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GEOLOGICAL SURVEY

Mineral resource potential of National Forest RARE II and wilderness areas in Colorado

Compiled
By

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ILLUSTRATIONS

INTRODUCTION

Information on the mineral and energy resource potential of National Forest lands and National Grasslands in Colorado, that have been, or are being, considered for inclusion in the National Wilderness Preservation System, has been compiled to provide a state-wide overview. This compilation includes data from a variety of sources. Where available, the primary source has been published reports by the U.S. Geological Survey and the U.S. Bureau of Mines prepared in response to the Wilderness Act (PL88-577) of 1984, which required a survey of the mineral resources and an evaluation of the mineral resource potential of lands to be included in the Wilderness System. Many areas in Colorado lack such surveys; therefore, information from other published and unpublished reports was used, as well as informal communications from U.S. Geological Survey geologists, principally Bruce Bryant, Ed DeWitt, Charles W. Spencer, and Alan R. Wallace. Constructive comments were made by Alfred L. Bush, Mary H. Miller, Barbara Nevins, Richard B. Taylor, and Ronald G. Worl. Any errors are the responsibility of this author.

The areas discussed are those listed in a report by the U.S. Forest Service, dated January 1979, entitled "Final environmental statement, roadless area review and evaluation (RARE II)." Since 1979, either parts or all of many RARE II areas have been converted to wilderness status. These changes, current through 1984, are noted both in the text and on Plate 1.

This report includes a text on each area (or group of areas) that gives a brief description of the status of work, the location and geology, the potential for mineral and energy deposits, and a list of pertinent references. A number of references were used in evaluating all areas and, instead of citing them each time, they are listed below. Mineral and (or) energy resource potential of each area is indicated on Plate 1 (scale, 1:1,000,000). The areas have been divided into two groups: (1) areas that have been covered by a mineral survey as mandated by the Wilderness Act, and (2) areas whose mineral potential has been determined from other geologic studies. Persons who need more detailed information are encouraged to refer to the listed references, as Plate 1 necessarily provides only generalized information.

Assignments of mineral resource potential, both in the text and on the map, are stated as high, moderate, low, or unknown, after Goudarzi (1984). Terrane can be classified as either favorable or unfavorable for the occurrence of mineral and (or) energy resources based on geologic environments, defined in terms of geological, geochemical, and geophysical characteristics. Geologic terranes that are considered unfavorable have low potential for the occurrence of resources (deposits). Terranes that are regarded as favorable have either moderate potential or high potential for the occurrence of resources. Resources do not have to be identified for an area to be assigned a high resource potential; however, evidence indicating that mineral forming processes were active in at least part of the area is required.

The study areas are arranged in numerical order within the national forest in which they occur. The national forests are arranged in alphabetical order. Some study areas occur in two national forests. These areas will be listed in both national forests but described in only one of them. Many study areas that share a common geologic and geographic setting are grouped together for convenience. Because of this grouping some areas will appear in the report out of their numerical order.

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GRAND MESA, GUNNISON, UNCOMPAHGRE NATIONAL FORESTS
ELK MOUNTAINS-COLLEGIATE (2-180)
COLLEGIATE PEAKS WILDERNESS (NF-180)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Parts of this area have been incorporated into the Snowmass-Maroon Bells Wilderness (NF-047) and into the Collegiate Peaks Wilderness (NF-180).

Mining districts, mines, and mineral occurrences

The study area is located in the Central Colorado Rockies. It stretches from the eastern flank of the Sawatch Range near the Arkansas River west to Crested Butte and north to Aspen, encompassing parts of the Sawatch Mountains, the Elk Mountains, and Taylor Park.

The study area is within the Colorado Mineral Belt. The area's eastern part, the Collegiate Peaks Wilderness, is in the Sawatch Range, and is composed of Precambrian granites and gneisses, minor amounts of Paleozoic and Mesozoic sedimentary rocks preserved in fault blocks, and some Tertiary granites. Tertiary volcanics of the Grizzly Peak caldera underlie the north-central part of the Collegiate Peaks Wilderness. The western part of the Elk Mountains-Collegiate study area is underlain by Late Paleozoic and Mesozoic sedimentary rocks and Tertiary granites with some minor exposures of Precambrian granites and gneisses (Bryant, 1970, 1971; Tweto and others, 1976, 1978; Brock and Barker, 1972). There are numerous mines and mining districts within and adjacent to the Collegiate Peaks Wilderness and Elk Mountain-Collegiate study area. The Cottonwood district southwest of Mt. Yale in the southern part of the Collegiate Peaks Wilderness contains small veins of silver, lead, and gold in Precambrian granites and schists. Veins bearing silver, lead, zinc, and gold also occur in Silver Creek near Mt. Yale (Vanderwilt, 1947; Heyl, 1964). The Cottonwood Hot Springs is along Cottonwood Creek near the base of Mt. Yale in the southeastern corner of the Collegiate Peaks Wilderness (Pearl, 1980). The Riverside district near Mt.

Harvard produced gold, silver, copper, and lead from veins in Precambrian granite cut by Tertiary dikes, and in Magdelane Gulch near Mt. Harvard in the wilderness area there are silver-, gold-, lead-, and copper-bearing veins. Placer gold deposits occur just east of the Collegiate Peaks Wilderness area in Lost Canyon on Cache Creek (Vanderwilt, 1947). Near Taylor Park on the west slope of the Sawatch Range placer gold deposits occur along Illinois Creek (Ed DeWitt, personal commun., 1985). The LaPlata district near Winfield in the center of the Collegiate Peaks Wilderness produced silver, gold, copper, and lead from veins associated with Tertiary intrusive rocks; molybdenum is also present but was never produced. Veins bearing gold, silver, copper, lead, zinc, molybdenum, and uranium occur north of Winfield in the wilderness area. Molybdenum is also present northwest of Winfield near La Plata Peak (Vanderwilt, 1947; Ed DeWitt, personal commun., 1985). The Twin Lakes district in the northern part of the Collegiate Peaks Wilderness has produced gold, silver, lead, and zinc from veins in Precambrian granites and schists, and in Tertiary volcanic and intrusive rocks. The Lincoln Gulch district is just west of the Twin Lakes district and has produced silver, gold, lead, and zinc from vein deposits (Vanderwilt, 1947; Heyl, 1964). Molybdenum is present in both Precambrian rocks and in Tertiary volcanic rock in the Lincoln Gulch district and at Red Mountain between the Lincoln Gulch district and the Twin Lakes district (Ed DeWitt, personal commun., 1985). The Independence district north of the Collegiate Peaks Wilderness has produced gold and silver from veins in Precambrian granites adjacent to the Grizzly Peak caldera (Vanderwilt, 1947). Near Taylor Pass in the Elk Mountains-Collegiate study area iron has been produced from a contact metamorphic magnetite deposit (Bryant, 1979). Molybdenum occurs at Tellurium Lake east of Taylor Pass (Ed DeWitt, personal commun., 1985). Gold and copper are present in shear zones in Precambrian gneisses at Gold Hill northwest of Taylor Pass (Bryant, 1979). The Dorchester district southeast of Taylor Pass and near Taylor Park has produced lead, zinc, silver, and gold from veins in Precambrian granites and Paleozoic carbonates (Vanderwilt, 1947). In the western part of the Elk Mountains-Collegiate study area lead, zinc, silver, gold, and lapis lazuli have been produced from veins and replacement deposits in the tactites of North Italian Mountain (Vanderwilt, 1947). A porphyry molybdenum deposit occurs here also (Ed DeWitt, personal commun., 1985). Near Brush Creek in the western part of the Elk Mountains-Collegiate study area there are gold-, silver, lead-, zinc-, and uranium-bearing veins (Bryant, 1979; Nelson-Moore and others, 1978). There are two warm springs along Cement Creek adjacent to the southwestern corner of the Elk Mountains-Collegiate study area (Pearl, 1980). West of the Elk Mountains study area the Ashcroft district has produced gold, silver, lead, and zinc from vein and replacement deposits in Paleozoic carbonates adjacent to Tertiary intrusions (Bryant, 1979). Northwest of the Elk Mountains-Collegiate study area the Aspen district has produced significant amounts of silver, lead, and zinc from vein and replacement deposits in Paleozoic carbonate rocks (Heyl, 1964; Bryant, 1979). Uranium is also associated with these ore deposits in Aspen, but has not been produced (Nelson-Moore and others, 1978).

Commodities

Molybdenum, silver, gold, lead, zinc, geothermal water.

Mineral and energy resource potential

There is a high potential for gold, silver, lead, and zinc vein deposits in the north-central part of the Collegiate Peaks Wilderness in Lincoln Gulch and east of Red Mountain (A) (letters refer to localities shown on plate 1), and a moderate potential at Cottonwood Creek (B), Silver Creek (C), and Magdelane Gulch (D), in the southern part of the wilderness, at Winfield (A) in the central part of the wilderness, near Independence (F) in the northern part of the wilderness, and at Gold Hill (G) and Brush Creek (H) in the western part of the wilderness and the Elk Mountains-Collegiate study area, respectively. There is a high potential for molybdenum in the north-central part of the Collegiate Peaks Wilderness near Winfield (E), west of La Plata Peak (I), near Red Mountain (A), in the western part of the Elk Mountains-Collegiate study area at North Italian Mountain (J), and a moderate potential in the western part of the Collegiate Peaks Wilderness at Tellurium Lake (K). There is a moderate potential for placer gold in Illinois Creek (L) near Taylor Park. There is a moderate potential "for the discovery and development of local sources of low temperature (<90°C) water" (Pearl, 1980) at Cottonwood Hot Springs (M) in the southeastern part of the Collegiate Peaks Wilderness, and at Cement Creek (N) in the southwestern part of the Elk Mountains-Collegiate study area.

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ELK MOUNTAINS-COLLEGIATE (2-180)
MAROON BELLS-SNOWMASS WILDERNESS (NF-047)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of the Elk Mountains-Collegiate study area have been incorporated into the Maroon Bells-Snowmass Wilderness (NF-047).

Mining districts, mines, and mineral occurrences

This area is located in the Elk Mountains near Aspen, in the Central Colorado Rockies. The wilderness area is underlain primarily by Paleozoic and Mesozoic sedimentary rocks that formed a large anticline plunging to the northwest. These rocks have been intruded by mid-Tertiary granodioritic stocks, dikes, and sills. The southern third of the wilderness area is in the Colorado Mineral Belt.

No mines are located within the wilderness area, but several mines and mining districts exist adjacent to it. Significant quantities of silver, lead, and zinc were produced in the Aspen district north of the wilderness and at Ashcroft just east of it. Silver, lead, and zinc have been produced from the Montezuma mine on the east boundary of the Maroon Bells-Snowmass Wilderness. Coal has been produced from the Holgate mine just west of the Maroon Bells-Snowmass Wilderness. Silver, lead, zinc, and minor amounts of molybdenum and copper occur in mineralized fractures and veins in many localities around the White Rock stock and adjacent areas in the southern third of the wilderness, and at one locality adjacent to the Mt. Sopris pluton in the northwest part of the wilderness. Geophysical and geochemical data as well as the presence of minor molybdenum and copper in Conundrum and Maroon Creeks suggest possible molybdenum porphyry deposits below the surface in these areas. Coal-bearing formations occur in the western corner of the wilderness area (Freeman and others, in press).

Commodities

Coal, molybdenum, silver, lead, zinc, copper.

Mineral and energy resource potential

There is a high mineral potential for silver, lead, and zinc in veins for the area adjacent to the Montezuma mine in the southeast corner (R) and adjacent to the Mt. Sopris Pluton in the northwest corner (S) of the wilderness area. A high potential for disseminated molybdenum and copper exists at Conundrum and Maroon Creeks in the southern part of the wilderness (T). A high potential for coal occurs in the western corner of the wilderness

(U). Several scattered areas of moderate mineral potential for silver, lead, and zinc occur throughout the southern third of the wilderness (V).

References

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OH-BE-JOYFUL (2-181)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines and mineral occurrences

The study area is northwest of Crested Butte in the Ruby-Anthracite Mountains in the Central Colorado Rockies. The study area is underlain by Cretaceous and Tertiary sedimentary rocks that have been intruded by dikes, sills, and stocks of Oligocene and Miocene dioritic to granitic rocks. Almost the entire study area is mineralized, and it is considered part of the Ruby-Irwin mining district. Silver has been produced from the northern and western part of the study area in Democrat and Peeler basins. Silver, gold, lead, and zinc have been produced from mines in Redwell basin adjacent to the southeast border of the study area. In recent years stockwork molybdenum deposits have been discovered and delineated in this same area. Silver, gold, lead, and zinc have been produced from the Augusta mine just north of the study area. Silver, lead, and zinc have been produced from the Independence vein and the Scarp vein in the southwestern part of the study area. Coal has been produced from the Crested Butte mining district just east of the study area (Ludington and Ellis, 1983).

Commodities

Molybdenum, silver, lead, zinc, coal.

Mineral and energy resource potential

There is a high potential for silver, lead, zinc, and molybdenum deposits in the southern, southeastern, and northwestern parts of the study area. There are significant proven molybdenum reserves southeast of the study area that extend slightly into the area. There is a high potential for coal deposits in all of the study area except the central part. There is a moderate potential for silver, lead, zinc, and molybdenum deposits in the central part of the study area.

References

Ludington, Steve, and Ellis, C. E., 1983, Map showing geology and mineral resource potential of the Oh-Be-Joyful wilderness study area, Gunnison, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1582A, scale 1:24,000.

RAGGED MOUNTAIN WILDERNESS (NF-181)
RAGGEDS (2-181)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Ragged Mountain Wilderness area (2-181).

Mining districts, mines, and mineral occurrences

The wilderness area lies within the Colorado Mineral Belt east of McClure Pass and contains much of the Ruby-Anthracite mountains. Precambrian crystalline rocks, Paleozoic, Mesozoic, and Tertiary sedimentary rocks and numerous Tertiary intrusive rocks of several different magmatic episodes crop out in the study area (Gaskill and Godwin, 1966a, 1966b; Gaskill and others, 1967; Godwin, 1968; Mutschler, 1970). The area contains the proposed Oh-Be-Joyful Wilderness area (Ludington and Ellis, 1983) and the Ruby-Irwin mining district, which has been addressed in another section of this report (see pages 9 and 10). Adjacent to the proposed Oh-Be-Joyful Wilderness area and within the Ragged Mountain wilderness area is the Tertiary Augusta stock and its associated mineralization. Silver, lead, and zinc have been produced from several mines here, and molybdenum is also present. Several mines in the Crystal mining district, in the northeastern part of the wilderness area, have produced silver, lead, zinc, and copper from vein deposits associated with the granitic intrusive rocks in the center of the Treasure Mountain Dome (Vanderwilt, 1947). Molybdenum occurs here also, although there has been no production (Mutschler and others, 1981). Marble has been produced from a quarry adjacent to the wilderness area near the town of Marble, and considerably more marble occurs within the study area. There is no mineralization known to be associated with the Miocene laccoliths of Ragged Mountain or Marcellina Mountain (Mutschler and others, 1981). In the adjacent Elk Mountain mining district near Gothic, the occurrence of silver, copper, lead, and zinc is widespread, but the veins are small and there has been only minor production (Vanderwilt, 1947). The wilderness area lies adjacent to and between the coal mining districts of Crested Butte and Carbondale, both of which produced coking and noncoking coal from the Late Cretaceous age lower Mesaverde Formation, which crops out in the middle of the wilderness area in the Anthracite Creek Basin and around the flanks of Ragged Mountain (Landis, 1959; Ladwig, 1981).

Commodities

Silver, lead, zinc, copper, molybdenum, coal, marble.

Mineral and energy resource potential

There is a high potential for silver, lead, zinc, copper, and molybdenum deposits, and marble in the area of Treasure Mountain dome in the northeastern part of the wilderness area, and a high potential for deposits of the same metals at Augusta Mountain in the east-central part of the wilderness area. A moderate potential for silver, lead, and zinc deposits occurs in the southern part of the wilderness adjacent to the Irwin mining district. There is a high potential for coal deposits in the central part of the wilderness, surrounded by Marcellina Mountain, Ragged Mountain, and the Ruby Range, and on the east and west flanks of Ragged Mountain.

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DRIFT CREEK (2-182)
PERHAM CREEK (2-183)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located east of Grand Mesa and Battlement Mesa in west-central Colorado. The Tertiary Wasatch Formation crops out in the western portion of the study areas; Mesozoic and late Paleozoic age formations are exposed in the eastern portions of the study areas (Tweto and others, 1978). A few miles east of the Perham Creek study area, on the south side of Mt. Sopris, silver, lead, zinc, and copper are present in sedimentary rocks adjacent to the Mt. Sopris pluton. There has been minor production here, but mineral occurrences do not continue into the study areas (Vanderwilt, 1947; Freeman and others, in press). The Drift Creek and Perham Creek study areas are within the Uinta coal region, and coal beds of the Mesaverde Formation, which occur in the middle and western parts of both study areas, produce coking and noncoking coal. The study areas lie outside that part of the Uinta Basin that is inferred to be favorable for the production of methane from coal-bearing formations (Tremain and others, 1981). There are no known natural gas fields in or near the study areas (Del Rio, 1960).

Commodities

Coal.

Mineral and energy resource potential

There is a high potential for coal deposits in the central portions of both study areas where coal beds of the Mesaverde Formation crop out. There is a high potential for coal deposits in the northwestern corner of the Perham Creek study area where the Mesaverde Formation is at or near the surface; and a moderate potential for coal in the western part of Perham Creek area and the southern part of the Drift Creek area where the Mesaverde Formation occurs at shallow depths beneath the Wasatch Formation.

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Tweto, Ogden, Moench, R. H., and Reed, J. J., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 70, 98, plate 4.

SPRINGHOUSE PARK (2-184)
ELECTRIC MOUNTAIN (2-185)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located northwest of Somerset on Buck Mesa in west-central Colorado. The Tertiary Wasatch Formation lies at the surface of both study areas (Tweto and others, 1976; 1978). There are no known radioactive mineral occurrences or metallic mineral deposits in or near the study areas (Vanderwilt, 1947; Nelson-Moore and others, 1978). The areas lie within the Uinta coal region, and the Somerset coal fields, adjacent to the Springhouse Park study area on the south, produce coking coal from the Mesaverde Formation, which lies at shallow depths in both study areas (Landis, 1959; Murray, 1981). The coals in this region are not considered favorable for the production of methane (Tremain and others, 1981). There is no known oil or gas production in or near the study areas (Sanborn, 1981).

Commodities

Coal.

Mineral and energy resource potential

A high potential for coal deposits occurs in the Springhouse Park area where it adjoins the Somerset coal fields, and a moderate potential for coal exists for the rest of the area and for the Electric Mountain study area. The potential for natural gas is not known, but is assumed to be low because canyons have breached the gas producing formations near the study areas.

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Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 70, 98, plate 4.

CLEAR CREEK (2-186)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

In this study area in the high mesas northeast of Grand Mesa in west-central Colorado, Tertiary Wasatch and Cretaceous Mesaverde Formations are exposed at the surface (Tweto and others, 1978). The area lies within the Uinta coal region and is adjacent to, and partly within, the Carbondale coal mining district. Coking and noncoking coal are produced in the district from the Mesaverde Formation, which crops out in the eastern portion of the study area (Landis, 1959; Murray, 1981). The northwestern part of the study area is within the part of the Uinta Basin that is inferred to be favorable for the production of methane from coal-bearing formations (Tremain and others, 1981). The northern part of the study area is adjacent to the Divide Creek gas field (Del Rio, 1960; Sanborn, 1981).

Commodities

Coal, methane, natural gas.

Mineral and energy resource potential

There is a high potential for coal deposits in the eastern part of the study area, which is in the Carbondale coal mining district. A high potential exists for natural gas in the northernmost part of the study area adjacent to the Divide Creek gas field. The rest of the study area has a moderate potential for coal and natural gas.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 595-623.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 147-148.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-265.

Tremain, C. M., Boreck, D. L., and Kelso, B. S., 1981, Methane in Cretaceous and Paleocene coals of western Colorado: in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 241-248.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

HIGHTOWER (2-189)

(see description with Baldy Mountain (2-187) and Horse Park (2-188) under White River National Forest)

PRIEST MOUNTAIN (2-191)
SALT CREEK (2-192)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are in the high mesas east of Grand Mesa in west-central Colorado where the Tertiary Green River and Wasatch Formations crop out. There are minor outcrops of basalt flows and dikes (Tweto and others, 1978).

The area lies within the Uinta coal region. The Grand Mesa coal fields lie just west of the Priest Mountain study area, and the Somerset coal field, which produces good coking coal, lies a few miles to the southeast. Both fields produce coal from the Mesaverde Formation, which occurs at depth in both study areas (Landis, 1959; Murray, 1981). The coal in this part of the Uinta coal region is not considered favorable for the production of methane (Tremain and others, 1981). The Salt Creek study area adjoins the Buzzard gas field and is near the Plateau gas field (Del Rio, 1960; Sanborn, 1981).

Commodities

Coal, natural gas.

Mineral and energy resource potential

There is a moderate potential for coal deposits, some of it possibly suitable for coking, beneath both study areas, with a high potential for coal in the southern part of the Priest Mountain area. There is a moderate potential for natural gas beneath both study areas.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 595-623.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-147.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado; in Epis, R. C., and Callender, J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-265.

Tremain, C. M., Boreck, D. L., and Kelso, B. S., 1981, Methane in Cretaceous and Paleocene coals of western Colorado; in Epis, R. C., and Callender J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 241-248.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

BATTLEMENT MESA (2-193)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area encompasses most of Battlement Mesa located in west-central Colorado. The mesa is underlain by flat lying Tertiary sedimentary rocks of the Uinta, Green River, and Wasatch formations and very minor amounts of overlying Pliocene basalt (Cashion, 1973; Tweto and others, 1978). The Grand Hogback coal fields lie 15 to 20 miles to the north and the Grand Mesa coal fields lie 10 to 15 miles to the south, but no coal-bearing formations crop out in the study area (Landis, 1959; Murray, 1981). Battlement Mesa lies within the Uinta coal region and formations that are known to contain persistent coal beds occur at depths less than 3,000 ft. Some studies indicate that these formations are potential producers of methane (Tremain and others, 1981). The study area is near the Rulison, Sheep Creek, and Coon Hollow natural gas fields, though structures favorable for gas are not evident within the study area (Del Rio, 1960; Sanborn, 1981).

Commodities

Coal, methane, natural gas.

Mineral and energy resource potential

There is a moderate potential for coal deposits at depths less than 3,000 ft in the study area, and a moderate potential for methane and natural gas throughout the study area. Although favorable structures are not apparent, stratigraphic traps for methane and natural gas may exist.

References

Cashion, W. B., 1973, Geologic and structural map of the Grand Junction quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-736, scale 1:250,000.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 595-623.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-146.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado; in Epis, R. C., and Callender, J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-265.

Tremain, C. M., Boreck, D. L., and Kelso, B. S., 1981, Methane in Cretaceous and Paleocene coals of Western Colorado; in Epis, R. C., and Callender, J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 241-248.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jrs., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

NICK MOUNTAIN (2-194)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Nick Mountain study area is in the northwestern part of Grand Mesa in west-central Colorado, and consists of Pliocene basalt flows overlying Tertiary- and Mesozoic-age sedimentary rocks. Quaternary talus deposits overlie these rocks over much of the study area (Cashion, 1973; Cole and Sexton, 1981). The study area lies within the Uinta coal region and is north of the Grand Mesa coal mining district, which occurs on the south and west side of Grand Mesa (Landis, 1959; Murray, 1981). Formations that are known to contain persistent coal beds south and northeast of the study area occur at depth in the Nick Mountain study area.

Commodities

Coal, natural gas, methane.

Mineral and energy resource potential

A high potential exists for coal deposits at depths less than 3,000 ft in the study area, and there is a moderate potential for methane and natural gas.

References

Cashion, W. B., 1973, Geologic and structure map of the Grand Junction quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-736, scale 1:250,000.

Cole, R. D., and Sexton, J. L., 1981, Pleistocene surficial deposits of the Grand Mesa area, Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 121-126.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-146.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado in Epis, R. C., and Callender, J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-265.

Tremain, C. M., Boreck, D. L., and Kelso, B. S., 1981, Methane in Cretaceous and Paleocene coals of western Colorado: in Epis, R. C., and Callender, J. F., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 241-248.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 141, Plate 4.

KANNAH CREEK (2-195)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Kannah Creek study area is in the southwestern part of Grand Mesa in west-central Colorado, where Pliocene basalt flows overlie Tertiary and Mesozoic sedimentary rocks (Cole and Sexton, 1981). North of the study area the Grand Mesa coal fields lie on the north and west flank of Grand Mesa and produce coal from six to eight fairly persistent horizons in the Mesaverde Formation (Landis, 1959: Murray, 1981). This formation crops out in the study area and may contain minable coal in the area (Williams, 1964).

Commodities

Coal.

Mineral and energy resource potential

The study area has a high potential for coal from the Mesaverde Formation in a sinuous north-trending zone in the central part of the area.

References

Cole, R. D., and Sexton, J. L., 1981, Pleistocene surficial deposits of the Grand Mesa area, Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 121-126.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-146.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

WEST ELK (2-196)
BEAVER-CASTLE (2-198)
WEST ELK WILDERNESS (NF-089)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of the study areas have been incorporated into the West Elk Wilderness (NF-089).

Mining districts, mines, and mineral occurrences

The study areas and wilderness area are in the West Elk Mountains northwest of Gunnison in the central Colorado Rockies. In the southern half of the wilderness and study areas Oligocene volcanic and related intrusive rocks of the West Elk volcanic center are present at the surface. The northern half of the wilderness and the study areas are underlain by Mesozoic- and Tertiary-age sedimentary rocks that have been intruded by numerous Tertiary porphyritic stocks. The wilderness and study areas are transected by a major fracture zone that extends into mineralized fractures in the nearby Ruby-Irwin mining district (Gaskill and others, 1981). There are no active mines within the wilderness and study areas but there are inactive mines and mining districts in or near the wilderness areas. Modest amounts of gold, silver, copper, lead, and zinc have been produced from nearby Ruby-Irwin mining district northeast of the West Elk wilderness. Coal was produced from the Mosely mine in the northwestern part of the West Elk study area. Many unpatented mining claims exist within the wilderness and study areas, but there has been no other production. Formations with known persistent coal beds occur extensively in the northwestern part of the West Elk study area and West Elk wilderness, and to a lesser extent in the eastern part of the Beaver-Castle study area. Geochemical and geophysical data and rock alteration studies indicate potential for molybdenum, copper, lead, zinc, silver, and gold at Sheep Mountain in the western part of the West Elk study area, at the West Elk volcanic center near the south-central part of the West Elk wilderness area, and at Coal Mountain and Lands End in the western part of the West Elk study area (Gaskill and others, 1977).

Commodities

Coal, molybdenum, lead, zinc, copper, gold, silver.

Mineral and energy resource potential

A high potential for coal deposits exists for much of the northwestern part of the West Elk wilderness area and northeastern part of the West Elk study area (A), and along Mill Creek in the eastern part of the Beaver-Castle study area (B). There is a high potential for molybdenum, copper, lead, zinc, gold, and silver deposits at Sheep Mountain in the west-central part of the West Elk study area (C). There is a moderate potential for the same deposits at the West Elk volcanic center in the central part of the West Elk wilderness area (D), as well as at Lands End in the far western part of the West Elk

study area (E). Other energy and mineral deposits are unknown and their potential is regarded as low.

References

Gaskill, D. L., Mutschler, F. E., and Bartleson, B. L., 1981, West Elk volcanic field, Gunnison and Delta Counties, Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 305-316.

Gaskill, D. L., Rosenbaum, J. G., King, H. D., Meenes, H. C., and Bieniewski, K. L., 1977, Mineral resources of the West Elk Wilderness and vicinity, Delta and Gunnison Counties, Colorado: U.S. Geological Survey Open-File Report 77-751.

GOTHIC MOUNTAIN (2-199)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

In the study area, which lies within the Colorado mineral belt near Crested Butte in the central Colorado Rockies, Tertiary granodiorite laccoliths intrude the Cretaceous Mancos Formation (Godwin and Gaskill, 1964). The northeastern part of the study area is adjacent to, and partly within, the Elk Mountain mining district where gold, silver, copper, lead, and zinc are widespread, but the veins are small and only minor production has been realized (Vanderwilt, 1947). Mineralization is not associated with the Gothic Mountain laccolith (Mutschler and others, 1981). Significant amounts of silver, lead, zinc, copper, and molybdenum occur west of the study area in the Oh-Be-Joyful and Redwell Basin areas where several mines have produced ore. Molybdenum, silver, copper, lead, and zinc occur north of the study area at Treasure Mountain (Mutschler and others, 1981).

Commodities

Gold, silver, copper, lead, zinc.

Mineral and energy resource potential

There is a moderate potential for gold, silver, copper, lead, and zinc in the northeastern portion of the study area adjacent to, and partly within, the Elk Mountain mining district.

References

Godwin, L. H., and Gaskill, D. L., 1964, Post Paleocene West Elk laccolithic cluster, west-central Colorado: U.S. Geological Survey Professional Paper 501-C, p. 66-68.

Mutschler, F. E., Ernst, D. R., Gaskill, D. L., and Billings, Patty, 1981, Igneous rocks of the Elk Mountains and vicinity, Colorado--Chemistry and related ore deposits, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 317-324.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 101-102.

WHETSTONE MOUNTAIN (2-200)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines and mineral occurrences

The Whetstone Mountain study area lies within the Colorado mineral belt southwest of Crested Butte in the central Colorado Rockies. Mount Whetstone, Mount Axtell, and Carbon Peak are all Tertiary laccoliths composed of porphyritic granodiorite. Cretaceous sedimentary rocks crop out in the rest of the study area around and between the laccoliths (Tweto and others, 1976). The study area is adjacent to, and partly within, the Crested Butte mining district and near the Ruby-Irwin mining district. Coal was produced from the Crested Butte mining district, and several abandoned coal mines occur adjacent to the study area on the north. Other abandoned coal mines of the Baldwin district occur adjacent to and near the study area to the south (Landis, 1959; Ladwig, 1981). Silver, lead, and zinc were produced from the Ruby-Irwin mining district to the north of the study area, and recently significant deposits of molybdenum have also been discovered (Dowsett and others, 1981). Many mineralized veins occur north of Elk Creek in the Ruby-Irwin district, but the rocks south of Elk Creek in and near the study area are barren of mineralized veins. Oil exploration wells were drilled in the Cretaceous rocks south of the study area, but no hydrocarbons were detected (Bartleson and Gaskill, 1981).

Commodities

Coal.

Mineral and energy resource potential

There is a high potential for coal in the central and western part of the study area in Cretaceous formations around and between the laccoliths. Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Bartleson, B. L., and Gaskill, D. L., 1981, Third day road log from Grand Junction to Crested Butte via Delta, Montrose, and Gunnison, in Western Slope Colorado, Epis, R. C., and Callender, J. F., eds., New Mexico Geological Society 32nd field conference guidebook, p. 39-47.

Dowsett, F. R., Jr., Ganster, M. W., Ranto, D. E., Baker, D. J., and Stein, H. J., 1981, Geology of the Mount Emmons molybdenum deposit, Crested Butte, Colorado, in Western Slope Colorado, Epis, R. C., and Callender, J. F., eds., New Mexico Geological Society 32nd field conference guidebook,p. 325-331.

Ladwig, L. R., 1981, Coking coals of western Colorado, in Western Slope Colorado, Epis, R. C., and Callender, J. F., eds., New Mexico Geological Society 32nd field conference guidebook, p. 249-254.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, 229 p.

Tweto, Ogden, Steven, T. A., Hail, W. L., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

FLATTOP MOUNTAIN (2-201)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Flattop Mountain study area is located north of Gunnison in the central Colorado Rockies and is underlain by thin Cretaceous sedimentary rocks that overlie Precambrian granites. Tertiary flood basalts cap the mesas of Red Mountain and Flattop Mountain (Tweto and others, 1976). There are no mines in the study area, but the O. C. coal mines and the inactive coal mining districts of Baldwin and Floresta lie adjacent to it on the northwest. In the northern part of the study area the coal-bearing Mesaverde Formation lies at or near the surface. No other known mineral deposits occur in the study area (Landis, 1959; Ladwig, 1981).

Commodities

Coal.

Mineral and energy resource potential

The northern part of the study area has a high potential for coal deposits. Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Ladwig, L. R., 1981, Coking coals of western Colorado, in Western Slope Colorado, Epis, R. C., and Callender, J. F., eds., New Mexico Geological Society 32nd field conference guidebook, p. 249-254.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-150.

Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

BOSTON PEAK (2-202)
MATCHLESS (2-203)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. The western part of the Matchless study area has been mapped and the mineral surveys required by the Wilderness Act (PL88-577) and related acts have been completed.

Mining districts, mines, and mineral occurrences

The study areas are within the Colorado mineral belt between the West Elk volcanic field and the Sawatch range, northeast of Almont in the central Colorado Rockies. The areas are made up primarily of Proterozoic layered and migmatitic gneisses and granites with some overlying and faulted blocks of late Paleozoic and Mesozoic sedimentary rocks. There is one late Cenozoic rhyolite dome in the western part of the Boston Peak study area (Tweto and others, 1976). There are several mining districts within and near the study areas. The Spring Creek mining district lies between the two study areas and has produced silver and zinc from replacement ore deposits in dolomite of the Leadville Limestone at the Doctor mine, where some copper, lead, and gold have also been reported. Italian Mountain lies just north of the Boston Peak study area and has produced lead and zinc, some gold, silver, and gem-quality lapis lazuli from several mines in vein and replacement-type deposits in the tactites of North Italian Mountain. Lead and zinc have been produced from the Forest Hill mine near Taylor Park in the eastern part of the Boston Peak study area (Vanderwilt, 1947). In the southwestern part of the Matchless study area at Summerville Creek and Gandy Gulch, anomalously high thorium and rare earths occur in Precambrian granite (DeWitt and others, 1985). At Jacks Cabin, adjacent to the southwestern part of the Boston Peak study area, uranium occurs along a fault that juxtaposes Paleozoic sedimentary rocks against Precambrian crystalline rocks in a geologic setting similar to the Marshall Pass uranium district (Nelson-Moore and others, 1978). Adjacent to the east boundary of the Boston Peak study area in Taylor Park there is uranium in sulfide-bearing veins in Precambrian rocks. Radioactive minerals are present in quartz, carbonate, and fluorite veins along faults in Precambrian rocks in Cement Creek, adjacent to the north side of this study area (Nelson-Moore and others, 1978). There are two warm springs in Cement Creek adjacent to the study area (Pearl, 1980).

Commodities

Thorium, rare earth elements, lead, zinc, uranium, geothermal waters.

Mineral and energy resource potential

There is a high potential for thorium and rare earth deposits in granite in the southern part of the Matchless study area, and a moderate potential for uranium and rare earth deposits in the southwestern and northeastern parts of the Boston Peak area and the northeastern and southwestern parts of the Matchless area. There is a moderate potential for lead and zinc deposits in both study areas adjacent to the Spring Creek mining district. The potential is moderate for "the discovery and development of local sources of low temperature (<90°C) water" (Pearl, 1980) along Cement Creek in the western part of the Boston Peak area.

References

DeWitt, Ed, Stoneman, R. J., Clark, J. R., and Kluender, S. E., 1985, Mineral resource potential map of the Fossil Ridge Wilderness Study Area, Gunnison County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1629A, scale 1:50,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 172-177.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose 1°x2° quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 98-110.

CRYSTAL CREEK/FOSSIL RIDGE (2-204)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The Crystal Creek/Fossil Ridge study area is located west of the Sawatch Range between Taylor Park and Almont in the central Colorado Rockies. The wilderness study area is made up primarily of Proterozoic gneisses and schists that have been intruded by Proterozoic syntectonic and post-tectonic granitic plutons. Thin Paleozoic sedimentary rocks crop out in places atop ridges and mountains. Several small Tertiary stocks, plugs, dikes, and sills are present in the southeastern part of the study area. The wilderness study area is within the Colorado mineral belt (DeWitt and others, 1985). There are no

active mines within the study area, but several mines and mining districts are within or adjacent to the area, including one active mine 0.3 miles from the study area boundary. Parts of the Cross Mountains, the Gold Brick, and the Tincup mining districts extend into the study area, and the Quartz Creek district borders it on the south. Gold, silver, and lead were produced from one mine, and gold, copper, and manganese were produced from another in the northern part of the study area. Gold, silver, and lead were produced from three mines in the southern part of the study area, and silver, molybdenum, and tungsten were produced from two mines in the northeastern part of the study area. All of these mines produced from vein or replacement type deposits. Placer gold was produced from Union Park just north of the study area. Lead and zinc are present along Boulder Creek in the southern part of the study area. Molybdenum occurs at several locales near the center of the area, and extensive uranium, thorium, and rare earth anomalies occur throughout the central and northern parts of the study area. Placer gold occurs in the east part of the study area (Kluender and McColly, 1983; DeWitt and others, 1985).

Commodities

Gold, silver, lead, zinc, copper, molybdenum, tungsten, uranium, thorium, rare earth elements, high calcium limestone.

Mineral and energy resource potential

There is a high potential for gold, silver, lead, and zinc in vein and replacement deposits in portions of the south, east, and northern parts of the study area (sites A, B, C, D, pl. 1). A moderate potential for molybdenum and tungsten occurs at two localities near the center of the study area (E). There is a moderate potential for uranium and thorium at several localities throughout the central and northern portions of the study area (sites E, F, G, H, pl. 1). A moderate potential for rare earth elements occurs at several localities near the center and northern parts of the study area (sites B, E, G). A high potential for high calcium mineralogical grade limestone exists in the southern part of the study area.

References

DeWitt, Ed, Stoneman, R. J., Clark, J. R., and Kluender, S. E., 1985, Mineral resource potential map of the Fossil Ridge wilderness study area, Gunnison County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1629A, scale 1:50,000.

Kluender, S. E., and McColly, R. A., 1983, Mineral investigation of the Fossil Ridge wilderness study area, Gunnison County, Colorado: U.S. Bureau of Mines Open File Report MLA66-83.

KREUTZER-PRINCETON (2-205)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is in the Sawatch Range southwest of Buena Vista in the central Colorado Rockies. The study area consists primarily of Oligocene and Miocene quartz monzonite of the Mount Princeton Batholith, with Proterozoic gneisses in the northern and western portions of the area. Minor slivers of Paleozoic sedimentary rocks crop out in the western portion of the study area (Tweto and others, 1976). The study area is adjacent to the Tincup mining district to the west, and the Chalk Creek district to the south, and contains the smaller Cottonwood Creek district in the west-central part of the study area. The Tincup district has produced significant amounts of silver, lead, and zinc, and minor amounts of gold and copper from replacement deposits in Paleozoic limestones (Vanderwilt, 1947). Mineralized Paleozoic carbonates, and other Paleozoic carbonates that may have been favorable for mineralization occur in several localities in the western portion of the study area, in and adjacent to the Tincup and Cottonwood Creek districts. Altered Tertiary quartz monzonite considered favorable for mineral occurrences occurs at Mount Princeton, and to the west and northwest of Mount Princeton (Taylor and others, 1984).

Commodities

Silver, gold, lead, zinc, copper.

Mineral and energy resource potential

A high potential for silver, lead, zinc, gold, and copper in vein and replacement deposits occurs in the southern part of the study area adjacent to the Chalk Creek district (site A, pl. 1), in the northwestern part of the area adjacent to the Tincup district (B), and at two locations in the west-central part of the study area in and adjacent to the Cottonwood Creek district (C). A moderate potential for gold and silver in vein deposits occurs at Mount Princeton (D) and to the west (E) and northwest (F) of it. Three hot springs occur adjacent to the study area at the southeastern and northeastern foot of Mount Princeton, and the eastern part of the study area is in an area "favorable for the discovery and development of local sources of low temperature ($<90^{o}C$) water" (Pearl, 1980). This area (D) has a moderate potential for geothermal energy.

References

Goddard, E. N., 1936, The geology and ore deposits of the Tincup mining district, Gunnison County, Colorado: Colorado Scientific Society Proceedings, v. 13, no. 10, p. 552-593.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, Part 3; Colorado: U.S. Geological Survey Bulletin 1135-C, p. 70-82.
Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.
Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.
Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 41-50, 98-110.

ROMLEY (2-206)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577).

Mining districts, mines, and mineral occurrences

The study area is in the Sawatch Range northeast of Pitkin in the central Colorado Rockies. The Romley study area contains primarily Tertiary-age quartz monzonite of the Mount Princeton batholith. Proterozoic gneisses and granites and some Paleozoic sedimentary rocks crop out in the western portion of the study area (Dings and Robinson, 1975). The study area is adjacent to the Tincup, Quartz Creek, and Cottonwood Creek mining districts on the east. Gold, silver, lead, zinc, copper, and some iron have been produced from replacement and vein deposits in the Tincup district (Goddard, 1936; Heyl, 1964). Silver, lead, zinc, and some gold have been produced from replacement deposits in the Quartz Creek district (Hill, 1909; Vanderwilt, 1947). Gold, lead, zinc, silver, and some copper have been produced from vein deposits in the Chalk Creek and Cottonwood Creek districts. A few prospect pits and one adit occur within the study area, but no production of base or precious metals has been reported. Graphite has been produced from Graphite Basin in the western part of the study area (Dings and Robinson, 1975). There are no known mineralized veins mapped within the study area.

Commodities

Graphite, gold, silver, copper, lead, zinc.

Mineral and energy resource potential

A high potential for graphite deposits occurs in Graphite Basin in the western part of the study area. There is a moderate potential for silver, lead, and zinc deposits in the Paleozoic carbonate rocks of the western part of the study area. Other energy and mineral deposits are unknown, and their

potential is regarded as low (Dings and Robinson, 1975; Taylor and others, 1984).

References

Dings, M. C., and Robinson, C. S., 1975, Geology and ore deposits of the Garfield quadrangle, Colorado: U.S. Geological Survey Professional Paper 289, p. 57-81.

Goddard, E. N., 1936, The geology and ore deposits of the Tincup mining district, Gunnison County, Colorado: Colorado Scientific Society Proceedings, v. 13, no. 10, p. 552-593.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, Part 3; Colorado: U.S. Geological Survey Bulletin 1135-C, p. 70-76.

Hill, J. M., 1909, Notes on the economic geology of southeastern Gunnison County, Colorado: U.S. Geological Bulletin 380, p. 21-40.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 98-110.

CANYON CREEK (2-207)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577).

Mining districts, mines, and mineral occurrences

The study area is in the Sawatch Range west of Whitepine in the central Colorado Rockies, and consists primarily of Oligocene and Miocene quartz monzonite of the Mount Princeton batholith and of Proterozoic granites. Small slivers of Paleozoic sedimentary rocks crop out in the northern part of the study area (Dings and Robinson, 1975). The study area is adjacent to, and partly included in the Tomichi mining district on the east side, adjacent to the Box Canyon district on the west side, and near the Quartz Creek district on the northwest side. The Tomichi district produced gold, silver, lead, zinc, and copper from several mines in replacement deposits in Paleozoic carbonates and vein deposits in Precambrian granites, and a small amount of bog iron ore (Vanderwilt, 1947; Heyl, 1964). The Box Canyon district produced gold and silver from quartz veins in Precambrian schist. The Quartz Creek district produced silver, lead, zinc, and gold from replacement deposits (Hill, 1909; Vanderwilt, 1947). Gold, silver, lead, and zinc were produced from veins in Brittle Silver Basin on the northern side of the study area. Within the study area there are numerous prospect pits and a few shafts and adits, although there is no recorded production from the study area. There are quartz-fluorite veins in the northern part of the study area, and quartz-pyrite veins in the eastern part of the study area near Whitepine (Dings and Robinson, 1975).

Commodities

Silver, gold, lead, zinc.

Mineral and energy resource potential

A moderate potential for silver, lead, and zinc deposits exists in the northern part of the study area. A moderate potential for gold and silver in veins exists in the eastern part of the study area. Hot springs occur at Waunita southwest of the study area, but there are no known geothermal sources within the study area (Pearl, 1980). Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Dings, M. C., and Robinson, C. S., 1957, Geology and ore deposits of the Garfield quadrangle, Colorado: U.S. Geological Survey Professional Paper 289, p. 62-81.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States Part 3; Colorado: U.S. Geological Survey Bulletin 1135-C, p. 70.

Hill, J. M., 1909, Notes on the economic geology of southeastern Gunnison County, Colorado: U.S. Geological Survey Bulletin 380, p. 21-40.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 98-110.

COCHETOPA HILLS (2-209)
COCHETOPA DOME (2-210)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located west of the Sawatch Range south of Doyleville in the south-central Colorado Rockies. The Cochetopa Hills study area consists of Oligocene andesitic to rhyolitic volcanic rocks, with minor outcrops of Mesozoic sedimentary and Precambrian crystalline rocks in the southern part of the study area. The Cochetopa Dome study area consists of Oligocene quartz latite and rhyolite lava flows and tuffs (Tweto and others, 1976). No mines or mining districts occur near the Cochetopa Dome area. The Cochetopa mining district, northwest of the Cochetopa Hills study area, has produced gold and silver from quartz veins in Precambrian gneisses (Hill, 1909; Vanderwilt, 1947). Uranium has been produced at the Los Ochos mine west of the study area from mineralized Cretaceous sandstones along the Los Ochos fault. Other uranium occurrences have been reported in sandstones north of the study area, and in Precambrian gneisses and granites south and southwest

of the Cochetopa Hills study area. Several mines in the Marshall Pass mining district northeast of the Cochetopa Hills study area have produced uranium, and uranium occurrences have been reported along Middle Creek in the eastern part of the Cochetopa Hills study area. Uranium occurrences in Precambrian gneisses and granites have been reported for areas adjacent to the Cochetopa Dome area on the north and on the south, but none are known to occur within the study area. Although uranium may occur in Precambrian and (or) Cretaceous rocks beneath the volcanic rocks in both study areas, none has been reported.

Commodities

Uranium.

Mineral and energy resource potential

The potential for uranium deposits near Middle Creek in the eastern part of the Cochetopa Hills is high, and is moderate in the western part of the area near Razor Creek. Other energy and mineral deposits are unknown, and their potential is regarded as low. The Cochetopa Dome area has low potential for both energy and mineral deposits.

References

Hill, J. M., 1909, Notes on the economic geology of southeastern Gunnison County, Colorado: U.S. Geological Survey Bulletin 380, p. 21-40.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 387-396.

Tweto, Ogden, Steven, T. A., Hail, W. L., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{\circ}x2^{\circ}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

Vanderbilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 100.

MONCHEGO (2-211)
SAGUACHE CREEK (2-277)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Cochetopa Hills south of Cochetopa Pass, in the south-central Colorado Rockies. Both study areas consist of Oligocene andesitic to rhyolitic lava flows and tuffs (Tweto and others, 1976). Although no mines or mining districts occur in or near the study areas, uranium minerals are present in Precambrian crystalline rocks several miles to the north of the study areas (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the study areas are unfavorable for the occurrence of mineral and energy deposits, and their potential is regarded as low.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences in Colorado: Colorado Geological Survey Bulletin 40, p. 387-396.

Tweto, Ogden, Steven, T. A., Hail, W. L., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

SAWTOOTH MOUNTAIN (2-212)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral survey as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

In this study area east of Powderhorn on the north flank of the San Juan Mountains in the south-central Colorado Rockies, Jurassic and Cretaceous sedimentary rocks and Tertiary latite and rhyolite flows and tuffs are exposed at the surface (Larsen and Cross, 1956). The Gunnison gold belt, which extends for several miles northwest, north, and northeast of the study area, has produced gold, silver, zinc, copper, and lead from vein and stratabound deposits in Precambrian greenstones and metavolcanics (Sheridan and others, 1981). The Cebolla and Vulcan mining districts northwest of the study area produced gold, silver, lead, and copper from Precambrian schists (Vanderwilt, 1947). The Cochetopa district, several miles northeast of the study area, produced gold, silver, and lead from Precambrian rocks and uranium from mineralized faults in Mesozoic sedimentary rocks (Vanderwilt, 1947; Nelson-Moore and others, 1978). The White Earth district, several miles west of the study area, produced gold from veins in Precambrian rocks (Hill, 1912). The Gunnison gold belt is not known to extend into the study area. Uranium is present in a fault on the flanks of Sawtooth Mountain, near the northern part of the study area, and uranium has been reported in a series of prospect pits just west of the study area, east of Powderhorn (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on available geologic information the potential is regarded as low for the occurrence of mineral and energy deposits within the study area.

References

Hill, J. M., 1912, The mining districts of the western United States: U.S. Geological Survey Bulletin 507, p. 134-145.

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, plate 1.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 387-396.

Sheridan, D. M., Raymond, W. H., and Cox, L. J., 1981, Precambrian sulfide deposits in the Gunnison region, Colorado: in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 273-277.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 98-100.

MINERAL MOUNTAIN (2-215)

Kind and amount of data

The area has been mapped and the mineral survey, as required by the Wilderness Act (PL88-577) and related acts, has been completed for part of the area. Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation for the rest of the area, but is not sufficient for the mineral surveys as required by the Wilderness Act and related acts. Parts of the study area have been incorporated into the La Garita Wilderness (NF-043). See discussion, p. 64.

Mining districts, mines, and mineral occurrences

The study area is in the northern San Juan Mountains east of Slumgullion Pass in the southern Colorado Rockies. Tertiary rhyolite and latite flows, tuffs, breccias, and intrusions related to the San Luis, La Garita, and Creede calderas (Larsen and Cross, 1956; Steven and Bieniewski, 1977) crop out. The Creede mining district, several miles south of the study area, produced significant amounts of gold, silver, lead, and zinc from vein deposits along a system northwest of Creede. These deposits are related to the collapse of the Creede caldera, but are not believed to extend into the study area (Steven and Ratté, 1965). In the central part of the study area a large area of hydrothermally altered rocks is cut by numerous quartz-pyrite veins, some of which contain sparse, local concentrations of base and precious metals. These occurrences are related to the resurgence of the San Luis caldera. Thorough

prospecting throughout the area has led to little production (Steven and Bieniewski, 1977). Large deposits of perlitized rhyodacite and latite occur in the north-central part of the study area and are related to post-subsidence eruptions in the San Luis caldera. The grade and extent of perlite are judged to be significant (Steven and Bieniewski, 1977).

Commodities

Gold, silver, lead, zinc, perlite.

Mineral and energy resource potential

The potential for the occurrence of gold, silver, lead, and zinc in vein deposits in the central part of the study area is moderate. There is a high potential for the occurrence of perlite deposits in the northeastern part of the study area.

References

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, plate 1.

Steven, T. A., and Bieniewski, C. L., 1977, Mineral resources of the La Garita Wilderness, San Juan Mountains, southwestern Colorado: U.S. Geological Survey Bulletin 1420, 65 p.

Steven, T. A., and Ratté, J. C., 1965, Geology and structural control of ore deposition in the Creede district, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 487, p. 1-3, 68.

MIDDLE FORK (2-217)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the La Garita Wilderness. See discussion, p. 64.

Mining districts, mines, and mineral occurrences

The Middle Fork study area is north of the La Garita Wilderness area in the northeastern San Juan Mountains in the southern Colorado Rockies. Tertiary rhyolite and latite flows and tuffs occur throughout the study area (Larsen and Cross, 1956). There are no mining districts or mines in or near the study area. Just east of the study area a zone of hydrothermally altered rocks contains quartz-pyrite veins associated with the east rim of the La Garita caldera. This zone does not extend into the study area (Steven and Bieniewski, 1977). No other altered or mineralized rocks are known within or near the study area.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the mineral and energy resource potential is regarded as low.

References

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, plate 1.

Steven, T. A., and Bieniewski, C. L., 1977, Mineral resources of the La Garita Wilderness, San Juan Mountains, southwestern Colorado: U.S. Geological Survey Bulletin 1420, p. 14-35.

CANNIBAL PLATEAU (2-218)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area lies east of Lake City in the southern Colorado Rockies. Oligocene and Miocene volcanic and minor intrusive igneous rocks are exposed at the surface. In places erosion has cut through the volcanic rocks to expose Precambrian crystalline rocks below. No mines or mining districts, and very few claims are known within the study area, although inactive mines are present near Lake City southwest of the study area. The southwestern corner of the study area lies within the Lake City-Uncompahgre caldera complex, and shows anomalous amounts of gold, silver, and molybdenum. Ore deposits associated with this caldera complex have been mined around Lake City. Geophysical and geochemical data, and geologic mapping reveal no other mineralized areas within the study area (Martin and Sharp, 1983; Sharp and others, 1983).

Commodities

Gold, silver, molybdenum.

Mineral and energy resource potential

The southwestern corner of the study area has a moderate potential for gold, silver, and molybdenum. No other mineral or energy deposits are known, and the potential for their presence is regarded as low.

References

Martin, R. A., and Sharp, W. N., 1983, Aeromagnetic map of the Powderhorn wilderness study area and the Cannibal Plateau roadless area, Gunnison and Hinsdale Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1483B, scale 1:50,000.

Sharp, W. N., and Lane, M. E., 1983, Geochemical map of the Powderhorn wilderness study area and the Cannibal Plateau roadless area, Gunnison and Hinsdale Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1483C, scale 1:50,000.

Sharp, W. N., Martin, R. A., and Lane, M. E., 1983, Mineral resource potential and geologic map of the Powderhorn wilderness study area and Cannibal Plateau roadless area, Gunnison and Hinsdale Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1483A, scale 1:50,000.

CARSON PEAK (2-220)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is in the central San Juan Mountains east of Silverton and Eureka in the southern Colorado Rockies. Rocks in the area are primarily Tertiary rhyolite and latite tuffs, flows, and breccias, with minor Precambrian crystalline rocks cropping out in the southern part of the study area (Larsen and Cross, 1956). The Eureka mining district just west of the study area has produced gold, silver, lead, zinc, and copper from vein and breccia pipe deposits associated with the Silverton caldera (Burbank and Luedke, 1969). A few miles south of the western part of the study area, the Beartown district produced gold, silver, and some copper from quartz veins in Precambrian metamorphic rocks (Steven and others, 1969). The White Cross (Burrows Park) district, several miles north of the western part of the study area, has produced gold, silver, copper, lead, and zinc from vein deposits in the Tertiary volcanic rocks (Vanderwilt, 1947). The Carson mining district, just outside the boundaries of the northern part of the study area, produced silver and lead and minor amounts of copper, gold, and zinc from discontinuous vein deposits associated with the Carson volcanic center (Vanderwilt, 1947). The Lake Fork (San Cristobal) district a few miles north of the northeastern part of the study area produced gold, silver, copper, lead, and zinc from vein deposits associated with the Lake City caldera (Burbank, 1947). Immediately south of the study area near Rio Grande Reservoir two prospect pits in fractures contain minor amounts of uranium but there has been no production from this location (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the potential is low for the occurrence of mineral and energy deposits within the borders of the study area.

References

Burbank, W. W., 1947, Lake City area, in Vanderwilt, J. W., ed., Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 439-443.

Burbank, W. S., and Luedke, R. G., 1969, Geology and ore deposits of the Eureka and adjoining districts San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 535, p. 1-2, 35-55.

Larsen, E. S., Jr., and Cross, Whitman, 1956, Geology and petrology of the San Juan region southwestern Colorado: U.S. Geological Survey Professional Paper 258, Plate 1.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 178-180.

Steven, T. A., Schmitt, L. J., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive Area, Colorado: U.S. Geological Survey Bulletin 1261-F, p. 67-71.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 112-118.

CRYSTAL PEAK (2-221)
ELK CREEK (2-223)
UNCOMPAHGRE (2-224)
EL PASO CREEK (2-225)
BALDY PEAK (2-228)
BEAVER CREEK (2-229)
UPPER WEST FORK DALLAS CREEK (2-231)
IRON MOUNTAIN (2-232)
SNEVA MOUNTAIN (2-359)
BIG BLUE WILDERNESS (NF-908) (NF-909)
MOUNT SNEFFELS WILDERNESS (NF-911)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these areas have been incorporated into the Mt. Sneffels Wilderness (NF-911) and the Big Blue Wilderness (NF-908).

Mining districts, mines, and mineral occurrences

The study areas are in the northern San Juan Mountains between Lake City and Ouray, and north of Telluride in the southern Colorado Rockies. Rocks in the areas are primarily Oligocene and Miocene volcanic and related intrusive rocks. In some places erosion has exposed Mesozoic and Paleozoic sedimentary rocks, and some Precambrian metamorphic and igneous rocks. The study and

wilderness areas are bordered on the south by the San Juan volcanic depression and the Silverton and Lake City calderas. The southwestern part of the wilderness and study area is adjacent to one of the most intensely mineralized regions in the United States; about 4,000 patented claims and two active mines are located within or adjacent to this area. Mines in the area have produced hundreds of millions of dollars worth of gold, silver, copper, lead, zinc, and minor amounts of bismuth, fluorspar, iron, tungsten, and uranium. The Camp Bird mine southwest of Ouray and the Idarado mine just east of Telluride produced gold, silver, copper, lead, and zinc from vein deposits. Northeast of Ouray, gold, silver, copper, lead, and zinc have been recovered from vein and replacement deposits associated with the Blowout stock. The Red Mountain area south of Ouray on the rim of the Silverton caldera has produced silver, copper, lead, and zinc from mineralized breccia pipes and veins, and the Engineer Mountain area east of Red Mountain has produced gold, silver, copper, lead, and zinc from vein, replacement, and breccia pipe deposits. Some gold, silver, copper, lead, and zinc have been produced at Capital City south of the Big Blue Wilderness, and some bog iron ore and uranium occur near it. The Henson Creek area in the eastern part of the Big Blue Wilderness adjacent to the Lake City caldera has produced gold, silver, copper, lead, and zinc; this mineralized area extends into the Big Blue Wilderness. Rhyolite intrusives in the southern part of the Crystal Peak study area contain anomalous uranium values. Minor mineralized veins occur in Cow Creek in the northern part of the Big Blue Wilderness area, but no mining and only modest prospecting has occurred. Mineralized veins radiate from the stock at Mt. Sneffels in the eastern part of the Mt. Sneffels Wilderness and in an area between Hayden Peak and Mt. Whipple in the western part of the wilderness area (Fisher and others, 1968; Steven and others, 1977). Modest drilling for oil, gas, and coal have occurred north of the study and wilderness areas, but there has been no development or production. Although there are warm springs near the wilderness and study areas at Ouray, Ridgway and Placerville, the potential for goethermal energy within the wilderness and study areas is regarded as low (Fischer and others, 1968; Steven and others, 1977).

Commodities

Gold, silver, copper, lead, zinc, uranium.

Mineral and energy resource potential

The potential is high for gold, silver, copper, lead, and zinc in the southeastern part of the Mt. Sneffels Wilderness, in the southwestern part of the Big Blue Wilderness and the Baldy Peak study area, and in the area along Henson Creek in the southern portions of the El Paso Creek and Crystal Peak study areas. A moderate potential is indicated for gold, silver, copper, lead, and zinc in the area from Mt. Sneffels west to Whipple Mountain in the Mt. Sneffels Wilderness. A moderate potential for gold, silver, copper, lead, zinc, iron, and uranium occurs south and west of Wetterhorn Peak in the Big Blue Wilderness and Baldy Peak and Beaver Creek study areas. A moderate potential for uranium occurs in the southern part of the Big Blue Wilderness and the Crystal Peak and El Paso Creek study areas. The potential for oil, gas, coal, and geothermal energy is regarded as low.

References

Fischer, R. P., Luedke, R. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre Primitive Area, Colorado: U.S. Geological Survey Bulletin 1261C, 91 p.

Steven, T. A., Lipman, P. W., Fisher, F. S., Bieniewski, C. L., and Meeves, H. C., 1977, Mineral resources of the study areas contiguous to the Uncompahgre Primitive area, San Juan Mountains, Colorado: U.S. Geological Survey Bulletin 1391E, 126 p.

UNCOMPAHGRE (2-224)
CIMARRON (2-226)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of the Uncompahgre study area was covered in the mandated mineral resource study of the Uncompahgre Primitive area, and has subsequently been incorporated in the Big Blue wilderness area (see page 34, this report).

Mining districts, mines, and mineral occurrences

The Uncompahgre and Cimarron study areas are on the north flank of the San Juan Mountains, northeast of Ridgway in the southern Colorado Rockies where Cretaceous sedimentary rocks and Tertiary volcanic and intrusive rocks crop out (Larsen and Cross, 1956). No mines are known in or adjacent to the study areas and hydrothermally altered and mineralized rocks are not known in the study areas, although they occur in areas several miles south of the study areas (Steven and Lipman, 1976; Steven and others, 1977).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the mineral and energy resource potential is regarded as low.

References

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, plate 1.

Steven, T. A., and Lipman, P. W., 1976, Calderas of the San Juan volcanic field, southwestern Colorado: U.S. Geological Survey Professional Paper 958, 33 p.

Steven, T. A., Lipman, P. W., Fisher, F. S., Bieniewski, C. L., and Meeves, H. C., 1977, Mineral resources of study areas contiguous to the Uncompahgre primitive area, San Juan Mountains, Colorado: U.S. Geological Survey Bulletin 1391E, p. 1-3, 27-30.

LIZARD HEAD (2-235)
SUNSHINE MESA (2-237)
WILSON MESA (2-238)
LIZARD HEAD WILDERNESS (NF-912)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these areas have been incorporated into the Lizard Head Wilderness Area (NF-912).

Mining districts, mines, and mineral occurrences

The wilderness and study areas are in the northwestern San Juan Mountains southwest of Telluride, in the southern Colorado Rockies. Mesozoic sedimentary and minor Tertiary sedimentary and volcanic rocks that have been intruded by several Tertiary granodioritic stocks, laccoliths, and sills along an east-west trend crop out in the wilderness and study areas. Two mining districts are in or near the wilderness area, which contains numerous individual claims and mines. The Mount Wilson mining district, entirely within the wilderness, produced gold, silver, copper, lead, and zinc from vein deposits at several mines, including the Silver Pick mine. Disseminated copper was found in Navajo Basin in the center of the wilderness. The Trout Lake mining district east of and partly within the wilderness study area produced silver, lead, and zinc from vein deposits. Vanadium has been produced 1/2-1 mile north of the wilderness and may occur at great depth within the wilderness. Coal has been produced from two mines just south of the wilderness area. Although the coal-bearing strata occur at depth within the wilderness, the coal is of poor grade, and the coal seams are thin and discontinuous (Bromfield and Williams, 1972).

Commodities

Copper, gold, silver, lead, zinc.

Mining districts, mines, and mineral occurrences

A high potential exists for gold, silver, copper, lead, and zinc for an area in the north-central part of the wilderness, and for silver, lead, and zinc in the eastern part of the wilderness. The potential for coal or vanadium is low throughout the area. Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Bromfield, C. S., and Williams, F. E., 1972, Mineral resources of the Wilson Mountains Primitive area, Colorado: U.S. Geological Survey Bulletin 1353A, 79 p.

OPHIR NEEDLES (2-239)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

Ophir Needles study area is in the western San Juan mountains south of Telluride near Ophir in the southern Colorado Rockies. The rocks that crop out in the study area are Tertiary intrusive rocks (Steven and others, 1974). The study area is adjacent to the Iron Springs (Ophir, Ames) mining district where gold, silver, lead, and zinc were produced from vein deposits. Most of the veins trend west toward the Mt. Wilson stock, while some trend northeast through the high ridge north of the study area. Areas of low grade, but widespread, auriferous pyrite occur in the wall rock of some of the gold veins. Molybdenum is associated with the Tertiary quartz monzonite intrusion that crops out in the study area (Varnes, 1947).

Commodities

Molybdenum, gold, silver, lead.

Mineral and energy resource potential

There is a moderate potential for gold, silver, lead, and molybdenum in the study area.

References

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Varnes, D. J., 1947, Iron Springs (Ophir, Ames) mining district, San Miguel County; in Vanderwilt, J. W., ed., Mineral resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 425-427.

SAN MIGUEL (2-240)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The San Miguel study area is located south of Ophir and southwest of Silverton in the western San Juan Mountains in the southern Colorado Rockies. It is characterized by Paleozoic, Mesozoic, and Tertiary sedimentary rocks and by Tertiary volcanic and intrusive rocks (Steven and others, 1974). The Ames (Ophir, Iron Springs) mining district just northwest of the study area has produced gold, silver, lead, and copper from vein deposits (Bromfield, 1967). The Ice Lake Basin district in the north-central part of the study area has produced gold, silver, copper, lead, and zinc from vein deposits (Vanderwilt, 1947). The Animas district just northeast of the study area around Silverton produced gold, silver, copper, lead, and zinc from vein deposits associated with the south rim of the Silverton caldera (Varnes, 1947). In the western part of the study area uranium and vanadium were produced from sandstone-type deposits in the Entrada Formation (Nelson-Moore and others, 1978).

Commodities

Gold, silver, copper, lead, zinc, uranium, vanadium.

Mineral and energy resource potential

There is a high potential for the occurrence of uranium and vanadium in sandstone-type deposits in the western part of the study area. A high potential for the occurrence of gold, silver, lead, zinc, and copper in vein deposits exists in the north-central part of the study area.

References

Bromfield C. S., 1967, Geology of the Mt. Wilson quadrangle, western San Juan mountains, Colorado: U.S. Geological Survey Bulletin 1227, p. 81-93.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 128-130.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 201-202.

Varnes, D. J., 1947, South Silverton area, Animas district, San Juan County; in Vanderwilt, J. W., ed., Mineral resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 431-433.

ROUBIDEAU (2-241)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Roubideau study area is a canyon in the south-central Uncompahgre Plateau west of Montrose in western Colorado. Mesozoic sedimentary formations, ranging from the Chinle to the Dakota Formation, nonconformably overlie Precambrian crystalline rocks that crop out in the bottom of the canyon (Williams, 1964; Stone, 1977). Uranium has been produced out of the Morrison Formation at the Duchess mine several miles east of the study area as well as out of many mines in the Uravan mineral belt 25 miles west of the study area. No other radioactive mineral occurrences are reported near the study area (Nelson-Moore and others, 1978). The study area lies between the Nucla-Naturita coal field to the west and the Tongue Mesa coal field to the east. The Nucla-Naturita field produces coal out of three seams in the Dakota Formation, and the Tongue Mesa field produces coal from four seams in the Mesaverde Formation. The Mesaverde Formation does not extend into the study area, but a partial section of the Dakota Formation does, though occurrences of coal are not known within the study area (Del Rio, 1960; Murray, 1981).

Commodities

None.

Mineral and energy resource potential

Although uranium and vanadium minerals could occur within the study area, the limited amount of favorable host rocks and the distance from the Uravan mineral belt suggests this is unlikely, and the potential is regarded as low. Geologic criteria suggest the area is unfavorable for the occurrence of coal or other energy and mineral deposits, and their potential is regarded as low.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 216-219, 327-366.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society Guidebook 32nd field conference, p. 233-239.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 283-357.

Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift; in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.
Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

TABEQUACHE (2-242)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is a canyon in the western flank of the Uncompahgre Plateau north of Naturita in western Colorado. Mesozoic sedimentary formations that range from the Chinle to the Morrison Formation nonconformably overlie Precambrian crystalline rocks that crop out in the bottom of the canyons (Williams, 1964; Stone, 1977). The nearest mining district is several miles south of the study area at Naturita where gold has been produced from placer deposits along the San Miguel River (Vanderwilt, 1947). Coal has been produced in this area from the Nucla-Naturita coal field, which extends north to Mesa County and includes terrain around the study area. Coal is produced from three seams in the Dakota Formation, which does not occur within the study area (Del Rio, 1960; Murray, 1981). The study area is several miles east of the Uravan mineral belt, and although there are no known occurrences of radioactive minerals near the area (Nelson-Moore and others, 1978), the Morrison Formation does crop out in the study area.

Commodities

None.

Mineral and energy resource potential

There is a low potential for uranium in the study area. Other energy and mineral deposits are unknown, and the potential is regarded as low.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 218.
Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.
Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 283-357.

Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift; in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 154.
Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

KELSO MESA (2-243)
BLACK POINT (2-244)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are near the center of the Uncompahgre Plateau southwest of Delta in western Colorado, where Mesozoic sedimentary formations ranging from the Chinle to the Dakota Formation nonconformably overlie Precambrian crystalline rocks that crop out in the bottoms of canyons (Williams, 1964; Stone, 1977). Several miles west of the study areas in the Uravan Mineral Belt, uranium and vanadium have been produced from deposits in the Morrison Formation. The study areas lie well outside this mineral belt. A few miles east of the Black Point study area, uranium-mineralized dinosaur bones occur in the Salt Wash Sandstone Member of the Morrison Formation, but there has been no production of uranium (Nelson-Moore and others, 1978). No other mineral or energy resources are known in or near the study areas (Del Rio, 1960).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the areas are unfavorable for the occurrence of mineral and energy deposits and the potential is regarded as low.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 200-205, 327-366.
Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 125-126.
Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift; in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.

Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

UTE CREEK (2-245)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is in the northwestern part of the Uncompahgre Plateau east of Gateway in western Colorado where Mesozoic clastic sedimentary formations from the Chinle to the Kayenta overlie the Precambrian gneisses and granites of the Uncompahgre uplift. Precambrian rocks crop out in the northern part of the study area in Unaweep Canyon, and in the southeastern part of the area (Cater, 1955; Williams, 1964; Stone, 1977). Adjacent to the study area on the southwest are the Sunflower claims, where uranium and vanadium have been produced from several mines and pits in roll-type and strataform deposits in the Salt Wash Sandstone Member of the Morrison Formation. One or 2 miles to the west on Tenderfoot Mesa, numerous mines have produced significant amounts of uranium and vanadium from similar deposits in the Salt Wash Member of the Morrison Formation (Nelson-Moore and others, 1978). At Gateway, a few miles west of the study area, modest amounts of copper and silver have been produced from mineralized faults and small irregular fissures. North of the study area a few miles in the Unaweep district copper, gold, and silver occur in fissure veins in Precambrian granites and overlying Triassic sandstones (Vanderwilt, 1947).

Commodities

None.

Mineral and energy resource potential

Despite the many mineral deposits adjacent to and surrounding the study area, the favored host rocks do not occur within the area boundaries. While it is possible that similar mineralization may occur within the study area, geologic criteria suggest that this is not likely, and many years of prospecting have failed to locate such deposits. Potential for energy and mineral deposits is regarded as low.

References

Cater, F. W., Jr., 1955, Geology of the Pine Mountain quadrangle, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-60, scale 1:24,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 221-251.

Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift; in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 141-142.
Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

CAMPBELL POINT (2-246)
JOHNSON CREEK (2-247)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are on the west flank of the Uncompahgre Plateau north of Uravan in western Colorado. The Mesozoic Chinle and Wingate Formations nonconformably overlie Precambrian gneisses and granites that crop out in the deeply incised canyons (Cater, 1955; McKay, 1955; Williams, 1964; Stone, 1977). The study areas adjoin the Uravan mineral belt, and numerous mines near the western border of the areas have produced significant quantities of uranium and vanadium from roll-type and stratiform deposits in the Salt Wash Sandstone Member of the Morrison Formation (Nelson-Moore and others, 1978). In the Calamity district just west of the Campbell Point study area copper and silver are present along faults and fractures, but production has been very modest (Vanderwilt, 1947).

Commodities

Uranium, vanadium.

Mineral and energy resource potential

In the northwestern corner of the Campbell Point study area, the Salt Wash Sandstone Member of the Morrison Formation crops out and is adjacent to several prospect pits and mines. This area has a moderate potential for uranium and vanadium deposits. In all other parts of the study areas, the favorable host rocks are not present within the area boundaries, and the potential for uranium and vanadium deposits is low. Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Cater, F. W., Jr., 1955, Geology of the Calamity Mesa Quadrangle, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ61, scale 1:24,000.
McKay, E. J., 1955, Geology of the Atkinson Creek Quadrangle, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ57, scale 1:24,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 221-251, 283-357.
Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift; in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 141-142.
Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab Quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360.

CHIPETA (2-358)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines and mineral occurrences

The Chipeta study area is in the southern Sawatch Range south of Monarch Pass in the south-central Colorado Rockies. Proterozoic gneisses and granites crop out in the north and east part of the study area. Paleozoic sedimentary rocks crop out in the south-central part of the study area, and Tertiary volcanic rocks crop out in the western part (Olson, 1983; Tweto and others, 1976). The wilderness study area curves around the northern side of the Marshall Pass mining district which produced significant amounts of uranium from several mines in sedimentary rocks in fault contact with Precambrian gneisses. The Pitch mine just south of the study area produced over 1 million pounds of uranium oxide between 1958 and 1962, and has been reactivated in recent years (Nelson-Moore and others, 1978). Several occurrences of uranium are adjacent to, and within the southwestern portion of the study area. Oligocene andesitic rocks similar to those in the western part of the study area are believed to have been the source of the uranium (Nelson-Moore and others, 1978). Proterozoic metavolcanic rocks in the central and northeastern part of the study area are considered favorable for stratabound copper-zinc deposits, and stream sediment samples exhibit anomalous copper, lead, and tungsten values. Such deposits are known to exist in such rocks in a belt from the Turret Peak area near Salida west to the Gunnison gold belt (Taylor and others, 1984).

Commodities

Uranium, copper, zinc.

Mining districts, mines, and mineral occurrences

A high potential for uranium exists for the central and southwestern parts of the study area that are adjacent to the Marshall Pass mining district. The potential for copper and zinc is moderate in the northern and

central part of the study area and moderate in the southern portion of the study area around Mount Ouray. Other energy and mineral deposits are unknown, and their potential is regarded as low.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 266-270.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 172-177, 387-396.

Olson, J. C., 1983, Geologic and structural maps and sections of the Marshall Pass mining district, Saguache, Gunnison, and Chaffee Counties, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1425.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 191-196.

MANTI LA SAL NATIONAL FOREST
ROC CREEK (4-434)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in Roc Creek Canyon north of Paradox in western Colorado. Mesozoic clastic rocks of the Triassic Moenkopi through the Jurassic Navajo Formations crop out in the study area. Some Late Paleozoic rocks crop out in the northern part of the study area. The study area is flanked by the Sinbad Valley salt anticline on the northeast and by the Paradox Valley salt anticline on the south (Shoemaker, 1956; Williams, 1964; Stone, 1977). Immediately east of the study area, in Roc Creek Canyon, the Rajah mine produced uranium and vanadium from mineralized faults. Uranium, vanadium, and copper also occur in small mines and prospect pits in faults just north of the Rajah mine. Southeast of the study area a few miles several stratiform and roll-type uranium, vanadium, and copper deposits in the Salt Wash Sandstone Member of the Morrison Formation have been mined (Nelson-Moore and others, 1978). In Sinbad Valley, copper and silver mineralization occurs in faults, but production has been very modest. The La Sal mining district, several miles south of the study area near Paradox, produced copper and silver from mineralized faults in the Triassic Dolores formation (Vanderwilt, 1947).

Commodities

None.

Mineral and energy resource potential

Despite the many mineral deposits adjacent to and surrounding the study area, few faults and favored host rocks occur within the area boundaries. While it is possible that similar deposits may occur within the study area, geologic criteria suggest this is not likely, and the potential is regarded as low. Due to the lack of appropriate source rocks and favorable structures the potential for oil and gas is low (Shoemaker, 1956).

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 221-251, 283-357.

Shoemaker, E. M., 1956, Geology of the Roc Creek quadrangle, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-83, scale 1:24,000.

Stone, D. S., 1977, Tectonic history of the Uncompahgre uplift, in Veal, H. K., ed., Exploration frontiers of the Central and Southern Rockies, Rocky Mountain Association of Geologists, Denver, Colorado, p. 23-30.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 141-142, 151-155.

Williams, P. L., 1964, Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-360, scale 1:250,000.

RIO GRANDE NATIONAL FOREST

COCHETOPA HILLS (2-209)

(See description under Grand Mesa, Gunnison, and Uncompahgre National Forests)

MONCHEGO (2-211)

(See description under Grand Mesa, Gunnison, and Uncompahgre National Forests)

MIDDLE FORK (2-217)

(See description under Grand Mesa, Gunnison, and Uncompahgre National Forests)

CARSON PEAK (2-220)

(See description under Grand Mesa, Gunnison, and Uncompahgre National Forests)

STARVATION CREEK (2-264)

PORPHYRY PEAK (2-265)

SAGUACHE PEAK (2-274)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

These three study areas are located at the southern end of the Sawatch Range in the south-central Colorado Rockies north of Saguache. Oligocene andesitic and rhyolitic flows and tuffs are exposed at the surface (Tweto and others, 1976). South of the study areas Paleozoic sedimentary rocks crop out from beneath the Tertiary volcanics. The Bonanza mining district, between the Porphyry Peak and Starvation Creek study areas, is associated with the Bonanza caldera. Several mines in this district produced silver, lead, copper, zinc, and gold from vein deposits; the Rowley mine was the biggest mine of this district and lies within a half mile of the Porphyry Peak study area (Burbank, 1932; Vanderwilt, 1947). Uranium occurs in some of the mines of the Bonanza district, but was never commercially produced there. Uranium also occurs in faults and fractures north of the Bonanza district in the vicinity of Porphyry Peak, and in the Ordovician Harding Formation adjacent to faults in the northeastern part of the Saguache Peak study area (Nelson-Moore and others, 1978). The Saguache Peak and Porphyry Peak study areas lie within a region designated as "favorable for the discovery and development of local sources of low temperature ($<90^{o}C$) water" (Pearl, 1979).

Commodities

Silver, lead, zinc, gold, copper, uranium, geothermal water.

Mineral and energy resource potential

There is a high potential for gold, silver, lead, zinc, copper, and uranium in vein deposits in the southwestern part of the Porphyry Peak study area, and a high potential for silver, lead, zinc, and uranium deposits along major faults in the northern part of the Porphyry Peak study area. The potential for silver, lead, and zinc in veins along faults in the northern part of the Starvation Creek study area is moderate, and the potential for Precambrian zinc-copper skarn deposits in Precambrian rocks is moderate in this area (Taylor and others, 1984). There is a high potential for uranium in sedimentary beds along faults in the northeastern part of the Saguache Peak study area, and a moderate potential for uranium in the southwestern part of the same area. The entire Saguache Peak and Porphyry Peak study areas have a moderate potential for the occurrence of geothermal waters.

References

Burbank, W. S., 1932, Geology and ore deposits of the Bonanza district, Colorado: U.S. Geological Survey Professional Paper 169, 166 p.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 387-396.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. W., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southcentral Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 191-196.

SANGRE DE CRISTO (2-266)
MOUNT BLANCA (2-267)

Kind and amount of data

The western part of the area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation for the eastern part of the Mount Blanca study area, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located along the length of the Sangre de Cristo Mountains from south of Salida to Blanca Peak northeast of Alamosa in the southern Colorado Rockies. Rocks exposed in the wilderness study area include Precambrian gneisses and granitic plutonic rocks, and Late Paleozoic clastic sedimentary rocks that have been folded and thrust during the Laramide orogeny. These rocks are locally intruded by Tertiary dikes and stocks. The Sangre de Cristo Mountains are bounded on the east and west by the high angle Alvarado and Sangre de Cristo faults respectively (Johnson and others, 1984). Although no mines with significant recorded production exist within the study area, there are numerous mining districts in the Sangre de Cristo Mountains in and adjacent to the wilderness study area. Gold occurs all along the western margin of the study area, particularly south of the town of Crestone, north of the Baca Land Grant, and in the Liberty area southeast of the land grant. Gold has been produced from several of these locations. Carbonate Mountain south of Mosca Pass has been extensively prospected, and gold, silver, copper, lead, and iron occur in several locations. The Blanca Peak area in the southern part of the study area contains numerous quartz veins rich in gold, silver, and tungsten. The Rito Alto stocks adjacent to, and partly in the northeastern part of the wilderness study area, have produced gold, silver, copper, and barite and contain molybdenum in Cloverdale Basin. Sedimentary hosted copper and uranium minerals occur throughout a large central portion of the study area in the Minturn and Sangre de Cristo Formations. Although the occurrences are widely distributed, the mineralized zones are very small, discontinuous, and of very low grade (Ellis and others, 1983; Johnson and others, 1984).

Commodities

Gold, silver, copper, iron, lead, molybdenum, tungsten, barite.

Mineral and energy resource potential

A moderate potential for iron, gold and lesser amounts of silver, copper, and lead occurs along a more or less continuous zone along the western margin of the study area. A moderate potential for molybdenum, copper, tungsten, and gold exists in the Rito Alto area in the northern part of the study area. There is a high potential for gold, silver, and tungsten in the Blanca Peak area in the southern portion of the study area and a low potential for geothermal waters in a small part of the study area along Cotton Creek in the western margin of the study area, southeast of Valley View Hot Springs. Although there are some oil and gas leases within the wilderness study area, no wells have been drilled and potential is regarded as low (Johnson and others, 1984; Taylor and others, 1984; Lindsey and others, 1985).

References

Ellis, C. E., Hannigan, B. J., and Thompson, J. R., 1983, Mineral investigation of the Sangre de Cristo Wilderness Study Area, Alamosa, Custer, Fremont, Huerfano, and Saguache Counties, Colorado: U.S. Bureau of Mines Open File Report MLA-65-83.

Johnson, B. R., Lindsey, D. A., Ellis, C. E., Hannigan, B. J., and Thompson, J. R., 1984, Mineral resource potential map of the Sangre de Cristo Wilderness Study Area, south-central Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1635A.

Lindsey, D. A., Hassemer, J. R., Abrams, G. A., Taylor, R. B., and Hannigan, B. J., 1985, Mineral resources of the Black Canyon and South Piney Creek Wilderness Study areas, Saguache County, Colorado: U.S. Geological Survey Bulletin 1716A, 15 p.

Taylor, R. B., Stoneman, R. J., and Marsh, S. P., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 34 p.

TRACY MOUNTAIN (2-275)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Tracy Mountain study area is located southwest of Saguache in the eastern San Juan Mountains in the southern Colorado Rockies. Oligocene andesitic to quartz latitic lava flows and tuffs crop out in the study area (Tweto and others, 1976). The nearest mining district is Crystal Hill, several miles south of the study area, where a modest amount of gold was produced from mineralized breccia pipes in volcanic rock. No mines or mineral occurrences are known to occur within the study area (Vanderwilt, 1947). The study area lies within a region designated as "favorable for the discovery and development of local sources of low temperature ($<90^{o}C$) water" (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic criteria the potential for mineral deposits is regarded as low. The study area has a moderate potential for the occurrence of geothermal waters.

References

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Tweto, Ogden, Steven, T. A., Hail, W. L., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrose $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 194.

SAGUACHE CREEK (2-277)

(See description under Grand Mesa, Gunnison, and Uncompahgre National Forests)

WHEELER-WASON (2-278)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed for the central part of the study area around the Wheeler Geologic area. Information on the geology and mineral deposits for the rest of the study area is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and other related acts.

Mining districts, mines, and mineral occurrences

The study area is in the eastern San Juan Mountains east of Creede and borders the La Garita Wilderness area on two sides in the southern Colorado Rockies. The study area is underlain by Tertiary rhyolite and latite flows and tuffs related to the La Garita, Creede, and San Luis calderas (Larsen and Cross, 1956; Ratte and Steven, 1967; Steven and Bieniewski, 1977). The Creede mining district adjacent to the western boundary of the study area has produced gold, silver, lead, and zinc from vein deposits in a fractured graben trending northwest from Creede (Steven and Ratté, 1965). These ore deposits are adjacent to the study area, but are not known to extend into it. The Sky City mining area in the eastern part of the study area on Wannamaker Creek contains some hydrothermally altered rocks and some quartz-pyrite veins associated with an andesite plug on the east rim of the La Garita caldera. An abandoned mine, mill, and several prospect pits are present, but occurrences are sparse and discontinuous, and there has been no known production. The U.S. Bureau of Mines has found small amounts of gold in grab samples from the mine dumps. Minor amounts of silver, lead, bismuth and tin have been found in

some samples from prospect pits in the Sky City area (Steven and Bieniewski, 1977). The Wheeler Wilderness Study Area in the central part of the study area was the subject of a mandated mineral resource study (Raymond and others, 1983). No mines, mining districts, or prospect pits exist within or near the study area, and no mineralized areas or geochemical anomalies were detected. The most southern and eastern parts of the study area are within an area "favorable for the discovery and development of local sources of low temperature (<90°C) water" (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic and geochemical criteria there is a low potential for gold, silver, and lead in vein deposits at Sky City in the eastern part of the study area. The southern and eastern portion of the study area has a moderate potential for the occurrence of geothermal water.

References

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado; U.S. Geological Survey Professional Paper 258, plate 1.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Ratté, J. C., and Steven, T. A., 1967, Ash flows and related volcanic rocks associated with the Creede caldera, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 524-H, p. 1-3.

Raymond, W. H., Crock, J. G., and Bieniewski, C. L., 1983, Maps showing geology and mineral resource potential of the Wheeler Wilderness Study Area, Mineral County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1571.

Steven, T. A., and Bieniewski, C. L., 1977, Mineral resources of the La Garita Wilderness, San Juan Mountains, southwestern Colorado: U.S. Geological Survey Bulletin 1420, 65 p.

Steven, T. A., and Ratté, J. C., 1965, Geology and structural control of ore deposition in the Creede district, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 487, p. 1-3, 68.

BRISTOL HEAD (2-279)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Bristol Head study area is in the central San Juan Mountains west of Creede in the southern Colorado Rockies. Tertiary latite and rhyolite flows and tuffs crop out in the study area (Steven, 1967; Steven and Ratté, 1973). The Creede mining district east of the study area has produced gold, silver, lead, and zinc from vein deposits in a fractured graben trending northwest from Creede. These ore deposits are adjacent to the study area, but are not known to extend into it (Steven and Ratté, 1965). In the northern part of the study area there is widespread hydrothermal alteration and development of small quartz-pyrite veins associated with quartz latite intrusions in the resurgent San Luis caldera. These quartz-pyrite veins contain sparse, local concentrations of lead, silver, and zinc (Steven, 1967; Steven and Bieniewski, 1977). Other alteration or mineralization is not known within the study area.

Commodities

Gold, silver, lead, zinc.

Mineral and energy resource potential

There is a moderate resource potential for gold, silver, lead, and zinc in vein deposits in the extreme northern part of the study area, adjacent to the Mineral Mountain study area (2-215).

References

Steven, T. A., 1967, Geologic map of the Bristol Head quadrangle, Mineral and Hinsdale Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-631, scale 1:24,000.

Steven, T. A., and Bieniewski, C. L., 1977, Mineral resources of the La Garita wilderness, San Juan Mountains, southwestern Colorado: U.S. Geological Survey Bulletin 1420, p. 14-15.

Steven, T. A., and Ratté, J. C., 1965, Geology and structural control of ore deposition in the Creede district, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 487, p. 1-3, 68.

-----1973, Geologic map of the Creede quadrangle, Mineral and Saguache Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-1053, scale 1:24,000.

DEEP CREEK-DECKER CREEK (2-280)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Weminuche Wilderness (NF-088).

Mining districts, mines, and mineral occurrences

The study area is located in the east-central part of the San Juan Mountains south of Creede in the southern Colorado Rockies. Tertiary rhyolite and latite flows, tuffs, and breccias, with some minor basalt flows crop out in the study area (Larsen and Cross, 1956; Steven and Lipman, 1973; Lipman and Steven, 1976). The Creede mining district lies just north of the study area, and has produced gold, silver, lead, and zinc from vein deposits in a northwest-trending graben structure. These deposits are not known to extend into the study area (Steven and Ratté, 1965). A few miles west of the study area is the Trout Creek area, where native sulfur has been produced from fumarolic sulfur deposits in the Huerto volcanic formation. This area exhibits extensive alteration and minor development of quartz-pyrite with traces of silver, copper, lead, zinc, and bismuth. Deeper mineral deposits cannot be ruled out, though none have been found (Steven and others, 1969). Near the north-central part of the study area, but not included within its boundaries, is the Spar City district, which lies at the intersection of the Deep Creek graben and the south rim of the Creede caldera. Two mines here produced silver, lead, and zinc from fault-controlled vein deposits that are similar to, and contemporary with the vein deposits at Creede. Mineralogical criteria suggest that only the tops of the ore deposits are exposed, and that the full extent of the deposits occurs at depth. Because of soil cover and heavy vegetation it is not known if the vein deposits extend into the study area, though structural considerations suggest that most of the mineralized area would occur outside the boundaries of the study area (Steven, 1964; Steven and Lipman, 1973). Adjacent to the northern part of the study area is the Wagon Wheel Gap fluorspar district, where fluorspar has been produced from fissure vein deposits associated with the east side of the Creede caldera (Aurand, 1920; Steven and Lipman, 1973). All potential coal-bearing strata were eroded before the onset of volcanic activity, but source and reservoir rocks for oil and gas do exist beneath the volcanic rocks. Such accumulations of oil and gas would depend on favorable structural or stratigraphic traps, and no information of such is available (Steven and others, 1969). The Antelope and Birdsie warm springs lie a few miles west of the study area, and the Wagon Wheel Gap hot springs lie just north of the study area. No hot springs are known to occur within the boundaries of the study area, but the northern half of the study area is within a region designated as "favorable for the discovery and development of local sources of low temperature ($<90^{o}C$) water" (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic criteria the potential for mineral deposits is regarded as low. Oil and gas may occur within the study area, but the potential is low. The northern two-thirds of the study area has a moderate potential for the occurrence of geothermal waters.

References

Aurand, H. A., 1920, Fluorspar deposits of Colorado: Colorado Geological Survey Bulletin 18, p. 61-74.

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, Plate 1.

Lipman, P. W., and Steven, T. A., 1976, Geologic map of the South Fork area, eastern San Juan Mountains, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-966, scale 1:48,000.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., 1964, Geologic setting of the Spar City district, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 475D, p. 123-127.

Steven, T. A., and Lipman, P. W., 1973, Geologic map of the Spar City quadrangle, Mineral County, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-1052, scale 1:24,000.

Steven, T. A., and Ratté, J. C., 1965, Geology and structural control of ore deposition in the Creede district, San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 487, p. 1-3, 68.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive area, Colorado: U.S. Geological Survey Bulletin 1261-F, p. 51-52, 75-77, 114-118.

FOX MOUNTAIN (2-281)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Fox Mountain study area is located east of Wolf Creek Pass in the eastern San Juan Mountains in the southern Colorado Rockies. Oligocene latite and rhyolite tuffs and flows capped by Miocene basalt flows crop out in the study area (Steven and others, 1974). There are no mining districts or mines in or near the study area. All potential coal-bearing strata were eroded before the onset of volcanic activity, but source and reservoir rocks for oil and gas do exist beneath the volcanic rocks. Such accumulations of oil and gas would depend on favorable structural or stratigraphic traps, and no information on such is available (Steven and others, 1969). No hot springs are known to occur within or near the study area, and the study area lies outside the region that is designated as favorable for geothermal waters (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the potential is low for the occurrence of mineral or energy related deposits.

References

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive area, Colorado: U.S. Geological Survey Bulletin 1261-F, p. 51-52.

BENNETT PEAK (2-282)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Bennett Peak study area is located west of Monte Vista in the eastern San Juan Mountains in the southern Colorado Rockies. Oligocene lava flows, breccias, and tuffs with related shallow intrusives occur in the study area (Lipman, 1974; Steven and others, 1974). Several mining districts are associated with the Platoro and Summitville calderas southwest of the study area, adjacent to and partly within it. The largest mining district is Summitville several miles west of the study area, where significant quantities of gold, and some silver, copper, and lead were produced from vein deposits (Vanderwilt, 1947). The Platoro, Stunner, and Axtell districts southwest of the study area all produced modest amounts of gold, silver, lead, and copper from vein deposits. Adjacent to, and partly within the southwestern part of the study area, is the Jasper district, where there are several small mines and prospect pits in gold, silver, lead, and zinc-bearing veins, though it is not known what production occurred there (Vanderwilt, 1947). All of these altered and mineralized regions occur at intersections between the northwest-trending Pass Creek fault zone and ring fracture zones of the Platoro and Summitville calderas (Lipman, 1975). A widespread zone of sporadic alteration and pyritization not associated with this structural setting occurs with the Cat Creek stock in the southern part of the study area. There are numerous prospect pits and adits here, but production is not known (Lipman, 1975). There are no other areas of mineralization or alteration within the study area. The study area lies within a region designated as "favorable for the discovery and development of local sources of low temperature ($<90^{\circ}C$) water" (Pearl, 1980).

Commodities

Gold, silver, copper, lead.

Mineral and energy resource potential

A high potential for gold, silver, copper, and lead in vein deposits occurs in the Jasper district in the southwestern part of the study area (site A, area 2-282, pl. 1). There is a moderate potential for vein deposits in the Cat Creek area in the southern part of the study area (site B). The study area has a moderate potential for the occurrence of geothermal waters, based on limited geologic data.

References

Lipman, P. W., 1974, Geologic map of the Platoro caldera area, southeastern San Juan mountains, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-828, scale 1:48,000.

-----1975, Evaluation of the Platoro caldera complex and related volcanic rocks, southeastern San Juan mountains, Colorado: U.S. Geological Survey Professional Paper 852, p. 113-115.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado State Mineral Resources Board, Denver, Colorado, p. 63, 182-184.

WILLOW MOUNTAIN (2-283)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Willow Mountain study area is located in the eastern San Juan Mountains northwest of Antonito in southern Colorado. Oligocene andesitic lava flows, breccias, and tuffs occur throughout the study area (Steven and others, 1974; Lipman, 1974, 1975b). There are several mining districts near the study area to the northwest. The Platoro and Stunner districts produced gold, silver, copper, and lead from vein deposits in the Potosi volcanic series. The Jasper district is north of the study area a few miles and has gold, silver, copper, and lead-bearing veins in an altered terrane. Adjacent to the study area on the northwestern side is the Axtell district where gold and silver bearing veins occur, but production is unknown (Vanderwilt, 1947). All of these mining districts are associated with the Platoro and Summitville caldera, but the calderas are not present in the study area

(Steven and Lipman, 1976). The hydrothermally altered and weakly mineralized area of Cat Creek occurs just north of the study area near the Alamosa River, but does not continue into the study area. No mineralized rocks or radioactive mineral occurrences are known in the study area (Lipman, 1975a; Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Although the study area is near several mining districts, the geologic evidence suggests that none of the mineralized terrane extends into the study area, and the potential for mineral and energy deposits is regarded as low.

References

Lipman, P. W., 1974, Geologic map of the Platoro caldera area, southeastern San Juan mountains, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-828, scale 1:48,000.

------1975a, Evaluation of the Platoro caldera complex and related volcanic rocks, southeastern San Juan mountains, Colorado: U.S. Geological Survey Professional Paper 852, p. 113-115.

------1975b, Geologic map of the lower Conejos River Canyon area, southeastern San Juan mountains, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-901, scale 1:48,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 111.

Steven, T. A., and Lipman, P. W., 1976, Caldera of the San Juan volcanic field, southwestern Colorado: U.S. Geological Survey Professional Paper 958, p. 33-34.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 63, 182-184.

SOUTH SAN JUAN (2-284)
SOUTH SAN JUAN WILDERNESS (NF-284)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Part of this area has been incorporated into the South San Juan Wilderness (2-284).

Mining districts, mines, and mineral occurrences

The study area is in the southern San Juan Mountains near Pagosa Springs, Platoro, and Cumbres in southern Colorado. In the wilderness study area Oligocene and Miocene volcanic and related intrusive rocks crop out. Cretaceous and Tertiary sedimentary rocks crop out in the extreme southern and western portions of the wilderness area. The Platoro and Cat Creek mining districts northeast of the wilderness area have recorded production of significant amounts of gold, silver, lead, zinc, and copper. The inactive Lady Bug mine is in the Crater Creek drainage in the northern part of the wilderness area. Though no production has been recorded for this mine, several hundred tons of low grade silver, lead, and zinc ore occur here. Rock alteration, mineralized rocks, and geophysical and geochemical data all suggest that large porphyry molybdenum deposits may occur at depth at Crater Creek. Coal-bearing strata crop out in the extreme western portion of the wilderness area, and several coal mines exist west of the wilderness area. Significant proven and inferred coal reserves occur within the wilderness area. Producing oil and gas fields occur near the boundary of the wilderness area, and favorable structures occur within the wilderness area (Lipman, 1975; U.S. Geological Survey and U.S. Bureau of Mines, 1977).

Commodities

Coal, oil and gas, silver, lead, zinc, molybdenum.

Mineral and energy resource potential

The potential for coal is high in the western part of the Chàma study area as proven reserves exist there. The potential for oil and gas is rated high for the southwestern portions of the Chama study area. The potential for molybdenum, silver, lead, and zinc is rated high for the Crater Creek area in the northern part of the South San Juan Wilderness area (U.S. Geological Survey and U.S. Bureau of Mines, 1977).

References

Lipman, P. W., 1975, Evolution of the Platoro caldera complex and related volcanic rocks, southeastern San Juan Mountains, Colorado: U.S. Geological Survey Professional Paper 852, 128 p.

U.S. Geological Survey and U.S. Bureau of Mines, 1977, Mineral resources of the Chama-Southern San Juan Mountains Wilderness Study Area, Mineral, Rio Grande, Archuleta, and Conejos Counties, Colorado: U.S. Geological Open-File Report 77-309, 210 p.

BEAR CREEK (2-299)

(See description under San Juan National Forest)

RIO GRANDE RESERVOIR (2-300)

(See description under San Juan National Forest)

RUBY LAKE (2-301)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Ruby Lake study area is in the central San Juan Mountains west of Spar City in the southern Colorado Rockies, and Tertiary rhyolite and latite flows, tuffs, and breccias crop out throughout the area (Larsen and Cross, 1956). Several miles south of the study area in the Trout Creek area, native sulfur has been produced from fumarolic sulfur deposits in the volcanic Huerto Formation. This area exhibits extensive alteration and minor amounts of quartz-pyrite occur with traces of silver, copper, lead, zinc, and bismuth. The mineralized area does not extend into the study area (Steven and others, 1969). Several miles northeast of the study area are the Antelope and Birdsie warm springs, but no warm springs are known within the study area (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the potential for the occurrence of mineral or energy deposits is regarded as low.

References

Larsen, E. S., and Cross, Whitman, 1956, Geology and petrology of the San Juan region, southwestern Colorado: U.S. Geological Survey Professional Paper 258, Plate 1.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive area, Colorado: U.S. Geological Survey Bulletin 1261-F, p. 75-77, 114-118.

BEAVER MOUNTAIN (2-331)
GROUSE MOUNTAIN (2-332)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are south and southwest of South Fork in the eastern San Juan Mountains in the southern Colorado Rockies, and Oligocene latite and rhyolite tuffs and flows of the San Juan volcanic field crop out throughout the areas (Lipman and Steven, 1976). There are no mining districts or mines in or near the study areas. All potential coal-bearing strata were eroded away before the onset of volcanic activity, but source and reservoir rocks for oil and gas do exist beneath the volcanic rocks. Such accumulations of oil and gas would depend on favorable structural or stratigraphic traps, and no information of such is available (Steven and others, 1969). No hot springs are known to occur within or near the study area but the area is within a region designated as "favorable for the discovery and development of local sources of low temperature (<90°C) water (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic criteria the potential for mineral deposits is regarded as low. Oil and gas may occur within the study area, but the potential is low. The study area has a moderate potential for the occurrence of geothermal waters.

References

Lipman, P. W., and Steven, T. A., 1976, Geologic map of the South Fork area, eastern San Juan Mountains, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-966, scale 1:48,000.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 51-52.

ALDER-BEAR (2-333)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Alder-Bear study area is north of South Fork in the southern Colorado Rockies and Oligocene rhyolite, latite, and andesite flows and tuffs of the Potosi volcanic group crop out in the area (Steven and others, 1974; Lipman and Steven, 1976). The nearest mining district is the Embargo district a few miles east of the study area, where gold, silver, lead, and copper minerals

are reported in veins for several miles along Embargo Creek, but there has been no production reported in recent years (Vanderwilt, 1947). There are no known mines within the study area. All potential coal-bearing strata have been eroded away before the onset of volcanic activity, but source and reservoir rocks for oil and gas do exist beneath the volcanic rocks. Such accumulations of oil and gas would depend on favorable structural or stratigraphic traps, and no information of such is available (Steven and others, 1969). No hot springs are known to occur within or near the study area, but the area is within a region designated as "favorable for the discovery and development of local sources of low temperature (<90°C) water" (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic criteria the potential for mineral deposits is regarded as low. Oil and gas may occur within the study area, but the potential is low. The study area has a moderate potential for the occurrence of geothermal waters.

References

Lipman, P. W., and Steven, T. A., 1976, Geologic map of the South Fork area, Eastern San Juan Mountains, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-966, scale 1:48,000.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 51-52.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 194.

SHAW SPRINGS (2-337)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Shaw Springs study area is north of Del Norte in the eastern San Juan Mountains in the southern Colorado Rockies, and Oligocene basaltic to

rhyolitic flows, tuffs, and breccias and related intrusive rocks of the Summer Coon volcanic center crop out throughout the study area. There is a radial dike system around the volcanic center near the north end of the study area (Lipman, 1968, 1976). In the Embargo mining district west of the study area gold, silver, lead, and copper are reported to occur in vein deposits. In the Crystal Hill district north of the study area minor amounts of gold have been produced from mineralized breccia pipes (Vanderwilt, 1947). Although there has been a minor amount of alteration and silicification associated with intersecting dikes within the Summer Coon caldera, there has been no apparent mineralization within the study area (Mertzman, 1971). Shaw warm springs is just east of the study area, and the study area lies within a region designated as "favorable for the discovery and development of local sources of low temperature (<90°C) water" (Pearl, 1980).

Commodities

Geothermal water.

Mineral and energy resource potential

Based on geologic criteria the potential for mineral deposits is regarded as low. The study area has a moderate potential for the occurrence of geothermal waters. The potential for coal, oil, and gas is low.

References

Lipman, P. W., 1968, Geology of Summer Coon volcanic center, eastern San Juan Mountains, Colorado: Colorado School of Mines Quarterly, v. 63, no. 3, p. 211-236.

-----1976, Geologic map of the Del Norte area, eastern San Juan Mountains, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-952, scale 1:48,000.

Mertzman, S. A., Jr., 1971, The Summer Coon volcano, eastern San Juan Mountains, Colorado; in James, H. L., ed., Guidebook of the San Luis Basin, Colorado, New Mexico Geological Society, p. 265-272.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 194.

CRUCES BASIN (2-999)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Cruces Basin study area is in the Tusas Mountains on the New Mexico border near Cumbres. The area is underlain by Tertiary andesitic and

rhyolitic volcanic flows and breccias (Steven and others, 1974). South of the study area in the Tusas Mountains these volcanic rocks lie nonconformably on Precambrian crystalline rocks (Butler, 1971). No mines or mining districts occur within or near the study area (Vanderbilt, 1947). There are no coal-bearing formations in or near the study area (Landis, 1959). Oil and gas have been produced from rocks in the San Juan Basin several miles west of the study area, but the area itself occurs in the Santa Fe-San Luis Rift Basin which has thus far not proven favorable for the occurrence of oil and gas (Spencer, 1983). The study area lies outside of the area regarded as favorable for the discovery and development of local sources of low temperature (<90°C) water in the Rio Grande Rift Basin (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the potential for mineral and energy deposits is low.

References

Butler, A. P., Jr., 1971, Tertiary volcanic stratigraphy of the eastern Tusas Mountains, southwest of the San Luis Valley, Colorado-New Mexico; in James, H. L., ed., Guidebook of the San Luis Basin, Colorado, New Mexico Geological Society, p. 289-300.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-159.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map, scale 1:500,000.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 63.

LA GARITA WILDERNESS (NF-043)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. See also discussion of Mineral Mountain study area 2-215, p. 30.

Mining districts, mines, and mineral occurrences

The wilderness area is in the northeastern San Juan mountains north of Creede in the southern Colorado Rockies. In the La Garita wilderness area Oligocene volcanic and intrusive rocks crop out throughout the area. The wilderness lies within the older La Garita caldera and the younger San Luis caldera. Four episodes of hydrothermal activity have affected the rocks. None of the hydrothermal activity associated with the La Garita caldera mineralized rocks within the wilderness, but there was minor mineralization associated with the San Luis caldera in the extreme western part of the wilderness area. The Creede mining district, the most important mineralized area of the central San Juan Mountains, lies south of the wilderness area, but faults that controlled mineralization at Creede do not extend into the wilderness area. Geochemical surveys indicate a low-level lead and zinc anomaly in the northwestern part of the wilderness area. Veins associated with this area are small, low grade, and erratically mineralized (Steven and Bieniewski, 1977).

Commodities

Lead, zinc, silver.

Mineral and energy resource potential

There is a low potential for silver, lead, and zinc in the northwestern corner of the wilderness area related to the San Luis caldera. Hydrated volcanic glass occurs in the western part of the wilderness area. "Inasmuch as all known perlite is outside the La Garita Wilderness, no tests were made to determine the commercial value of the deposits. A subjective judgment based on field appearance, however, is that such testing would be well worthwhile." Other energy and mineral resources are unknown, and their potential is regarded as low.

References

Steven, T. A., and Bieniewski, C. L., 1977, Mineral resources of the La Garita Wilderness, San Juan Mountains, southwestern Colorado: U.S. Geological Survey Bulletin 1420, 65 p.

WEMINUCHE WILDERNESS (NF-088)

(See description under San Juan National Forest)

ROOSEVELT/ARAPAHOE NATIONAL FOREST
HALL CREEK (2-096)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Hall Creek study area is located in the Rabbit Ears Range southeast of Willow Creek Pass in the northern Colorado Rockies. Tertiary volcanic and sedimentary rocks crop out throughout the area (Tweto, 1976). There are no mining districts in the study area, but just north of the study area near the Continental Divide the natural asphalt gilsonite (grahamite) has been mined (Vine, 1957; Izett, 1968). Coal has been prospected for in the southern half of the study area in the Middle Park Formation, but no coal reserves were found--only thin, shaly, lignitic seams (Izett, 1968). Several dry wells were drilled for oil in the Granby anticline south of the study area (Newton, 1957). Although the area has been heavily prospected for uranium, none has been found in or near the study area (Izett, 1968; Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Although it is possible that coal or oil and gas may occur at depth within the study area, geologic data suggests the area is unfavorable for these resources, and the potential is regarded as low.

References

Izett, G. A., 1968, Geology of the Hot Sulfur Springs quadrangle, Grand County, Colorado: U.S. Geological Survey Professional Paper 586, p. 71-72.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, P. 167-171, 186-188.

Newton, W. A., 1957, North and Middle Parks as an oil province, in Finch, C. W., ed., Guidebook to the geology of North and Middle Park Basins, Colorado, Rocky Mountain Association of Geologists, p. 104-108.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-972.

Vine, J. D., 1957, Grahamite deposit near Willow Creek Pass, Grand County, Colorado, in Finch, C. W., ed., Guidebook to the geology of North and Middle Park Basins, Colorado, Rocky Mountain Association of Geologists, p. 125.

ARAPAHOE CREEK DS (2-109)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Arapahoe Creek study area is located in the Rabbit Ears Range north of Hot Sulfur Springs in the northern Colorado Rockies where Tertiary volcanic rocks and associated intrusive rocks overlie Tertiary sedimentary rocks (Izett, 1968; Tweto, 1976). Uranium occurs south of the study area in the Troublesome Creek area in the lacustrine facies of the Troublesome Formation, but there has been no production (Malan, 1957; Nelson-Moore and others, 1978). Placer gold has been reported along Willow Creek on the eastern border of the study area, but there has been very little production (Izett, 1968). Coal seams occur in the Coalmont Formation north of the study area, and lignitic beds occur in the equivalent Middle Park Formation south of the study area. Coal has been mined from the Hartman mine several miles west of the study area. There has been prospecting and drilling for coal in the southern part of the study area, but no economic deposits of coal were found--only thin lignitic seams (Landis, 1959; Izett, 1968). Several oil and gas test wells have been drilled several miles north of the study area and many miles southwest and southeast. All of these wells have proven to be dry holes although several oil and gas fields occur farther north in North Park (Newton, 1957).

Commodities

None.

Mineral and energy resource potential

Although the possibility exists for the occurrence of uranium minerals in the Troublesome and Middle Park Formations within the study area, the potential is regarded as low. The formations are overlain by the Rabbit Ears volcanic sequence making discovery and exploitation difficult. The possibility also exists for the occurrence of coal within the study area in the Middle Park and Coalmont Formation, but these coal beds are thin, and discontinuous, and the potential for coal is regarded as low. Oil and gas are not known in or near the study area, and favorable structures are unknown, hence the potential is regarded as low.

References

Izett, G. A., 1968, Geology of the Hot Sulfur Springs quadrangle, Grand County, Colorado: U.S. Geological Survey Professional Paper 586, p. 71-72.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 169-171.

Malan, R. C., 1957, Geology of uranium occurrences in North and Middle Parks, Colorado, in Finch, W. C., ed., Guidebook to the geology of North and Middle Park Basins, Colorado: Rocky Mountain Association of Geologists, p. 126-136.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 167-171.

Newton, W. A., 1957, North and Middle Parks as an oil province; in Finch, W. C., Ed., Guidebook to the geology of North and Middle Park Basins, Colorado, Rocky Mountain Association of Geologists, p. 104-108.
Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-972.

NEVER SUMMER (2-111)
NEVER SUMMER WILDERNESS (NF-111)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed for the northern part of the study area. Information on the geology and mineral deposits for the southern and western part of the study area is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Never Summer Wilderness (2-111).

Mining districts, mines, and mineral occurrences

The study area and Never Summer Wilderness area are located where the Rabbit Ears Range meets the Never Summer Range east and northeast of Willow Creek Pass in northern Colorado. In the study and wilderness area Tertiary sedimentary rocks were intruded by Tertiary dikes in the western part. The Never Summer thrust, a thin sheet of Proterozoic gneisses and granites, has been thrust westward over Mesozoic and Tertiary sedimentary rocks in the eastern and northern parts of the study area. Some Tertiary volcanic rocks overlie the Precambrian rocks in the southern tip of the study area (Tweto, 1974; 1976). In the Teller mining district adjacent to and partly within the north-central part of the wilderness area, modest amounts of silver and copper were produced from veins in Precambrian granites and gneisses. The ore was described as rich but small in quantity (Vanderwilt, 1947). A Tertiary granitic pluton that may have been responsible for the alteration in the Teller district underlies the north-central part of the wilderness area. Numerous small veins and mineralized fractures containing molybdenum, silver, lead, zinc, fluorite, and some tin and niobium occur in this area and are associated with the Mount Cumulus stock to the east. Exploratory drilling, geochemical sampling, and a significant gravity anomaly reveal this hidden stock and the related mineralized rocks to be similar to the porphyry deposits of Climax and Henderson (Pearson and others, 1981). Near the southwest border of the study area the natural asphalt gilsonite has been produced from fissures (Vine, 1957; Izett, 1968). Several wells have been drilled for oil in the Granby anticline south of the study area, but all were dry holes (Newton, 1957). No uranium is known to occur within or near the study or wilderness area (Nelson-Moore and others, 1978).

Commodities

Molybdenum, silver, lead.

Mineral and energy resource potential

There is a high potential for molybdenum, silver, and lead deposits in the north-central part of the study area. The potential for other mineral and energy deposits in the rest of the study area is regarded as low.

References

Izett, G. A., 1968, Geology of the Hot Sulfur Springs quadrangle, Grand County, Colorado: U.S. Geological Survey Professional Paper 586, p. 71-72.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 167-171, 186-188.

Newton, W. A., 1957, North and Middle Parks as an oil province, in Finch, C. W., ed., Guidebook to the geology of North and Middle Park Basins, Colorado: Rocky Mountain Association of Geologists, p. 104-108.

Pearson, R. C., Braddock, W. A., Flanigan, V. J., and Patten, L. L., 1981, Mineral resources of the Comanche-Big South, Neota-Flat Top, and Never Summer Wilderness Study Areas, north-central Colorado: U.S. Geological Survey Open-File Report 81-578, 73 p.

Tweto, Ogden, 1974, Geologic map of Colorado: U.S. Geological Survey Map, scale 1:500,000.

------1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 121.

Vine, J. D., 1957, Grahamite deposit near Willow Creek Pass, Grand County, Colorado, in Finch, C. W., ed., Guidebook to the geology of North and Middle Park Basins, Colorado: Rocky Mountain Association of Geologists, p. 125.

COOK CREEK (2-112)
KELLY CREEK (2-136)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located south of Hot Sulfur Springs in the northern Colorado Rockies. Precambrian gneisses and Tertiary sedimentary rocks crop out in both study areas (Izett, 1968; Tweto and others, 1978). No mines or mineral deposits are known within the study areas. A couple of miles northwest of the study areas the CPG and Undecided claims produced modest amounts of uranium from the Tertiary Middle Park Formation where it nonconformably overlies Precambrian granite (Nelson-Moore and others, 1978). Several oil and gas exploration wells were drilled northeast of the study

areas near the Mount Bross fault, and in the Granby anticline, but no oil or gas was discovered (Lovering, 1930; Izett, 1968). The structures within the study areas do not appear favorable for the accumulation of hydrocarbons. There are lignitic and carbonaceous lenses in the Middle Park Formation, but no exploitable coal was discovered (Izett, 1968). There are hot springs at Hot Sulfur Springs, but there does not appear to be any potential for geothermal energy in the study areas (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Possible uranium deposits similar to that near Hot Sulfur Springs may occur within the Kelly Creek study area, but the potential is low. Based on geologic criteria the study areas appear unfavorable for the occurrence of other energy and mineral deposits and their potential is regarded as low.

References

Izett, G. A., 1968, Geology of the Hot Sulfur Springs quadrangle, Grand County, Colorado: U.S. Geological Survey Professional Paper 586, p. 1-5, 71.

Lovering, T. S., 1930, The Granby anticline, Grand County, Colorado: U.S. Geological Survey Bulletin 822B, p. 71-76.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 167-170.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Tweto, Ogden, Moench, R. H., and Reed, J. C. Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-999, scale 1:250,000.

WILLIAMS PEAK AM (2-113)
WILLIAMS PEAK WEST (2-360)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Williams Fork Mountains southeast of Kremmling in north-central Colorado. Precambrian granites and gneisses of the Williams Range thrust sheet overlie Cretaceous and Jurassic sedimentary rocks in both study areas. In the northern part of the study areas, there are small outcrops of Tertiary volcanic rocks and dikes (Tweto and others, 1978). The Blue Ridge mining district is adjacent to the northeastern boundary of the

Williams Peak AM study area where copper is reported, but no details are given and no production is reported (Vanderwilt, 1947). Coal seams have been reported in Cretaceous and Paleocene rocks in Middle Park, but none occur within the study areas (Landis, 1959). The possibility exists for oil and gas accumulations in the Jurassic and Cretaceous rocks beneath the Williams Range thrust fault, but Spencer (1983) considers that the potential is unknown.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the areas are unfavorable for the occurrence of mineral or coal deposits, and the potential is low. The potential for petroleum is not known.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 171.

Spencer, C. W., 1983, Petroleum potential of wilderness lands in Colorado: U.S. Geological Survey Circular 902-E, 8 p.

Tweto, Ogden, Moench, R. C., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 96.

WILLIAMS FORK AH (2-114)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed for the western half of the study area. Information on the geology and mineral deposits for the eastern half of the study area is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Williams Fork study area is located in the Front Range north of Loveland Pass and Dillon in the north-central Colorado Rockies. Proterozoic granites, gneisses, and migmatites with some Tertiary monzonite intrusions crop out in the area. Along the western margin of the study area Mesozoic sedimentary rocks crop out adjacent to the east-dipping Williams Mountains thrust fault (Bryant and others, 1981). The study area is in the Colorado Mineral Belt and is adjacent to, and partly within several mining districts. Southeast of the study area the Georgetown-Silverplume mining district produced gold, silver, lead, and zinc from vein deposits (Lovering and Goddard, 1950). Northeast of the study area the Empire district produced gold

and some silver and copper from vein and gossan deposits (Lovering and Goddard, 1950). Adjacent to the central part of the study area the Urad mine produced molybdenum with subordinate amounts of lead and zinc from veins and a stockwork deposit. North of, and partly within the study area are the Dailey and La Plata mining districts which produced silver, lead, and zinc from vein deposits that also contained molybdenum. These veins are thought to be genetically related to the porphyry molybdenum system beneath Red Mountain (Theobald and others, 1983). North of the study area is the large molybdenum mine at Henderson which produces ore from the porphyry system beneath Red Mountain. In the central part of the study area, along the Continental Divide, there are lead and silver minerals, altered rocks, geophysical gravity lows and geochemical anomalies. This pattern of mineralized and altered rock is similar to that found at Red Mountain and may indicate a similar molybdenum porphyry deposit at depth in the study area beneath the Continental Divide (Theobald and others, 1983). Northwest of the study area near Jones Pass, uranium mineralization occurs in a shear zone in the Silverplume granite, but there has been no production from this site (Nelson-Moore and others, 1978).

Commodities

Silver, lead, zinc, molybdenum, tungsten, copper.

Mineral and energy resource potential

There is a moderate potential for silver, lead, zinc, and molybdenum in vein and porphyry deposits in the central part of the study area, and a high potential exists for silver, lead and zinc in vein deposits in the north-central and south-central parts of the study area. A moderate potential exists for tungsten in skarn deposits and for silver, lead, zinc, and copper in massive sulfides in the northwestern part of the study area (Theobald and others, 1983).

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 138-160, 280-283.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 167-171.

Theobald, P. K., Bielski, A. M., Eppinger, R. G., Moss, C. K., Kreidler, T. J., and Barton, H. N., 1983, Mineral resource potential map for the Vasquez Peak Wilderness Study Area, and the Williams Fork and St. Louis Peak Roadless areas, Clear Creek, Grand, and Summit Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1588A, scale 1:24,000.

EAST RAWAH (2-115)
RAWAH WEST (2-157)
MONTGOMERY PASS (2-322)
RAWAH SOUTH (2-323)
EAST RAWAH A (2-324)
RAWAH WILDERNESS (NF-066)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these areas have been incorporated into the Rawah Wilderness (NF-066).

Mining districts, mines, and mineral occurrences

The wilderness and study areas are located in the Medicine Bow Range east of North Park in northern Colorado. In the Rawah Wilderness area Proterozoic granitic rocks crop out, with minor amounts of Permian sedimentary rocks preserved in down-faulted slivers in the northern part of the area. Major northwest-trending faults extend through the area. Minor Tertiary lava flows crop out in the extreme southern part of the wilderness area. No mines and very few prospect pits exist in the wilderness area. The nearest mining district is 10 miles to the northeast. Weak traces of copper occur along fault zones in the northeastern part of the wilderness. Geochemical surveys disclose a few weak, widely scattered, discontinuous anomalies of silver, copper, tungsten, uranium, and molybdenum (Pearson and others, 1982).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical data, the mineral potential for mineral and energy deposits in the wilderness area is regarded as low.

References

Pearson, R. C., McCallum, M. E., Griswold, M. L., and Patten, L. L., 1982, Mineral resources of the Rawah Wilderness, Larimer County, Colorado: U.S. Geological Survey Open-File Report 82-376, 27 p.

GREEN RIDGE (2-116)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Green Ridge study area is located in the Front Range north of Kinnikinik and Idylwide in northern Colorado. Precambrian granites and gneisses with some Tertiary intrusive dikes and volcanic rocks occur throughout the area (Braddock and Cole, 1978). The Home and Maysville mining districts lie just south of the study area. At Home, gold and copper occur in veins in Precambrian granite and gneiss, but production was unsuccessful. At Maysville, a few miles east of Home, gold and copper also occur in veins in the Precambrian rocks, and production is unknown. The Manhattan district just east of the study area has produced modest amounts of gold and copper from vein and placer deposits (Vanderwilt, 1947). Near the Home mining district the pegmatites of the Chaney-Sims prospect were prospected for beryl, but there was no production (Hanley and others, 1950). Just south of the study area at Spencer Heights are the Lucky Strike claims where uranium occurs in pegmatites in the Precambrian rock. Just east of the study area is the Batterson lode where uranium occurs in a quartz-pyrite vein. There has been no production at either location (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, potential is low for the occurrence of mineral and energy deposits.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, P. 87-104.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 207-210.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 137-139.

GREYROCK (2-117)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral mineral resource evaluation, but is not sufficient for the mineral survey as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Greyrock study area is located in the Front Range northwest of Fort Collins in northern Colorado where Precambrian granites and gneisses are exposed at the surface (Braddock and Cole, 1978). In the Steamboat Rock (Greyrock) district in the vicinity of the study area, gold and copper in Precambrian rocks is reported, but production is unknown and location is not certain (Vanderwilt, 1947). The Glen Echo pegmatite prospect is southeast of the study area but production is not known (Hanley and others, 1950).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the potential is low for the occurrence of mineral and energy deposits.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, P. 87-104.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 137-139.

LITTLE SOUTH (2-118)
CACHE LA POUDRE WILDERNESS (NF-118)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. This area has been incorporated into the Cache La Poudre Wilderness (NF-118).

Mining districts, mines, and mineral occurrences

The wilderness area is located in the Front Range south of Eggers and Poudre Parks in northern Colorado, where Precambrian hornblende, biotite, and calc-silicate gneisses occur at the surface (Braddock and Cole, 1978). There is a tungsten mining area mainly south of, but partly within the wilderness area from which tungsten was produced from vein and skarn deposits at the Lookout and Challenger mines (Belser, 1956). The wilderness area is underlain by Precambrian gneisses that are the preferred host rocks for tungsten skarn deposits in the central and northern part of the Colorado (Tweto, 1960). Other mineral deposits are not known to occur within the wilderness area.

Commodities

Tungsten.

Mineral and energy resource potential

The wilderness area has a moderate potential for the occurrence of small tungsten deposits in veins and calc-silicate skarns.

References

Argall, G. O., 1943, Scheelite in Colorado: Mines Magazine (Colorado), v. 33, p. 313-314.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colorado: U.S. Bureau of Mines Information Circular 7748, 31 p.

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greely $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

COMANCHE-BIG SOUTH (2-119)
COMANCHE PEAK WILDERNESS (NF-119)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed for the northern part of the wilderness area. Information on the geology and mineral deposits for the southeastern part of the wilderness area is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Most of this area has been incorporated into the Comanche Peak Wilderness (2-119). Part of Rocky Mountain National Park has also been incorporated into this wilderness.

Mining districts, mines, and mineral occurrences

The wilderness study area is located in the Front Range north and east of Rocky Mountain National Park in northern Colorado where Precambrian granites and gneisses crop out. The wilderness area is cut by numerous east-northeast-trending faults (Braddock and Cole, 1978). At Spencer Heights north of the wilderness area exploratory drilling and mine work have been done at a uranium prospect; the mineralized areas are significant and occur in a shear zone adjacent to the wilderness area. Other similar shear zones exist within the wilderness area but no other mineralized rocks or geochemical anomalies were detected (Pearson and others, 1981). Adjacent to, and partly within the eastern part of the Comanche-Big South study area are the Crystal silica mine and the Radial beryl prospect. The Crystal silica mine produced bismuth, columbite, and some beryl from pegmatites, but no production is known from the Radial beryl prospect. Just east of the Comanche-Big South study area are the

Big Boulder prospect, which produced beryl from pegmatite, and the Lewis prospect, which contained minor quantities of beryl (Hanley and others, 1950). The High Above Lode, the Hyatt Ranch deposit, and the New Hope claims all occur adjacent to, and partly within the southeastern part of the Comanche-Big South study area. The High Above Lode and the Hyatt Ranch deposit produced modest amounts of beryl, tourmaline, and uranium from pegmatite, and the New Hope claims were successfully mined, but production records are not available. These claims contain uranium (Nelson-Moore and others, 1978).

Commodities

Bismuth, beryllium, uranium, columbite.

Mineral and energy resource potential

The potential for uranium in the northern part of the wilderness area is considered low, although the possibility exists that some uranium could be localized along shear zones in the northern part of the study area. There is a moderate potential for bismuth, beryllium, uranium, and columbite deposits in pegmatites in the southeasternmost part of the Comanche-Big South study area.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, p. 87-104.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 207-210.

Pearson, R. C., Braddock, W. A., Flanigan, V. J., and Patten, L. L., 1981, Mineral resources of the Comanche-Big South, Neota-Flat Top, and Never Summer Wilderness Study Areas, north-central Colorado: U.S. Geological Survey Open-File Report 81-578, 73 p.

NEOTO-FLAT TOP (2-120)
NEOTO WILDERNESS (NF-120)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Most of this area has been incorporated into the Neoto Wilderness.

Mining districts, mines, and mineral occurrences

The wilderness area is located southeast of Cameron Pass in northern Colorado and is underlain principally by Oligocene and Miocene rhyolite and andesite tuffs and flows, with a minor amount of Proterozoic granite cropping

out in the southern part of the wilderness area (Braddock and Cole, 1978). No mines or prospect pits exist in the wilderness and study area, and no mineralized rocks or geochemical anomalies were discovered in it (Pearson and others, 1981).

Commodities

None.

Mineral and energy resource potential

Based on geologic, geochemical, and geophysical criteria, the potential is low for the occurrence of mineral or energy deposits.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Pearson, R. C., Braddock, W. A., Flanigan, V. J., and Patten, L. L., 1981, Mineral resources of the Comanche-Big South, Neota-Flat Top, and Never Summer Wilderness Study Areas, north-central Colorado: U.S. Geological Survey Open-File Report 81-578, 73 p.

CROSIER MOUNTAIN (2-121)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range east of Estes Park in northern Colorado where Precambrian granites and gneisses occur throughout the study area (Braddock and Cole, 1978). The mining district of Drake is east of, and partly within the study area. Gold and copper minerals occur in the Precambrian rocks, but no production is reported (Vanderwilt, 1947). The Hershmann pegmatite prospect occurs within the eastern part of the study area, but information is not available on production. This pegmatite is at the southern end of a belt of pegmatites that have produced beryl, uranium, and bismuth (Hanley and others, 1950).

Commodities

Gold, copper, beryllium, uranium.

Mineral and energy resource potential

There is a moderate potential for the occurrence of gold and copper in vein deposits and beryl and uranium in pegmatites in the easternmost part of the study area.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, p. 87-104.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 137.

HELL CANYON (2-122)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range west of Berthoud in northern Colorado and is composed of Precambrian granites and gneisses (Braddock and Cole, 1978). There are no mining districts or mines near the study area. There is uranium reported at Carter Lake several miles east of the study area, but there has been no production (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the potential for the occurrence of mineral and energy deposits is low.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 207-209.

NORTH ST. VRAIN (2-123)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range east of Park in northern Colorado. Precambrian granites and gneisses crop out throughout the area (Braddock and Cole, 1978). The Jamestown mining district several miles south of the study area has produced gold, silver, lead, zinc, copper, and fluorite from veins and fault breccias (Vanderwilt, 1947). In the Allens Park district west of the study area gold and silver occur in veins in the Precambrian rocks. There has been only very minor, if any, production from this district (Lovering and Goddard, 1950). Neither of these mining districts appears to extend into the study area.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the potential is low for the occurrence of mineral and energy deposits.

References

Braddock, W. A., and Cole, J. C., 1978, Preliminary geologic map of the Greeley $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Open-File Report 78-532, scale 1:250,000.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 283.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 323-329.

INDIAN PEAKS A (2-124)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range west of Raymond in northern Colorado and consists primarily of the Precambrian St. Vrain granite, with

some gneisses and schists. The nearest mining district is the Allens Park district north of the study area. This area exhibits gold and silver mineralization along fractures and fault breccias, but due to the low grade, mining has been unsuccessful (Lovering and Goddard, 1950). Just south of the study area is the Argo mine which produced gold, lead, zinc, and some fluorspar. This mine also has uranium mineralization, but has produced no uranium ore (Aurand, 1920; Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Despite the nearby occurrence of mineralized veins, geologic criteria suggest that the area contains no deposits and the potential is regarded as low.

References

Aurand, H. A., 1920, Fluorspar deposits of Colorado: Colorado Geological Survey Bulletin 18, p. 38-61.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 283.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 80-81.

INDIAN PEAKS B (2-125)
INDIAN PEAKS C (2-126)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Front Range west of Ward in the northeast Colorado Rockies. Precambrian granites and gneisses intruded by some Tertiary monzonites are exposed at the surface of both areas (Lovering and Goddard, 1950). The Ward mining district, adjacent to and partly within the study areas, produced gold, silver, lead, copper, and zinc from vein deposits (Goddard, 1947; Lovering and Goddard, 1950). Southwest of the study areas is the Lake Albion district, which produced lead, gold, silver, and minor amounts of zinc from vein deposits and mineralized breccia zones (Lovering and Goddard, 1950; Pearson and U.S. Bureau of Mines, 1980). Uranium has been reported in a vein in the Precambrian Boulder Creek Granite southwest of Ward and adjacent to the eastern boundary of the Indian Peaks C study area, but there has been no production (Nelson-Moore and others, 1978).

Commodities

Gold, silver, lead.

Mineral and energy resource potential

The eastern parts of the study areas have a moderate potential for gold, silver, and lead in vein deposits. The study areas have a low potential for other mineral and energy deposits.

References

Goddard, E. W., 1947, Ward District, Boulder County: in Vanderwilt, J. W., ed., Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 318-319.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 202-207, 283-284.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 85.

Pearson, R. C., and U.S. Bureau of Mines, 1980, Mineral resources of the Indian Peaks study area, Boulder and Grand Counties, Colorado: U.S. Geological Survey Bulletin 1463, p. 56-57.

INDIAN PEAKS D (2-127)
INDIAN PEAKS E (2-128)
INDIAN PEAKS G (2-131)
INDIAN PEAKS F (NF-208)
INDIAN PEAKS WILDERNESS (NF-208)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Part of the Indian Peaks Wilderness (NF-208) has been incorporated into Rocky Mountain National Park.

Mining districts, mines, and mineral occurrences

The Indian Peaks Wilderness area and study areas are located in the Front Range northwest of Nederland, in the northeastern Colorado Rockies. Proterozoic gneisses intruded by several Proterozoic and Laramide (late Cretaceous to early Tertiary age) granitic plutons, dikes, and sills crops out throughout the Indian Peaks region. Several major northwest-trending faults transect the area. The southern part of the wilderness area is in the Colorado Mineral Belt. Several mining districts are adjacent to or near the wilderness and study areas. The Eldora and Lost Lake mining districts to the south have produced gold and silver, and the Caribou mining district to the east has produced silver and lead as well as minor amounts of gold, copper, zinc, and uranium. Three inactive mines, as well as numerous claims and

prospect pits, lie within the boundaries of the wilderness. Lead and silver were produced from the Snowy Range vein at Lake Albion. Copper and silver were produced at the head of Roaring Fork Creek in the northern part of the wilderness. Copper, lead, zinc, gold, and silver were all produced at the 4th of July mine in the southern part of the wilderness. Reserves of these commodities exist at Roaring Fork and may exist at Lake Albion and at the 4th of July mine. Disseminated sulfide mineralization containing copper and gold occurs in the Audubon stock near Blue Lake. Anomalous amounts of copper, molybdenum, lead, silver, and tungsten occur west of Rainbow Lakes. Uranium occurs in the border zone adjacent to a large granite body in Wheeler Basin (Pearson and U.S. Bureau of Mines, 1980).

Commodities

Copper, gold, silver, lead, molybdenum, uranium, tungsten.

Mineral and energy resource potential

Within the wilderness area there are known deposits of copper and silver at Roaring Fork (A), and of uranium at Wheeler Basin (B). Near Rainbow Lakes (C), there is a high potential for copper, lead, silver, molybdenum, and tungsten deposits. There is a moderate potential for copper and gold in disseminated sulfides in the Audubon stock between Blue and Mitchell Lakes (D). A high potential for copper, molybdenum, lead, silver, and tungsten occurrences at Caribou (C) adjacent to area 2-127 and at Lost Lake (E) adjacent to area 2-128.

References

Pearson, R. C., and U.S. Bureau of Mines, 1980, Mineral resources of the Indian Peaks study area, Boulder and Grand Counties, Colorado: U.S. Geological Survey Bulletin 1463, 109 p.

JAMES PEAK (2-129)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range northeast of Berthoud Pass in the north-central Colorado Rockies. Precambrian granites, gneisses, and schists with some Tertiary monzonite intrusions occur throughout the study area (Braddock, 1969; Bryant and others, 1981). Southeast of the study area is the Empire district where gold and some silver and copper were produced from vein and gossan deposits (Lovering and Goddard, 1950). The Alice-Yankee Hill district east of the southern part of the study area produced gold from quartz-pyrite veins in the Idaho Springs schist (Lovering and Goddard, 1950). East of the northern part of the study area the North Gilpin district produced modest amounts of gold, silver, and copper from vein deposits in

schist. Most of the veins are gold-bearing quartz-pyrite veins of lower grade that are widely scattered and irregularly distributed throughout the northern part of Gilpin County. Several mineralized faults and brecciated fault zones occur in the northern part of the study area (Lovering and Goddard, 1950). Several uranium occurrences exist within the study area; a vein with uranium minerals occurs near the Continental Divide near Mt. Flora in the southern part of the study area, and near James Peak there is a uranium-bearing pegmatite (Nelson-Moore and others, 1978).

Commodities

Gold, uranium, silver.

Mineral and energy resource potential

There is a moderate potential for gold veins with subordinate amounts of silver in the northern part of the study area. A moderate potential for uranium occurs near Mt. Flora in the south-central part of the study area.

References

Braddock, W. A., 1969, Geology of the Empire quadrangle, Grand, Gilpin, and Clear Creek Counties, Colorado: U.S. Geological Survey Professional Paper 616, p. 1-2.

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 156-160, 164-165, 193-196.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p 159-171.

STRAWBERRY CREEK (2-132)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range east of Granby in the northern Colorado Rockies and consists primarily of Precambrian granite and gneiss (Tweto, 1979). South of the study area at the High Lonesome Mine copper minerals are present in a calc-silicate gneiss of the Idaho Springs Formation. Information on production from this mine is not available (Lovering and Goddard, 1950). Other mineralization in or near the study area is not known. Pearson and U.S. Bureau of Mines (1980) state that although there has been considerable production of gold, silver, copper, lead, and zinc

east of the Continental Divide in Boulder County, there has been only very modest mineral production west of the divide in Grand County where the present study is located.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 71.

Pearson, R. C., and U.S. Bureau of Mines, 1980, Mineral resources of the Indian Peaks study area, Boulder and Grand Counties, Colorado: U.S. Geological Survey Bulletin 1463, p. 32.

Tweto, Ogden, 1979, Geologic map of Colorado: U.S. Geological Survey Map, scale 1:500,000.

INDIAN PEAKS H (2-133)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Indian Peaks Wilderness (NF-208).

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range east of Fraser along the western slope of the Continental Divide north of the Colorado Mineral Belt. Precambrian granites, gneisses, and schists crop out in the study area (Tweto, 1979; Bryant and others, 1981). The nearest mining districts are the Lost Lake, Grand Island, and Lake Albion districts, which all lie several miles east of the study area. These districts produced varying amounts of gold, silver, lead, and some copper, with additional tungsten occurrences and productive titaniferous iron deposits in the Caribou-Grand Island district. The Lake Albion district is within the Indian Peaks Wilderness area. At the High Lonesome mine, just north of the study area, copper, lead, and zinc are present in what appears to be a Precambrian skarn deposit (Lovering and Goddard, 1950; Pearson and U.S. Bureau of Mines, 1980). Production is not known. The Arapahoe fault zone trends northwestward through the northern part of the study area and is partly altered and weakly mineralized. There are many prospect pits along this fault in Meadow Creek within the study area, but there are no mines and there has been no production (Pearson and U.S. Bureau of Mines, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria, the area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Dever $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 70, 197-202, 283-285.

Pearson, R. C., and U.S. Bureau of Mines, 1980, Mineral resources of the Indian Peaks study area, Boulder and Grand Counties, Colorado: U.S. Geological Survey Bulletin 1463, p. 1-7, 48-68.

Tweto, Ogden, 1979, Geologic map of Colorado: U.S. Geological Survey Map, scale 1:500,000.

HARRIGAN CREEK (2-137)
MARYLAND CREEK (2-138)
CORRAL CREEK (2-139)
ELLIOTT RIDGE (2-151)
OTTER CREEK (2-350)
BRUSH CREEK (2-351)
EAGLES NEST WILDERNESS (NF-021)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these study areas have been incorporated into the Eagles Nest Wilderness (NF-021).

Mining districts, mines, and mineral occurrences

The wilderness area is located in the Gore Range west of Silverthorne and Frisco in north-central Colorado. The majority of the Eagles Nest Wilderness consists of Proterozoic migmatites, granites, and gneisses bounded on the east and west by major high-angle fault zones. Paleozoic and Mesozoic sedimentary rocks crop out along the eastern and western margins of the wilderness area adjacent to these fault zones. Small outcrops of Tertiary volcanic and intrusive rocks exist in the northern part of the wilderness area. At the inactive Boss mine along the Mosquito and Blue River faults on the east side of the wilderness area, gold and silver and minor amounts of copper, lead, and zinc were produced. Geochemical anomalies are known in the altered zones and

mineralized veins along the Blue River fault between the Boss Mine and Frisco near the southeastern side of the wilderness area (Tweto and others, 1970).

Commodities

Silver, lead, zinc.

Mineral and energy resource potential

There is a moderate and high potential for silver, lead, and zinc in vein deposits along the southeastern part of the wilderness area, between Frisco and the Boss mine. There is no potential for coal, oil, or gas because of unfavorable geologic terrane. Other mineral and energy deposits are unknown, and their potential is regarded as low.

References

Tweto, Ogden, Bryant, Bruce, and Williams, F. E., 1970, Mineral resources of the Gore Range-Eagles Nest Primitive area, Summit and Eagle Counties, Colorado: U.S. Geological Survey Bulletin 1319C, 123 p.

JACQUE PEAK (2-140)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located south of Vail Pass in central Colorado and is in the Colorado Mineral Belt. The area consists of Paleozoic sedimentary rocks intruded by Tertiary quartz monzonite, with minor outcrops of Precambrian gneisses in the northeastern corner of the study area (Bergendahl and Koschmann, 1971; Tweto and others, 1978). The eastern half of the study area is in the Kokomo-Tenmile district, which has produced significant amounts of silver, lead, zinc, copper, and gold from replacement deposits in limestone beds in the Pennsylvanian Minturn Formation (Bergendahl and Koschmann, 1971). South of the study area several miles is the Climax district where molybdenum has been produced from a stockwork porphyry deposit near Fremont Pass (Del Rio, 1960). Several miles northwest of the study area, the Gilman district produced significant amounts of zinc, silver, copper, lead, and gold from replacement and vein deposits in lower Paleozoic and Precambrian rocks (Lovering and others, 1978). Within the study area all known mineralized carbonate rocks at or near the surface have been extensively mined or prospected. Two areas of molybdenum, garnet, and magnetite deposits are known in the area though neither has been successfully mined because of the low grade and sporadic nature of the mineralization.

Commodities

Silver, lead, zinc.

Mineral and energy resource potential

It is doubtful that further prospecting on the surface will reveal additional ore deposits in the district; however, exploration of the carbonate units may disclose new deposits down dip from those already mined. For this reason the eastern part of the study area is regarded as having a moderate potential for silver, lead, and zinc. Other energy and mineral resources are unknown and their potential is regarded as low (Bergendahl and Koschmann, 1971).

References

Bergendahl, M. H., and Koschmann, A. H., 1971, Ore deposits of the Kokomo-Tenmile district, Colorado: U.S. Geological Survey Professional Paper 652, 53 p.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel; Colorado Mineral Resource Board, Denver, Colorado, p. 317-321.

Lovering, T. A., Tweto, Ogden, and Lovering, T. G., 1978, Ore deposits of the Gilman district, Eagle County, Colorado: U.S. Geological Survey Professional Paper 1017, p. 1-3.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{\circ}x2^{\circ}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

TENMILE (2-141)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Tenmile Range west of Breckenridge in central Colorado and consists primarily of Precambrian gneisses, migmatites, and granites with some Paleozoic and Mesozoic sedimentary rocks cropping out in the eastern part of the study area, and some Tertiary granitic intrusions cropping out near the middle (Bergendahl, 1963). The study area is within the Colorado Mineral Belt and lies within, or adjacent to several mining districts. The Climax district adjacent to the southwestern corner of the study area is the most productive district in the state. Significant quantities of molybdenum and lesser amounts of tungsten, tin, and rare earth elements are produced from a porphyry deposit in this district (Del Rio, 1960). The Kokomo-Tenmile district, adjacent to and partly within the western part of the study area, produced gold, silver, lead, zinc, and copper from replacement deposits in the Late Paleozoic carbonates in the Kokomo-Tenmile district. Some molybdenum is also present (Bergendahl and Koschmann, 1971).

The Blue River district is adjacent to, and partly within, the eastern part of the study area where gold, silver, lead, and zinc were produced from vein and replacement deposits in Precambrian and Paleozoic rocks (Singewald, 1951). The Breckenridge district adjacent to the eastern border of the study area produced gold, silver, lead, and zinc from vein, replacement, stockwork, and placer deposits (Lovering, 1934). Tungsten is present in many of the gold veins in small amounts, and tungsten was reported at Hoosier Pass near the southeastern corner of the study area (Singewald, 1951; Tweto, 1960). Most sulfide-bearing quartz veins in the northern Tenmile Range occupy shear zones. Most of these deposits are small and of low grade (Bergendahl, 1963). There are numerous veins and many old mines and prospect pits in the northern part of the study area associated with the Kokomo district. There are also many veins with many old mines and prospect pits in the southern and southeastern part of the study area associated with the Blue River district (Singewald, 1951). Uranium is reported along the Blue River just north of Breckenridge, but no details are given and no production is known (Nelson-Moore and others, 1978).

Commodities

Gold, silver, lead, zinc.

Mineral and energy resource potential

There is a moderate potential for gold, silver, lead, and zinc in vein deposits in the northern, southern, and southeastern parts of the study area. The potential for other energy and mineral deposits is regarded as low.

References

Bergendahl, M. H., 1963, Geology of the northern part of the Tenmile Range, Summit County, Colorado: U.S. Geological Survey Bulletin 1162D, p. 1-19D.

Bergendahl, M. H., and Koschmann, A. H., 1971, Ore deposits of the Kokomo-Tenmile district, Colorado: U.S. Geological Survey Professional Paper 652, 53 p.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 317-321.

Lovering, T. S., 1934, Geology and ore deposits of the Breckenridge mining district, Colorado: U.S. Geological Survey Professional Paper 176, 64 p.

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Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

RED PEAK (2-142)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Colorado Mineral Belt south of Breckenridge in central Colorado. Paleozoic red beds intruded by Tertiary monzonite stocks and dikes occur at the surface in the study area (Tweto and others, 1978; Bryant and others, 1981). The study area is within the Blue River district where gold, silver, lead, and zinc were produced from vein and replacement deposits in Paleozoic rocks (Singewald, 1951). Tungsten is associated with many of the gold veins and scheelite is reported at Hoosier Pass near the southwestern corner of the study area (Singewald, 1951; Tweto, 1960). Several mines occur within the study area in the western part near Blue River, and in the eastern part near Boreas Pass. The Breckenridge district north of the study area produced gold, silver, lead, and zinc from vein and replacement, stockwork, and placer deposits (Lovering, 1934).

Commodities

Gold, silver, lead, zinc.

Mineral and energy resource potential

There is a high potential for gold, silver, lead, and zinc deposits in the western and eastern portions of the study area. Other resources are not known to occur within the study area, and their potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

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JEFFERSON (2-143)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located at the northern end of South Park in central Colorado and consists primarily of Precambrian gneisses and granites with some Mesozoic sedimentary rocks preserved in down-faulted blocks, and some Tertiary monzonite intrusions (Bryant and others, 1981). The Montezuma mining district, which lies several miles north of the study area, has produced gold, silver, lead, zinc, and copper from vein, stockwork, and placer deposits. The Swan River, just north of the study area, was the site of gold placers. The White Swan mine is just north of the study area, but there are no mines within the study area (Lovering, 1935; Goddard, 1947). Uranium has been produced from several mines a few miles east of the study area near Kenosha Pass, from fractures and shear zones in the Precambrian Pikes Peak and Silver Plume granites (Nelson-Moore and others, 1978). There is an occurrence of uraniferous lignite within the Belden Formation just north of the study area, but there has been no production. There are no known occurrences of uranium within the study area.

Commodities

None.

Mineral and energy resource potential

There are no known mineral or energy deposits within the study area, and the potential for such is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

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SQUARE TOP MOUNTAIN (2-144)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Square Top Mountain study area is located south of Silver Plume in the Front Range in the north-central Colorado Rockies. Precambrian granites, migmatites, and gneisses with some minor outcrops of Tertiary rhyolite occur throughout the study area. The study area is adjacent to, and partly within, the Colorado Mineral Belt (Bryant and others, 1981). The Montezuma mining district west of the study area has produced gold, silver, lead, zinc, and copper from vein, stockwork, and placer deposits (Lovering, 1935). Northwest of the study area is the Argentine district, where gold, silver, lead, and some copper and zinc were produced from vein deposits (Lovering and Goddard, 1950). The Silver Plume-Georgetown district lies just north of the study area and produced silver, lead, gold, and zinc from vein deposits in the Precambrian rocks (Lovering and Goddard, 1950). Although there are several mines near the study area, none occurs within the boundaries of the study area, nor are significant mineral deposits known.

Commodities

None.

Mineral and energy resource potential

There is no known geologic evidence for the occurrence of mineral or energy deposits within the study area, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., 1935, Geology and ore deposits of the Montezuma quadrangle, Colorado: U.S. Geological Survey Professional Paper 178, p. 51-65.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 135-150.

WILLOW CREEK (2-309)
SAND CREEK (2-329)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines and mineral occurrences

The areas are located northeast of Greeley on the high plains in northeastern Colorado and are underlain by flat-lying Cretaceous sedimentary rocks of the Denver Basin. The coal-bearing Laramie Formation crops out at the surface for most of the study areas (Tweto, 1979). Coal has been produced from seams in the Laramie Formation at several localities in the Denver Basin, and coal occurs in this formation north of the South Platte river into Wyoming (Soister, 1978). Uranium occurs in sandstone beds of the Fox Hills Formation at several locations along Willow Creek in the study area (Nelson-Moore and others, 1978). These and other uranium deposits in nearby Weld County are stacked rollfront deposits in carbonaceous sandstones and they contain considerable reserves (Reade, 1978). The Sand Creek uranium deposit is partly within the study area, and the Grover deposit occurs just east of the study areas (Reade, 1978). Although there is considerable production of oil and gas from several formations in the Denver Basin, there are no oil or gas fields in or near the study areas. Several dry holes have been drilled east and southeast of the study areas, but exploratory drilling is not known within the areas, or north and west of them (McClure, 1973).

Commodities

Coal, uranium, oil and gas.

Mineral and energy resource potential

There is a high potential for uranium at the Sand Creek deposit in the Sand Creek study area. There is a moderate resource potential for coal and oil and gas in both study areas.

References

McClure,D. V., 1973, Structural top of J sandstone and equivalents, Plate I in Pruit, J. D., and Coffin, P. E., eds., Energy resources of the Denver Basin, Rocky Mountain Association of Geologists.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 456-459.

Reade, H. L., 1978, Uranium deposits: northern Denver-Julesberg Basin, Colorado, in Pruit, J. D., and Coffin, P. E., eds., Energy Resources of the Denver Basin, Rocky Mountain Association of Geologists, p. 161-171.

Soister, P. E., 1978, Geologic setting of coal in the Denver Basin, in Pruit, J. D., and Coffin, P. E., eds., Energy Resources of the Denver Basin, Rocky Mountain Association of Geologists, p. 183-185.
Tweto, Ogden, 1979, Geologic map of Colorado: U.S. Geological Survey Map, scale 1:500,000.

MT. SNIKTAU (2-321)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range adjacent to Loveland Pass in north-central Colorado. Precambrian granite, migmatites, and gneisses, with minor amounts of Tertiary quartz monzonite crop out in the study area (Bryant and others, 1981). The study area is within the Colorado Mineral Belt and is adjacent to two mining districts. The Argentine district to the east produced gold, silver, lead, zinc, and copper from fault-controlled vein deposits (Lovering and Goddard, 1950). Southwest of the study area lies the Montezuma district where gold, silver, lead, zinc, and copper were produced from vein, stockwork, and placer deposits (Lovering, 1935). No mines or mineralized veins are known to occur within the study area (Lovering and Goddard, 1950).

Commodities

None.

Mineral and energy resource potential

There is no known geologic evidence for the occurrence of mineral or energy deposits within the study area, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.
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KEOTA (2-328)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located northwest of Fort Morgan on the high plains and is underlain by Tertiary and Cretaceous sedimentary rocks of the Denver Basin. The Tertiary White River Formation crops out at the surface, with the coal-bearing Laramie Formation near the surface (Tweto, 1979). There are several oil fields immediately south of the study area and at least one dry hole has been drilled in the middle of the study area (McClure, 1973).

Commodities

Coal, oil and gas.

Mineral and energy resource potential

There is a moderate potential for coal within the study area. Although one unsuccessful exploratory oil well was drilled within the study area, there are several producing fields immediately south of the study area; therefore, the potential for oil and gas is regarded as moderate.

References

McClure, D. V., 1973, Structural top of J sandstone and equivalents, Plate I, in Pruit, J. D., and Coffin, P. E., eds., Energy Resources of the Denver Basin, Rocky Mountain Association of Geologists.

Tweto, Ogden, 1979, Geologic map of Colorado: U.S. Geological Survey Map, scale 1:500,000.

STRAIGHT CREEK (2-357)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range east of Dillon in north-central Colorado. Precambrian granites, migmatites, and gneisses are exposed in the study area (Bryant and others, 1981). The study area is within the Colorado Mineral Belt and is adjacent to mining districts and mineralized zones. Southeast of the study area the Montezuma district produced gold, silver, lead, zinc, and copper from vein, stockwork, and placer deposits

(Lovering, 1935). Adjacent to the northern side of the study area part of the Williams Fork Roadless area contains silver-rich lead zinc veins in altered rocks. This area is indicated by negative gravity anomalies, and geochemical samples are anomalous for lead and silver. This mineralized area, which seems to extend into the study area, exhibits scattered molybdenum occurrences similar to that overlying molybdenum porphyry deposits at Henderson (Theobald and others, 1983).

Commodities

Silver, lead, zinc, molybdenum.

Mineral and energy resource potential

There is a high potential for silver, lead, and zinc in vein deposits in the northernmost point of the study area. This area also has a moderate potential for buried molybdenum porphyry deposits. Throughout the central part of the study area there is a moderate potential for silver, lead, and zinc in veins and for molybdenum in porphyry deposits.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., 1935, Geology and ore deposits of the Montezuma quadrangle, Colorado: U.S. Geological Survey Professional Paper 178, p. 51-65.

Theobald, P. K., Bielski, A. M., Eppinger, R. G., Moss, C. K., Kreidler, T. J., and Barton, H. N., 1983, Mineral resource potential map for the Vasquez Peak Wilderness Study Area, and the Williams Fork and St. Louis Peak Roadless areas, Clear Creek, Grand, and Summit Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1588A, scale 1:50,000.

ST. LOUIS PEAK (2-361)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts have been completed.

Mining districts, mines, and mineral occurrences

The study area is located northwest of Berthoud Pass in north-central Colorado and contains Proterozoic gneisses intruded by syntectonic and post-tectonic Proterozoic granitic plutons. These Precambrian rocks have been intruded by several Tertiary dikes (Theobald and others, 1983). No active mines are in the study area, but numerous mines and mining districts are within or adjacent to the wilderness study area. Within 2 miles of the study area lie the Henderson and Urad mines, developed in one of the largest molybdenum deposits in the world. The southern part of the St. Louis Peak wilderness study area is in the La Plata and Dailey mining districts. These

districts have produced silver, lead, and zinc from vein deposits that may be genetically related to the molybdenum at Henderson. In the Byers Peak and Iron Creek mining districts just east of the study area, silver, lead, and zinc were produced out of calc-silicate assemblages in the Precambrian gneisses. Anomalous amounts of uranium occur in the Silver plume granite in the eastern part of the study area (Bielski and others, 1983).

Commodities

Silver, lead, zinc, molybdenum, copper, tungsten, uranium.

Mineral and energy resource potential

A moderate potential for silver, lead, and zinc in veins, and for concealed stockwork molybdenum deposits exists in the southern part of the study area. A moderate potential exists for silver, lead, zinc, and copper in massive sulfides and for tungsten in skarns in the northwestern part of the study area. A low potential for uranium exists in the eastern part of the study area. There is no known geologic evidence for oil, gas, coal, or geothermal resources within the area (Theobald and others, 1983).

References

Bielski, A. M., Kreidler, T. J., and Hamm, L. W., 1983, Mineral investigation of the Vasquez Peak Wilderness Study Area, and St. Louis Peak and Williams Fork Roadless areas, Clear Creek, Grand, and Summit Counties, Colorado: U.S. Bureau of Mines Open File Report MLA 67-83.

Theobald, P. K., Bielski, A. M., Eppinger, R. G., Moss, C. K., Kreidler, T. J., and Barton, H. N., 1983, Mineral resource potential map of the Vasquez Peak Wilderness Study Area, and the Williams Fork and St. Louis Peak Roadless areas, Clear Creek, Grand, and Summit Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1588A, scale 1:50,000.

ROUTT NATIONAL FOREST
PLATTE RIVER (2-080)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in North Park on the Wyoming border. The study area consists of early Proterozoic interlayered felsic and mafic gneiss with some Oligocene volcaniclastic rocks cropping out in the southern part (Tweto, 1976). The study area is near the Northgate fluorspar district where significant quantities of fluorite have been produced from several mines in mineralized fault zones. A few small copper mines in pegmatites occur near the study area, though production was very modest. Other copper-bearing

pegmatites exist in the district and may occur within the study area. Small vermiculite mines occur within and adjacent to the study area but production is not known. Other vermiculite-bearing deposits occur within and near the southwestern part of the study area (Steven, 1960). Though the Northgate fluorspar district is near the study area, the mineralized faults do not continue into the study area. Copper minerals occur in pegmatites in the region but are very spotty and discontinuous.

Commodities

Vermiculite.

Mineral and energy resource potential

There is a moderate potential for vermiculite in the southwestern portion of the study area. Other mineral and energy deposits are unknown, and their potential is regarded as low.

References

Steven, T. A., 1960, Geology and fluorspar deposits of the Northgate district, Colorado: U.S. Geological Survey Bulletin 1082-F, p. 323-422.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

SUGARLOAF DE(2-097)
NIPPLE CREEK DD(2-098)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Elkhead Mountains northwest of Steamboat Springs in the northern part of Colorado. The study areas consist primarily of early Tertiary Browns Park, Lewis, and Mesaverde Formations with some Pliocene volcanic rocks of the Elkhead Mountains capping peaks and mesas. Intermittent outcrops of Cretaceous sedimentary rocks occur in the southern half of the study areas (Tweto, 1976). The nearest mining district is at Hahns Peak a few miles east of the Nipple Creek study area. Silver, lead, and copper have been produced from a mineralized breccia pipe associated with the Pliocene laccolith of Hahns Peak, and some gold has been produced from placer deposits in the vicinity. Hahns Peak contains enough stibnite to be considered a resource for antimony (Segerstrom and Young, 1972; Young and Segerstrom, 1973). Just north of the Nipple Creek study area near the Wyoming border is the Slater (Three Forks) district where lead, silver, copper, and gold occur in veins in Precambrian gneisses near the Wyoming border, but no production has been reported (Vanderwilt, 1947). Adjacent to the Nipple Creek

study area on the northern side is an occurrence of uranium in a contact zone of a Tertiary rhyolite dike intruding Cretaceous sandstone. East of the study area, southwest of Columbine, minor uranium occurs in carbonaceous mudstones of the Morrison Formation. There is no recorded production from either site (Nelson-Moore and others, 1978). All of the Sugarloaf and part of the Nipple Creek study areas lie within the eastern part of the Green River coal district. Many thick beds of bituminous and sub-bituminous coal are present in the Mesaverde Group and the Lance Formation in the study areas. Coal is mined extensively at Oak Creek, Mount Harris, and at Hayden many miles to the south of the study areas. Nine billion tons of coal are estimated to be present in the Yampa coal field, of which the study areas are a part (Bass and others, 1956; Landis, 1959). The western portion of the Sugarloaf area is believed to be favorable for methane production from coal seams (Tremain and others, 1981). Though thick sequences of Mesozoic strata are known at depth beneath the study areas, most, if not all, Paleozoic strata are missing. This lack of source rocks suggests that the Mesozoic strata may be poor targets for oil and gas exploration (Sanborn, 1981).

Commodities

Coal.

Mineral and energy resource potential

Based on geologic and geochemical criteria, both study areas are unfavorable for the occurrence of base and precious metal deposits. In the eastern part of the Nipple Creek area near Willow Creek there is a moderate potential for uranium in the Morrison Formation. The Sugarloaf area has a high potential for coal inasmuch as it is underlain by formations that produce coal from numerous mines to the south, and there is no indication of facies changes from the coal mining areas to the study area. The southwestern part of the Nipple Creek study area has a moderate potential for coal-generated methane.

References

Bass, N. W., Eby, J. B., and Campbell, M. R., 1956, Geology and mineral fuels of parts of Routt and Moffat Counties, Colorado: U.S. Geological Survey Bulletin 1027-D, p. 143-182.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 143-144.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Segerstrom, Kenneth, and Young, E. J., 1972, General geology of the Hahns Peak and Farwell Mountain quadrangles, Routt County, Colorado: U.S. Geological Survey Bulletin 1349, 63 p.

Tremain, C. M., Boreck, D. L., and Kelson, B. S., 1981, Methane in Cretaceous and Paleocene coals of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 241-248.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p.

Young, E. J., and Segerstrom, Kenneth, 1973, A disseminated silver-lead-zinc sulfide occurrence at Hahns Peak, Routt County, Colorado: U.S. Geological Survey Bulletin 1367, 33 p.

ELKHORN MOUNTAIN DC (2-099)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, has been completed for the eastern part of the study area.

Mining districts, mines, and mineral occurrences

The Elkhorn Mountain study area is located in the Elkhorn Mountains north of Hahns Peak in northern Colorado. In the study area Proterozoic gabbro and minor quartz monzonite intrusions crop out (Tweto, 1976; Snyder, 1980). The Elkhorn district, adjacent to the east side of the study area produced gold, silver, lead, zinc, and copper from two mines. This district also contains minor molybdenum and mercury occurrences (Snyder and others, in press). Near the Wyoming border to the northwest of the study area in the Slator (Three Forks) district lead, silver, copper, and gold occur in veins in Precambrian gneisses, but no production has been reported (Vanderwilt, 1947). The possibility exists that chromium and nickel are present in the Elkhorn Mountain gabbro, but field studies and geochemical surveys have not located any deposits or anomalies (Snyder and others, in press). Copper- and zinc-bearing skarns occur several miles southeast of the study area at Slavonia, but such rock types do not crop out in the study area (Tweto, 1960). There are no known occurrences of radioactive minerals within the study area, but just west of the area uranium occurs in the contact zone of a Tertiary rhyolite dike intruding the Cretaceous Mesaverde Formation. There is no recorded production from this site (Nelson-Moore and others, 1978).

Commodities

Gold, silver, lead, zinc, copper.

Mineral and energy resource potential

There is a moderate resource potential for gold, silver, lead, zinc, and copper in the eastern part of the study area adjacent to the Elkhorn mining

district, and in the northwestern part of the study area adjacent to the Three Forks district. Although the possibility exists for chromium and nickel, geochemical data are not favorable and the potential is regarded as low.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences in Colorado: Colorado Geological Survey Bulletin 40, p. 383-386.

Snyder, G. L., 1980, Geologic map of the northernmost Park Range and southernmost Sierra Madre, Jackson and Routt Counties, Colorado: U.S. Geological Survey Map I-1113.

Snyder, G. L., Patten, L. L., and Daniels, J. J., in press, Mineral resources of the Mount Zirkel Wilderness and northern Park Range vicinity, Jackson and Routt Counties, Colorado: U.S. Geological Survey Bulletin 1554.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Map I-972.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 189.

DAVIS PEAK (2-100)
REPUBLIC CREEK (2-101)
RAINBOW LAKES (2-102)
MAD CREEK (2-355)
MOUNT ZIRKEL WILDERNESS (NF-057)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these study areas have been incorporated into the Mt. Zirkel Wilderness (NF-057).

Mining districts, mines, and mineral occurrences

The wilderness and study areas are located in the Park Range northeast of Steamboat Springs in northern Colorado. The wilderness and study areas consist of Proterozoic gneisses, amphibolites, and calc-silicates that have been extensively intruded by syntectonic and post-tectonic Proterozoic felsic, intermediate, and mafic plutonic rocks. Northeast-trending mylonite shear zones transect the area. Minor erosional remnants of Mesozoic sedimentary rocks occur in the wilderness area. There are no active mines within the wilderness area, but several inactive mines and mining districts lie adjacent to, or within, the wilderness and study areas. Fluorite was produced for several years at the Crystal mine adjacent to the eastern boundary of the wilderness area. The Crystal district also contains uranium, thorium, and molybdenum. Gold, silver, lead, zinc, and copper were produced at the Greenville mine adjacent to the western border of the Mad Creek study area. Copper, silver, and gold were produced at the Wolverine mine in the northeastern corner of the Republic Creek study area. Copper and zinc are

present at the Slavonia mine on the western border of the wilderness area, but there is no record of production. Placer gold has been recovered from the Farwell district to the west of the Davis Peak study area. Copper, lead, zinc, and molybdenum occur in the Gilpin district in the center of the wilderness area. Uranium and thorium occur in the Bear Creek district in the southwestern corner of the Mad Creek study area as well as in Farwell district and north of the Gilpin district. Chromium, platinum, cobalt, and nickel are present in ultramafic intrusive rocks in the eastern part of the wilderness, but not in concentrations great enough to be considered a resource. Geophysical and geochemical data suggest the possibility of stockwork molybdenum deposits associated with Tertiary intrusions at depth in the Crystal and Gilpin districts near the center of the wilderness area (Snyder and others, in press).

Commodities

Gold, silver, lead, zinc, copper, uranium, molybdenum, fluorite, platinum, chromium, thorium.

Mineral and energy resource potential

There is a high potential for copper, lead, zinc, silver, and gold deposits in the central and north-central parts of the wilderness and study areas. A moderate potential exists for fluorite deposits in the southern half of the Mad Creek and Rainbow Lakes study areas and the Mt. Zirkel Wilderness area. A moderate potential for uranium and thorium deposits occurs in the southern part of the Mad Creek study area, in the Farwell district, and in the north-central part of the wilderness area and the Mad Creek study area. There is a low potential for platinum and chromium deposits in the northwestern corner of the Davis Peak study area, and east of the Gilpin district in the center of the wilderness area. A low potential for molybdenum deposits exists in the central part of the wilderness area. There is no known geologic evidence for oil, gas, coal, or geothermal resources within the area.

References

Snyder, G. L., Patten, L. L., and Daniels, J. J., in press, Mineral resources of the Mount Zirkel wilderness and northern Park Range vicinity, Jackson and Routt Counties, Colorado: U.S. Geological Survey Bulletin 1554.

FISHHOOK DQ (2-103)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. The area has been mapped and the mineral survey, as required by the Wilderness Act (PL88-577) and related acts, has been completed for the extreme northern part of the study area.

Mining districts, mines, and mineral occurrences

The study area is located in the Park Range just north of Rabbit Ears Pass in northern Colorado. The study area is underlain by Early Proterozoic migmatitic and interlayered felsic/hornblendic gneisses, and quartz monzonite with some overlying Miocene basalts in the southeastern part of the area (Tweto, 1976; Snyder, 1978; Snyder and Hedge, 1980). There are no mines within the study area. The nearest mining districts are several miles northeast at Crystal and several miles northwest at Bear Creek and Greenville. Significant quantities of fluorspar were produced from vein deposits in the Crystal district (Snyder and others, in press). At Greenville, gold, silver, lead, zinc, and copper were produced from vein deposits. Uranium and thorium mineralization occurs in the Bear Creek district, but production is unknown (Nelson-Moore and others, 1978). Iron occurs at Buffalo Pass in the northern part of the study area, and geochemical data indicate the possibility of gold, silver, lead, copper, and zinc in this area (Snyder and others, in press). Uranium occurs in pegmatites and associated gneisses in the Fish Creek area in the northern part of the study area (Nelson-Moore and others, 1978). Steamboat Springs and Routt Hot Springs lie northwest of the study area, though no hot springs occur within the study area (Pearl, 1980).

Commodities

Uranium, lead, zinc, copper, gold, silver.

Mineral and energy resource potential

A moderate potential for lead, zinc, copper, gold, and silver deposits occurs in the northern part of the study area around Buffalo Pass. The mineral potential is regarded as low for uranium and thorium in the northern part of the study area. There is a high potential for geothermal energy east of the study area, but the potential is regarded as low within the study area itself (Tweto, 1960; Schmidt and others, 1984; Snyder and others, in press).

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 383-386.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Schmidt, P. W., Lovering, T. G., and Kluender, S. E., 1984, Geologic and mineral resource potential map of the Service Creek Roadless area, Routt County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1639, scale 1:48,000.

Snyder, G. L., 1980, Geologic map of the northernmost Gore Range and southernmost North Park Range, Grand, Jackson, and Routt Counties, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1114, scale 1:48,000.

Snyder, G. L., and Hedge, C. E., 1978, Intrusive rocks northeast of Steamboat Springs, Park Range, Colorado: U.S. Geological Survey Professional Paper 1041, 42 p.
Snyder, G. L., Patten, L. L., and Daniels, J. J., in press, Mineral resources of the Mount Zirkel Wilderness and northern Park Range vicinity, Jackson and Routt Counties, Colorado: U.S. Geological Survey Bulletin 1554.
Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.
Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

SERVICE CREEK (2-104)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the northern Gore Range, just south of Rabbit Ears Pass in the northern Colorado Rockies. Most of the Service Creek Roadless area is underlain by a Proterozoic quartz monzonite batholith that is cut by younger Precambrian dikes. The batholith extends well beyond the study area to the northwest, east, and south. Miocene sedimentary rocks crop out along the western margin, and Miocene volcanics crop out in the northeastern corner of the study area (Snyder, 1980). There are no mines or mining districts in or adjacent to the study area. No mineral deposits or geochemical anomalies were discovered (Schmidt and others, 1984).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria, the potential is regarded as low for mineral and energy deposits.

References

Kluender, S. A., 1982, Mineral resources investigation of the Service Creek Roadless area, Routt County, Colorado: U.S. Bureau of Mines Open-File Report MLA 123-182.
Schmidt, P. W., Lovering, T. G., and Kluender, S. A., 1984, Geologic and mineral resource potential map of the Service Creek Roadless area, Routt County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1639, scale 1:48,000.

Snyder, G. L., 1980, Geologic map of the northernmost Gore Range and southernmost North Park range, Grand, Jackson, and Routt Counties, Colorado: U.S. Geological Survey Miscellaneous Field Investigation Map I-1114, scale 1:48,000.

MORRISON DN (2-105)
COBERLY GULCH DK (2-106)
GREEN RIDGE DO (2-354)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Gore Range east of Toponas and Yampa in the northern Colorado Rockies. The northern two study areas (Green Ridge and Morrison) contain Early Proterozoic quartz monzonite in fault contact with upturned Mesozoic sedimentary rocks. Miocene Browns Park Formation and Pliocene basalt flows occur in parts of the study areas. The eastern portion of the Coberly Gulch study area contains Proterozoic quartz monzonite; Mesozoic and Paleozoic sedimentary rocks nonconformably overlie the quartz monzonite in the western part (Tweto, 1976). The nearest mining district is several miles south of the Coberly Gulch area at Yarmony, near State Bridge. Minor amounts of copper were produced from fault zones in Paleozoic sedimentary rocks at Yarmony. Copper is present in the Oak Creek area northwest of the study areas, but no production is recorded. Lead, zinc, and copper minerals have been reported in Proterozoic granites and schists in Rock Creek several miles east of the study areas, but there has been no production (Vanderwilt, 1947). Coal is produced at Oak Creek, but all coal-bearing strata have been removed by erosion from the study areas (Bass and others, 1956; Landis, 1959). There are no known occurrences of radioactive minerals within the study areas (Nelson-Moore and others, 1978). No oil or gas has been produced in the vicinity of the study areas, and geologic structures in the area are not favorable (Sanborn, 1981).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the areas are unfavorable for the occurrences of mineral and energy deposits, and their potential is regarded as low.

References

Bass, N. W., Eby, J. B., and Campbell, M. R., 1956, Geology and mineral fuels of parts of Routt and Moffat Counties, Colorado: U.S. Geological Survey Bulletin 1027-D, p. 143-182.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 383-386.

Sanborn, A. F., 1981, Potential petroleum resources of northwestern Utah and northeastern Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p.

FISH CREEK DH (2-107)
PAGODA PEAK (2-108)
BIG BEAVER BASIN (2-334)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas lie north of the Flattop Wilderness area in northern Colorado. The study areas are underlain by Tertiary, Mesozoic, and Paleozoic sedimentary rocks. Some Tertiary flood basalts correlative with basalts in the Flattops cap some of the mesas (Tweto, 1976). The Coal Creek mining district lies just west of, and partly in, the Pagoda Peak study area (Landis, 1959). Uranium and vanadium have been produced at several locations from mines in the Morrison Formation and uranium occurs in Jurassic and Cretaceous sedimentary rocks in the study area in Fawn Creek (Nelson-Moore and others, 1978). These Cretaceous and Jurassic rocks crop out along the southern margin of the Pagoda Peak study area. In the Danforth Hills coal field, west of the study areas, coal is produced from the Mesaverde Group. These same formations produce coal in the Yampa coal fields, which extend into Rio Blanco County near the Fish Creek and Pagoda Peak study areas. This group of rocks lies at or near the surface in the northern parts of the Pagoda Peak study area (Murray, 1981). The Nine Mile, Thornburg, and Danbury Hills oil fields of northern Rio Blanco County lie near the study areas on the north and west sides. The major oil-producing Paleozoic and Mesozoic formations of the local oil fields underlie the Pagoda Peak and Fish Creek study areas along with favorable geologic structures such as the Yellowjacket, Papoose Creek, and Thornberg anticlines (Sanborn, 1981).

Commodities

Uranium, vanadium, coal, oil.

Mineral and energy resource potential

There is a high potential for uranium and vanadium deposits in the northwestern part of Big Beaver Basin (A), and the western part of Pagoda Peak study areas (B) as well as a moderate potential for uranium deposits along the southern edge of the Pagoda Peak study area (C) and through the central part of the Big Beaver Basin study area (D). There is a moderate potential for coal in two regions in the northern part of the Pagoda Peak study area, north of Horse Mountain (E) and north of Sleepy Cat Peak (F). A moderate potential for oil exists in the Pagoda Peak study area in favorable structures in the northern (F), central (G), and eastern parts (H), and in the northern part of the Fish Creek study area (I). The possibility for oil in stratigraphic traps throughout the study areas cannot be dismissed, although the potential for oil is regarded as low.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 143, 148-149.

Murray, D. K., 1981, Upper Cretaceous coal resources of western Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 377-381.

Sanborn, A. F., 1981, Potential petroleum resources of northwestern Utah and northeastern Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

ARAPAHO CREEK DS (2-109)

(See description under Roosevelt National Forest)

OWL MOUNTAIN (2-110)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in North Park east of Rand in northern Colorado where Tertiary volcanic rocks overlie the Tertiary Coalmont Formation (Tweto, 1976). The nearest mining district is the Teller district southeast of the study area where modest amounts of silver and copper were produced from Precambrian granite and schist. The ore was described as rich but small in quantity (Vanderbilt, 1947). Coal has been produced from the Coalmont Formation more than a dozen miles north of the study area, but no such mines

or seams occur in or near the study area (Landis, 1959; Tweto, 1976). Oil and gas are produced from Jurassic and Cretaceous sedimentary rocks in oil fields 20 miles north and west of the study area, but no oil or gas has been discovered near the area, and favorable structures appear to be lacking (Newton, 1957).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the study area appears unfavorable for the occurrences of mineral and energy deposits, and their potential is regarded as low.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 169-171.

Newton, W. A., 1957, North and Middle Parks as an oil province, in; Finch, C. W., ed., Guidebook to the geology of North and Middle Park Basins, Colorado, Rocky Mountain Association of Geologists, p. 104-108.

Tweto, Ogden, 1976, Geologic map of the Craig $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-972, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 121.

RAWAH WEST (2-157)

(See description with East Rawah (2-115) under Roosevelt National Forest)

SAN ISABEL/PIKE NATIONAL FOREST

JEFFERSON (2-143)

(See description under Roosevelt National Forest)

SQUARE TOP MOUNTAIN (2-144)

(See description under Roosevelt National Forest)

MT. EVANS WILDERNESS (NF-145)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of the area has been incorporated into the Mt. Evans Wilderness (2-145).

Mining districts, mines, and mineral occurrences

The wilderness area is located south of Idaho Springs in the Front Range in north-central Colorado. Precambrian granites, migmatites, gneisses, and schists crop out throughout the study area (Bryant and others, 1981). The wilderness is adjacent to, but south of, the Colorado Mineral Belt. The Chicago Creek and Freeland-Lamartine mining districts lie just northwest of

the wilderness area and produced gold, silver, lead, zinc, and copper from fault-controlled vein deposits. Some uranium occurs in many of the veins, but there has been no production of uranium due to the low grade and sporadic nature of occurrences (Harrison and Wells, 1956, 1959; Sims and Sheridan, 1964). The Idaho Springs district is several miles north-northeast of the wilderness area and has produced gold, silver, lead, zinc, copper, and some uranium from fault controlled vein and stockwork deposits (Lovering and Goddard, 1950). Uranium also occurs south of the wilderness area near Shawnee, where there has been modest production out of mineralized shear zones in the Idaho Springs formation (Nelson-Moore and others, 1978). Pegmatites have been prospected adjacent to the southeastern part of the wilderness area in Harris Park, but no production is known (Hanley and others, 1950). There are no known mines or deposits within the boundaries of the wilderness area.

Commodities

None.

Mineral and energy resource potential

There is no known geologic evidence for the occurrence of mineral or energy deposits within the wilderness area, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah 1942-1944: U.S. Geological Survey Professional Paper 227, Plate 1.

Harrison, J. E., and Wells, J. D., 1956, Geology and ore deposits of the Freeland-Lamartine District, Clear Creek County, Colorado: U.S. Geological Survey Bulletin 1032-B, p. 73-85.

_____1959, Geology and ore deposits of the Chicago Creek area, Clear Creek County Colorado: U.S. Geological Survey Professional Paper 319, p. 38-44.

Lovering, T. S., and Goddard, E. W., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 135-150.

Nelson-Moore, J. L., Collins, D. B., Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 364-371.

Sims, P. K., and Sheridan, D. M., 1964, Geology of uranium deposits in the Front Range, Colorado: U.S. Geological Survey Bulletin 1159, p. 14-24.

HOLY CROSS WILDERNESS (NF-170)

Kind and amount of data

The area has been mapped and the mineral survey as required by the Wilderness Act (PL88-577) and related acts, has been completed. The area has been incorporated into the Holy Cross Wilderness (NF-170).

Mining districts, mines, and mineral occurrences

The wilderness area is located at the north end of the Sawatch Range, northwest of Leadville in north-central Colorado. Precambrian gneisses, migmatites, and granites occur throughout the study area, with some Paleozoic sedimentary rocks in the north and west, and some Tertiary intrusions in a northwest-trending belt near the center. The northeast-trending Homestake shear zone occurs throughout much of the wilderness area (Tweto, 1974; Tweto and Lovering, 1977; Tweto and others, 1978). The Wilderness area is partly within the Colorado Mineral Belt and is within or adjacent to several mining districts. The Gilman district adjacent to the northeastern border of the wilderness is the largest zinc-producing district in the state and has produced zinc, silver, lead, gold, and copper from replacement and vein deposits in Paleozoic carbonate rocks (Lovering and others, 1978). The Sugarloaf-St. Kevin district, adjacent to and partly within the southern part of the wilderness area has produced silver, gold, lead, and zinc from vein deposits in Precambrian granites. Uranium is associated with the veins, but there has been no production (Singewald, 1955). The Tennessee Pass district adjacent to the southeastern border of the wilderness area has produced gold and silver from vein deposits in dolomite of the Leadville Limestone and from placer deposits. The Fulford district, adjacent to and partly within the western part of the wilderness area has produced silver and lead from vein and replacement deposits in Paleozoic carbonates (Vanderwilt, 1947). Within the study area is the Holy Cross mining district where moderate amounts of gold, silver, copper, and lead were produced from vein deposits in Precambrian gneisses and granites. There are numerous mineral occurrences throughout the wilderness area. A porphyry molybdenum deposit has been located by drilling west of Turquoise Lake at Timberline Lake in the southern part of the study area. In the center of the wilderness area at Middle Mountain there is also a drill-located molybdenum-copper porphyry deposit. A northwest-trending belt, several miles wide, of gold, silver, lead, and zinc-bearing veins occurs from Holy Cross City in the southeastern part of the wilderness to Fulford in the northwest (Wallace, personal commun., 1985, 1986). High calcium limestone has been quarried for coking purposes adjacent to the wilderness areas and the same formations crop out in the northwestern and southwestern parts of the wilderness area.

Commodities

Gold, silver, copper, lead, zinc, molybdenum, high calcium limestone.

Mineral and energy resource potential

A high potential for silver, gold, zinc, and lead veins exists in the St. Kevin district in the southeastern corner of the wilderness (A). There is a high potential for a molybdenum porphyry deposit in the southern part of the wilderness area at Timberline Lake (B), and at Middle Mountain in the north central part of the wilderness (C). A high potential for base and precious metals in veins occurs in a northwest-trending belt through the central part of the wilderness area (D). The high potential for high calcium limestone is high in the northwestern and southwestern corners of the wilderness (E).

References

Lovering, T. S., Tweto, Ogden, and Lovering, T. G., 1978, Ore deposits of the Gilman district, Eagle County, Colorado: U.S. Geological Survey Professional Paper 1017, p. 1-5.

Singewald, Q. D., 1955, Sugarloaf and St. Kevin mining districts, Lake County, Colorado: U.S. Geological Survey Bulletin 1027-E, p. 251-299.

Tweto, Ogden, 1974, Geologic map and sections of the Holy Cross quadrangle, Eagle, Lake, Pitkin, and Summit Counties, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-830, scale 1:24,000.

Tweto, Ogden, and Lovering, T. S., 1977, Geology of the Minturn 15-minute quadrangle, Eagle and Summit Counties, Colorado: U.S. Geological Survey Professional Paper 956, p. 1-3, 69-77.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 77-80, 130-131.

ELK MOUNTAINS-COLLEGIATE (2-180)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

KREUTZER-PRINCETON (2-205)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

ROMELY (2-206)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

SILVERHEELS (2-248)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the northern part of South Park north of Fairplay in the central Colorado Rockies. Late Paleozoic red beds and Tertiary monzonite intrusions crop out in the study area (Tweto and others, 1978; Bryant and others, 1981). Numerous small mineralized veins are associated with contact metamorphism around the Montgomery Gulch stock, but these veins contain only pyrite (Singewald, 1947a). The study area lies

within the Colorado mineral belt and is near a couple of mining districts. The Tarryall Creek district adjacent to the north and east side of the study area produced gold from placer deposits in Tarryall and Como Creeks. Southwest of the study area the Alma district has produced gold from placer deposits in the South Platte River (Singewald, 1947b).

Commodities

None.

Mineral and energy resource potential

No gold-bearing placers occur within the study area. The veins within the study area are small, mineral occurrences are sparse, and favorable host rocks contain no mineral deposits. For these reasons the potential for mineral deposits within the study area is considered low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Singewald, Q. D., 1947a, Lode deposits of the Beaver-Tarryall area, Park County: in Vanderwilt, J. W., ed., Mineral Resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 341-342.

-----1947b, Placers of northwestern Park County: in Vanderwilt, J. W., ed., Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 346-349.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

WESTON PASS (2-249)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Weston Pass study area is located in the Mosquito Range southwest of Fairplay in central Colorado. Proterozoic gneisses and migmatites crop out in the west, and Paleozoic sedimentary rocks crop out in the eastern part of the study area. The Weston fault in the western part and the London fault in the northern part of the study area juxtapose Precambrian crystalline rocks against Paleozoic sedimentary rocks. The study area is adjacent to, and partly within two mining districts. The Weston Pass mining district west and partly within the area produced silver and zinc from replacement deposits in the Leadville Limestone along the Weston fault (Behre, 1932; Vanderwilt, 1947). The Horseshoe mining district north and partly within the area

produced lead, silver, and minor amounts of gold, zinc, and copper from replacement deposits in the Leadville Limestone and from vein deposits in Precambrian rocks along the London fault. Zinc was produced from oxidized breccia zones at the Hilltop mine just north of the study area (Heyl, 1964). Gold veins may occur farther south of the Horseshoe district (Del Rio, 1960).

Commodities

Silver, lead, zinc, gold, copper.

Mineral and energy resource potential

A high potential for silver, lead, and zinc and a moderate potential for gold and copper occurs in the northern part and along the western margin of the study area. Other energy and mineral deposits are unknown, and their potential is regarded as low (Taylor and others, 1984).

References

Behre, C. H., 1932, The Weston Pass mining district, Lake and Park Counties, Colorado: Colorado Scientific Society Proceedings, v. 13, no. 3, p. 55-73.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 231-243.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, part 3, Colorado: U.S. Geological Survey Bulletin 1135-C, p. 69.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: State of Colorado Mineral Resources Board, Denver, Colorado, p. 176.

BUFFALO PEAKS (2-250)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The Buffalo Peaks study area is located in the Mosquito Range northwest of Antero Junction in central Colorado. Three-fourths of the study area consists of older Proterozoic migmatites, amphibolites, and granodiorites intruded by younger Proterozoic granites. Northeast-dipping Paleozoic strata of the east limb of the Sawatch anticline comprise the eastern portion of the study area. The Buffalo Peaks consist of 1,600 feet of Tertiary andesitic lava flows and ash-flow tuffs. Most of the mineral deposits in the study area are localized along major faults. Four inactive mining districts extend into the study area. Silver-bearing base metal veins and replacement deposits

occur in the Weston Pass district in the northeastern part; gold-bearing quartz-pyrite veins occur in the Granite district and the Four Mile district in the northwestern and southwestern parts of the study area respectively; uraniferous jasperoids occur in the Salt Creek district in the southeastern part. Barite is present in a rhyolite stock at Rough and Tumbling Creek in the eastern part of the study area (Vanderbilt, 1947; Hedlund and others, 1984; Nowlan and others, 1984, Nowlan and Gerstel, 1984).

Commodities

Barium, gold, silver, uranium.

Mineral and energy resource potential

A moderate potential for silver exists in the northeastern part of the study area, and a moderate potential for gold exists in the northwestern and southwestern part. There is a moderate potential for uranium in the southern part, and moderate potential for barium in the eastern part of the study area (Hedlund and others, 1984).

References

Hedlund, D. C., Nowlan, G. A., and Woods, R. H., 1984, Mineral resource potential map of the Buffalo Peaks wilderness study area, Lake, Park, and Chaffee Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1628A.

Nowlan, G. A., Ficklin, W. H., and Dover, R. A., 1984, Water geochemistry of the Buffalo Peaks wilderness study area, Lake, Park, and Chaffee Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1628E.

Nowlan, G. A., and Gerstel, W. J., 1984b, Stream sediment and panned concentrate geochemistry of the Buffalo Peaks wilderness study area, Lake, Park, and Chaffee Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1628B.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, p. 45-47.

BURNING BEAR (2-251)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range northwest of Grant in the north-central Colorado Rockies. Precambrian granites, migmatites, gneisses, and schists occur throughout the study area (Bryant and others, 1981). The nearest mining district is the Montezuma district, which has produced gold, silver, lead, zinc, and copper from vein, stockwork, and placer deposits.

Although no mines in this district are within the study area, several are adjacent to it in Geneva Basin (Lovering, 1935). The Kenosha Pass uranium district is several miles southwest of the study area; here uranium was produced from shear zones in the Pikes Peak and Silver Plume batholiths (Nelson-Moore and others, 1978). There are no known uranium occurrences near or within the study area.

Commodities

None.

Mineral and energy resource potential

There is no known geologic evidence for the occurrence of mineral or energy deposits within the study areas, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Lovering, T. S., 1935, Geology and ore deposits of the Montezuma quadrangle, Colorado: U.S. Geological Survey Professional Paper 178, p. 51-65.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 364-370.

LOST CREEK (2-252)
LOST CREEK WILDERNESS (NF-252)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation for the very southern tip of the area, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Lost Creek Wilderness (NF-252).

Mining districts, mines, and mineral occurrences

The wilderness area is located in the Tarryall Mountains between Bailey, Grant, and Lake George in north-central Colorado. Proterozoic granites of the Pikes Peak batholith crop out in the southeastern part, and older Proterozoic gneisses, migmatites, and granites crop out in the central and northwestern part (Bryant and others, 1981). The nearest mining districts are the Lake George and Tarryall Springs districts that lie south of, and partly within, the Lost Creek study area. Beryllium has been produced from greisens in Precambrian granites in the Lake George (Boomer) district, and some of the mines occur within the Lost Creek study area, but outside of the Lost Creek wilderness area. Modest amounts of fluorspar also have been produced from

this district (Hawley, 1969). Tungsten has been produced from skarn deposits in the Tarryall Springs district adjacent on the southwest, and partly within the Lost Creek study area. These deposits occur in calc-silicate pods in the Proterozoic Idaho Springs Formation (Del Rio, 1960; Heinrich, 1981). Uranium has been produced from mines in Precambrian shear zones north of the Lost Creek study area at Shawnee, and northwest of the area at Kenosha Pass (Nelson-Moore and others, 1978).

Commodities

Beryllium, fluorspar.

Mineral and energy resource potential

In the south end of the Lost Creek study area there is a high potential for beryllium in greisens. A slightly larger area in the southern tip of the Lost Creek study area has a moderate potential for beryllium and fluorspar. Based on geologic and geochemical criteria, the Lost Creek wilderness area is unfavorable for the occurrence of mineral and energy deposits and the potential is regarded as low (B. R. Johnson, personal commun., 1985).

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle, northcentral Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado Mineral Resources Board, Denver, Colorado, p. 240-241.

Hawley, C. C., 1969, Geology and beryllium deposits of the Lake George (or Badger Flats) beryllium area, Park and Jefferson Counties, Colorado: U.S. Geological Survey Professional Paper 608-A, 43 p.

Heinrich, E. W., 1981, Precambrian tungsten and copper-zinc skarn deposits of south-central Colorado: Colorado Geological Survey Resource Series 21, p. 45-50.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 189-196, 364-370.

THIRTYNINE MILE (2-253)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in South Park north of Guffy, in central Colorado. The study area is comprised of Oligocene andesitic volcanic rocks of the Thirtynine Mile volcanic center. Beneath these lie Eocene clastic rocks and Precambrian migmatitic gneisses (Epis and Chapin, 1968; Epis, 1974;

Epis and others, 1979). The nearest mining district is Guffy which lies several miles to the south of the study area. Copper, zinc, and small amounts of gold, silver, and lead were produced from two mines in vein deposits in the Precambrian rocks (Vanderwilt, 1947) around Guffy. Uranium occurs several miles to the southwest and to the northwest of the study area, but there is no reported production. No uranium occurrences were reported within the study area (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Epis, R. C., and Chapin, C. E., 1968, Geologic history of the Thirtynine Mile volcanic field, central Colorado: Colorado School of Mines Quarterly, v. 63, no. 3, p. 51-85.

-----1974, Stratigraphic nomenclature of the Thirtynine Mile volcanic Field, central Colorado: U.S. Geological Survey Bulletin 1395-C, 23 p.

Epis, C. E., Wobus, R. A., and Scott, G. R., 1979, Geologic map of the Guffy quadrangle, Park County, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1180, scale 1:62,500.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 364-370.

Vanderbilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 168-170.

GREEN MOUNTAIN (2-254)
GUNBARREL (2-345)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Front Range southwest of Denver. The study areas are composed entirely of Proterozoic granites of the Pikes Peak batholith (Bryant and others, 1981). The mining district nearest to the study areas is the South Platte pegmatite district where feldspar has been produced. This district lies several miles north of the Gunbarrel study area (Hanley and others, 1950; Del Rio, 1960). There are several occurrences of uranium minerals in pegmatites several miles north of the Gunbarrel study area, but there has been no reported production from any of them. No uranium-

bearing pegmatites have been found in the study areas (Nelson-Moore and others, 1978). There are no known mineral occurrences within either study area (Lovering and Goddard, 1950; Tweto, 1960).

Commodities

None.

Mineral and energy resource potential

Despite the possible occurrences of pegmatites in the study areas, the geologic criteria are unfavorable for mineral and energy deposits and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorato Mineral Resources Board, Denver, Colorado, p. 167-171.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, p. 82-87.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 19-63.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 189-196.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

RAMPART WEST (2-255)
THUNDER BUTTE (2-347)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the Front Range west-southwest of Castle Rock, in central Colorado. The study areas consist primarily of Proterozoic granite of the Pikes Peak batholith, with small amounts of Paleozoic sedimentary rocks preserved in a graben in the southernmost part of the Rampart West study area (Bryant and others, 1981). The mining district nearest to the study areas is the Devils Head pegmatite district, where topaz and feldspar have been produced (Hanley and others, 1950). This district is a couple of miles east of the Rampart West study area. There are no radioactive

mineral occurrences near the study areas (Nelson-Moore and others, 1978). No mineral occurrences are known in the study areas (Lovering and Goddard, 1950; Tweto, 1960).

Commodities

None.

Mineral and energy resource potential

Despite the possible occurrence of pegmatites in the study areas, the geologic criteria are unfavorable for mineral and energy deposits and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, p. 31-32.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 19-63.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 131-132.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

FRONT RANGE (2-256)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Front Range study area is located northwest of Palmer Lake in the east-central Colorado Rockies. The study area is composed primarily of Proterozoic Pikes Peak granite, with Late Paleozoic and Mesozoic sedimentary rocks cropping out in the northeastern part of the area (Bryant and others, 1981). The mining district nearest to the study area is the Devils Head pegmatite district, where topaz and feldspar have been produced (Hanley and others, 1950). This district is 1 to 2 miles west of the study area. There are two occurrences of uranium adjacent to, or partly within the study area in Precambrian pegmatite, and in the contact between Precambrian granites and the Pennsylvanian Fountain Formation, but no production has occurred at either locality (Nelson-Moore and others, 1978). No other mines or mineral

occurrences are known in or near the study area (Lovering and Goddard, 1950; Tweto, 1960).

Commodities

None.

Mineral and energy resource potential

Despite the occurrences of minor uranium minerals, the study area is regarded as having a low potential for mineral and energy deposits.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah 1942-1944: U.S. Geological Survey Professional Paper 227, p. 31-32.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 19-63.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological survey Bulletin 40, p. 131-132.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

EAST PIKES PEAK (2-257)
WEST PIKES PEAK (2-258)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located on the Pikes Peak massif west of Colorado Springs. The study area is composed entirely of Proterozoic granites of the Pikes Peak batholith (Scott and others, 1978). The nearest mining district is the Cripple Creek district southwest of the study area. Significant amounts of gold and silver were produced from breccia deposits formed in a subsiding volcanic depression in Precambrian crystalline rocks (Lindgren and Ransome, 1906; Vanderwilt, 1947). These rocks do not extend into the study area. Uranium has been produced from mines in the Tallahasee Creek Formation southwest of the study area, but these rocks do not extend into the study area. Uranium, thorium, and fluorite have been produced from veins and pegmatites in the Mount Rosa fayalite granite at St. Peter's Dome southeast of the study area. This granite may contain other uranium and thorium

occurrences adjacent to, and partly within the southeastern part of the study area (Hanley and others, 1950; Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Though the possibility exists that uranium and thorium may occur in the study area, such occurrences are not known, and their potential is regarded as low.

References

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U.S. Geological Survey Professional Paper 227, p. 32-34.

Lindgren, Waldemar, and Ransome, F. L., 1906, Geology and gold deposits of the Cripple Creek district, Colorado: U.S. Geological Survey Professional Paper 54, 516 p.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 140-142, 452-454.

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ}x2^{\circ}$ quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.

Vanderbilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 387-395.

MOUNT MASSIVE WILDERNESS (NF-259)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. This area has been incorporated into the Mount Massive Wilderness area (2-259).

Mining districts, mines, and mineral occurrences

The wilderness area is located in the Sawatch Range southwest of Leadville in central Colorado. Proterozoic migmatitic gneisses intruded by Middle Proterozoic quartz monzonite of the St. Kevin Pluton occur in the study area (Tweto and Sims, 1964; Tweto and others, 1978). North of the wilderness area the Sugarloaf mining district produced silver and small amounts of gold, zinc, and lead from vein deposits (Singewald, 1955). These veins are believed to be related to the Tertiary Turquoise Lake stock, which also contains molybdenum. These and similar mineralized veins trend south toward the wilderness area, but have not been found within the boundaries of the wilderness area (Thompson, 1984; Van Loenen, personal commun., 1985). The Mount Champion-Lackawanna district lies south of the wilderness area and has produced gold, silver, copper, and lead from vein deposits (Thompson, 1984).

The Independence district west of the wilderness area a few miles produced gold from quartz veins (Ludington and Ellis, 1981). The Eureka Mine is just southwest of the wilderness area and has produced gold and silver from vein deposits (Ludington and Ellis, 1981). Small quartz and sulfide-bearing veins occur in the southwestern part of the wilderness area adjacent to the Mt. Champion-Lackawanna and the Independence districts and geochemical sampling has revealed molybdenum in the northern part and southern part of the wilderness area (Van Loenen, personal commun., 1985, 1986).

Commodities

Gold, silver, lead, zinc, molybdenum.

Mineral and energy resource potential

A low potential for gold, silver, lead, and zinc in vein deposits and a moderate potential for molybdenum in vein and porphyry deposits occurs in the very northern part of the wilderness area. A high potential for small gold, silver, lead, and zinc vein deposits exists in the southwestern part of the wilderness area. There is a moderate potential for molybdenum in a porphyry deposit associated with the Halfmoon Creek stock in the southern part of the wilderness area in Halfmoon Creek (Van Loenen, personal commun., 1985, 1986).

References

Ludington, Steve, and Ellis, C. E., 1981, Mineral resource potential of the Hunter-Fryingpan Wilderness and the Porphyry Mountain wilderness study area, Pitkin County, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map MF-1236D, scale 1:50,000.

Singewald, Q. D., 1955, Sugarloaf and St. Kevin mining districts, Lake County, Colorado: U.S. Geological Survey Bulletin 1027-E, p. 251-297.

Thompson, J. R., 1984, Mineral investigation of the Mount Massive Wilderness, Lake County, Colorado: U.S. Bureau of Mines Open File Report MLA XX-84.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Tweto, Ogden, and Sims, P. K., 1964, St. Kevin granite, Sawatch Range, Colorado, in Short papers in geology and hydrology: U.S. Geological Survey Professional Paper 475-D, p. D28-D30.

MOUNT ELBERT (2-260)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Sawatch Range southwest of Leadville in central Colorado. It is composed of Early Proterozoic granite and migmatitic

gneiss; Tertiary quartz monzonite of the Twin Lakes Pluton crops out in the southern part (Tweto and others, 1978). The Twin Lakes mining district south and southeast of the study area produced gold and silver and minor amounts of lead, zinc, and molybdenum from vein deposits in Precambrian and Tertiary rocks. The Independence district lies west of the study area and has produced gold and some silver, copper, and lead from quartz veins in Precambrian gneisses (Vanderwilt, 1947). Vein systems are found around Independence Pass and around the Twin Lakes area (Taylor and others, 1984).

Commodities

Gold, silver, lead, and zinc.

Mineral and energy resource potential

There is a moderate potential for gold, silver, lead, and zinc in vein deposits from Twin Lakes northwest across the study area (Taylor and others, 1984).

References

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 131, 179.

MOUNT ANTERO (2-261)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Sawatch Range north of Garfield in central Colorado. The area is part of the Sawatch uplift and is underlain by Oligocene and Miocene granodiorite intrusions with some Proterozoic granodiorite and gneiss cropping out in the southeastern portion of the study area. The area is adjacent to two mining districts and contains a third one. The Chalk Creek mining district lies within the northeastern part of the study area. The Mary Murphy, the principal mine of this district, produced gold, silver, zinc, lead, and copper from vein deposits. Numerous other mines and prospects occur in this district, but records of production are unknown. The Monarch mining district, containing the Madonna mine, lies south of the study area and has produced gold, silver, zinc, lead and copper from vein

deposits, and metallurgical-grade limestones from quarries in the Leadville Limestone. The Tomichi mining district to the west of the study area has produced silver, lead, zinc, and some gold (Dings and Robinson, 1957). Beryllium-bearing pegmatites and miarolitic cavities occur on Mount Antero. Pegmatites and molybdenum-bearing veins occur in a zone on the south and west slopes of Mount Antero. Molybdenum minerals in altered country rock in the Chalk Creek district and on Boulder Mountain west of Mount Antero suggest buried stockwork molybdenum deposits (Sharp, 1976).

Commodities

Molybdenum, gold, silver, zinc, lead, copper, beryllium.

Mineral and energy resource potential

There is a high potential for molybdenum in buried stockwork porphyry deposits in an area on the south and southwest slopes of Mount Antero, and in the Chalk Creek district in the western part of the study area. The molybdenum prospect on Mount Antero has been drilled by private companies, but the results are not publicly available. A high potential for gold and silver, and a moderate potential for lead, zinc, and copper exists in the Chalk Creek district. There is a high potential for beryllium on Mount Antero (Sharp, 1976; Taylor and others, 1984).

References

Dings, M. G., and Robinson, C. S., 1957, Geology and ore deposits of the Garfield quadrangle, Colorado: U.S. Geological Survey Professional Paper 289, p. 81-104.

Sharp, W. N., 1976, Geologic map and details of the beryllium and molybdenum occurrences, Mount Antero, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-810.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

ASPEN RIDGE (2-262)
ARNOLD GULCH (2-341)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the very southern part of the Mosquito Range just south of Trout Creek Pass in central Colorado. The areas are composed of Proterozoic granodiorites in the western part and by overlying Paleozoic sedimentary rocks in the eastern part. Some Tertiary volcanic rocks

crop out in the northern part of the study area (Tweto and others, 1976). Just southwest of the study area is the Browns Canyon district where significant quantities of fluorite have been produced from epithermal fluorite veins along faults (Van Alstine, 1969). The Calumet district south of the study area contains small veins of gold, silver, and copper associated with a Tertiary porphyry stock. No production has been reported (Vanderwilt, 1947). In an area adjacent to the southwestern corner of the study area there are prospect pits in a lenticular, metasomatized copper deposit between two faults (Van Alstine, 1969). Placer gold deposits along the Arkansas River in Browns Canyon have been worked intermittently over the years and have produced small amounts of gold (Vanderwilt, 1947; Van Alstine, 1969). A number of pegmatites in the southern half of the study area have been prospected and a quarry in pegmatite at the Homestake mine east of the study area has been the state's largest producer of potash feldspar for glass making. The pegmatites in the vicinity of the study area contain much high quality potash feldspar, but have only poor quality and (or) poor quantity soda feldspar, beryllium, micas, and columbite-tantalite (Van Alstine, 1969). The Browns Canyon warm springs occur just west of the study area, and the southwestern part of the study area is in an area mapped as having "significant lateral extent favorable for the discovery and development of local sources of low ($<90^{o}C$) temperature water" (Pearl, 1980).

Commodities

High calcium limestone, alkali feldspar, geothermal water.

Mineral and energy resource potential

There is a high potential for metallurgical grade limestone in the eastern part of the study area (Taylor and others, 1984). A moderate potential for alkali feldspar in pegmatites and for geothermal water exists in the southwestern part of the study area.

References

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Tweto, Ogden, Steven, T. A., Hail, W. J., Jr., and Moench, R. H., 1976, Preliminary geologic map of the Montrost $1^{o}x2^{o}$ quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-761, scale 1:250,000.

Van Alstine, R. E., 1969, Geology and mineral deposits of the Poncha Springs NE quadrangle, Chaffee County, Colorado: U.S. Geological Survey Professional Paper 626, p. 1-2, 30-37.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 41-50.

BADGER CREEK (2-263)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located east northeast of Salida in central Colorado and is composed of Proterozoic granites and gneisses in the eastern part and Cretaceous granodiorite in the western part. Small amounts of Tertiary volcanic rocks and Paleozoic sedimentary rocks crop out in the area (Scott and others, 1978). In the Badger Creek mining district south of the study area copper occurrences are reported, but there has been no known production. The Calumet-Whitehorn district, just west of the study area, reportedly has gold, silver, and copper in a Tertiary porphyry stock but there has been no recorded production. The Turret Creek district several miles west of the study area is where modest amounts of gold, silver, and copper were produced from deposits in Precambrian schist (Vanderwilt, 1947). In general the copper occurrences near the study area are discontinuous and of low grade.

Commodities

High calcium limestone.

Mineral and energy resource potential

There is a high potential for metallurgical grade limestone near the center of the study area (Taylor and others, 1984), and a low potential for other mineral resources.

References

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{o}x2^{o}$ quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 41-50, 83-87.

STARVATION CREEK (2-264)

(See description under Rio Grande National Forest)

PORPHYRY PEAK (2-265)

(See description under Rio Grande National Forest)

SANGRE DE CRISTO (2-266)

(See description under Rio Grande National Forest)

TANNER PEAK (2-268)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the northern Wet Mountains south of Canon City in the east-central Colorado Rockies. Proterozoic migmatitic gneisses and granodioritic intrusions of the Wet Mountains fault block occur in the area. West of the study area is the McClure Mountain complex of layered gabbroes, alkalic syenites, and carbonatites. This area also contains a large number of thorium- and rare earth-bearing veins that are thought to be related to Cambrian alkalic intrusions (Olson and others, 1977; Armbrustmacher, 1984). West of the study area in the Grape Creek mining district gold, silver, copper, lead, and zinc were produced, but the nature of the occurrence is not known. South of the study area the Oak Creek mining district produced lead from carbonate veins in a fault shear zone. Most of this production came from the Terrible Mine a couple of miles south of the study area (Vanderwilt, 1947). A small amount of uranium ore has been mined from a vein deposit on the Griffin Ranch just south of the study area, and from Precambrian vein deposits in the Tanner Boy prospect north of the study area (Nelson-Moore and others, 1978). East of the study area the Canon City coal field produced coal from numerous lenticular and discontinuous coal seams in the Vermejo Formation (Landis, 1959). In the Florence-Canon City oil field east of the study area, production is from fractures and carbonate zones in the Pierre Shale (Bass, 1964). None of the coal- or oil-bearing formations occur in the study area.

Commodities

Thorium, rare earths, uranium, copper, zinc.

Mineral and energy resource potential

There is a high potential for thorium- and rare earth-bearing vein deposits in the far western portion of the study area and a moderate potential for uranium in vein deposits in the northern part of the study area. This same area may be favorable for the occurrence of copper and zinc-bearing stratabound deposits (Taylor and others, 1984), and the potential is rated as moderate.

References

Armbrustmacher, T. J., 1984, Alkaline rock complexes in the Wet Mountains area, Custer and Fremont Counties, Colorado: U.S. Geological Survey Professional Paper 1269, 33 p.

Bass, N. W., 1964, Oil and gas; in Mineral and water resources of Colorado: U.S. 88th Congress, 2nd Session, Senate Committee on Interior and Insular Affairs, Committee Print, p. 45-67.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 166-167.
Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 143-153.
Olson, J. C., Marvin, R. F., Parker, R. L., and Mehnert, H. H., 1977, Age and tectonic setting of lower Paleozoic alkalic and mafic rocks, carbonatites, and thorium veins in south-central Colorado: U.S. Geological Survey Journal of Research, v. 5, no. 6, p. 673-687.
Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 69, 83-87.

SCRAGGY PEAKS (2-269)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Wet Mountains west of Beulah in the southeastern Colorado Rockies. Proterozoic granite and migmatitic gneiss with some mid-Paleozoic sedimentary rocks crop out in the eastern part of the area (Scott and others, 1978). There are no mines or mining districts in or near the study area (Vanderwilt, 1947). There have been no reported occurrences of radioactive mineral deposits in or near the study area (Nelson-Moore, 1978). The mid-Paleozoic formations in the extreme eastern part of the study area are not coal-bearing formations and are not favorable for the occurrence of oil and gas.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the potential is low for mineral and energy deposits.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 118-124.

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo 1°x2° quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 66-70.

GREENHORN MOUNTAIN (2-270)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the southern Greenhorn Mountains east of Gardner in the southeastern Colorado Rockies. The core of the Greenhorn mountain complex consists of Proterozoic granite gneisses, amphibolite gneisses, calc-silicate gneisses, migmatites, and schists intruded by younger Proterozoic granite. The Precambrian rocks are bounded on the west, south, and east by high-angle normal faults. West-dipping Pennsylvanian to Cretaceous sedimentary rocks crop out along the western margin of the study area. Tertiary alkalic intrusive and volcanic rocks occur in the southern, western, and northern portions of the study area (Toth and others, 1983). There are no mines or mining districts in or near the wilderness study area, but there are several prospect pits near the borders of the area. Uranium and fluorite were produced at the Stumbling Stud mine south of the study area near Badito cone (Baskin, 1983). Geochemical surveys indicate a tungsten anomaly between North and South Apache Creek near the center of the study area, though no tungsten minerals were seen during reconnaissance mapping. Several oil and gas exploration holes were drilled in the Greenhorn Mountain anticline south of the study area, but there has been no production.

Commodities

Tungsten, uranium, fluorite.

Mineral and energy resource potential

There is a moderate potential for tungsten near the center of the study area in Precambrian rocks. A moderate potential for uranium and fluorite exists at Badito cone.

References

Baskin, G. D., 1983, Mineral investigation of the Greenhorn Mountain wilderness study area, Huerfano and Pueblo Counties, Colorado: U.S. Bureau of Mines Open File Report MLA-26-83.
Toth, M. I., Birch, D. R., and Baskin, G. S., 1983, Mineral resource potential of the Greenhorn Mountain wilderness study area, Huerfano and Pueblo Counties, Colorado: U.S. Geological Survey Open-File Report 83-473, 9 p.

SPANISH PEAKS (2-271)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the Spanish Peaks southwest of Walsenburg in southern Colorado. The Spanish Peaks consist of Paleozoic to Tertiary age sedimentary rocks that have been intruded by Miocene porphyritic granite and granodioritic stocks, and by trachytic dikes (Budding and Laurence, 1983; Budding and others, 1983). The mineralized rocks in the study area are associated with veins in the contact metamorphic aureole surrounding the West Spanish Peak pluton. Modest amounts of gold, silver, copper, and lead have been produced from the Bulls Eye mine on the north side of West Spanish Peak. Minor amounts of gold have been produced from placers north of the study area. There has been drilling for petroleum and carbon dioxide south of the study area, and much of the area is under oil and gas lease application. No drilling has been done within the study area (Vanderwilt, 1947; Budding and others, 1983).

Commodities

Gold, silver, copper, lead, zinc.

Mineral and energy resource potential

There is a moderate potential for gold, silver, copper, lead, and zinc in contact metamorphic deposits in the center of the study area. The potential for oil and gas is regarded as low because of the igneous activity and the lack of favorable structures (Budding and others, 1983).

References

Budding, K. E., and Laurence, V. A., 1983, Geochemical maps of the Spanish Peaks wilderness study area, Huerfano and Las Animas Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1542B, scale 1:50,000.

Budding, K. E., Laurence, V. A., and Kluender, S. E., 1983, Mineral resource potential map of the Spanish Peaks wilderness study area, Huerfano and Las Animas Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1542C, scale 1:50,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 118-119.

PURGATOIRE (2-272)
CUCHARA (2-273)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the southern Sangre de Cristo Mountains east of Fort Garland in southern Colorado. The areas contain Late Paleozoic sedimentary rocks. Proterozoic migmatites and gneisses crop out in the extreme western portion of the study area. The area is transected by south-trending thrust and normal faults (Johnson, 1969). There are no mining districts or mines within the study area, but several miles west of the area in the Plomo district, gold has been produced from gold-quartz veins. These veins do not extend into the study area (Vanderwilt, 1947). The migmatitic gneisses in the western portion of the study area are a geologically favorable terrane for Precambrian age stratabound copper and zinc sulfide deposits, but no such deposits or mineralization have been found (Taylor and others, 1984).

Commodities

None.

Mineral and energy resource potential

Geologic criteria are unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Johnson, R. B., 1969, Geological map of the Trinidad quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-558, scale 1:250,000.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel national forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 45.

CHICAGO RIDGE (2-335)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The Chicago Ridge study area is located east of Tennessee Pass in the north-central Colorado Rockies. Late Paleozoic sedimentary rocks are intruded by Tertiary quartz monzonite stocks in the study area (Tweto, 1974; Tweto and others, 1978). The study area is in the Colorado mineral belt and is surrounded by mining districts. Adjacent to and partly within the study area is the Tennessee Pass district where gold and silver were produced from vein and replacement deposits in the Leadville Limestone. Some placer gold was also produced along Tennessee Creek (Vanderwilt, 1947). The Climax district east of the study area produced large amounts of molybdenum from a stockwork porphyry deposit associated with Tertiary granitic intrusions at Fremont Pass (Del Rio, 1960). Northeast of the study area is the Kokomo district where gold, silver, lead, zinc, and copper were produced from replacement deposits in Pennsylvanian limestones (Vanderwilt, 1947). The Leadville mining district lies just south of the study area. This district has produced gold, silver, lead, zinc, copper, bismuth, iron, and manganese from vein and replacement deposits, and gold from placer deposits. Although most of the deposits occur within the Leadville Limestone, all Paleozoic formations contain some occurrences and structure appears to be the controlling factor (Vanderwilt, 1947; Heyl, 1964). Within the western and southern part of the study area are several mines and prospect pits and a major zone of altered rocks east of Cooper Hill. There are a large number of faults in the Paleozoic rocks of the central part of the study area.

Commodities

Gold, silver, lead, zinc, copper.

Mineral and energy resource potential

There is a high potential for gold, silver, lead, zinc, and copper in the southwestern part of the study area. A moderate potential for gold, silver, lead, zinc, and copper occurs in the south-central part of the study area where Pennsylvanian rocks are heavily faulted.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel, Colorado Mineral Resources Board, Denver, Colorado, p. 317-321.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, part 3. Colorado: U.S. Geological Survey Bulletin 1135C, p. 62-65.

Tweto, Ogden, 1974, Geologic map and sections of the Holy Cross quadrangle, Eagle, Lake, Pitkin, and Summit Counties, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-830, scale 1:24,000.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, P. 131, 350-378.

HIGHLINE (2-338)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Wet Mountains west of Wetmore in the east-central Colorado Rockies. Proterozoic migmatitic gneiss occurs with small amounts of upturned Mesozoic sedimentary rocks in the southeastern corner of the study area (Scott and others, 1978). The Oak Creek mining district lies a few miles northwest of the study area and produced lead from carbonate veins in a fault shear zone (Vanderwilt, 1947). No radioactive mineral occurrences are reported in or near the study area (Nelson-Moore, 1978). The Florence-Canon City oil field lies northeast of the study area in the Canon City embayment. Oil is produced here from fractures and carbonate zones in the Pierre Shale (Bass, 1964).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the potential is low for mineral deposits. Because of the upturned nature of the Mesozoic formations exposed in the southeastern corner of the study area, the study area is not favorable for oil and gas deposits and the potential is regarded as low.

References

Bass, N. W., 1964, Oil and gas: in, Mineral and water resources of Colorado, U.S. 88th Congress, 2nd Session, Senate Committee on Interior and Insular Affairs, Committee Print, p. 45-67.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 118-124.

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ}x2^{\circ}$ quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 69.

HARDSCRABBLE (2-339)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Wet Mountains southwest of Wetmore in the east-central Colorado Rockies. Proterozoic migmatitic gneisses and granite occur in the study area (Scott and others, 1978). The Rosita-Querida mining district lies several miles west of the study area and produced gold, silver, and copper from veins and mineralized breccia pipes associated with the Rosita Hills volcanic center (Vanderwilt, 1947). Perlite is still produced at Rosita. West of the study area and possibly extending into the western portion of it is the Wet Mountains thorium district, where many thorium and rare-earth-bearing dikes and veins occur (Olson and others, 1977). West of the study area uranium occurs in the thorium and rare-earth-bearing veins (Nelson-Moore and others, 1978).

Commodities

Thorium, rare earths.

Mineral and energy resource potential

There is a high potential for thorium and rare earth elements to occur in vein deposits in the extreme western part of the study area.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 118-124.

Olson, J. C., Marvin, R. F., Parker, R. L., and Mehnert, H. H., 1977, Age and tectonic setting of lower Paleozoic alkalic and mafic rocks, carbonatites, and thorium veins in south-central Colorado: U.S. Geological Survey Journal of Research, v. 5, no. 6, p. 673-687.

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ}x2^{\circ}$ quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 69-70.

ST. CHARLES PEAK (2-340)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The St. Charles Peak study area is located in the Wet Mountains north of the Greenhorn Mountain wilderness area in east-central Colorado. Proterozoic migmatitic gneiss and granite crop out with some Tertiary andesitic intrusive and extrusive rocks of the Deer Peak volcanic formation in the study area (Scott and others, 1978). There are no mining districts in or near the study area, but a Precambrian zinc- and copper-bearing stratabound deposit is present west of Lake Isabel in the eastern part of the study area (Taylor and others, 1984). West of the study area and extending into it is the Wet Mountains thorium district where some uranium- and vanadium-bearing thorium veins occur (Olson and others, 1977). Some of these occurrences have prospect pits and minor underground workings developed, but there has been no recorded production (Nelson-Moore and others, 1978).

Commodities

Thorium, rare earth elements, uranium, copper, zinc.

Mineral and energy resource potential

There is a high potential for copper and zinc in stratabound deposits in the eastern part of the study area and a high potential for thorium, rare earths, and uranium in the western part of the study area.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 121.

Olson, J. C., Marvin, R. F., Parker, R. L., and Mehnert, H. H., 1977, Age and tectonic setting of lower Paleozoic alkalic and mafic rocks, carbonatites, and thorium veins in south-central Colorado: U.S. Geological Survey Journal of Research, v. 5, no. 6, p. 673-687.

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ}x2^{\circ}$ quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1022, scale 1:250,000.

Taylor, R. B., Stoneman, R. J., Marsh, S. P., and Dersh, J. S., 1984, An assessment of the mineral resource potential of the San Isabel national forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, 42 p.

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the northern part of South Park north of Como in central Colorado and consists of Tertiary monzonite intrusions (Bryant and others, 1981). The study area is adjacent to the Colorado Mineral Belt and is near a couple of mining districts. The Tarryall Creek district south of the study area has produced gold from placer deposits near Silverheels Mountain; no placer gravels occur within the study area (Singewald, 1947). The Blue River district adjacent to the northern boundary of the study area produced gold, silver, lead, and zinc from vein and replacement deposits in Paleozoic rocks. Several mines occur near Boreas Pass adjacent to the study area, but none occur within the study area (Singewald, 1951). Uranium occurs in the northern corner of the study area in the contact between granite and the Cretaceous Dakota Sandstone, as well as in fractures in the sandstone. No production has been reported (Nelson-Moore and others, 1978).

Commodities

Uranium.

Mineral and energy resource potential

There is a moderate resource potential for uranium in the northern corner of the study area. Other energy and mineral deposits are not known to occur within the boundaries of the study area and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 364-370.

Singewald, Q. D., 1947, Placers of northwestern Park County: in, Vanderwilt, J. W., ed., Mineral resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 346-349.

Singewald, Q. D., 1951, Geology and ore deposits of the Upper Blue River area, Summit County Colorado: U.S. Geological Survey Bulletin 970, 74 p.

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in South Park northwest of Tarryall in central Colorado. The area consists of Proterozoic gneisses and granodiorite (Hawley and Wobus, 1977). The nearest mining district is Badger Flats (Boomer) near Lake George where beryllium was produced from greisen deposits. Minor amounts of molybdenum and uranium were produced, and some silver-lead minerals have been reported in this same district (Vanderwilt, 1947). Several occurrences of tungsten in skarn deposits were also found in this vicinity and at Tarryall Springs, but no tungsten was produced. The two types of deposits do not appear to be genetically related (Heinrich, 1981). The study area was prospected for tungsten during World War II and during the Korean War, but no deposits were discovered (Del Rio, 1960). Southwest, south, and southeast of the study area uranium occurs in Tertiary lacustrine deposits, Precambrian veins, and in greisen deposits, but there has been no production from them (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Despite terrane favorable for the occurrence of tungsten skarns, none have been noted, and the potential is regarded as low. Based on geologic evidence, the areas are unfavorable for the occurrence of other mineral and energy deposits and the potential is regarded as low.

References

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Colorado State Mineral Resources Board, Denver, Colorado, p. 240-241.

Hawley, C. C., and Wobus, R. A., 1977, General geology and petrology of the Precambrian crystalline rocks, Park and Jefferson Counties, Colorado: U.S. Geological Survey Professional Paper 608B, 75 p.

Heinrich, E. W., 1981, Precambrian tungsten and copper-zinc skarn deposits of south-central Colorado: Colorado Geological Survey Resource Series 21, p. 45-50.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 364-370.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 174.

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in South Park south of Wilkerson Pass in central Colorado. Proterozoic granodioritic gneiss of the Boulder Creek intrusions, with lesser outcrops of Silver Plume quartz monzonite and Idaho Springs metasediments crop out in the study area (Hawley and Wobus, 1977; Bryant and others, 1981). The nearest mining district is several miles to the northeast at Badger Flats (Boomer) near Lake George where beryllium was produced from greisens in the Redskin granite of the Pikes Peak batholith. These rocks do not crop out in the study area. Minor amounts of molybdenum and uranium were also produced in this district. Some silver, lead, and tungsten have also been reported. The nearest mine to the study area is the Katydid mine to the north, where feldspar and mica were produced from Precambrian pegmatites (Wobus, 1966). Tungsten occurs in calc-silicate skarns in the Idaho Springs Formation north and northeast of the study area, but there has been no recorded production. Extensive prospecting yielded no tungsten skarns within the study area (Tweto, 1960; Heinrich, 1981). Uranium occurs in several pegmatites adjacent to the study area to the north, but there has been no production (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, and despite the occurrence of mineral deposits near the study area, the area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic map of the Denver $1^{\circ}x2^{\circ}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.

Hawley, C. C., and Wobus, R. A., 1977, General geology, and petrology of the Precambrian crystalline rocks, Park and Jefferson Counties, Colorado: U.S. Geological Survey Professional Paper 608B, 73 p.

Heinrich, E. W., 1981, Precambrian tungsten and copper-zinc skarn deposits of south-central Colorado: Colorado Geological Survey Resource Series 21, p. 45-50.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 45-50.

Tweto, Ogden, 1960, Scheelite in the Precambrian gneisses of Colorado: Economic geology, v. 55, p. 1406-1428.
Wobus, R. A., 1966, Petrology and structure of Precambrian rocks of the Puma Hills, southern Front Range, Colorado: Stanford University Ph.D. thesis, 146 p.

SHEEPROCK (2-346)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the Front Range southwest of Deckers in central Colorado. Proterozoic granite of the Pikes Peak batholith makes up the study area (Bryant and others, 1981). There are several mining districts several miles southwest of the study area. The Badger Flats, China Wall, Mary Lee, and Redskin districts are all associated with the Precambrian Redskin granitic stock and have all produced beryllium out of greisen deposits. The Redskin stock is several miles outside the study area. Although greisenized areas are known to occur outside of the Redskin stock at Tappen Mountain, there are no known greisens within the study area (Hawley, 1969). Minor amounts of molybdenum and uranium have been produced from the Badger Flats (Boomer) district, and there are some silver-lead and tungsten occurrences, but favorable host rocks for these deposits are absent from the study area (Lovering and Goddard, 1950; Tweto, 1960; Nelson-Moore and others, 1978; Heinrich, 1981).

Commodities

None.

Mineral and energy resource potential

The possibility for pegmatites in the study area exists, but the potential for mineral or energy deposits and for greisenized terranes within the study area is low.

References

Bryant, Bruce, McGrew, L. W., and Wobus, R. A., 1981, Geologic maps of the Denver $1^{o}x2^{o}$ quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1163, scale 1:250,000.
Hawley, C. C., 1969, Geology and beryllium deposits of the Lake George (or Badger Flats) beryllium area, Park and Jefferson Counties, Colorado: U.S. Geological Survey Professional Paper 608A, 42 p.
Heinrich, E. W., 1981, Precambrian tungsten and copper-zinc skarn deposits of south-central Colorado: Colorado Geological Survey Resource Series 21, p. 45-50.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U.S. Geological Survey Professional Paper 223, p. 19-63.
Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 189-196.
Tweto, Ogden, 1960, Scheelite in Precambrian gneisses of Colorado: Economic Geology, v. 55, p. 1406-1428.

CHIPETA (2-358)

(See description under Grand Mesa National Forest)

HUNTER-FRYING PAN WILDERNESS (NF-096)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the Sawatch Range east of Aspen in the central Colorado Rockies. The rocks of the wilderness area consist primarily of Proterozoic gneisses and migmatites intruded by post-tectonic Proterozoic granites and by numerous late Cretaceous and Tertiary age dikes. The wilderness area is adjacent to two mining districts. The Aspen district west of the wilderness area produced significant quantities of silver from the Leadville and Belden Formations. These host rocks have been eroded away in the wilderness area, and there is no evidence for mineral occurrences in the western portion of the wilderness area. The Independence district adjacent to the southern edge of the wilderness area produced gold and silver from quartz-sulfide veins in Precambrian rocks at the Mt. Hope and Independence mines. Mineral occurrences similar to those found at the Mt. Hope and Independence mines occur in the southern tip of the wilderness area (Ludington and Ellis, 1981).

Commodities

Gold, silver.

Mineral and energy resource potential

There is a high potential for gold and silver in the southeastern portion of the wilderness area adjacent to Independence Pass. Other mineral and energy deposits are unknown, and the potential is regarded as low.

References

Ludington, Steve, and Ellis, C. E., 1981, Mineral potential of the Hunter-Frying Pan wilderness and Porphyry Mountain wilderness study area, Pitkin County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1236D, scale 1:50,000.

SAN JUAN NATIONAL FOREST
LIZARD HEAD (EASTERN PART) (2-235)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this area has been incorporated into the Lizard Head Wilderness area (NF-912).

Mining districts, mines, and mineral occurrences

The study area is located north of Lizard Head Pass in the western San Juan mountains in the southwestern Colorado Rockies. The area is underlain by Mesozoic sedimentary rocks and Tertiary volcanic and intrusive rocks (Bush and Bromfield, 1966; Bromfield, 1967). The Mount Wilson mining district is two miles north of the study area and has produced gold, silver, copper, lead, and zinc from vein deposits associated with the Wilson stock. Northeast of the study area the Iron Springs (Ames) district has produced gold, silver, lead, and copper from vein deposits (Bromfield, 1967). The Dunton mining district west of the study area several miles has produced gold, silver, lead, and copper (Vanderwilt, 1947). South of the study area the Blue Eagle mine produced uranium and vanadium from carnotite deposits in the Morrison Formation (Nelson-Moore and others, 1978). Uraniferous vanadium deposits occur in the Entrada Sandstone north and northwest of the area, and drilling has shown vanadium to be present in the subsurface south of the study area (Bromfield, 1967). Coal has been produced for local use from the Dakota Formation adjacent to the southwestern part of the study area (Landis, 1959; Bromfield, 1967).

Commodities

Uranium, vanadium, coal.

Mineral and energy resource potential

Deposits of uranium, vanadium, and coal occur adjacent to the southern and southwestern border of the study area, and the host formations extend well into the study area. This southwestern part of the study area is regarded as having a low potential for the occurrence of uranium, vanadium, and a moderate potential for coal deposits. The base and precious metal deposits north of the study area do not appear to extend into the area, and the potential for this area is regarded as low.

References

Bromfield, C. S., 1967, Geology of the Mount Wilson quadrangle, western San Juan mountains, Colorado: U.S. Geological Survey Bulletin 1227, p. 1-2, 81-93.

Bush, A. L., and Bromfield, C. S., 1966, Geologic map of the Dolores Peak quadrangle, Dolores and San Juan Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-536, scale 1:24,000.
Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-156.
Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 128-130.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 71.

SAN MIGUEL (2-240)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

SOUTH SAN JUAN (2-284)

(See description under Rio Grande National Forest)

TREASURE MOUNTAIN (2-285)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located south of Wolf Creek Pass in the eastern San Juan Mountains in southern Colorado. Latite and rhyolite tuffs and flows with some minor intrusions crop out in the study area (Steven and others, 1974). Mineralized areas east of the study area are associated with Tertiary intrusions in and near the Platoro and Summitville calderas. The most significant mining district near the study area is Summitville, 3 miles east of the study area, which produced gold, silver, copper, and lead from vein deposits at the intersection of the Summitville fault zone and the Summitville caldera (Vanderwilt, 1947; Lipman, 1975). Several small mines occur just southeast of the study area in the Crater Creek area, but there has been no production. Pervasive alteration, and many small veins in this area are associated with the Bear Creek stock cluster. Geologic, geochemical, and geophysical data indicate a possible ore body in this area, which probably does not extend into the study area (Lipman, 1975; U.S. Geological Survey and U.S. Bureau of Mines, 1977). Low-sulfur coals occur in the Cretaceous Fruitland Formation a couple of miles southwest of the study area. This formation dips 10^{o} to 15^{o} east beneath the Tertiary volcanic rocks of the study area. Coal reserves have been estimated for the Pagosa Junction district several miles southwest of the study area, and coal may occur at depth in the western part of the study area, but the subsurface extent of the coal is not known (Landis, 1959; U.S. Geological Survey and U.S. Bureau of Mines, 1977). Source and reservoir rocks for oil and gas occur beneath the volcanic rocks of the study area, but the potential for oil and gas deposits in this area is regarded as low (Spencer, 1983).

Commodities

None.

Mineral and energy resource potential

Based on geologic, geochemical, and geophysical criteria, the potential is low for mineral deposits. Coal may occur at depth beneath the study area, but the subsurface extent of the coal is not known; the potential is regarded as low. The potential for oil and gas deposits is regarded as low.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 151.

Lipman, P. W., 1975, Evaluation of the Platoro caldera complex and related volcanic rocks, southeastern San Juan mountains, Colorado: U.S. Geological Survey Professional Paper 852, p. 113-115.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000, and Circular 902E.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

U.S. Geological Survey and U.S. Bureau of Mines, 1977, Mineral resources of the Chama-southern San Juan mountains wilderness study area, Mineral, Rio Grande, Archuleta, and Conejos Counties, Colorado: U.S. Geological Survey Open-File Report 77-309.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 184-186.

TURKEY CREEK (2-286)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located north of Pagosa Springs in the southeastern San Juan mountains in southern Colorado. Tertiary latite and rhyolite flows, tuffs, and breccias and some Cretaceous sedimentary rocks crop out in the study area (Steven and others, 1974). There are no mines or mineralized areas within the study area. North of the study area several miles near Red Mountain there occurs some highly altered and pyritized rock near intrusive plugs, but geochemical surveys have shown no anomalous concentrations of elements in this area (Steven and others, 1969). The nearest mining districts are at Summitville and Platoro 15 to 20 miles east of the study area (Vanderwilt, 1947). Coal has been produced for local use from the Fruitland Formation just

south of the study area, and this coal-bearing formation occurs in the extreme southeastern corner of the study area (Landis, 1959; Steven and others, 1974). Source and reservoir rocks for oil and gas occur beneath the volcanic rocks of the study area, but the potential for oil and gas deposits in this area is regarded as low (Spencer, 1983).

Commodities

Coal.

Mineral and energy resource potential

There is a high potential for the occurrence of coal deposits in the Fruitland Formation in the extreme southeastern corner of the study area. Based on geologic and geochemical criteria, the potential is low for the occurrence of other mineral and energy deposits within the study area.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 167-168.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000 and Circular 902E.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 39.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 184-186.

MARTINEZ CREEK (2-287)
DAVIS MOUNTAIN (2-288)
MONK ROCK (2-289)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the southern San Juan Mountains adjacent to the Weminuche wilderness area in southern Colorado. Tertiary latite and rhyolite flows, tuffs, and breccias crop out in the study areas (Steven and others, 1969). There are no mines in or near the study areas. At Piedra Peak a few miles northeast of the study areas there are intrusive plugs surrounded by alteration halos in a setting similar to that in the Summitville

district. This area has been extensively prospected in the past, but recent geochemical surveys have not discovered any deposits or significant anomalies. It is possible that this alteration is the surface expression of deeper mineralization, but data are unavailable that could confirm or deny this possibility. The areas of alteration do not extend into the study areas (Steven and others, 1969). The coal-bearing formations were eroded from this region before the deposition of the volcanic rocks (Landis, 1959; Steven and others, 1969). Favorable source and reservoir rocks occur beneath the volcanic rocks, but such accumulations of oil and gas would depend on favorable structural or stratigraphic features, and no information of such is currently available.

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria the potential is regarded as low for the occurrence of mineral or energy deposits.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-156.

Steven, T. A., Schmitt, L. J., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 51-53, 77-83.

POISON PARK (2-290)
GRAHAM PARK (2-291)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the southern San Juan Mountains between the Piedra wilderness and the Weminuche wilderness in southern Colorado. The study areas contain Paleozoic and Mesozoic sedimentary rocks, and minor amounts of Tertiary volcanic and volcaniclastic rocks (Steven and others, 1974). There are no mines or known mineralized areas within the study areas, nor mining districts near the study areas. Geochemical surveys and geologic mapping have revealed no areas of alteration or anomalies (Steven and others, 1969). Coal-bearing formations have been removed by erosion (Landis, 1959; Steven and others, 1974). The Paleozoic and Mesozoic sedimentary rocks have been deeply incised by canyons, and formations that produce oil and gas in other parts of the San Juan Basin are exposed in some of the canyon walls.

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria the study areas appear unfavorable for the occurrence of uranium, coal, or mineral deposits. Wilderness areas adjacent to the study areas have been rated as having low potential for oil and gas deposits, and the geology within the study areas does not appear favorable for such deposits (Spencer, 1983).

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-152.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 38.

PIEDRA (2-292)

Kind and amount of data

The central part of the area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation for the rest of the study area, but is not sufficient for the mineral surveys as required by the Wilderness Act and related acts. Part of this study area has been incorporated into the Weminuche Wilderness (NF-088).

Mining districts, mines, and mineral occurrences

The study area lies at the northern end of the San Juan Basin north of the townsite of Piedra in southern Colorado. It is underlain by Paleozoic and Mesozoic sedimentary rocks that dip regionally to the south. The area is transected by several low-amplitude folds and faults that trend north-northwest. Erosion has cut through the sedimentary rocks to expose Precambrian granites and gneisses in a few localities (Steven and others, 1974; Condon and others, 1984). The East and West Medicine mines occur just west of the study area boundary, and produced minor amounts of gypsum for medicinal purposes. No other mines occur within or near the study area. A mile south of the study area very minor uranium mineralization occurs in an exposed cut in limestone. Geological mapping and geochemical sampling have

revealed no other occurrences of any mineralization in or near the study area (Bush and others, 1984). The study area lies north of the San Juan River coal region where coal is produced from the Fruitland and Menefee Formations, and where it occurs discontinuously within the Dakota Formation. The Fruitland and Menefee Formations are absent from the study area, but the Dakota Formation does occur (Landis, 1959; Steven and others, 1974; Condon and others, 1984). Coal seams in the Dakota Formation do occur within the study area, but the seams are thin (< 1 foot), discontinuous, and low in grade (Bush and others, 1984). The Hermosa Formation produces oil and gas in other parts of the San Juan Basin, but it is breached by several canyons in the study area. Favorable structures such as the First Fork and the Second Box anticlines are cut by canyons, and the homoclinally dipping strata are all exposed updip in the wilderness study area (Bush and others, 1984). The Piedra River warm springs lies adjacent to the southern boundary of the study area, and another warm springs is reported at Davis Creek within the study area. The area does not lie within a designated area of high geothermal potential (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria, the study area has a low potential for mineral, coal, and oil deposits. The possibility exists for geothermal waters, but the potential is rated as low.

References

Bush, A. L., Condon, S. M., Franczyk, K. J., and Brown, S. D., 1984, Mineral resource potential map of the Piedra wilderness study area, Archuleta and Hinsdale Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1630A, scale 1:50,000.

Condon, S. M., Franczyk, K. J., and Bush, A. L., 1984, Geologic map of the Piedra wilderness study area, Archuleta and Hinsdale Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1630B, scale 1:50,000.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 150-157.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this study area has been incorporated into the Weminuche Wilderness (NF-088).

Mining districts, mines, and mineral occurrences

The study area is located in the southern San Juan Mountains northeast of Vallecito Reservoir in southern Colorado and consists of Paleozoic sedimentary rocks and Precambrian metaconglomerates (Steven and others, 1974). There are no known mines or mineral occurrences within the study area. North of the study area is the Cave Basin area where there are unverified reports of prospect pits with silver, gold, and copper minerals (Vanderwilt, 1947). Geochemical surveys have revealed no anomalies or alteration in or near the study area (Steven and others, 1969). Coal-bearing and oil-bearing formations of the San Juan Basin have been removed from the study area by erosion (Steven and others, 1974; Spencer, 1983).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria the area appears unfavorable for the occurrence of uranium, coal, oil, or mineral deposits, and the potential is rated as low.

References

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin, 1261F, p. 36.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 135-137.

FLORIDA RIVER (2-294)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. Part of this study area has been incorporated into the Weminuche Wilderness (NF-088).

Mining districts, mines, and mineral occurrences

The study area is located in the southern San Juan Mountains northeast of Durango in southern Colorado where Paleozoic and Mesozoic sedimentary rocks lie nonconformably upon Precambrian crystalline rocks (Steven and others, 1974). The Needle Mountains mining district lies a few miles north of the study area and has produced gold and silver from numerous mines in vein deposits in the crystalline rocks. Copper and lead also occur in this district, though none has been commercially produced (Vanderwilt, 1947). Geochemical surveys show anomalous metal concentrations in the area just north of the study area, but this is believed to be controlled by the mineralization in the Needle Mountains district and does not extend into the study area (Steven and others, 1969). Placer gold has been reported in the Animas River north of Durango, but there has been no systematic sampling of the river and production has been very modest. The placer gravels do not extend into the study area (Vanderwilt, 1947). Source beds for oil and gas do not occur in the subsurface of the study area, and formations that produce coal, oil, and gas in the north San Juan Basin have been removed by erosion from the study area (Landis, 1959; Steven and others, 1974; Spencer, 1983). The Trimble, Tripp, and Pinkerton hot springs all occur just west of the study area. The area of significant lateral extent favorable for the discovery and development of low temperature ($<90^{\circ}C$) water impinges upon the western boundary of the study area, but does not extend an appreciable distance into the study area (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria the area appears unfavorable for the occurrence of uranium, coal, oil and gas, or mineral deposits.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072-C, p. 150-154.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.
Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 30-31, 90-94.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 133-137.

H D MOUNTAIN (2-295)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the San Juan Basin south of the San Juan Mountains, southwest of the town of Piedra in southern Colorado. The area consists of Tertiary and Cretaceous sedimentary rocks that regionally dip to the south. The H D syncline trends through the area plunging to the south (Steven and others, 1974). There are no mines or known mineralized areas within or near the study area (Vanderwilt, 1947). The study area lies mostly within the Bayfield-Yellowjacket Pass coal district, where coal has been produced from continuous seams in the Fruitland Formation and from discontinuous seams in the Dakota Formation (Landis, 1959). The study area also lies within the San Juan Basin petroleum province, just north of known production on the Southern Ute Indian Reservation. Natural gas is produced in this part of the San Juan Basin from stratigraphic traps in the Dakota and Mesaverde Group formations, as well as from fracture-porosity traps in the Mancos Shale and Gallup Sandstone formations, all of which occur at depth within the study area. The possibility also exists for the occurrence of coal gas from the Mesaverde group within the study area (Spencer, 1983).

Commodities

Coal, natural gas.

Mineral and energy resource potential

Based on geological criteria the study area appears unfavorable for the occurrence of uranium or mineral deposits and the potential is rated as low. The study area has a high potential for the occurrence of coal and natural gas.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-152.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.
Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, plate 1.

TENMILE CREEK (2-296)
WHITEHEAD PEAK (2-297)
CUNNINGHAM CREEK (2-298)
BEAR CREEK (2-299)
RIO GRANDE RESERVOIR (2-300)
SHEEP MOUNTAIN (2-307)
WEMINUCHE WILDERNESS (NF-088)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed. Parts of these areas have been incorporated into the Weminuche Wilderness area (NF-088).

Mining districts, mines, and mineral occurrences

The wilderness area and adjacent study areas are located in the central San Juan mountains from Wolf Creek Pass west to Silverton in southern Colorado. Proterozoic gneisses, granites, and metasediments of the Needles Mountains uplift crop out in the western portion of the Weminuche wilderness area. The central and eastern portions of the wilderness area contain Oligocene and Miocene volcanic and related intrusive rocks. Paleozoic and Mesozoic sedimentary rocks crop out along the southern margin of the wilderness area and extend north beneath the volcanic rocks (Steven and others, 1969). Four different mining districts lie adjacent to, and partly within, the wilderness area. The Needles Mountains mining district is in the southwestern part of the wilderness area and contains the greatest amount of acreage in the wilderness, with several inactive mines within and near it. Gold and silver were produced from vein deposits throughout the district, and copper, lead, and zinc also occur in these veins although they were not produced. Geologic mapping, geophysical and geochemical data suggest the strong likelihood of large disseminated molybdenum deposits at depth (Schmitt and Raymond, 1977). The Beartown mining district is adjacent to the northwestern part of the wilderness area and produced gold, silver, copper, and lead from several mines in the district, none of which is located within the wilderness. Production was from vein deposits that extend to within 1/2 mile of the wilderness, and it is possible that additional veins exist within the wilderness. The Whitehead Gulch district lies at the extreme northwestern corner of the wilderness and is part of the Silverton caldera. Gold and silver were produced from quartz veins. Within the wilderness area many small quartz veins occur, and there are significant if somewhat sporadic occurrences

of gold and silver. The Trout Creek area is to the northeast of the wilderness and extends into it. Native sulfur has been produced from fumarolic deposits along Trout Creek just outside the wilderness. The extent of the sulfur deposits into the wilderness area is unknown.

Commodities

Molybdenum, gold, silver, lead, zinc, copper, sulfur.

Mineral and energy resource potential

The potential is high for molybdenum in disseminated porphyry deposits and for gold, silver, copper, lead, and zinc in vein deposits in the Needle Mountains mining district in the southwestern part of the wilderness (A). The potential is high for gold in vein deposits in the Beartown mining district in the northwestern part of the wilderness (B). There is a high potential for gold, silver, copper, lead, and zinc in vein deposits in the Whitehead Gulch district in the northwestern corner of the wilderness (C). The potential for sulfur in fumarolic deposits is high for the Trout Creek area in the northeastern part of the wilderness (D).

References

Schmitt, L. J., and Raymond, W. H., 1977, Geology and mineral deposits of the Needle Mountains district, southwestern Colorado: U.S. Geological Survey Bulletin 1434, 40 p.

Steven, T. A., Schmitt, L. J., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan Primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, 187 p.

EAST ANIMAS (2-302)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the southern San Juan Mountains east of Rockwood in southern Colorado and is underlain by Paleozoic sedimentary rocks and Precambrian granite (Steven and others, 1974). The Needle Mountains district lies 1 to 3 miles east of the study area and has produced mainly gold and silver and minor amounts of copper and lead from numerous mines in vein deposits in the Precambrian granites (Vanderwilt, 1947; Steven and others, 1969). These deposits are not known to extend into the study area. Geochemical surveys report anomalies in streams that drain the Needle Mountains district, but no anomalies are known in the study area (Steven and others, 1969). Placer gold has been reported in the Animas River north of Durango, but there has been no systematic sampling of the river and production of only a few ounces of gold has been reported (Vanderwilt, 1947). Coal-

bearing and possibly oil and gas-bearing formations have been removed from the study area by erosion (Landis, 1959; Steven and others, 1974; Spencer, 1983). The Pinkerton hot springs occur several miles south of the study area. The area of significant lateral extent favorable for the discovery and development of low temperature (<90°C) water is adjacent to the study area, but does not extend into it (Pearl, 1980).

Commodities

None.

Mineral and energy resource potential

Based on geologic and geochemical criteria the area appears unfavorable for the occurrence of uranium, coal, oil and gas, or other mineral deposits, and the potential is rated as low.

References

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-154.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Spencer, C. W., 1983, Petroleum potential of wilderness lands, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1539, scale 1:1,000,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado: U.S. Geological Survey Bulletin 1261F, p. 31, 90-94.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 133-137.

WEST NEEDLES (2-303)

Kind and amount of data

The area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the western San Juan Mountains southwest of Silverton in southern Colorado. Older Proterozoic age gneisses and younger Proterozoic age metasediments and granites of the Needles Mountains uplift occur in the study area. Paleozoic sedimentary rocks crop out in the northern part of the study area. Parts of two mining districts extend into the study area and a third is adjacent to it to the west (Van Loenen and Scott, 1984). The Needle Mountains mining district extends into the southern part of the

study area and two mines occur within it. Gold and silver were reported at the mines, though neither mine recorded any production and mineralized veins appeared discontinuous. The Animas mining district extends into the northern part of the study area, but no mines or mineralized zones were found within the study area. The Centennial deposit and Elk Park mine are adjacent to the northeastern part of the study area, and have produced uranium from vein deposits. Significant concentrations of molybdenum, lead, zinc, silver, nickel, and cobalt also occur in these veins. The folds and fractures that controlled the mineralization in Elk Park extend into the northern part of the study area (Scott, 1983; Van Loenen and Scott, 1984).

Commodities

Uranium.

Mineral and energy resource potential

The potential for mineral and energy deposits within the study area is regarded as low.

References

Scott, D. C., 1983, Mineral investigation of the West Needle wilderness study area and the BLM West Needle contiguous wilderness study area, La Plata and San Juan Counties, Colorado: U.S. Bureau of Mines Open File Report MLA 35-83.

Van Loenen, R. E., and Scott, D. C., 1984, Mineral resource potential map of the West Needles wilderness study area, San Juan and La Plata Counties, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-1632A, scale 1:50,000.

BLACKHAWK MOUNTAIN (2-304)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located east of Rico in the western San Juan mountains in southwestern Colorado. Upper Paleozoic and Mesozoic sedimentary rocks are intruded by Tertiary igneous rocks in the study area (Haynes and others, 1972; Steven and others, 1974). The study area is adjacent to the Rico mining district that produced gold, silver, lead, zinc, and copper from vein and replacement deposits in Paleozoic rocks associated with Tertiary intrusions at the center of the Rico dome. Some mines from this district are adjacent to, but not within, the study area (McKnight, 1974). Significant amounts of vanadium and some uranium have been produced from a sandstone-type deposit in the Entrada Formation at the Graysill mine in the eastern part of the study area. Another such occurrence is reported in the study area east of the

Graysill mine (Nelson-Moore and others, 1978). All oil and gas, and coal-bearing formations have been removed from the study area by erosion (Landis, 1959; Bass, 1964).

Commodities

Vanadium, uranium.

Mineral and energy resource potential

There is a high potential for vanadium and uranium sandstone-type deposits in the eastern part of the study area. The potential is low for other mineral and energy deposits.

References

Bass, N. W., 1964, Oil and gas; in Mineral and water resoures of Colorado, U.S. 88th Congress, 2nd Session, Senate Committee on Interior and Insular Affairs, Committee Print, p. 62-63.

Haynes, D. D., Vogel, J. D., and Wyant, D. G., 1972, Geology, structure and uranium deposits of the Cortez quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-629, scale 1:250,000.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-156.

McKnight, E. T., 1974, Geology and ore deposits of the Rico district, Colorado: U.S. Geological Survey Professional Paper 723, p. 1-4, 57-58.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 128-130, 397-399.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

STORM PEAK (2-305)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located west of Rico in the western San Juan Mountains in southwestern Colorado. The area contains Upper Paleozoic and Mesozoic sedimentary rocks intruded by latites and monzonites in the Rico Mountains in the eastern part of the study area (Haynes and others, 1972). Adjacent to the eastern border of the study area is the Rico mining district where gold, silver, lead, zinc, and copper were produced from vein and replacement deposits in the Paleozoic rocks associated with the Tertiary intrusions at the

center of the Rico Dome (McKnight, 1974). The Dunton mining district adjacent to the northern boundary of the study area produced gold, silver, lead, and copper (Vanderwilt, 1947). Some uranium and vanadium has been produced from the Blue Eagle mine in the northern part of the study area, east of Dunton. This is a sandstone carnotite deposit in the Morrison Formation. Uranium occurs in the Entrada Formation at the Silver Swan mine adjacent to the eastern border of the study area south of Rico. This mine produced gold and silver but uranium production is not known (Nelson-Moore and others, 1978). Coking coal has been produced near Rico from the Dakota Formation and Landis (1959) reports that coal reserves occur in the Dakota Formation from the San Juan basin in the south to the Gunnison River in the north. The coal is often thin, shaly, or discontinuous. The Dakota Sandstone crops out in the study area in the western part and is included in the state map of coal-bearing regions (Murray, 1981). The study area is bordered on the east by the Rico hot springs and on the northwest by the Dunton, Paradise, and Geyser hot springs, and the northern part of the study area is included in an area designated as favorable for discovery and development of local sources of low temperature (<90°C) waters (Pearl, 1980).

Commodities

Coal, uranium, vanadium, geothermal water.

Mineral and energy resource potential

There is a moderate potential for the occurrence of coal deposits in the western part of the study area, and for uranium and vanadium deposits in the northern part of the study area. Formations that produce oil and gas in the adjacent San Juan Basin have been cut into by canyons, and the potential for oil and gas deposits is regarded as low. There is a moderate potential for the discovery and development of low temperature (<90°C) water in the northeastern part of the study area.

References

Haynes, D. D., Vogel, J. D., and Wyant, D. G., 1972, Geology, structure, and uranium deposits of the Cortez quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-629, scale 1:250,000.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 150-156.

McKnight, E. T., 1974, Geology and ore deposits of the Rico district, Colorado: U.S. Geological Survey Professional Paper 723, p. 1-4, 57-58.

Murray, D. K., 1981, Upper Cretaceous (Campanian) coal resources of western Colorado, in; Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-239.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 128-130.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado, Colorado Mineral Resources Board, Denver, Colorado, p. 71.

HERMOSA (2-306)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located in the southwestern part of the San Juan mountains near Durango in southwestern Colorado. In the study area domed Upper Paleozoic and Mesozoic sedimentary rocks are intruded by intermediate Tertiary stocks and laccoliths (Haynes and others, 1972; Steven and others, 1974). There are several mines and mining districts in and near the study area, most of them in the La Plata mountains. The La Plata district is located in the southern part of the study area and has produced gold, silver, copper, and lead from vein, replacement, mineralized breccia, and contact metamorphic deposits (Eckel and others, 1949). The East Mancos district is located in the southwestern corner of the study area and has produced gold and silver from vein and replacement deposits. The Bear Creek district in the northeastern part of the study area contains copper in the Shinarump sandstone, but no production has been reported. Minor amounts of gold have been produced from placer deposits in the Animas River east of the study area, and in the East Mancos River in the far western part of the area (Vanderwilt, 1947). There are several occurrences of uranium in and near the study area. On the eastern boundary near Hermosa there is uranium in carbonaceous sandstone of the Rico Formation. Uranium was produced from the Entrada sandstone at the Good Hope-Nevada claims near the southern boundary of the study area, and modest amounts of uranium and vanadium were produced from vein deposits in a Tertiary stock in the southwestern part of the study area. North of this location, on the boundary of the study area, uranium is reported in an old gold mine and in veins near it (Nelson-Moore and others, 1978). Carbonaceous shale and thin coal seams occur in the Dakota Sandstone which crops out in the northwestern part of the study area, but there has been no production (Eckel and others, 1949).

Commodities

Gold, silver, copper, uranium, vanadium, geothermal water.

Mineral and energy resource potential

There is a high potential for gold, silver, and copper in the southern (A) and southwestern (B) parts of the study area, near the town of La Plata. There is a moderate potential for uranium in this same area, and in the eastern (C) part of the study near Hermosa. There is a possibility that coal may occur in the Dakota Sandstone in Bear Creek, but the potential is unknown. A moderate potential for copper occurs in the northwestern corner

(D) of the study area in Bear Creek. Trimble, Tripp, and Pinkerton hot springs all occur just east of the study area (C) along the Animas River, and the eastern part of the study area is favorable for discovery and development of local sources of low temperature (<90°C) water (Pearl, 1980).

References

Eckel, E. B., Williams, J. S., and Galbraith, F. W., 1949, Geology and ore deposits of the La Plata district, Colorado: U.S. Geological Survey Professional Paper 219, p. 1-7, 63-82.

Haynes, D. D., Vogel, J. D., and Wyant, D. G., 1972, Geology, structure, and uranium deposits of the Cortez quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-629, scale 1:250,000.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 204-206.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Luedke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-764, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 133-135, 149-151.

RYMAN (2-315)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located south of Rico in the southwestern part of the San Juan Mountains in southwestern Colorado. The area is underlain by Upper Paleozoic red beds (Haynes and others, 1972). There are no mines or mineral occurrences within the study area, but the Rico district is several miles north of the study area, where gold, silver, lead, zinc, and copper were produced from vein and replacement deposits in Paleozoic rocks. These deposits are associated with Tertiary intrusive igneous rocks at the center of the Rico Dome (McKnight, 1974). Neither the Tertiary stocks of Rico, nor the same host rocks crop out within the study area, and no mineral occurences are known (Haynes and others, 1972). There are no known occurrences of uranium within the study area (Nelson-Moore and others, 1978).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the mineral and energy resource potential is regarded as low.

References

Haynes, D. D., Vogel, J. D., and Wyant, D. G., 1972, Geology, structure and uranium deposits of the Cortez quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-629, scale 1:250,000.

McKnight, E. T., 1974, Geology and ore deposits of the Rico district: U.S. Geological Survey Professional Paper 723, p. 1-2, 57-58.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 276-282.

WHITE RIVER NATIONAL FOREST

PAGODA PEAK (2-108)

(See description under Routt National Forest)

JACQUE PEAK (2-140)

(See description under Roosevelt National Forest)

TWO ELK (2-146)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located south of Vail in north-central Colorado and is underlain by upper Paleozoic red beds. The Gilman mining district lies west of the study area and has produced zinc, silver, lead, gold, and copper primarily from replacement deposits in Paleozoic carbonate rocks and from a few veins in Early Paleozoic quartzites and Precambrian gneisses (Lovering and others, 1978). The Gilman district was the largest zinc producer in Colorado (Heyl, 1964). The ore deposits extend downdip beneath Battle Mountain, and may occur beneath the study area. Mineral occurrences in carbonate rocks along faults may contain hidden ore deposits in several locations adjacent to, and partly within, the southwestern part of the study area (Tweto and Lovering, 1977; Vanderwilt, 1947). Uranium has been found in the clastic rocks of the Minturn Formation and some exploratory drilling was done, but no ore bodies were found (Tweto and Lovering, 1977). The structures and the occurrences of ore deposits make the area unfavorable for the occurrence of oil and gas.

Commodities

Zinc, lead, silver.

Mineral and energy resource potential

There is a moderate potential for zinc, lead, and silver deposits beneath the study area in the southwestern corner.

References

Heyl, A. V., 1964, Oxidized zinc deposits of the United States Part 3. Colorado: U.S. Geological Survey Bulletin 1135C, p. 57.

Lovering, T. S., Tweto, Ogden, Lovering, T. G., 1978, Ore deposits of the Gilman district, Eagle County, Colorado: U.S. Geological Survey Professional Paper 1017, p. 1-3.

Tweto, Ogden, and Lovering, T. S., Geology of the Minturn 15-minute quadrangle, Eagle and Summit Counties, Colorado: U.S. Geological Survey Professional Paper 956, p. 69-79.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 80.

SPRADDLE CREEK (2-147)
MIDDLE CREEK (2-148)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located on the west flank of the Gore Range north of Vail in north-central Colorado. Late Paleozoic red beds crop out in the western part of the study areas and are in fault contact with Precambrian granites and gneisses in the eastern part of the study areas (Tweto and Lovering, 1977). There are no mines or mining districts in or near the study areas (Vanderwilt, 1947). There is an occurrence of uranium mineralization in limestone in Spraddle Creek, but it is spotty and of low grade and there has been no production (Nelson-Moore and others, 1978). The geologic structure of the area is unfavorable for the occurrence of oil and gas.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the areas are unfavorable for the occurrence of mineral and energy deposits and their potential is regarded as low.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 133-136.

Tweto, Ogden, and Lovering, T. S., 1977, Geology of the Minturn 15-minute quadrangle, Eagle and Summit Counties, Colorado: U.S. Geological Survey Professional Paper 956, p. 1-3, 69-77.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 77-80.

SOUTH FORK PINEY RIVER (2-149)
PINEY (2-150)
ELLIOTT RIDGE (2-151)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located on the northwestern edge of the Eagles Nest Wilderness area southeast of State Bridge in north-central Colorado. Paleozoic and Mesozoic sedimentary rocks and some Tertiary basalts crop out in the study area (Tweto and others, 1978). There are no mines or mineral deposits in or near the study areas. No coal-bearing formations occur within the study areas. There are no oil and gas fields near the study areas, and the structure does not appear favorable for the entrapment of hydrocarbons (Sanborn, 1981).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the areas are unfavorable for the occurrence of mineral and energy deposits and their potential is regarded as low.

References

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado, in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

DOME PEAK (2-152)
DERBY AREA (2-153)
RED DIRT (2-154)
SWEETWATER (2-155)
HUNNS PEAK (2-156)
COW LAKE (2-158)
CANYON CREEK (2-167)
GRIZZLE CREEK (2-168)
GRAND MESA (2-169)
DEEP CREEK (2-348)
MITCHELL CREEK (2-349)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are all adjacent to, or south of, the Flat Tops Wilderness area in the northwestern Colorado Rockies. Whereas the wilderness area contains primarily flood basalts, the contiguous areas east and south of it contain Paleozoic sedimentary rocks. Precambrian crystalline rocks crop out in the canyon bottoms throughout these areas (Tweto and others, 1976). The area as a whole lies outside the Colorado Mineral Belt, and there is a lack of Tertiary intrusions that have accounted for so many of the mineral deposits in Colorado. Geochemical surveys carried out within and near the wilderness area have found no evidence for mineral resources (Mallory and others, 1966). Coal-bearing Cretaceous sedimentary rocks crop out in the Grand Hogback west and south of the study areas, but all such rocks have been eroded away from the study areas (Bass and Northrop, 1963). The nearest mines to the study areas occur south and west of Glenwood Springs in the Grand Hogback (Landis, 1959). Because erosion has cut numerous canyons into the Paleozoic sedimentary rocks down to the Precambrian basement, the potential for oil is low. Those formations not breached by erosion are not known to contain reservoirs of oil in Colorado (Sanborn, 1981). The study areas Mitchell Creek, Grizzle Creek, and Grand Mesa are near the Glenwood and Dotsero hot springs. The study areas of Grizzle Creek and Grand Mesa are partially in the Glenwood geothermal area, an area that contains many springs (Pearl, 1980).

Commodities

Geothermal energy.

Mineral and energy resource potential

There is a moderate potential for the discovery and development of low temperature ($<90^{o}C$) water in the Grizzle Creek and Grand Mesa study areas (Pearl, 1980). Based on geologic and geochemical criteria, the remaining areas are unfavorable for the occurrence of mineral and energy deposits, and their potential is regarded as low.

References

Bass, N. W., and Northrop, S. A., 1963, Geology of the Glenwood Springs quadrangle and vicinity, northwestern Colorado: U.S. Geological Survey Bulletin 1142J, 74 p.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 148.

Mallory, W. W., Post, E. V., Ruane, P. J., and Lehmbeck, W. L., 1966, Mineral resources of the Flat Tops Primitive area, Colorado: U.S. Geological Survey Bulletin 1230C, 30 p.

Pearl, R. H., 1980, Geothermal resources of Colorado: Colorado Geological Survey Map Series 14, scale 1:500,000.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado, in; Epis, R. C. and Callender, J. F., Western slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

BURRO MOUNTAIN (2-159)
WHITE RIVER (2-160)
SKINNY FISH (2-162)
NORTH ELK (2-163)
THREE FORKS (2-164)
BUTLER CREEK (2-165)
MAIN ELK (2-166)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas lie west and southwest of the Flat Tops Wilderness area in the northwestern Colorado Rockies. They contain primarily Paleozoic sedimentary rocks, with some Precambrian granites and gneisses exposed in the canyon bottoms (Tweto and others, 1978). The nearest mining districts are the Rifle Creek district and the Elk Creek district, which lie to the south of the study areas. Two mines in the Rifle Creek district, the Garfield mine and the Rifle mine, have produced significant amounts of vanadium and uranium from sandstone deposits in the Entrada and Morrison formations. Minor amounts of gold, silver, and lead have also been produced from replacement deposits in the Leadville Limestone in this district. In the Elk Creek district uranium has been produced from the Entrada and Morrison formations, and modest amounts of gold, silver, and lead have been produced from veins in Precambrian gneiss (Vanderwilt, 1947). Both of these districts lie south and southwest of the Main Elk study area. There are other small uranium mines in the Entrada and Morrison formations to the south of the Main Elk study area (Nelson-Moore and

others, 1978). Coal is produced from several mines in the Cretaceous sedimentary rocks of the Grand Hogback south of the Main Elk and Butler Creek study areas (Landis, 1959). There are no mineral occurrences reported in any of the study areas, and all coal, oil, and uranium-bearing formations have been removed from the study areas by erosion (Landis, 1959; Sanborn, 1981; Bass and Northrop, 1963).

Commodities

None.

Mineral and energy resource potential

There is no known geologic evidence for oil, gas, coal, uranium, or geothermal resources within the areas. The possibility exists for stratiform zinc-tungsten deposits in the Precambrian rocks beneath the Paleozoic sedimentary rocks, but resources are unknown and the potential is regarded as low.

References

Bass, N. W., and Northrop, S. A., 1963, Geology of Glenwood Springs quadrangle and vicinity, northwestern Colorado: U.S. Geological Survey Bulletin 1142J, 74 p.

Landis, E. R., 1959, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 144-148.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 154-157.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado; in Epis, R. C., and Callender, J. F., eds., Western Slope Colorado: New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 90.

HOLY CROSS WILDERNESS (2-170)

(See description under San Isabel National Forest)

GARDNER PARK (2-171)

ADAMS MOUNTAIN ((2-172)

SEVEN HERMITS (2-173)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located south of Eagle near Hardscrabble Mountain in north-central Colorado and consist of Late Paleozoic and Mesozoic sedimentary rocks with some Tertiary intrusives and volcanic rocks (Tweto and others, 1978). The nearest mining district is at Brush Creek north of the study areas where silver, copper, lead, and gold were produced from veins in the Dakota Sandstone. Trace amounts of vanadium and uranium occur in the sandstone as well, but there are no significant occurrences of these elements (Vanderwilt, 1947). There are no other known uranium occurrences in the study areas (Nelson-Moore and others, 1978). There is no known coal or oil and gas within or near the study areas (Landis, 1957; Murray, 1981; Sanborn, 1981).

Commodities

Silver, copper.

Mineral and energy resource potential

There is a moderate potential for silver and copper in vein deposits in the southern portion of the Gardner Park study area adjacent to the Brush Creek mining district.

References

Landis, E. R., 1957, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 134-142.

Murray, D. K., 1981, Upper Cretaceous coal resources of Colorado, in; Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-240.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 233-240.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado, in; Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 77-81.

HARDSCRABBLE (2-174)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located south of Eagle on Hardscrabble Mountain in north-central Colorado and contains Late Paleozoic and Early Mesozoic red beds (Tweto and others, 1978). There are no mines or mining districts in or near the study area (Vanderwilt, 1947). There are no known uranium occurrences, no coal-bearing formations, and no oil or gas production in or near the study area (Landis, 1957; Nelson-Moore and others, 1978; Murray, 1981; and Sanborn, 1981).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the area is unfavorable for the occurrence of mineral and energy deposits and the potential is regarded as low.

References

Landis, E. R., 1957, Coal resources of Colorado: U.S. Geological Survey Bulletin 1072C, p. 134-142.

Murray, D. K., 1981, Upper Cretaceous coal resources of western Colorado, in; Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 233-240.

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 133-136.

Sanborn, A. F., 1981, Potential petroleum resources of northeastern Utah and northwestern Colorado, in; Epis, R. C., and Callender, J. F., eds., Western Slope Colorado, New Mexico Geological Society 32nd field conference guidebook, p. 255-266.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{\circ}x2^{\circ}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 77-81.

RED TABLE NORTH (2-175)
RED TABLES (2-176)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is located northeast of Basalt in north-central Colorado and consists primarily of Late Paleozoic red beds and some Mesozoic

sedimentary rocks and Tertiary basalts capping Basalt Mountain in the western part of the area (Tweto and others, 1978). The nearest mining district is at Fulford a few miles east of the study area where silver and lead occur in stratiform beds in Paleozoic dolomite. Production is not known (Vanderwilt, 1947). There are no known occurrences of uranium in or near the study areas (Nelson-Moore and others, 1978). Potential coal-bearing formations have been removed from the study area by erosion (Landis, 1957; Murray, 1981). The occurrence of oil and gas within the study area is not known, but appears unlikely due to the lack of favorable structures (Sanborn, 1981).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

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Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 133-136.

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Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northeastern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

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PORPHYRY MOUNTAIN (2-177)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts. The area has been mapped and the mineral survey, as required by the Wilderness Act (PL88-577) and related acts, has been completed for the eastern part of the study area. Part of the study area has been incorporated into the Hunter-Frying Pan Wilderness (NF-096).

Mining districts, mines, and mineral occurrences

The study area is located in the northeastern part of the Sawatch Range north of Aspen in central Colorado. The area contains primarily Late Paleozoic and Triassic sedimentary rocks of the paleo Central Colorado Trough (Freeman, 1971, 1972a, 1972b; Mallory, 1971; Tweto and others, 1978). In the eastern part of the study area Proterozoic granites and gneisses crop out. This area has recently been included in the Hunter-Frying Pan wilderness area and has been evaluated in the mandated study of Ludington and Ellis (1981). The study area is adjacent to the Colorado Mineral Belt. Significant quantities of silver, lead, and zinc have been produced from vein and replacement deposits in Paleozoic carbonate rocks in the Aspen district south of the study area, and at the Lenado district east of the study area (Vanderwilt, 1947; Heyl, 1964; Bryant, 1971). These rocks do not crop out within the study area, nor do the faults controlling mineralization occur within the study. A minor amount of uranium has been produced from mineralized fault breccias at the Frying Pan claims in the eastern part of the study area. Other anomalous radioactive occurrences have been noted in the vein deposits in the Aspen and Lenado districts (Nelson-Moore and others, 1978). Geologic structure and depth of erosion make it unlikely that oil and gas occur within the study area (Bryant, 1971; Freeman, 1972a,b).

Commodities

Uranium.

Mineral and energy resource potential

There is a moderate potential for uranium in the extreme eastern part of the study area. Based on geologic criteria the area appears unfavorable for the occurrence of other energy and mineral deposits, and their potential is regarded as low.

References

Bryant, Bruce, 1971, Geologic map of the Aspen quadrangle, Pitkin County, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-933, scale 1:24,000.

Freeman, V. L., 1971, Stratigraphy of the State Bridge formation in the Woody Creek quadrangle, Pitkin and Eagle Counties, Colorado: U.S. Geological Survey Bulletin 1324F, 17 p.

-----1972a, Geologic map of the Ruedi quadrangle, Pitkin and Eagle Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-1004, scale 1:24,000.

-----1972b, Geologic map of the Woody Creek quadrangle, Pitkin and Eagle Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-967, scale 1:24,000.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, part 3. Colorado: U.S. Geological Survey Bulletin 1135C, p. 59-62.

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Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 372-373.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 176-182.

IVANHOE (2-179)

Kind and amount of data

Information on geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study area is adjacent to the Hunter-Frying Pan wilderness area west of Leadville in north-central Colorado. Proterozoic gneisses and granites are cut by dikes of Tertiary age quartz monzonite in the study area. The nearest mining district is the Sugarloaf-St. Kevin district several miles east of the study area where silver, gold, lead, and zinc were produced from vein deposits in Precambrian granite (Vanderwilt, 1947; Singewald, 1955; Tweto and others, 1978). Uranium is associated with the silver and sulfide veins but none has been produced due to low concentration (Nelson-Moore and others, 1978). No mineral occurrences are known within the study area.

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria the area is unfavorable for the occurrence of mineral and energy deposits and the potential is regarded as low.

References

Nelson-Moore, J. L., Collins, D. B., and Hornbaker, A. L., 1978, Radioactive mineral occurrences of Colorado: Colorado Geological Survey Bulletin 40, p. 199-203.

Singewald, Q. D., 1955, Sugarloaf and St. Kevin mining districts, Lake County, Colorado: U.S. Geological Survey Bulletin 1027E, p. 251-299.

Tweto, Ogden, Moench, R. H., and Reed, J. C., Jr., 1978, Geologic map of the Leadville $1^{o}x2^{o}$ quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-999, scale 1:250,000.
Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, p. 130.

ELK MOUNTAINS-COLLEGIATE (2-180)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

RAGGEDS (2-181)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

DRIFT CREEK (2-182)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

PERHAM CREEK (2-183)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

BALDY MOUNTAIN (2-187)
HORSE PARK (2-188)
HIGHTOWER (2-189)

Kind and amount of data

Information of geology and mineral deposits is adequate for a preliminary mineral resource evaluation, but is not sufficient for the mineral surveys as required by the Wilderness Act (PL88-577) and related acts.

Mining districts, mines, and mineral occurrences

The study areas are located in the high mesas northeast of Grand Mesa in western Colorado and are underlain by the Tertiary Wasatch Formation and Cretaceous Mesaverde Formation (Tweto and others, 1978). There are no radioactive mineral occurrences or metallic mineral deposits in or near the study areas (Vanderwilt, 1947; Nelson-Moore and others, 1984). The areas lie within the Uinta coal region several miles east of the Carbondale coal mining district where coking and noncoking coal are produced from the Mesaverde Formation. This formation crops out in the eastern parts of the Baldy Mountain and Horse Park study areas and occurs in the subsurface beneath the Hightower study area (Landis, 1959; Murray, 1981). The Hightower area is within the part of the Uinta Basin that is inferred to be favorable for the production of methane from coal-bearing formations (Tremain and others, 1981). The three study areas are adjacent to, or partly within, the Divide Creek, Wolf Creek, and Sheep Creek oil and gas fields (Del Rio, 1960; Sanborn, 1981).

Commodities

Coal, methane, natural gas.

Mineral and energy resource potential

In the eastern portions of the Baldy Mountain and Horse Park study areas there is a high potential for coal deposits. In the western part of the Baldy Mountain and the eastern part of the Hightower areas there exists a high potential for natural gas, as these areas are adjacent to, and partly within, the Divide Creek gas field. The northwestern part of the Hightower area is adjacent to the Sheep Creek gas field and has a high potential for natural

gas. The rest of the areas have a high potential for coal deposits and (or) natural gas and methane.

References

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Vanderwilt, J. W., 1947, Mineral resources of Colorado: Colorado Mineral Resources Board, Denver, Colorado, plate 1.

BATTLEMENT MESA (2-193)

(See description under Grand Mesa, Uncompahgre, and Gunnison National Forests)

BIG BEAVER BASIN (2-334)

(See description under Routt National Forest)

CHICAGO RIDGE (2-335)

(See description under San Isabel and Pike National Forests)

FLAT TOPS WILDERNESS (NF-025)

Kind and amount of data

The wilderness area has been mapped and the mineral surveys, as required by the Wilderness Act (PL88-577) and related acts, have been completed.

Mining districts, mines, and mineral occurrences

The study area is located in the Flat Tops north of Glenwood Springs in the northwestern Colorado Rockies. In the Flat Tops Wilderness area a thick sequence of flat-lying Tertiary basalt flows overlie Paleozoic and Mesozoic sedimentary rocks. Cretaceous shales crop out in the northern part of the wilderness area, and Precambrian to Paleozoic rocks crop out in the canyons in the southern part (Bass and Northrop, 1963). There are no mines in the wilderness area, and no mining districts adjacent to it. Geochemical studies indicate no anomalies within the wilderness area. Geologic structures are not

favorable for the entrapment of oil and gas beneath the basalt flows. Coal is produced south of the wilderness in the Grand Hogback, but no coal-bearing formations exist within the wilderness area (Mallory and others, 1966).

Commodities

None.

Mineral and energy resource potential

Based on geologic criteria, the wilderness area is unfavorable for the occurrence of mineral and energy deposits, and the potential is regarded as low.

References

Bass, N. W., and Northrop, S. A., 1963, Geology of Glenwood Springs quadrangle and vicinity, northwestern Colorado: U.S. Geological Survey Bulletin 1142J, 74 p.

Mallory, W. W., Post, E. V., Ruane, P. J., Lehmbeck, W. L., and Stotelmeyer, R. B., 1966, Mineral resources of the Flat Tops Primitive area, Colorado: U.S. Geological Survey Bulletin 1230C, 30 p.

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