

The following addresses the known prospects, mineral occurrences and mineralized areas of the Gunnison Gorge WSA.

GUNNISON GORGE WSA (CO-030-388)

The prospects in this WSA consist mostly of mineralized areas. The major north-south fault shown on Figure I-1 is almost wholly contained within the WSA. The field consultants have noted it as being mineralized, possibly for copper (Aerial photos 1-12n-8, 10, 12; Black Ridge Quadrant topographic map, both in Appendix A). In addition, a prospect shaft is noted within the extreme western border of the WSA (Black Ridge Quadrant, topographic map, Appendix A). The western border of the WSA also contains a small part of bituminous coal fields with less than 3000 feet of overburden (Overlay C). There are known gypsum prospects and occurrences in the WSA.

MINING CLAIMS, LEASES AND MATERIAL SITES

In the Gunnison Gorge GRA, there are 136 unpatented mining claims, of which, 129 are lode claims and 7 are placer claims (Overlay A). These claims are primarily located west of the Gunnison Gorge WSA. There are no major mining and/or exploration companies with claim holdings in this GRA. The unpatented claim data was compiled from the Bureau of Land Management's June 14, 1982, Geographic Index (Appendix C).

There are no patented mining claims existing within the GRA.

Research on leases was restricted to the WSA and the area surrounding the WSA. As of August 27, 1982, there were no leases in the vicinity of the WSA.

The following addresses the mining claims, leases, and material sites for the Gunnison Gorge WSA.

GUNNISON GORGE WSA (CO-030-388)

Approximately 16 unpatented lode claims and 1 unpatented placer claim are located within the Gunnison Gorge WSA (Overlay A). The lode claims are located in section 24, T50N, R9W (N.M.P.M.) and the placer claim is located in section 24, T15S, R94W (6th P.M.). Both of these sections are not wholly contained within the WSA. Since the Geographic Index only locates claims to within a quarter section, it can not be determined if all of the claims in the above mention sections are within the WSA (Appendix C). Researching the claim location notices recorded with the BLM, provide an accurate claim figure.

There are no patented claims, leases or material sites within the WSA.

MINERAL DEPOSIT TYPES

The deposit types in the Gunnison Gorge GRA include coal, precious and base metals, and sand, gravel, and clays.

The known coal deposits are located at the southwestern portion of the Grand Mesa Coal Field. The coal occurs in the Cretaceous Mesaverde Group, particularly, from youngest to oldest, in the Paonia Shale Member and the Bowie Shale Member. The Paonia Member is a fresh water facies lying unconformably on the Bowie, consisting of shale, some sandstone and coal. The Paonia coals contain up to eight persistent seams. The lower most seams are the most productive and persistent and attain a thickness of up to 7 feet. The Bowie Member is a marine-brackish-water facies composed of one coal bed, shales and massive sandstones. At the Rollins mine the Rollins sandstone is recognized as the base of the coal-bearing Mesaverde Group. The Rollins is a white cliff forming marine sandstone. Coal occurs above the Rollins Sandstone (Schwochow, 1978). Underlying the Rollins Sandstone unconformably at the Rollins mine is a tongue of the Mancos shale. The coal from the Grand Mesa Field is ranked as high-volatile C bituminous to sub-bituminous A. The GRA also contains the Tongue Mesa Field, an erosion remnant of the Mesaverde Formation. The coal beds are concealed for the most part by talus and vegetation. The coal is reported to be sub-bituminous B. The reserves have been estimated at 2,354.94 millions of tons (Yingst, 1960).

The precious and base metal deposits include a past productive iron mine, and placer deposits. No information was available on the formation from which the iron mine, The Iron Cap, produced. The placer deposits occur near Cedar Creek in the southwestern portion of the GRA. No information as to the source of these deposits was available.

The sand, and gravel deposits are a result of drainage patterns along the Gunnison River and its tributaries. Clays are known to occur in the Brushy Basin Member of the Morrison Formation, the Dakota Group and in the lower Mancos Shale. The Brushy Basin Member has yielded bentonitic clays; the Dakota Group and the Mancos Shale have yielded clays for nonrefractory uses.

GUNNISON GORGE WSA (CO-030-388)

As there are no known mineral deposit types in this WSA, any discussion would be basically theoretical.

MINERAL ECONOMICS

The inherent nature of discussing the economics of the minerals existing within the Gunnison Gorge GRA and its WSA can only provide for a general approach inasmuch as there are many economic factors that enter into the development of an ore body. These include access, market value, grade, transportation, recovery and extraction methods, etc., therefore, the discussion herein addresses the U.S. and Colorado demand and production status of each of the existing minerals in the WSA.

Mineral resources in the GRA include coal, precious and base metals, and sand, gravel, and clays.

Coal deposits occur in the Cretaceous Grand Mesa Coal Field, and Tongue Mesa Field. Two active coal mines are present in the GRA (No production statistics are available). Coal production for Colorado mines is currently at an all time high. Approximately 20,000,000 tons of high-grade low-sulphur coal was produced from open pit and underground operations (Colo. Div. Mines Rept., 1980; and Schwochow, 1978). The future looks encouraging for coal as more and more utilities are switching back to coal for power generation (Schwochow, 1978; Colo. Div. Mines Rept., 1980). Change in technology and improvements in combustion/distillation techniques will increase the demand for Colorado coal, and coal byproducts (Gentry, Personal Communication, 1982).

The precious and base metal deposits in the GRA consist of placer gold, and a past productive iron mine. Currently, a strong demand for precious metals exists in the U.S. and Colorado due to high prices. Production and demand for base metals, however, is down from past levels due to a general down-turn in the U.S. and world economy (Eng. and Mining Journal, Dec. 1982). Commodities such as iron are not being currently produced at a substantial profit by any of the major mining operations in Colorado (Eng. and Mining Journal, Dec. 1982; Carpenter, Personal Communication, 1982).

Sand, gravel and clays are considered to be "high place" industrial minerals (Eyde, Personal Communication). These minerals are of economic value only when the deposits are readily accessible, and in close proximity to a market.

The economic viability of the mineral resources of the Gunnison Gorge WSA is summarized as follows:

<u>WSA</u>	<u>Mineral Resources</u>	<u>Accessibility</u>	<u>Economic Potential</u>
Gunnison Gorge WSA (CO-030-388)	Coal	Poor	Poor
	Gypsum	?	?

SECTION IV

LAND CLASSIFICATION FOR GEM RESOURCES POTENTIAL

After thoroughly reviewing the existing literature and data base sources, MSME/Wallaby personnel plotted all known and documented mineral occurrences, mines, prospects, oil and gas fields, sand and gravel operations, processing facilities, mining claims, mineral leases, and the locations of anomalous geochemical samples from the National Uranium Resource Evaluation - Hydrological and Stream Sediment Reconnaissance - Airborne Radiometric and Magnetic Survey (NURE-HSSR-ARMS) programs. This plotted information and the data bases on each WSA was made available to a multi-faceted team of experts which made three successive evaluations of the GEM resource potential of each of the WSA's.

The team or panel of geological experts was comprised of:

Dr. Paul Gilmour: Base and precious metal deposits in western U.S. and Canada, expert on Precambrian mineral resources.

Mr. Ted Eyde: Base and precious metal deposits in western U.S., expert on industrial mineral resources.

Mr. Annan Cook: Base and precious metal deposits in western U.S., expert on porphyry deposits and mine evaluation.

Mr. Edward Heylmun: Oil, gas and oil shale deposits of western U.S.

Dr. Robert Carpenter: Mineral deposits of Colorado and western U.S., expert on geology of Colorado.

Dr. Donald Gentry: Expert in coal and oil shale deposits of Colorado and western U.S.

Dr. Larry Lepley: Expert in remote sensing and geothermal resources.

Mr. Walter E. Heinrichs: Geophysics and base and precious metal deposits of western U.S., expert on porphyry copper deposits.

As indicated earlier, Dr.'s Gilmour and Gentry, and Mr. Ted Eyde made certain field investigations as result of the base data analysis phase. The purpose of the field investigations was to either verify the existing data or assess relatively unknown areas. Dr. Lepley reviewed all aerial photographs for observable anomalies, which were then investigated by the field team, or verified against the existing base data.

The evaluations were then made on the basis of examination of the data bases, field investigations and the individual experiences of the members of the panel in such areas as base and precious metal, industrial and energy mineral deposits; oil and gas deposits; and geothermal resources. In the course of these evaluations, every

attempt was made to objectively rate the potential for a particular commodity within the respective study area. In this effort, the evaluation criteria proposed by the Bureau was rigorously used. The classification scheme used is shown in Table IV-1. In many cases the lack of information did not allow for a full determination of the GEM resource potential and the panel was forced to leave some areas unranked or classified for some commodities. The situation thus arises where there is an area that has been unclassified for a commodity, despite a reported occurrence, because it is next to an area where there is insufficient data to make a meaningful attempt at classification. Nonetheless, each resource has been additionally rated as to what level of confidence the panel of experts attached to the selected classification level. This is denoted by the letter associated with each rate classification. These are defined in Table IV-1.

A further restraint on this classification and delineation effort comes in the area of the lack of subsurface information. Some areas are very well known from past exploration efforts and have an abundance of subsurface information. Other areas are practically unknown due to an absence of any past exploration or development efforts.

The WSA, for the most part, is not well known geologically. For this reason, our expert team had to extrapolate geologic information from adjacent areas to make any sort of reasonable classification with some level of confidence. The following pages address those resources considered to be leasable, locatable and/or salable with associated maps locating the resource area (Figures IV-1 through 3):

TABLE IV-1
RESOURCE RATING CRITERIA

CLASSIFICATION SCHEME

1. The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.
2. The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.
3. The geologic environment, the inferred geologic processes, and the reported mineral occurrences indicate moderate favorability for accumulation of mineral resources.
4. The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

LEVEL OF CONFIDENCE SCHEME

- A. The available data are either insufficient and/or cannot be considered as direct evidence to support or refute the possible existence of mineral resources within the respective area.
- B. The available data provide indirect evidence to support or refute the possible existence of mineral resources.
- C. The available data provide direct evidence, but are quantitatively minimal to support or refute the possible existence of mineral resources.
- D. The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

LEASABLE RESOURCES

GUNNISON GORGE WSA (CO-030-388)

<u>Resource</u>	<u>Classification</u>	<u>Comments</u>
Oil & Gas	2B	Lack of favorable section.
Coal	3C	Coal members present in the Cretaceous Dakota.
Geothermal	2B	Unknown potential.

LEGEND FOR MINERALS MANAGEMENT SERVICE CLASSIFICATIONS

Defined KGS and/or Coal Leasing Areas

Areas Prospectively Valuable for Sodium or Potassium

Defined Oil Shale Leasing Area

Areas Identified as Prospectively Valuable for Coal or Oil, Gas

Coal [NPV]
OG [NPV]

Areas Identified as Not Being Prospectively Valuable for Coal, or Oil, Gas

LOCATABLE MINERALS

GUNNISON GORGE WSA (CO-030-388)

<u>Resource</u>	<u>Classification</u>	<u>Comments</u>
Precious Metals	2B	Au, Ag mineralization potential associated with Precambrian felsic volcanics and sediments.
	3B	Placer Au associated with Quaternary alluvium.
Base Metals	3B	Pb, Zn, Cu mineralization potential associated with N-S fault zone. No known production, prospect.
	2B	Pb, Zn, Cu mineralization potential associated with Precambrian felsic volcanics and sediments.
Locatable Energy Minerals	3B	Uranium-Vanadium potential associated with Cretaceous. Dakota Formation.
Other Locatable Minerals Gypsum	3B	

SALABLE RESOURCES

GUNNISON GORGE WSA (CO-030-388)

<u>Resource</u>	<u>Classification</u>	<u>Comments</u>
Dimension Stone	4D	The Junction Creek Formation may contain favorable units. The economic potential is, however, rated low.
Mica, Feldspar, Quartz	2B	Derived from Precambrian pegmatites.

MONTROSE

R 93 W

R 94 W

T 15 S

T 51 N

T 50 N

*Black Canyon
of the
Gunnison Wilderness Area*

0 1 2 3 4 5 Miles

LOCATABLE RESOURCES
Figure IV-2

(After BLM, 1980)

Vertical text or markings along the right edge of the main rectangular frame.

Vertical text or markings along the far right edge of the page.

SECTION V

RECOMMENDATIONS FOR FURTHER STUDY

In the course of analyzing, assessing and evaluating each of the WSA's in the Gunnison Gorge GRA - both in the field and in available data - certain unknowns were uncovered that should be investigated in order that each WSA's GEM resources be more fully documented. This section recommends the type of studies and data gathering that should be made to inventory more completely each WSA.

GUNNISON GORGE WSA (CO-030-388)

In this area the potential for GEM resources is largely unknown. Detailed geologic and geochemical studies are warranted to ascertain the mineral potential of the Precambrian lithologies. Special attention should be paid to possible sedimentary and felsic lithologic assemblages associated with Precambrian base and precious metal exhalite systems. Stratigraphic and lithofacies mapping should be carried out to determine if any environments with favorable depositional characteristics exist. A relatively low-cost way to accomplish these goals is to conduct a stream sediment and outcrop sampling program in conjunction with a geologic mapping effort.

All existing mines, prospects and known mineral occurrences should be mapped and thoroughly sampled to delineate the full extent of the existing mineralization and the potential of the host lithologies. This is of particular importance in the determination of the base and precious metal potential of the Precambrian and the coal potential of the Cretaceous Dakota Formation. With regards to these specific units, a detailed study should be made of facies changes within these units, and the correlations with other units in western Colorado and eastern Utah. In other areas these units have significant potential GEM resources and thus, should be studied in this area where there is little available information. Though the airborne and ground NURE-HSSR-ARMS information does not delineate any areas with anomalous values, ground radiometrics in conjunction with the geological-geochemical would be helpful in identifying any areas of mineral potential.

A detailed program of geologic mapping and sampling should be carried out to fully delineate the extent of the coal bearing horizons in the Cretaceous section. Any sampling carried out under such a program must include analysis of the coal material for the ash and sulphur content as well as BTU content.

Stream sediment samples should be analyzed for their copper, molybdenum, lead, arsenic, uranium, vanadium and gold content. This data will supplement the existing National Uranium Resource Evaluation - Hydrologic Stream Sediment Reconnaissance information.

Since some of the Jurassic have been used in the past as a local source of gypsum, it would be wise to do further work on the demand for this material.

In conclusion, from the work to date and the material compiled in the course of this project, it appears that the potential for GEM resources in this area is largely unknown. It is recommended that this area receive further extensive study. (For further detailed discussion of the potential thought to exist within the WSA, see Section IV).

SECTION VI

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