OPEN-FILE REPORT 03-13

History, Geology, and Environmental Setting of the Southern Cross and 7D Mines, Hahns Peak Mining District, Routt National Forest, Routt County, Colorado

By

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FOREWORD

Open-File Report 03-13 describes the history, geology, and environmental setting of two mines in the Hahns Peak mining district. Both of the sites lie on U.S. Forest Service administered land and are within the Willow Creek drainage basin, a tributary of the Elk River. The U.S. Forest Service selected the sites based on the results of an abandoned mine inventory recently completed by the Colorado Geological Survey. This information is useful for State and Federal agencies and private owners for developing realistic and cost-effective reclamation plans for mines in the Willow Creek watershed.

Funding for this project was provided mostly by the U.S. Forest Service (Agreement No. 1102-0007-98-035). Partial funding came from the Colorado Department of Natural Resources Severance Tax Operational Fund. Severance taxes are derived from the production of gas, oil, coal, and minerals.

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LIST OF ABBREVIATIONS AND SYMBOLS

AMLIP	Abandoned Mined Land Inventory Project
~	approximate value
bk.	book
cm	centimeter(s)
CBM	Colorado Bureau of Mines
CDMG	Colorado Department of Minerals and Geology
CDPHE	Colorado Department of Public Health and Environment
CGS	Colorado Geological Survey
CMA	Colorado Mining Association
cps	counts/second
∞	degree
DO	dissolved oxygen
EDR	Environmental Degradation Rating
EPA	Environmental Protection Agency
4WD	four-wheel drive
gpm	gallons per minute
GPS	Global Positioning System
>	greater than
<	less than
≤	less than or equal to
μg/L	micrograms per liter
μ	microns
μS/cm	microSiemens
mg/L	milligrams per liter
NFS	National Forest System
n/a	not applicable
no.	number
#	number
p.	page(s)
ppm	parts per million
ppb	parts per billion
%	percent
lb	pound(s)
PBS	Primary Base Series
quad	quadrangle (7.5-minute)
TDS	total dissolved solids
trec	total recoverable
oz	troy ounce(s)
U.S.	United States
USFS	United States Department of Agriculture - Forest Service
BLM	United States Department of Interior - Bureau of Land Management
v.	Volume

INTRODUCTION

During the summer of 1997 the Colorado Geological Survey (CGS) inventoried mines in the Hahns Peak area of the Hahns Peak Ranger District, Routt National Forest. This project was part of an eight-year, statewide inventory of abandoned mines on U.S. Forest Service administered lands in Colorado. Not all of the mines were on National Forest System (NFS) lands; in some instances the forest boundary or mine locations were incorrectly located on Primary Base Series (PBS) maps. Some mines close to NFS lands and mines that potentially impacted NFS lands were also inventoried. In September 2000, the U.S. Forest Service (USFS) requested more detailed studies on the 7D adit (inventory area #337-4522-1, feature #100/200) and Southern Cross Mine (inventory area #337-4521-1, feature #102/202) in the Hahns Peak mining district. Both of the mines are totally on NFS lands and had received an Environmental Degradation Rating (EDR) of 2 from the CGS (Appendix). This study presents the results of the detailed work performed by CGS on the Southern Cross Mine and 7D adit.

LOCATION

The Hahns Peak mining district is in northern Routt County about 25 miles north of Steamboat Springs and 10 miles south of the Wyoming border. Hahns Peak is at the center of the district. County Road 129 from Steamboat Springs provides access to the town of Columbine on the western side of Hahns Peak (Figure 1). Forest Service roads and mine roads from Columbine provide access to the two mines. Both mines are at an elevation of about 9,600 feet above sea level. Some of the mines on the western side of Hahns Peak were once considered part of the Columbine mining district.

PREVIOUS INVESTIGATIONS

The following discussion of previous geologic investigations of Hahns Peak is summarized from Young and Segerstrom (1973, p. 3–5) and Casaceli (1984, p. 9–12). Emmons (1877) described two of the three main igneous intrusive phases of Hahns Peak and identified and correlated the surrounding sedimentary rock sequence. Gale (1906) suggested that the area placer gold deposits originated from Hahns Peak and concluded that Hahns peak was a laccolith. George and Crawford (1909) suggested that the basal Dakota conglomerate and Precambrian metamorphic rocks could be additional sources for the placer gold. Hunter (1955) described the geology in the northern part of Hahns Peak, and Barnwell (1955) described the southern part. Bowes initiated surveys to determine economic potential of Hahns Peak and was joined by USGS in 1966 (Bowes and others, 1968; Bowes, 1969; and Young and Segerstrom, 1973). Core drilling and various geochemical and geophysical surveys were performed and to define mineralized zones. Gosling, Jenne, and Chao (1971) studied natural waters of Hahns Peak for gold content. Using lead isotope data, Antweiler, Doe, and Delevaux (1972) determined that the source of the placer gold was the Hahns Peak porphyry. Between 1971 and 1978, Anaconda conducted core drilling and various mapping, geochemical, and aerial magnetometer studies (Park, 1972). Dowsett published results of a hydrothermal alteration study of Hahns peak in 1980. Casaceli (1984) completed a thesis on the geology and mineral potential of the Hahns Peak porphyry. Neubert (1994) studied mineralized areas in the Routt National Forest.

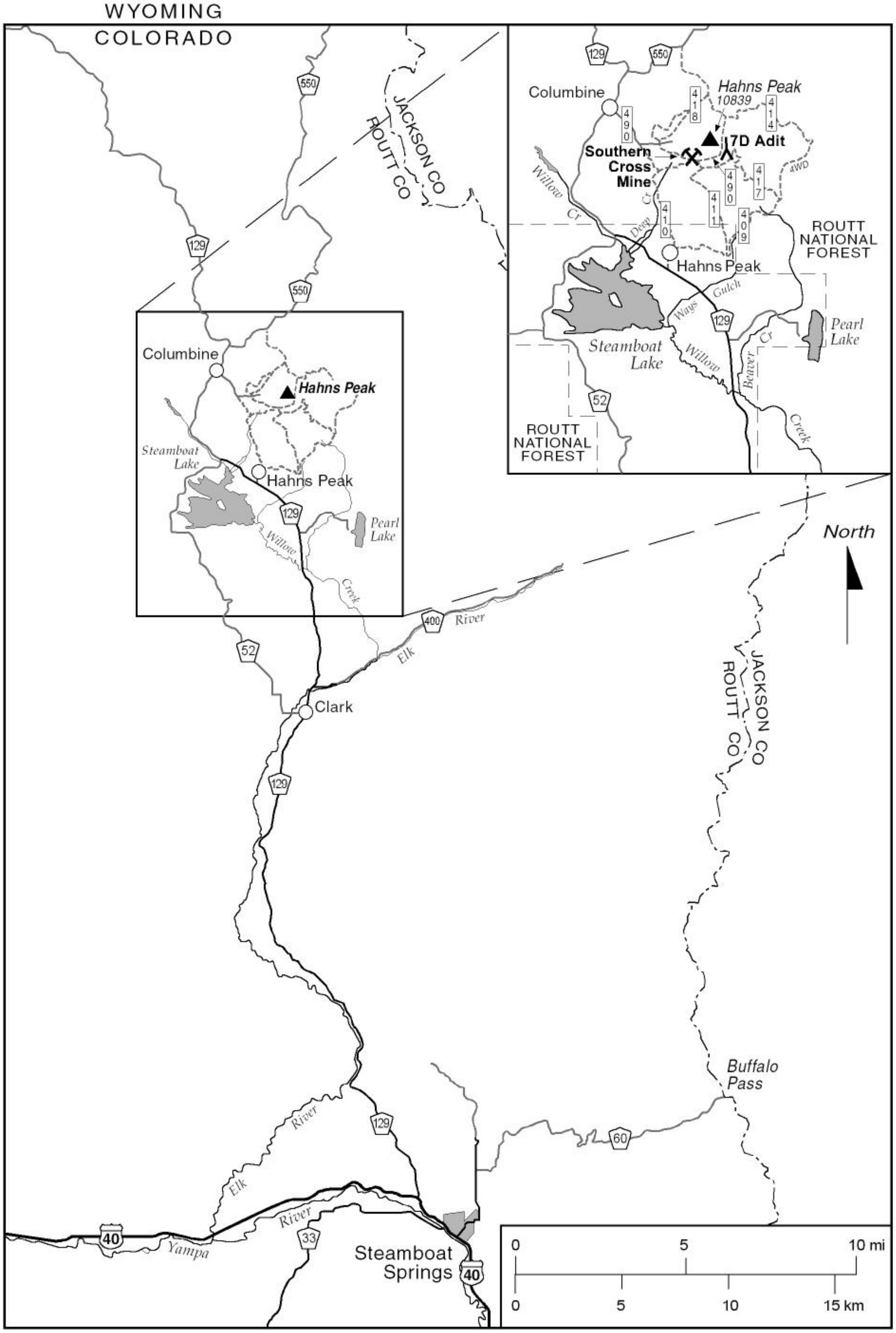


Figure 1. Index map of Hahns Peak.

METHODS OF INVESTIGATION

Recent ownership of unpatented claims was determined through BLM records. Original mining claim location certificates were reviewed in the Routt County recorderís office. Books and pages, abbreviated bk. #, p. # in this report refer to the location where documents are filed in the county courthouse. Reports by the Director of the Mint and annual mineral-resources reports by the U.S. Geological Survey were also reviewed. Colorado Bureau of Mines (CBM) inspector and mine managerís reports from the early 1900ís were also excellent sources of historical information. U.S. Bureau of Mines annual mineral resources reports document mining activity only from 1924 through 1994.

Field work for this study included a site visit to see if major changes had occurred since the 1997 inventory by Ellis and Wood (1998). Although water samples were collected at both sites in 1997, supplementary samples were collected in 2001. In addition, a water sample was collected near the base of the 7D waste-rock pile. The 7D waste-rock pile was sampled on a grid pattern to assess its potential environmental effects. Waste-rock was analyzed for numerous metallic elements, wet acid-base potential, and paste PH.

At water sample sites, filtered (0.45 µ) and unfiltered waters were collected for laboratory analyses. Depending on a variety of factors, including weather, time of day, distance from the vehicle, etc., subsampling into the filtered and raw bottles was done on site, at the vehicle, or indoors. Samples and/or subsamples were refrigerated until delivery to the lab.

Water samples were analyzed at the Colorado Department of Public Health and Environment laboratory for total recoverable (raw) and dissolved (filtered) constituents. The most stringent standards, usually domestic water supply or aquatic life standards, were used in the tables in this text. Most domestic water supply standards are based on total recoverable metals, and most aquatic-life standards are based on hardness of the water and dissolved ion concentrations. Iron and manganese are important exceptions to these standards. Both of these metals have aquatic life standards of 1,000 µg/L (total recoverable). The much lower dissolved concentrations (300 µg/L for iron; 50 µg/L for manganese) shown as the standards on the tables in this report are secondary standards for aesthetic purposes in drinking water.

Because of the software used for calculations and creation of the tables in this report, formats and use of significant figures do not conform to standardized methodology. Analytical values for water samples are reported in dissolved concentrations unless noted.

HISTORICAL OVERVIEW

In 1864, George Way discovered placer gold in the gravels of Willow Creek near the present site of Hahns Peak Village (Young and Segerstrom, 1973, p. 3–4; Casaceli, 1984, p. 4–6). Joseph Hahn and William Doyle prospected the area during the summer of 1865 and returned the following summer with 40 workers. The Hahns Peak mining district was organized in 1866. Mining resumed in 1874 with the Purdy Mining Companyís development of the Ways Gulch placer east of Hahns Peak Village (Figure 1). Robert McIntosh developed the Poverty Bar placer west of the village of Hahns Peak during 1880. During one summer, $84,000 worth of gold was recovered from the Poverty Bar placer. Both placer deposits were worked intermittently between

1905 and 1910 and in the 1930ís. Placers on the south side and north of Hahns Peak have had minor prospecting activity in recent years.

Gold and silver occurrences at higher elevations on Hahns Peak were reported in 1881 (Casaceli, 1984, p. 7–8). Subsequent prospecting eventually led to the discovery of the Royal Flush and Tom Thumb mines. Hahns Peak Mining and Milling Company (Henry Granberg, Pat McGill, and J.R. Caron) began the first major development effort on the Royal Flush Mine in 1906. The Royal Flush Mine is the largest underground mine in the district. Developed on two levels, mine workings total over 2,300 feet. Although production was small, the Royal Flush was worked at least into the 1920ís. A total of 200 tons of galena ore containing high silver values was shipped from the Tom Thumb Mine. Routt County precious and base metals production between 1873 and 1960 had a total value less than $500,000. Placer gold recovered between 1873 and 1878 accounted for over $300,000 worth of the Countyís production.

William A. Bowes began a more recent phase of exploration on Hahns Peak in 1963 (Casaceli, 1984, p. 8, 11–12). Anaconda leased claims on Hahns Peak in 1971 and proceeded to conduct a comprehensive exploration program, including core drilling. Anaconda conducted an aerial magnetometer survey in 1978.

GEOLOGIC SETTING

Hahns Peak is within a west-trending horst on the western flank of the Park Range uplift. The King Solomon fault forms the northern boundary of the horst and the Grouse Mountain fault from its southern boundary (Figure 2). Maximum vertical displacement of the horst was estimated at 600 feet on the northern side and 500 feet on the southern side. Lateral displacement was estimated at about 600 feet. Steamboat Lake is within the broad shallow graben on the south side of the horst (Segerstrom and Young, 1972, p. 46, 49–50).

Nine intrusive rock units have been documented in the Hahns peak area (Casaceli, 1984, p. 60–86; Neubert, 1994, p. 13–14). Hahns Peak is the center of a 10–12 million-year-old composite quartz-latite-porphyry laccolith or stock. Sills similar in composition encircle the central intrusion. Surrounding Mesozoic and Tertiary sedimentary rocks were domed upward. A breccia zone surrounds Hahns Peak (Figure 3), the center of the intrusion. Mineralized pods in the breccia zone contain lead, zinc, silver, gold, and copper minerals. Rock units in the central part of the intrusion exhibit a higher degree of alteration. Argillic alteration was the most widespread; advanced argillic and phyllitic alteration have also been recognized.

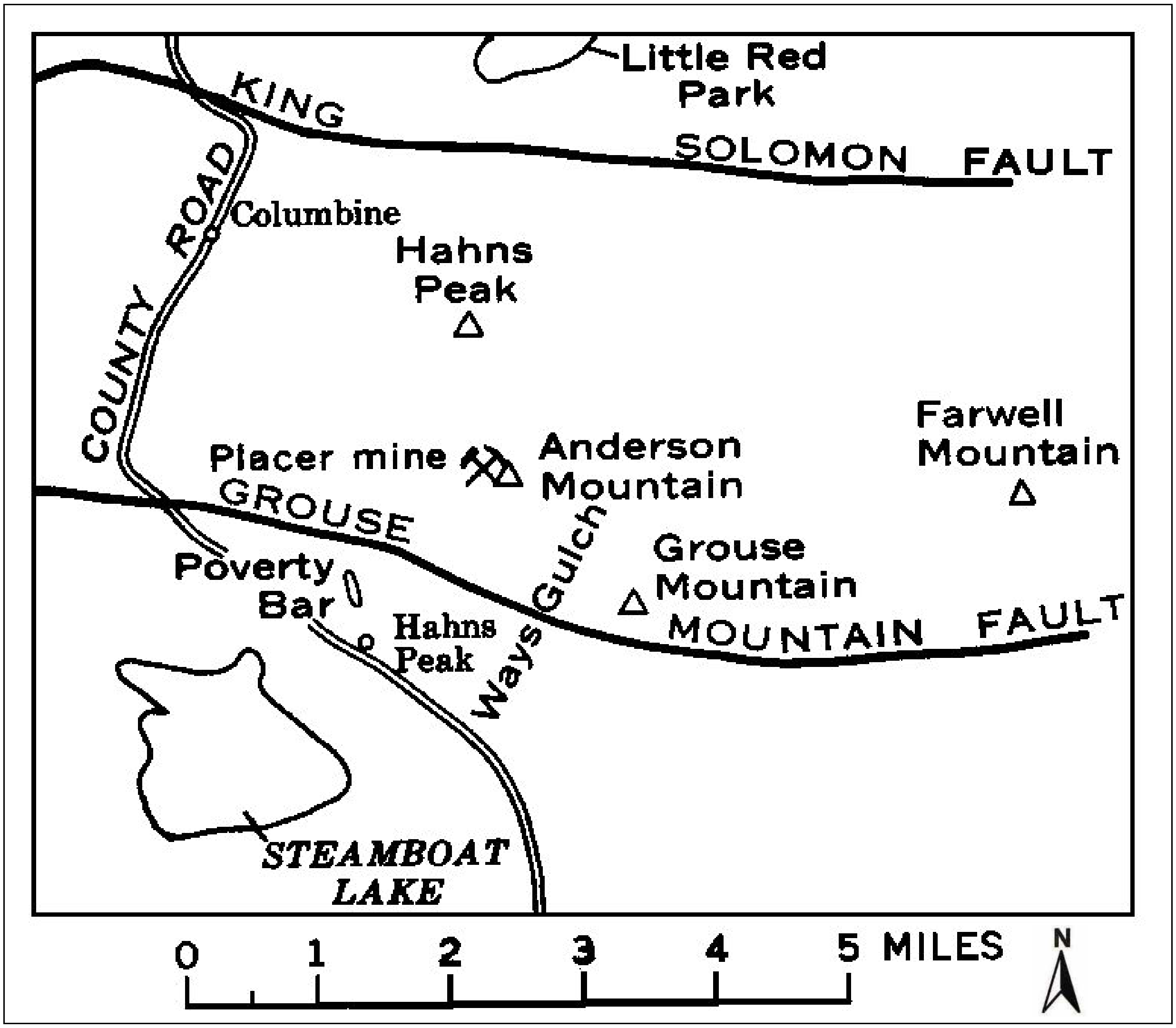
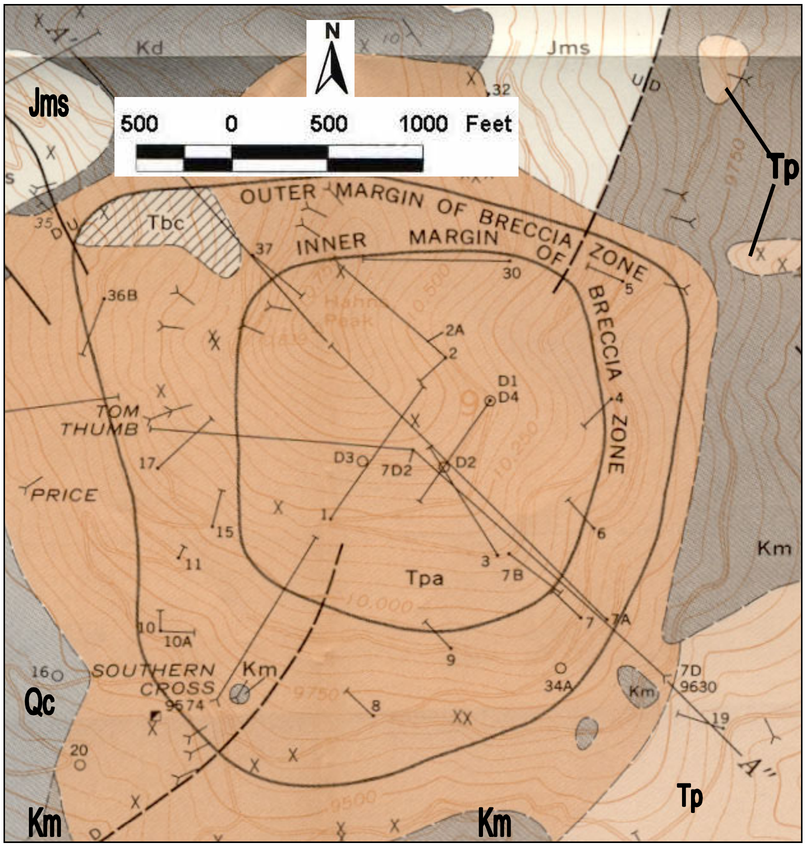


Figure 2. King Solomon and Grouse Mountain faults (modified from Young and Segerstrom, 1973, figure 1).



Explanation of geologic map symbols:

Qc=Quaternary colluvium
Tp=intrusive Tertiary porphyry
Tpa=altered Tertiary porphyry
Tbc=Tertiary Browns Park Formation

Km=Cretaceous Mancos Shale
Kd=Cretaceous Dakota Sandstone
Jms= Jurassic Morrison and Sundance Formations

Contact
Dashed where approximately located or inferred

U
D
High-angle fault
Dashed where approximately located or inferred; dotted where concealed. U, *upthrown side;* D, *downthrown side. Arrows show relative direction of movement*

30
Horizontal **Inclined**
Strike and dip of beds

20 7D2
Vertical **Inclined**
Drill hole, showing number

Prospect

Mine shaft

7D
9630
Adit, showing elevation of portal, in feet
Length shown to scale by crossbar where known

Figure 3. Geogic map of Hahns Peak (modified from Young and Segerstrom, 1973, plate 1).

SOUTHERN CROSS MINE

The Southern Cross Mine (adit #102/202) is in the northern part of the Ways Gulch placer/Southern Cross Mine inventory area #337/4521-1 (Figure 4). Forest Roads 490, 417, and 411 intersect on top of the Southern Cross dump next to the portal. Columbine is about 2 miles along FR-490. The Hahns Peak quadrangle map labeled the working as the Southern Cross Mine, but because no production was recorded, some reports refer to the working as the Southern Cross adit rather than mine. The U.S. Bureau of Mines lists the Southern Cross Mine as a ìraw prospect,î suggesting that there was no known production (U.S. Bureau of Mines, 1995). Production if any was probably small.

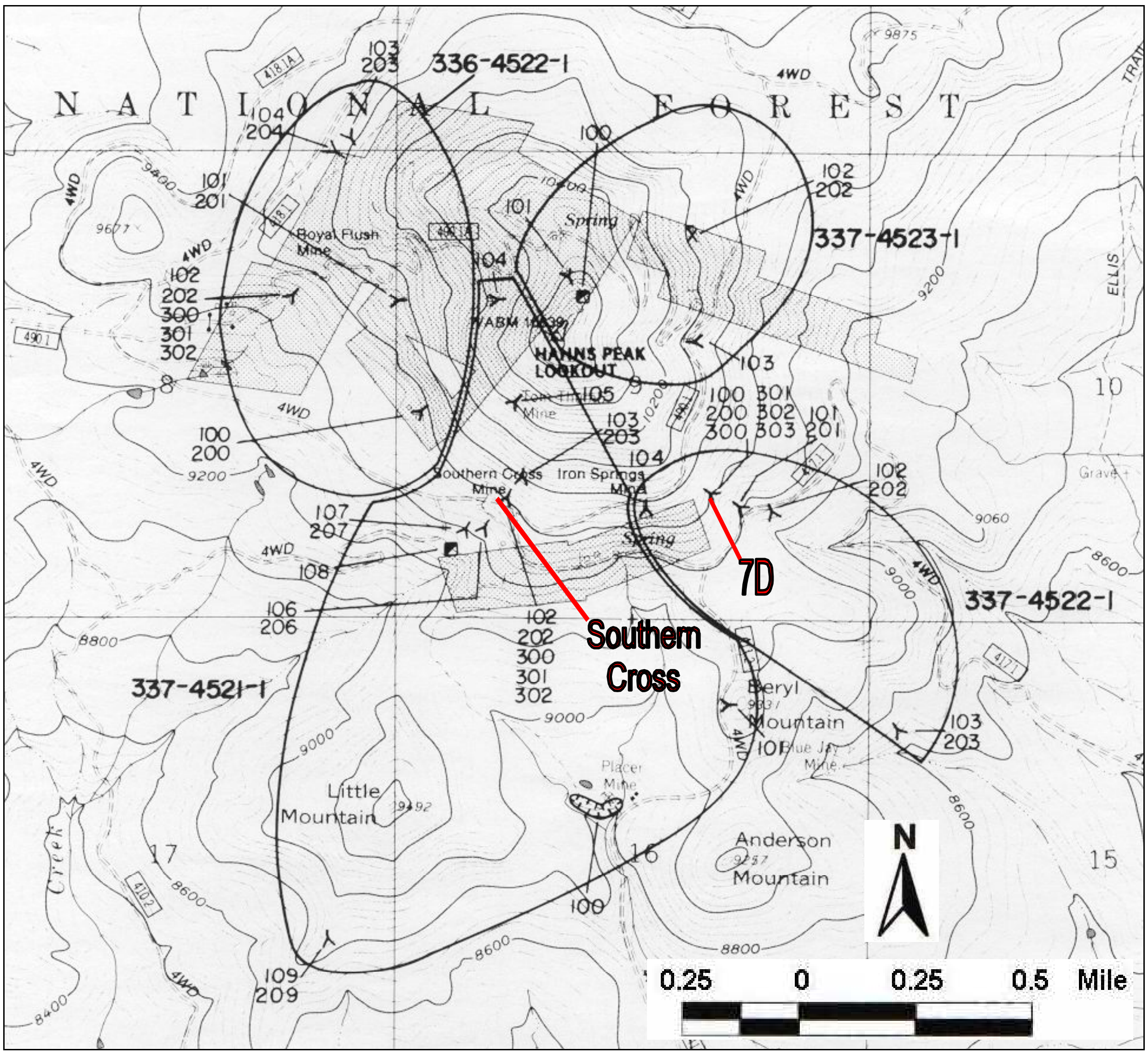


Figure 4. Inventory areas and mine features in the Hahns peak area. The Southern Cross Mine (#102) is in inventory area 337-4521-1 and the 7D adit (#100) is in inventory area 337-4522-1. (Scale is approximate; shaded areas represent patented mining claims.)

Mining History

Circa 1903. Owen Paulson started work on the Southern Cross Mine (Casaceli, 1984, p. 7).

1907. Richard Paulson and Robert McIntosh owned the Southern Cross Mine. Workings included an 800-foot-long adit with a 50-foot-deep winze 400 feet from the portal (George and Crawford, 1909, p. 225).

1910. Owen Paulson was working the Southern Cross Mine (Stevenson, 1976, p. 67). The adit was well timbered, trending straight toward the central core of Hahns Peak. Paulson worked the Southern Cross Mine for 17 consecutive years.

1921. Richard Paulson and Robert McIntosh owned and operated the Southern Cross Mine (F.R. Kenahen (?), Inspectors report-Southern Cross Mine, August 5, 1921; CBM, 1921 Mine managers report-Southern Cross Tunnel Site). Their unpatented mining claim block included the Admiral #2, Admiral #3, and Hiram of Tyre lodes and the Southern Cross tunnel site. A cabin, blacksmith shop, and the top of a 1,100 foot-long tram were located on the Southern Cross dump. In August, the main adit was over 800 feet long. Veins intersected in the adit ranged from a few inches to 5 feet wide. Annual development included 42 feet of crosscut tunnel and 10 feet of drifts. Paulson reported that the main adit was straight and about 1,000 feet long. A 75-foot-deep shaft and other long drifts were also on the property. No annual production was reported.

1931. The Hahns Peak Gold Mining & Milling Company repaired track in the Southern Cross adit (Henderson, 1934, p. 533).

1934–1935. The Hahns Peak Gold Mining & Milling Company mostly repaired and developed company mines in the Hahns Peak mining district (Henderson, 1935, p. 228; 1936, p. 267). It was not determined if any of the work was done on the Southern Cross Mine or if the company had continued interest in the property.

1965. William Bowes and others (James Keighley, Francis Kingsley, Ora Kingsley, Bertha Martin, Ora Smith, Harry Sykes, and Gerrish, Justin, Minot, and Roger Milliken) located the HP claim block over an area that included the Southern Cross Mine (BLM files).

1967. U.S. Geological Survey reopened and examined the 973-foot-long Southern Cross adit (Young and Segerstrom, 1973, p. 3, 30). Thirty-eight samples from the Southern Cross adit averaged 0.01% copper, 0.11% lead, 0.1% zinc, 2 ppm in silver, and 5 ppm in molybdenum.

1968. John Tamm Jr. retimbered the Southern Cross Mine for Bowes Mining Company. Two or three log cabins and the blacksmith shop were removed (Stevenson, 1976, p. 68). About 1968, Bowes sampled a quartz-pyrite vein 170 feet from the face. The sample contained 4.4 oz/ton silver, 2,000-ppm zinc, 1,000-ppm lead, and 200-ppm copper (Neubert, 1994, p. 15).

1971–1984. Anaconda leased Hahns Peak and conducted a variety of exploration activities including core drilling (Casaceli, 1984, p. 8).

1976. The Southern Cross Mine was open, but flooded. Water was photographed (Figure 5) draining from the open Southern Cross adit (Stevenson, 1976, p. 66–68). The photograph, presumably taken by Stevenson around 1976, was not dated.

Figure 5. Southern Cross Mine (From Stevenson, 1976).

1984. Casaceli (1984, p. 74) published a map of the Southern Cross adit (Figure 6).

1991. Last year William Bowes and others performed assessment work on the HP claim block (BLM files). Subsequently, BLM closed the case file on the HP claims.

1992. The Southern Cross adit was caved at the time the U.S. Bureau of Mines performed a mineral appraisal. Waste-rock and a select sample of pyritized quartz-latite were sampled. The samples contained low base and precious metal concentrations. No ìhigh-gradeî material was found on the dump (Neubert, 1994, p. 15, A-5, B-2).

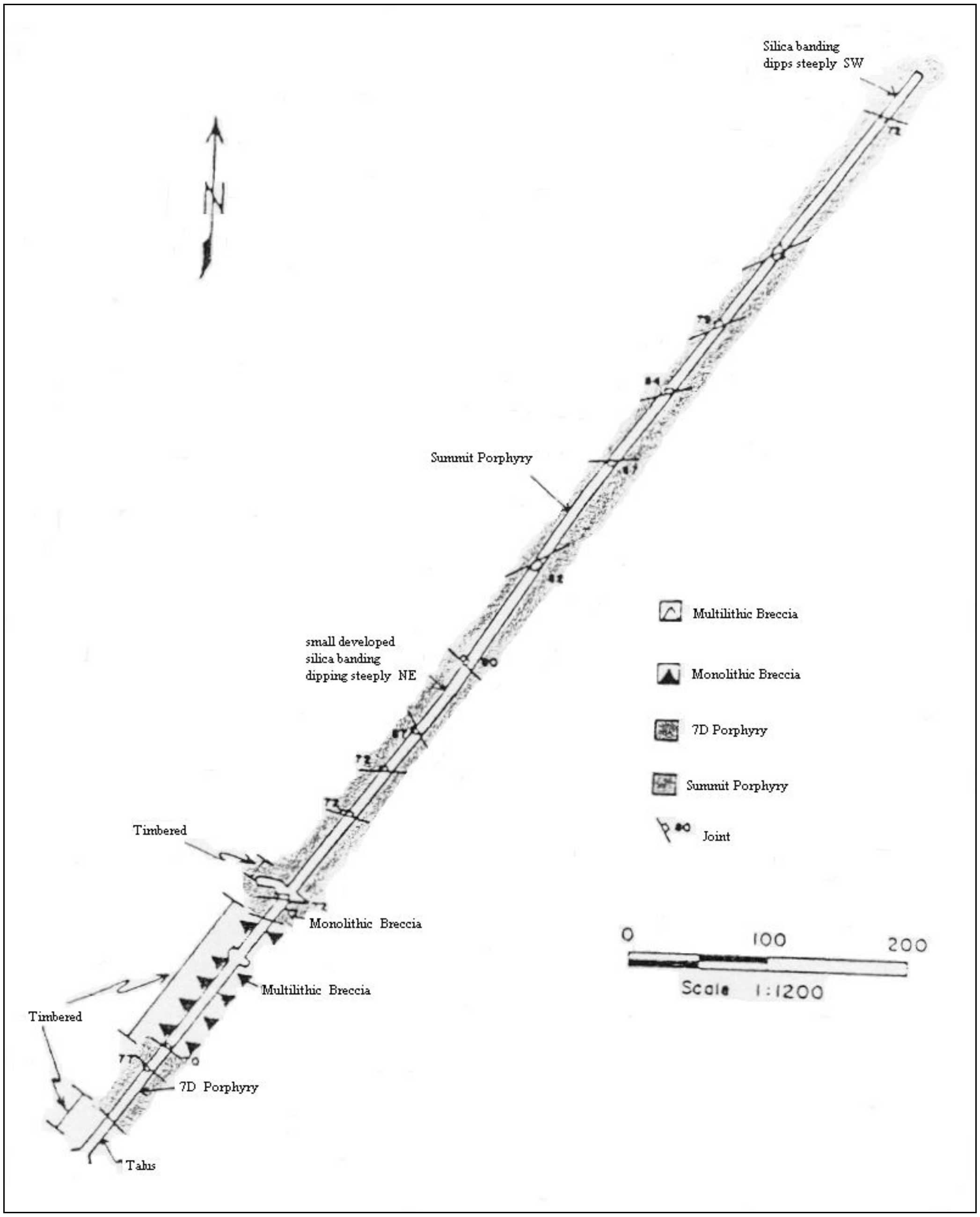


Figure 6. Southern Cross adit (modified from Casaceli, 1984, figure 13, p. 74).

Geology

The Southern Cross adit was driven in the breccia zone that surrounds Hahns Peak (Figures 3 and 6). Waste rock consists of bleached white, highly argillized porphyry, with vugs from weathered feldspar and possibly pyrite. Casaceli (1984, p. 7) mapped the adit (Figure 6) and concluded that the breccia zone was the only mineralized area in the adit. The first 200 feet of the adit exposed the breccia zone. Pyrite is pervasive in the breccia zone; galena and tetrahedrite occur as streaks. George and Crawford (1909, p. 225), identified galena and silver minerals (mainly ruby silver) in the fault zone. Assay returns from select samples were high, but sufficient quantity was lacking. Any production was probably small and limited to the breccia zone.

Site Description

The Southern Cross Mine is on the southern slope of Hahns Peak about 2 miles southeast of Columbine. Adit #102 (the Southern Cross Mine) was the only feature of concern in inventory area #337-5421-1. The associated waste-rock pile did not appear mineralized. Casaceli (1984, p. 7) reported that the only mineralized material was from the weakly mineralized breccia zone exposed along the first 250 feet of the adit. This material is probably near the base of the dump and not exposed. The flat area on top of the dump is a road intersection and has probably been disturbed by road grading activity. CGS had assigned an EDR rating of 4 (slight degradation) to the waste rock.

In September 2000, the portal of the Southern Cross Mine was completely caved. It apparently caved between 1984 and 1992 when evaluated by the U.S. Bureau of Mines. Most of the effluent flowed east from the collapsed portal and formed a 30-foot-long, 10-foot-wide, Ω-foot-deep pool (Figures 7 and 8). Abundant fine white precipitate or sediment was deposited in the pool. From the pool, the effluent flowed across the road on the top of the dump and along the eastern side of the dump. This effluent creates a gully, actively eroding the dump (Figure 9). Surface flow infiltrated about 200 feet below the toe of the dump. The clear effluent supported a moderate amount of algae. A minor amount of effluent flowed west of the portal and infiltrated into the top of the dump.

Figure 7. Effluent pool and drainage across the road at the Southern Cross Mine.

Figure 8. Effluent emerging from the caved Southern Cross portal.

Figure 9. Gully and effluent on the eastern side of Southern Cross dump.

Waste and Hazard Characteristics

Water samples were collected near the caved portal of the Southern Cross Mine (adit #102) during the abandoned mine inventory in 1997 (Ellis and Wood, 1998, p. 8-9; USFS-AML inventory form 377/4522-1) and during this investigation in 2000. Flow was estimated at 15 gpm in June 1997. By September 1997 the flow had diminished to 9 gpm (flume). In 1997 pH was 3.33 in June, 3.38 in July, and 2.79 in September (Appendix). Conductivity increased with reduced flow conditions during 1997 (305 µS in June, 315 µS in July, and 333 µS in September). Effluent sampled in July 1997 exceeded State standards in concentrations of aluminum (18,000 µg/L), cadmium (4 µg/L), copper (60 µg/L), iron (1,400 µg/L), manganese (350 µg/L), nickel (30 µg/L), lead (3 µg/L), and zinc (270 µg/L).

Effluent was sampled near the portal during September 2000 for this investigation (Table 1, sample MH-2000-43). Effluent appeared clear and supported a moderate growth of algae.

Table 1. Analytical results for water samples from the Southern Cross Mine. Parameter concentrations are dissolved unless specified as total recoverable (trec); ì<î denotes less than lab detection limit.

Sample	MH-2000-43, SOUTHERN CROSS (6/14/00)				
Parameter	Concentration/ measurement		Standard	Factor above standard	Load (grams/day)
Flow (gpm)		3.4			
pH (standard units)		3.58			
Conductivity (µS/cm)		451			
Alkalinity (mg/L $CaCO_3$)					
Hardness (mg/L $CaCO_3$)		13	None	N/A	
Aluminum (trec) (µg/L)		39,000	None	N/A	722.8
Antimony (trec) (µg/L)	<	1.0	6	Below standard	N/A
Arsenic (trec) (µg/L)		2.0	10	Below standard	N/A
Iron (trec) (µg/L)		2,000	1,000	2	37.1
Thallium (µg/L)	<	1.0	0.5	Not detected	N/A
Zinc (trec) (µg/L)		430	2,000	Below standard	8
Aluminum (µg/L)		39,000	87	448.3	722.8
Cadmium (µg/L)		7.2	0.2	31.7	0.1
Calcium (mg/L $CaCO_3$)		8	None	N/A	148.3
Chloride (mg/L)		3	250	Below standard	55.6
Chromium (µg/L)	<	20	11	1.8	N/A
Copper (µg/L)		71	2.1	34.5	1.3
Fluoride (mg/L)	<	0.10	2	Below standard	N/A
Iron (µg/L)		2,000	300	6.7	37.1
Lead (µg/L)		6	0.2	28	0.1
Magnesium (mg/L)		1.2	None	N/A	22.2
Manganese (µg/L)		460	50	9.2	8.5
Nickel (µg/L)		120	20.2	5.9	2.2
Potassium (mg/L)		5	None	N/A	92.7
Silicon (mg/L)		24.	None	N/A	444.8
Silver (µg/L)	<	0.2	N/A	Not detected	N/A
Sodium (mg/L)		1.9	None	N/A	35.2
Sulfate (mg/L)		240	250	Below standard	4,448
Zinc (µg/L)		430	18.7	23	8

White sediment lined the effluent pool near the portal. Flow discharge from the pool was measured at 3.4 gpm using a flume. Conductivity and pH were similar at the portal (451 µS/cm, 3.58 pH), discharge area from the pool (456 µS/cm, 3.59 pH), and 200 feet below the dump where the effluent infiltrated the subsurface (479 µS/cm, 3.59 pH). Effluent exceeded State standards in concentrations of aluminum (39,000 µg/L), cadmium (7.2 µg/L), copper (7.1 µg/L), iron (2,000 µg/L), manganese (460 µg/L), nickel (120 µg/L), lead (6.0 µg/L), and zinc (230 µg/L). The extreme concentration of aluminum in this sample indicates that the white sediment in the effluent pool is probably an amorphous aluminum precipitate. Compared to the 1997 sample, concentrations had increased in all of the elements that had exceeded State standards except for zinc, which decreased slightly. Decreased flow and greater residence time inside the mine workings probably accounted for the increased conductivity and metal concentrations.

7D ADIT-IRON SPRINGS AREA

The 7D adit (100/200) is in the northern part of the Iron Springs Mine inventory area #337/4522-1 (Figure 4). Forest Road 290 from Columbine provides access to a mine road that leads to the 7D adit. Columbine is about 2 miles northwest of the mine. The adit was driven for exploration and no production was reported. The Hahns Peak quadrangle locates the Iron Springs Mine just west of the 7D adit. Attempts to locate the Iron Springs Mine were unsuccessful. It may have been concealed by the 7D workings or by the construction of the access road.

Mining History

1963. William A. Bowes began an exploratory program on Hahns Peak (Casaceli, 1984, p. 8).

1965. William Bowes and others (James Keighley, Francis Kingsley, Ora Kingsley, Bertha Martin, Ora Smith, Harry Sykes, and Gerrish, Justin, Minot, and Roger Milliken) located the HP claim block over an area that included the 7D adit (BLM files).

1967. W.A. Bowes contracted Phil Ward to drive the 1,700-foot-long 7D adit (John Doyle, Inspectors report-7 D Tunnel, October 24, 1967, CBM). Bowes intended to use the adit mainly for exploratory drilling.

1968. Boyle Brothers conducted exploratory drilling in the 1,700-foot-long 7D adit for Bowes (John Doyle, Inspectors report-7 D Tunnel, March 18, 1968, CBM). Thirty-eight holes were drilled totaling over 22,000 feet. A 1,377-foot-long horizontal hole was drilled in the face of the 1,742-foot-long 7D adit (Young and Segerstrom, 1973, p. 3).

1971–1984. Anaconda leased Hahns Peak and conducted a variety of exploration activities including drilling (Casaceli, 1984, p. 8).

1973. Young and Segerstrom (1973, p. 31) published estimated subeconomic reserves for the 7D adit based on the drilling information.

1984. Casaceli (1984, p. 73) published a map of the 7D adit.

1991. Last year William Bowes and others performed assessment work on the HP claim block (BLM files). Subsequently, BLM closed the case file on the HP claims.

1992. The U.S. Bureau of Mines collected and analyzed 13 samples (Figure 10) from the 7D adit (Neubert, 1994, p. 15–16).

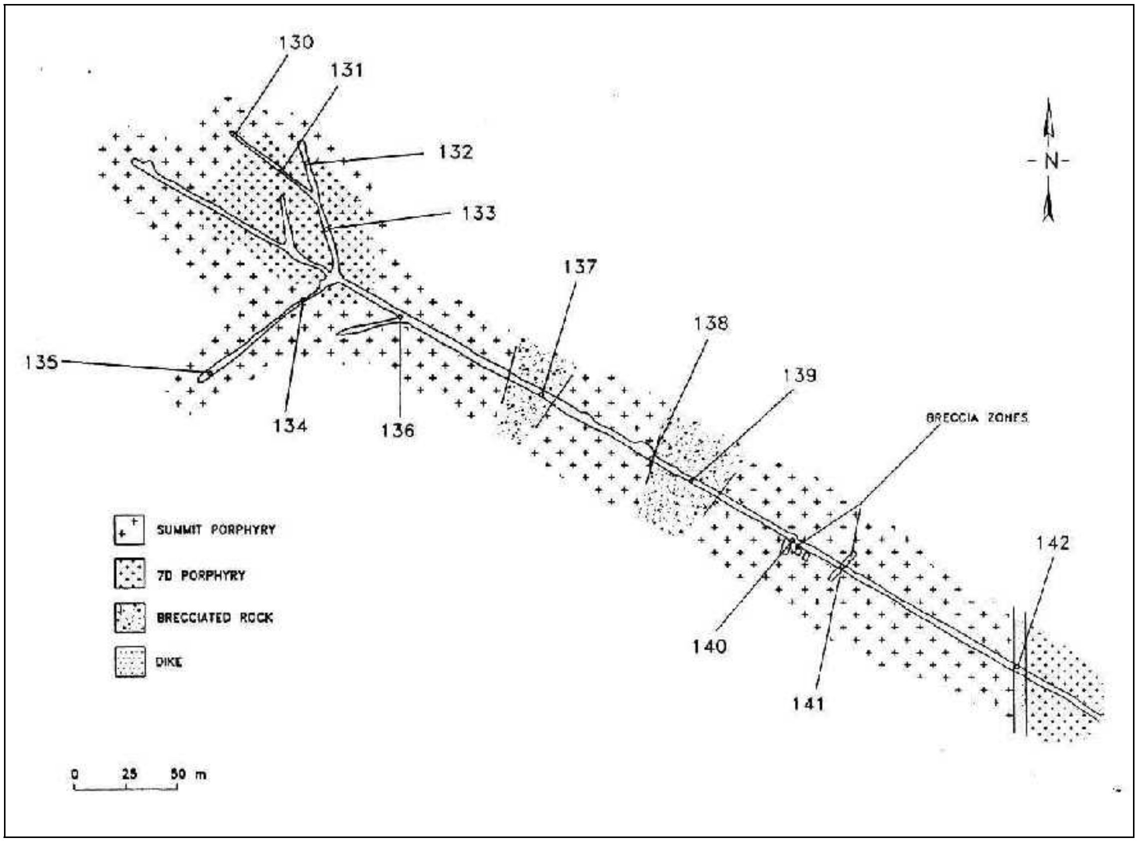


Figure 10. 7D adit. Numbers indicate sample sites. (From Neubert, 1994, Figure 10, which were modified from Casaceli,1984, p. 74.)

Geology

The 7D adit was driven in the 7D Porphyry and intersected the Summit Porphyry, a dike, and several breccia zones (Figure 10). Analytical results from US Bureau of Mines samples contained a maximum of 330 ppb gold, 8.8 oz/ton silver, 4.6% lead, 0.82% zinc, 0.34% copper, 0.52 % antimony, 0.35% arsenic, 260 ppm vanadium, 184 ppm molybdenum, and 130 ppm tungsten. (See Neubert, 1994, p. 16.) Sulfide minerals identified at Hahns Peak include pyrite, galena, sphalerite, silver-bearing tetrahedrite, chalcopyrite, proustite, covellite, and molybdenite (Casaceli, 1984, p. 161; Young and Segerstrom, 1973, p. 24). Waste rock consists of bleached white, highly argillized porphyry, with very fine disseminated pyrite and rare galena.

Subeconomic reserves, based on 1970 prices, were calculated from the drill core data (Young and Segerstrom, 1973, p. 31). An area near the end of the 7D adit, encompassing the most intensely mineralized rock, contained 1,300,000 short tons worth about $4 million ($3.12/ton).

Metal content average 0.58 oz/ton in silver, 0.5% lead, and 0.2% zinc. A larger volume (710 million short tons) of even lower-grade ($0.97/ton) material containing disseminated silver-lead-zinc resources had an estimated value of about $690 million.

Site Description

The 7D adit is on the southern slope of Hahns Peak about one-half mile east of the Southern Cross Mine discussed in the previous section. Adit #100 (7D adit) and the associated waste-rock pile #200 were the only features of concern in inventory area #337-5422-1. CGS had assigned an EDR rating of 2 (significant) to the 7D adit and 3 (potentially significant) to the dump.

In June 1997 the portal of the 7D adit was caved. Apparently the portal caved between 1992 and 1997. Effluent emerges from several seeps over a 15-foot interval along the base of the slope (Figure 11). Some of the seeps had white precipitate. During higher flow the effluent flowed down the dump face in several places (Figure 12). In September 2000 the two largest seeps joined on the top of the dump east of the seeps. The effluent contained moderate amounts of filamentous algae. Minor red staining lined the channel. From the top of the dump, the effluent flowed down the dump face and carved a deep channel, up to 10-feet-deep (Figure 13). About 40 feet above the toe of the dump, the effluent channel begins to braid (Figure 14) and the effluent infiltrates and re-emerges. About 40 feet below the toe, the effluent completely infiltrates the subsurface. Abundant dump material is evident in the channel at least 200 feet below the last traces of effluent, indicating greater surface flow during snow melt and storm events.

Figure 11. Effluent seeps from the caved 7D adit.

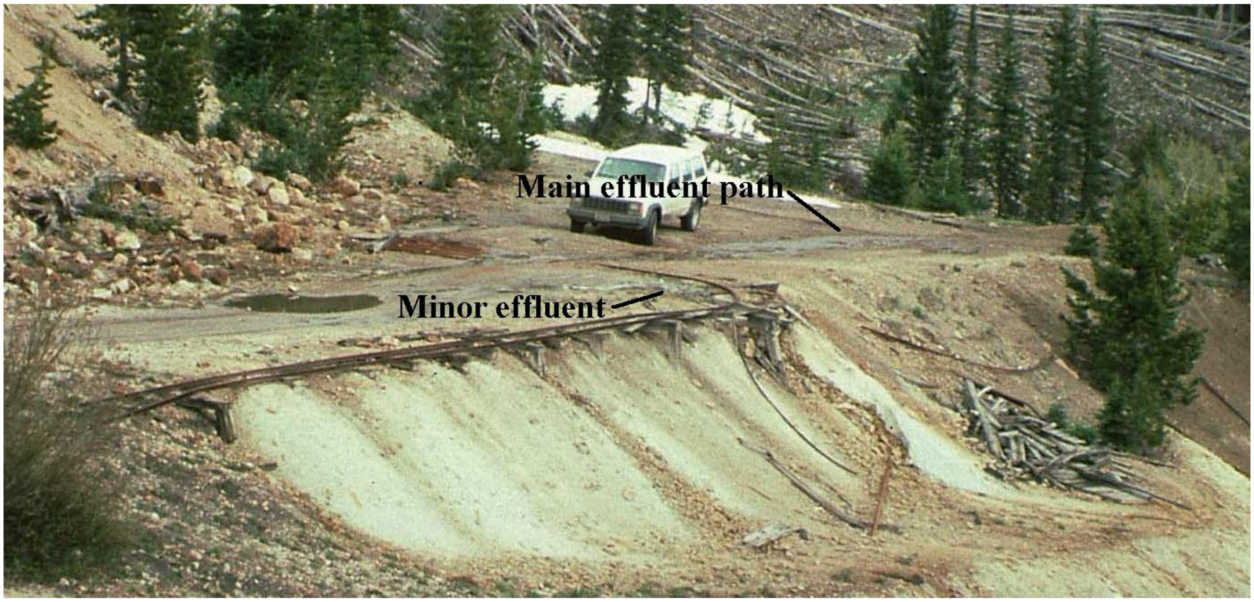


Figure 12. Effluent path across the 7D dump bench (6/16/1997).

Figure 13. Effluent channel from the top of the 7D dump.

Figure 14. 7D dump from water sample location #41.

Waste and Hazard Characteristics

In June 1997 effluent from the 7D adit (feature #100) flowed at an estimated rate of 50 gpm and had pH of 3.37 and conductivity of 164 µS/cm (Ellis and Wood, 1998, p. 9–10; USFS-AML inventory form 377/4522-1). When the effluent was sampled in July 1997 the flow rate was 20 gpm (flume) and the conductivity had increased to 273 µS/cm. The effluent exceeded State standards in concentrations of iron (1,600 µg/L), aluminum (9,400 µg/L), cadmium (3 µg/L), copper (54 µg/L), lead (70 µg/L), manganese (95 µg/L), nickel (51 µg/L), silver, (0.2 µg/L), and zinc (380 µg/L). In September 1997 the flow decreased to 10 gpm (flume), pH decreased to 2.87, and the conductivity was 287 µS/cm.

On September 27, 2000 the effluent was sampled near the caved portal (sample MH-2000-42) and about 40 feet above the toe of the dump (sample MH-2000-41). Flow near the portal was 6 gpm (flume) and the effluent had a pH of 3.52 and conductivity of 270 µS/cm. Effluent appeared clear and contained a moderate amount of filamentous algae. The effluent exceeded State standards in concentrations of iron (1,100 µg/L), aluminum (10,000 µg/L), cadmium (1.5 µg/L), copper (22 µg/L), lead (130 µg/L), manganese (83 µg/L), nickel (42 µg/L), silver (0.3 µg/L), and zinc (360 µg/L) (Table 2). Flow was measured at 8 gpm (catchment) above the dumpís toe (sample MH-2000-41) and the effluent had a pH of 3.72 and conductivity of 239 µS/cm. Concentrations of parameters in the sample above the toe were sightly lower than at the portal

(Table 2). This suggests that the brief contact with the waste-rock along the effluent path had very little affect on the water quality of the effluent.

Ellis and Wood (1998, p. 10) estimated waste-rock pile #200 (7D dump) to be about 25,000 cubic yards in volume. A calculation based on a map of the workings (Figure 10) suggests that the dump size should be between 15- and 20-thousand cubic yards. Effluent was in contact with the top of the dump and in a deep gully down the center of the dump. Vegetation (mostly pine, aspen, and weeds) is sparse, did not appear stressed, and occurs on or near the flatter areas of the dump. The moderately cemented white to light-yellow colored dump (Figure 15) is mostly composed of fine altered country rock. Coarser material is more prevalent in the channels and toward the base of this very steep dump. Fine disseminated pyrite was observed on fresh surfaces of some dump material. Galena was very rare; small pieces were found near the tracks just below the top of the dump. Waste rock material is weakly mineralized. A composite sample contained about 0.17% zinc, nearly 0.16% lead, and 0.4 oz/ton silver. Paste pH was 4.05, and net acid-base potential was -2.9 tons $CaCO_3$/1,000 tons (Table 3).

Figure 15. 7D dump.

Table 2. Analytical results for water samples from the 7D adit. Parameter concentrations are dissolved unless specified as total recoverable (trec); ì<î denotes less than lab detection limit.

Sample	MH-2000-41, 7D BELOW (9/27/00)				MH-2000-42, 7D (9/27/00)			
Parameter	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)
Flow (gpm)	8				6			
pH (standard units)	3.72				3.52			
Conductivity (µS/cm)	239				270			
Alkalinity (mg/L $CaCO_3$)								
Hardness (mg/L $CaCO_3$)	18	None	N/A		6	None	N/A	
Aluminum (trec) (µg/L)	9,400	None	N/A	409.9	10,000	None	N/A	327.1
Antimony (trec) (µg/L)	< 1.0	6	Below standard	N/A	< 1.0	6	Below standard	N/A
Arsenic (trec) (µg/L)	< 1.0	10	Below standard	N/A	< 1.0	10	Below standard	N/A
Iron (trec) (µg/L)	850	1,000	Below standard	37.1	1,100	1,000	1.1	36
Thallium (µg/L)	< 1.0	0.5	Not detected	N/A	< 1.0	0.5	Not detected	N/A
Zinc (trec) (µg/L)	340	2,000	Below standard	14.8	360	2,000	Below standard	11.8
Aluminum (µg/L)	9,400	87	108	409.9	10,000	87	114.9	327.1
Cadmium (µg/L)	1.3	0.3	4.4	0.1	1.5	0.1	12.2	N/A
Calcium (mg/L $CaCO_3$)	16	None	N/A	697.7	4	None	N/A	130.8
Chloride (mg/L)	< 1.0	250	Below standard	N/A	< 1.0	250	Below standard	N/A
Chromium (µg/L)	< 20	11	1.8	N/A	< 20	11	1.8	N/A
Copper (µg/L)	22	2.7	8	1	22	1.1	20.8	0.7
Fluoride (mg/L)	0.1	2	Below standard	4.4	0.1	2	Below standard	N/A
Iron (µg/L)	810	300	2.7	35.3	1,000	300.0	3.3	32.7
Lead (µg/L)	120	0.3	348.9	5.2	130	0.1	1,831.6	4.3
Magnesium (mg/L)	0.5	None	N/A	21.8	0.47	None	N/A	15.4
Manganese (µg/L)	79	50	1.6	3.4	83	50	1.7	2.7
Nickel (µg/L)	37	26	1.4	1.6	42	11.2	3.8	1.4
Potassium (mg/L)	4.5	None	N/A	196.2	4.3	None	N/A	140.6
Silicon (mg/L)	30	None	N/A	1,308.2	30	None	N/A	981.2
Silver (µg/L)	< 0.2	N/A	Not detected	N/A	0.3	0.001	515.6	N/A
Sodium (mg/L)	2.9	None	N/A	126.5	2.9	None	N/A	94.8
Sulfate (mg/L)	100	250	Below standard	4,360.8	100	250	Below standard	3,270.6
Zinc (µg/L)	340	24.8	13.7	14.8	360	9.7	37.2	11.8

Table 3. Analytical data for a composite sample of waste-rock pile #200 of the 7D adit. (Waste rock was collected from 4 to 6 inches deep on an approximate 10-20 foot grid.)

ANALYZED PARAMETER	SAMPLE #MWR-2000-10
Paste pH	4.05
Neutralization potential (tons $CaCO_3$/1,000 tons)	<0.1
Potential acidity (tons $CaCO_3$/1,000 tons)	2.9
Net acid-base potential (tons $CaCO_3$/1,000 tons)	-2.9
Al_2O_3 (%)	17.1
BaO (%)	0.23
CaO (%)	0.09
Chlorine (%)	<0.02
Fe_2O_3 (%)	2.26
K_2O (%)	8.19
MgO (%)	1.10
MnO (%)	<0.01
Na_2O (%)	0.54
P_2O_5 (%)	0.25
SiO_2 (%)	63.7
Sulfur (%)	0.32
TiO_2 (%)	0.43
Arsenic (ppm)	66
Chromium (ppm)	53
Cobalt (ppm)	<10
Copper (ppm)	74
Gold (oz/ton)	0.004
Lead (ppm)	1,584
Mercury (ppm)	<0.1
Molybdenum (ppm)	<10
Nickel (ppm)	21
Niobium (ppm)	<10
Rubidium (ppm)	183
Silver (oz/ton)	0.4
Strontium (ppm)	273
Thorium (ppm)	22
Tin (ppm)	101
Tungsten (ppm)	<10
Uranium (ppm)	20
Vanadium (ppm)	104
Yttrium (ppm)	52
Zinc (ppm)	1,713
Zirconium (ppm)	174

MIGRATION PATHWAYS

Surface Water Pathway

Effluent from both mines is degraded with respect to iron, aluminum, cadmium, copper, lead, manganese, nickel, silver, and zinc. A water sample collected partway down the 7D dump had similar metal concentrations compared to the portal sample. None of the effluent from either the Southern Cross Mine or 7D adit flows directly into a creek, but infiltrates colluvium on the slopes of Hahns Peak.

The Southern Cross Mine is located above the headwaters of Deep Creek. According to topographic maps, the easternmost branch of Deep Creek starts as an intermittent stream about 800 feet downstream of the Southern Cross adit and becomes a perennial stream about 1,000 feet below the portal. Deep Creek enters Willow Creek at Steamboat Lake about 2Ω miles below the Southern Cross Mine. Steamboat Lake is a State Park and popular fishing and recreation area.

The 7D adit is about 600 feet above the start of an intermittent and unnamed tributary to Beaver Creek. Beaver Creek is about 1º miles below the 7D adit. Beaver Creek enters Willow Creek about 5 miles below the confluence with the unnamed tributary, downstream from Steamboat Lake. Willow Creek is a tributary of the Elk River. Elk River enters the Yampa River about 7 miles east of Steamboat Springs. The 7D adit is, therefore, approximately 13º stream miles above the Elk River-Yampa River confluence.

Ground Water Pathway

All of the 122 permitted wells that were drilled and encountered water within a 4-mile radius of the Southern Cross Mine and 7D adit are south or west of the mine features (Colorado Division of Water Resources records). Permits included 105 wells for domestic uses, 11 for household use, 1 municipal use, and 5 for commercial or other uses. None of the wells were drilled within one mile of either mine feature. Within a 2-mile radius, 41 wells were permitted for domestic use, 8 for household use, and one was the Hahns Peak Village municipal well. Within Beaver Creek drainage basin, downstream from the 7D adit, 26 wells have domestic use permits and one well was for household use. The closest well down gradient from the 7D adit is about 3 miles downstream and was permitted for domestic uses. Apparently, none of the wells were drilled in the Deep Creek drainage basin, which could potentially be affected by effluent from the Southern Cross Mine.

Soil Exposure Pathway

No one works or lives on or near either mine feature described in this report. The nearest residence is about 2 miles to the northwest, near Columbine. Hahns Peak is a popular tourist area. Hikers and 4WD enthusiasts frequent the myriad of roads on Hahns Peak. Located at an intersection, the Southern Cross mine is more frequently visited than the 7D adit, at the end of a mine road.

Visual examination and a waste-rock sample from the 7D indicate that neither the Southern Cross nor 7D dumps are very mineralized. Any exposures to the public would be brief. For these reasons, the soil exposure pathway poses little risk to the public.

Air Exposure Pathway

No evidence of windblown particulates or wind erosion was observed at either site. Although the surface of the 7D dump is mostly composed of finer material, the dump is moderately cemented. Waste-rock at the Southern Cross Mine was considered a slight environmental problem (EDR of 4). In addition, parts of the year the dumps are covered by snow. The air exposure pathway is considered insignificant because there is 1) no evidence of wind erosion, 2) the dump is moderately cemented, and 3) the lack of long-term exposure to the public.

SUMMARY AND CONCLUSIONS

Effluent from the Southern Cross and 7D mines are degraded with respect to iron, aluminum, cadmium, copper, lead, manganese, nickel, silver, and zinc. Effluent sampled partway down the 7D dump had similar metal concentrations compared to the sample near the portal. This indicates that the effluent was not significantly affected by the waste rock. Diversion of the effluent away from the dump may only have a slight benefit. Flow from the Southern Cross Mine in mid-summer and fall ranged from 15- to 3.4-gpm. Flow from the 7D adit ranged from 50- to 6-gpm. Although the effluent from both mines is degraded, during most of the year surface flow is very low and does not directly enter a watercourse. The Southern Cross Mine is about 800 feet above the start of an intermittent segment of Deep Creek and 1,000 feet above the point where Deep Creek becomes perennial. Deep Creek enters Willow Creek at Steamboat Lake about 2Ω miles below the Southern Cross Mine. The 7D adit is about 600 feet above an intermittent branch of Beaver Creek and 1º miles above Beaver Creek. The waterway from the 7D adit is over 6 miles from Willow Creek. Because of the low flow volumes from the adits and distances to active streams, the surface water pathway is not considered a significant problem.

Similarly, the ground water pathway does not appear to be a significant problem. Of the 122 permitted water wells drilled within a 4-mile radius of the two mines. None of the wells are in the Deep Creek drainage basin below the Southern Cross Mine. Downstream from the 7D adit, 26 wells drilled in the Beaver Creek drainage basin were permitted for domestic uses and one was intended for household use. The closest well permitted for domestic uses near Beaver Creek, is about 3 miles below the 7D adit. Effluent from these mines may infiltrate into the fractured bedrock below colluvium and alluvium. Water quality in wells penetrating the bedrock and hydrologically down gradient from the Southern Cross and 7D could be affected, but any impacts are probably minimal because distances to wells are greater than one mile.

A composited waste-rock sample from the 7D and visual examination of the Southern Cross and 7D dumps indicate that neither dump is especially mineralized. Past investigations support this conclusion (see geology sections). Brief exposure to the waste-rock would pose little risk to the public. Similarly, the air exposure pathway is considered insignificant. The dump is relatively unmineralized and moderately cemented. No wind erosion or potential of long-term exposure to the public is apparent.

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APPENDIX: ABANDONED MINE INVENTORY FORMS FOR THE SOUTHERN CROSS MINE AND 7D ADIT

USFS-AMLI FIELD DATA FORM

LOCATION AND IDENTIFICATION

(1) **ID#:** 02- 08- 11 - 03 - 337 / 4521 - 1
rgn st fst rd xutm yutm area#

(2) **Sitename:** Ways Gulch placer / Southern Cross Mine

(3) **Other name/reference:** ____

2 (4) **Highest priority Environmental Degradation occurring in this area:** 1=extreme; 2=significant; 3=potentially significant; 4=slight; 5=none

3 (5) **Highest priority Mine Hazard noted in this area:** E=emergency; 1=extreme danger; 2=dangerous; 3=potentially dangerous; 5=no significant hazard

M (6) **Commodity:** C=coal; U=uranium; M=metals; I=industrial material. (Metal or Indust. material type: gold)

(7) **Quad name and date:** Hahns PK 1986

(8) **County:** Routt

(9) **2° map:** Craig

(10) **Water Cataloguing Unit #:** 14050001

(11) **Mining district/coal field:** Hahns PK 1986

(12) **Land survey location:** N - W - 1/4 sec 16 ,T 10N ,R 85W

(13) **Receiving stream:** Ways Gulch flowing into Dutch Crk
nearest named stream next named

(14) **Elevation** (ft): 8840

2 (15) **General Slope:** 1=0-10°; 2=11-35°; 3=greater than 35°

M (16) **Regional terrain:** R=rolling or flat; F=foothills; T=mesa; H=hogback; M=mountains; S=steep/narrow canyon

J (17) **Type of access:** N=no trail; T=trail; J=jeep road; G=gravel road; M=paved road; P=private/restricted road

P (18) **Quality of access for construction vehicles:** G=good; M=moderate; P=poor; X=very poor

(19) **Nearest town on map:** Hahns PK

3 (20) **Road distance from nearest town** (#.# miles)

(21) **Nearest road** (name and/or #): FR 411
FR=forest rd; CR=county rd; SH=state highway; I=interstate

Distance to following types of public uses (#.# miles):

0 (22) Road

3 (23) Dwelling (year-round)

(24) Campground/picnic area

____ (25) Marked trail

____ (26) Other public use (explain) ____

ENVIRONMENTAL INFORMATION

M (27) **Vegetation density adjacent to site:** D=dense; M=moderate; S=sparse; B=barren

A,P (28) **Vegetation type adjacent to site:** B=barren; W=weeds; G=grass; R=riparian S=sagebrush/oakbrush/brush; J=juniper/piñon; A=aspen; P=pine/spruce/fir; T=tundra

N (29) **Evidence of intentional reclamation:** Y=yes; N=no (if yes, use comments)

3 (30) **Size of disturbed area in acres**

N (31) **Potential historical structures in area:** Y=yes; N=no (if yes, use comments)

N (32) **Positive evidence of BATS:** G=guano; I=insect remains; B=bat sighting; O=other(use comments); N=no (use comments to expand on any positive evidence;"No" only indicates absence of positive evidence, **not** absence of bats)

____ (33) **Recorded by/date:** 6/15/97 Dor

ADITS, SHAFTS, AND OPENINGS													
Feature Nos.		100	101	102	103	104	105	106	107	108	109	110	111
Type of Feature		PT	A	A	A	A	A	A	A	S	A		
Opening Size (ft)	H	600	1.5	5	UNK	6	-	UNK	UNK	12	UNK		
	W	200	2.5	5	UNK	5	-	UNK	UNK	15	UNK		
Depth (ft)		20	25	900	UNK	30	-	UNK	UNK	12	UNK		
Condition		P	P	F	F	I	N	F	F	P	F		
Drainage		W	N	W	N	N	-	N	N	N	N		
Access Deterents		N	N	N	N	N	—	N	N	N	N		
Deterent Condition													
Ratings	Env. Deg.	5	5	2	5	5	5	5	5	5	5		
	Hazard	5	3	5	5	3	5	5	5	5	5		
Photo	Roll No.	Doc3	Doc3	Doc3		Doc6	Doc6	Doc6	Doc6	Doc6			
	Frame No.	14,15	16	17		13,14	15	20	22	21			
Comments?		Y	Y	Y						Y			

DUMPS, TAILINGS, AND SPOIL BANKS											
Feature No.		200	201	202	203	204	205	206	207	208	209
Type of Feature				D	D			D	D		D
Plan view Dimension (ft.)	L			150	9			15	40		
	W			45	12			12	12		24
Volume (yds)				10,000	60			100	80		60
Steepest Slope Angle (dgr)				35	35			33	34		
Steepest Slope Length (ft)				90	69			30	10		
Size of Materials				SGL	SG			SGL	SGL		
Cementation				U	U			U	U		
Vegetation Type				B	P			P	P		WG
Vegetation Density				B	S			S	S		
Drainage				W	N			N	N		N
Stability				S	P			S	S		
Water Erosion	of Feature			S	S			S	S		S
	Storm Runoff			N	N			N	N		N
Wind Erosion				N	N			N	N		N
Radiation Count				-	-			-	-		
Access Deterents				N	N			N	N		N
Deterent Condition											
Ratings	Env. Deg.			4	5			5	5		
	Hazard			5	5			5	5		
Photo	Roll No.				Doc 3						
	Frame No.				17						
Comments?											
Soil Sample No.											

337/4521

DRAINAGE/WATER SAMPLES						
Item Nos.	300	301	302	303	304	305
Adit/Shaft/Dump No./Other=0 (If other location, describe in comments)	102 A	102 A	102 A			
pH (standard units)	3.33	3.38	2.79			
Conductivity (uS)	305	315	333			
Flow (gpm)	15	~~37.4~~	9			
Method of Flow Measure	E	~~[illegible]~~	Flume			
Date Flow/Sample (m/d/y)	6/15/97	7/14/97	9/3/97			
Location of Sample/Flow	A	A	A			
Evidence of Toxicity in Site Drainage	P	P	P			
Evidence of Toxicity in Receiving Stream	N	N	N			
Distance from Stream (ft)	500	500	500			
Comments?		water sample				
Lab Water Sample No.		337/4521.7 301				

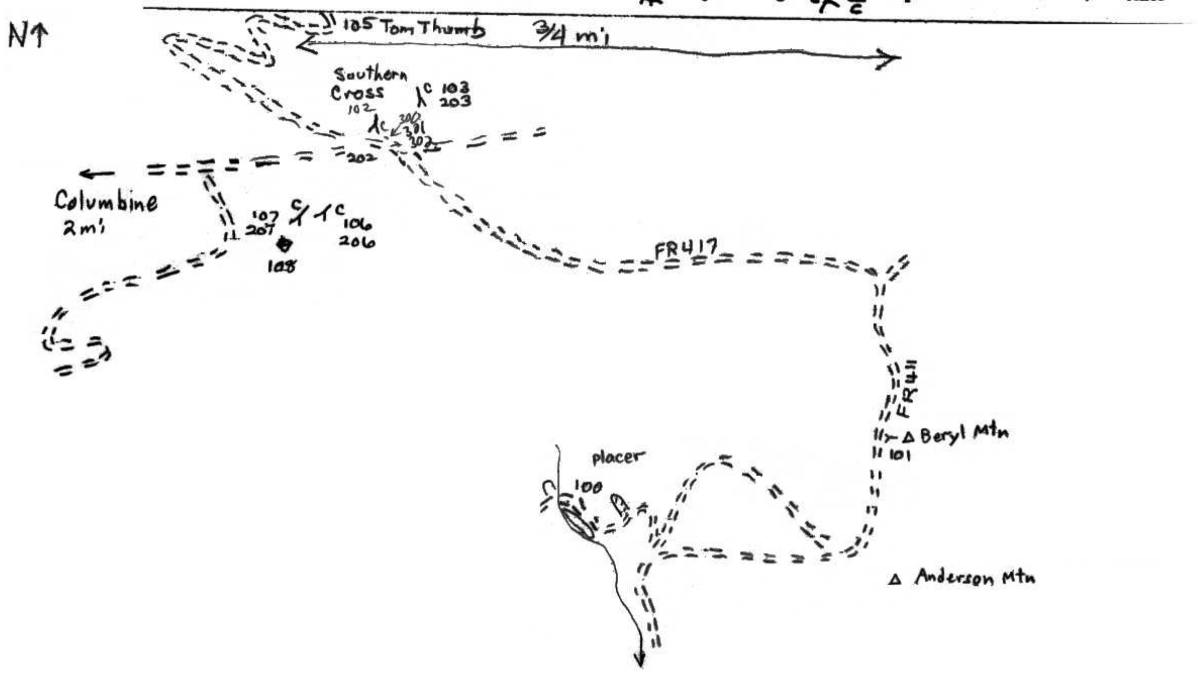
GPS READINGS		
Ftr. No.	Location	
100	Lat. N40° 49' 47.5" Long. W106° 55' 24.0"	PDOP 3.3
101	Lat. N40° 50' 18.5" Long. W106° 55' 10.3"	PDOP 4.7
103 102	Lat. N40° 49' 42.3" Long. W106° 55' 35.8"	PDOP 3.9
104	Lat. N40° 50' 28.0" Long. W106° 53' 57.6"	10340 PDOP 4.1
Tom Thumb 105	Lat. N40° 50' 23.1" Long. W106° 55' 54.0"	10,240' PDOP 3.5
106 107 108	Lat. N40° 50' 14.8" Long. W106° 55' 55.9"	9550' PDOP 6.1
106 206	Lat. N40° 49' 35.1" Long. W106° 56' 16.0"	9060 PDOP 3.2
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	

DIAGRAM OF PROBLEM AREA (Locate all adits, shafts, dumps, prospects, etc. on topo map.) 337492 4522538 4.5 5

> 104

Check off upon completion: ___ north arrow; ___ scale bar or general size noted; ___ direction to nearest trail/road/town noted; ___ significant mine features numbered

Adit | shaft | X prospect hole | building | dump or tailings | collapsed adit and shaft | fence



337/4521

•81. Local person interviewed ______________________________
Name Address

•82. Name and address of person desiring a copy of this form: ______________________________

•83. Describe the minimum work needed to mitigate any public health, safety, welfare, or environmental problems observed at the site. Note specific reclamation activities along with an estimated cost and time period to implement each activity described. Code costs as: 1= less $10,000; 2= $10,000 to $100,000; 3= $100,000 to $500,000; 4= more than $500,000. Code estimated time to complete the activity as: 1= less than 1 month; 2= 1 to 12 months; 3= 1 to 3 years; 4= over 3 years

Cost	Time	Recommended reclamation activity

•84. Comments relating to geology, health, safety, welfare, environmental, or restoration problems of a certain feature. All comments must be keyed to mine feature # or drainage/water sample item #.

Ftr.# 100 site of hydraulic placer w/some trenches of non-hydraulic origin
Creek runs through site

101 No dump. Right on road. Cruddy rock

103 Southern Cross Mine
202 has been used for road building. Hard to tell how much is dump

105 is at location shown for Tom Thumb adit. No indication of anything but road cut

108 rates a 5 hazard if a shaft (small dump present) but a 2 if it is subsidence.

-if more comments use back of page →

General Comment (on whole inventory area or group of mine features): ______________________________

-if more comments use back of page →

OFFICE/LITERATURE INFORMATION

•41. Owner of surface ______________________________
•42. Last known operator ______________________________
•43. Estimated production ______________________________
•44. Dates of production ______________________________
•45. Literature not cited in comments ______________________________
•46. Citation of any historical register listing ______________________________

USFS-AMLI FIELD DATA FORM

LOCATION AND IDENTIFICATION

(1) **ID#:** 02- 08- 11 - 03 - 337 / 4522 - 1
rgn st fst rd xutm yutm area#

(2) **Sitename:** Iron Springs Mine area

(3) **Other name/reference:** 7D adit

2 (4) **Highest priority Environmental Degradation occurring in this area:** **1**=extreme; **2**=significant; **3**=potentially significant; **4**=slight; **5**=none

3 (5) **Highest priority Mine Hazard noted in this area:** **E**=emergency; **1**=extreme danger; **2**=dangerous; **3**=potentially dangerous; **5**=no significant hazard

M (6) **Commodity:** **C**=coal; **U**=uranium; **M**=metals; **I**=industrial material. (Metal or Indust. material type: gold)

(7) **Quad name and date:** Hahns PK 1986

(8) **County:** Routt

(9) **2° map:** Craig

(10) **Water Cataloguing Unit #:** 14050001

(11) **Mining district/coal field:** Hahns PK

(12) **Land survey location:** S - E - ¼ sec 9 ,T 10N ,R 85W

(13) **Receiving stream:** Beaver Crk flowing into Willow Crk
nearest named stream next named

(14) **Elevation (ft):** 9600

2 (15) **General Slope:** **1**=0-10°; **2**=11-35°; **3**=greater than 35°

M (16) **Regional terrain:** **R**=rolling or flat; **F**=foothills; **T**=mesa; **H**=hogback; **M**=mountains; **S**=steep/narrow canyon

J (17) **Type of access:** **N**=no trail; **T**=trail; **J**=jeep road; **G**=gravel road; **M**=paved road; **P**=private/restricted road

M (18) **Quality of access for construction vehicles:** **G**=good; **M**=moderate; **P**=poor; **X**=very poor

(19) **Nearest town on map:** Hahns PK

3.5 (20) **Road distance from nearest town** (#.# miles)

(21) **Nearest road** (name and/or #): FR 490B
FR=forest rd; **CR**=county rd; **SH**=state highway; **I**=interstate

Distance to following types of public uses (#.# miles):

0 (22) Road

(23) Dwelling (year-round)

(24) Campground/picnic area

(25) Marked trail

(26) Other public use (explain)

ENVIRONMENTAL INFORMATION

M (27) **Vegetation density adjacent to site:** **D**=dense; **M**=moderate; **S**=sparse; **B**=barren

A, P (28) **Vegetation type adjacent to site:** **B**=barren; **W**=weeds; **G**=grass; **R**=riparian **S**=sagebrush/oakbrush/brush; **J**=juniper/piñon; **A**=aspen; **P**=pine/spruce/fir; **T**=tundra

N (29) **Evidence of intentional reclamation:** **Y**=yes; **N**=no (if yes, use comments)

2 (30) **Size of disturbed area in acres**

N (31) **Potential historical structures in area:** **Y**=yes; **N**=no (if yes, use comments)

N (32) **Positive evidence of BATS:** **G**=guano; **I**=insect remains; **B**=bat sighting; **O**=other(use comments); **N**=no (use comments to expand on any positive evidence;"No" only indicates absence of positive evidence, **not** absence of bats)

(33) **Recorded by/date:** 6/16/97 Doc

ADITS, SHAFTS, AND OPENINGS													
Feature Nos.		100	101	102	103	104	105	106	107	108	109	110	111
Type of Feature		A	A	A	A	A							
Opening Size (ft)	H	5	UNK	UNK	UNK	–							
	W	5	UNK	UNK	UNK	–							
Depth (ft)		1600	UNK	UNK	UNK	–							
Condition		F	F	F	F	N							
Drainage		W	N	N	N	–							
Access Deterents		N	N	N	N	–							
Deterent Condition						–							
Ratings	Env. Deg.	2	5	5	5	5							
	Hazard	5	5	5	5	5							
Photo	Roll No.	Doc 3	Doc 3		Doc 6	–							
	Frame No.	18	21		30	–							
Comments?		Y	Y		Y	Y							

DUMPS, TAILINGS, AND SPOIL BANKS											
Feature No.		200	201	202	203	204	205	206	207	208
Type of Feature		D	D	D	D					
Plan view Dimension (ft.)	L	150	75	22	45					
	W	54	10	18	24					
Volume (yds)		25,000	200	150	500					
Steepest Slope Angle (dgr)		36	33	33	33					
Steepest Slope Length (ft)		200	20	24	24					
Size of Materials		SGL	SGL	SGL	SGL					
Cementation		M	U	U	U					
Vegetation Type		P	P	P	WPA					
Vegetation Density		S	S	S	M					
Drainage		W	UNK	N	N					
Stability		P	S	S	S					
Water Erosion	of Feature	S, RG	G	S	S					
	Storm Runoff	S	S	N	N					
Wind Erosion		N	N	N	N					
Radiation Count		–	–	–	–					
Access Deterents		N	N	N	N					
Deterent Condition										
Ratings	Env. Deg.	3	5	5	5					
	Hazard	3	5	5	5					
Photo	Roll No.	Doc 3	Doc 3	Doc 3	Doc 6					
	Frame No.	19, 20	21	22	31					
Comments?		Y								
Soil Sample No.										

337/4522

DRAINAGE/WATER SAMPLES						
Item Nos.	300	301	302	303	304	305
Adit/Shaft/Dump No./Other=0 (If other location, describe in comments)	100 A	100 A	100 A	100 A		
pH (standard units)	3.37	3.36	3.36	2.57		
Conductivity (uS)	164	273	273	287		
Flow (gpm)	50	20	20	10		
Method of Flow Measure	E	Flume	Flume	Flume		
Date Flow/Sample (m/d/y)	6/16/97	7/14/97	8/14/97	9/3/97		
Location of Sample/Flow	A	A	A	A		
Evidence of Toxicity in Site Drainage	P	P	P	P		
Evidence of Toxicity in Receiving Stream	N	N	N	N		
Distance from Stream (ft)	500	500	500	500		
Comments?	Y	water sample				
Lab Water Sample No.		337/4522-1 301	337/4522-1 302			

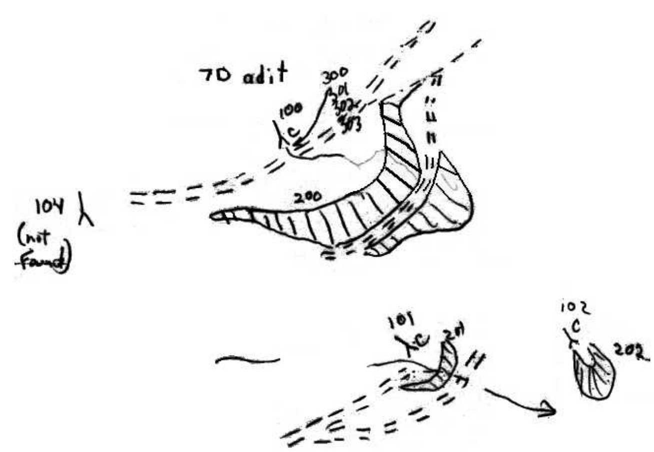
GPS READINGS	
Ftr. No.	Location
200	Lat. N40° 50' 18.5" Long. W106° 55' 19.8" PDOP 3.4
201	Lat. N40° 50' 7.1" Long. W106° 55' 18.7" PDOP 2.8
202	Lat. Long. same
103 203	Lat. N40° 49' 48.1" 8650' Long. W106° 54' 52.5" PDOP 3.0
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.

DIAGRAM OF PROBLEM AREA (Locate all adits, shafts, dumps, prospects, etc. on topo map.)

Check off upon completion: ___ north arrow; ___ scale bar or general size noted; ___ direction to nearest trail/road/town noted; ___ significant mine features numbered

Adit; shaft; prospect hole; building; dump or tailings; collapsed adit and shaft; fence

N↑



337/4522

•81. Local person interviewed ______________________________

Name Address

•82. Name and address of person desiring a copy of this form: ______________________________

•83. Describe the minimum work needed to mitigate any public health, safety, welfare, or environmental problems observed at the site. Note specific reclamation activities along with an estimated cost and time period to implement each activity described. Code costs as: 1= less $10,000; 2= $10,000 to $100,000; 3= $100,000 to $500,000; 4= more than $500,000. Code estimated time to complete the activity as: 1= less than 1 month; 2= 1 to 12 months; 3= 1 to 3 years; 4= over 3 years

Cost	Time	Recommended reclamation activity

•84. Comments relating to geology, health, safety, welfare, environmental, or restoration problems of a certain feature. All comments must be keyed to mine feature # or drainage/water sample item #.

Ftr.# 300 Flow sinks into dump about 100Ft down. Dump shows sulFides leached out. Very minor yellow-brown precipitate on dump

200 dump is oversteepened & could collapse in a serious debri slide, but there is nothing below but trees, and the road probably would not be affected.

100 major working not located (correctly) on any map. Much leached pyritec rock on dump

101 just below base of 200. Just rained; can't tell about drainage

103/203 is barren rock. This is the Blue Jay

302 is replicate of 301

104 - SHOWN ON TOPO - NOT SEEN. MAYBE COVERED DURING ROAD BUILDING.

-if more comments use back of page →

General Comment (on whole inventory area or group of mine features): ______________________________

-if more comments use back of page →

OFFICE/LITERATURE INFORMATION

•41. Owner of surface ______________________________

•42. Last known operator ______________________________

•43. Estimated production ______________________________

•44. Dates of production ______________________________

•45. Literature not cited in comments ______________________________

•46. Citation of any historical register listing ______________________________

CODES FOR TABULAR INFORMATION

ALL TABLES: If appropriate code is not listed, use: **N** = none or no; **N/A** = not applicable; **UNK** = unknown; **O** = other, explain in #84

ADITS, SHAFTS, & OPENINGS

- Type of feature: **A** = adit; **S** = vertical shaft; **I** = incline shaft; **P** = prospect hole; **ST** = stope; **G** = glory hole; **SU** = subsidence feature; **PT** = open pit; **O** = other, explain in #84.

Condition: **I** = intact; **P** = partially collapsed or filled; **F** = filled or collapsed; **N** = feature searched for but not found (mine symbol on map)

Drainage: **N** = no water draining; **W** = water draining; **S** = standing water only (note at what depth below grade)

Access deterents: **N** = none; **S** = sign; **F** = fence; **C** = sealed or capped; **D** = open door or hatch; **L** = locked door or hatch; **G** = open grill; **O** = other, explain in #84.

Deterent condition: **P** = prevents access; **D** = discourages access; **I** = ineffective

Ratings:
Hazard: **E** = emergency; **1** = extreme danger; **2** = dangerous; **3** = potential danger; **5** = no significant hazard
Env. Deg.: **1** = extreme; **2** = significant; **3** = potentially significant; **4** = slight; **5** = none

Comments?: **Y** = yes; **N** = no

DUMPS, TAILINGS, AND SPOIL AREAS

- Type of feature: **D** = mine dump; **T** = mill tailings; **W** = coal waste bank; **S** = overburden or development spoil pile; **DS** = dredge spoil; **HD** = placer or hydraulic deposit; **H** = highwall; **P** = processing site

Size of materials: **F** = fine; **S** = sand; **G** = gravel; **L** = cobbles; **B** = boulders

Cementation: **W** = well cemented; **M** = moderately cemented; **U** = uncemented

Vegetation Type: **G** = mixed grass; **S** = sagebrush/oakbrush/brush; **J** = juniper/piñon; **A** = aspen; **P** = pine/spruce/fir; **T** = tundra; **R** = riparian; **F** = tilled crops; **B** = barren/no vegetation; **W** = weeds

Vegetation Density: **D** = dense; **M** = moderate; **S** = sparse; **B** = barren

Drainage: **N** = no water draining; **W** = water draining across surface; **S** = standing water only; **SP** = water seeping from side of feature

Stability: **U** = unstable; **P** = potentially unstable; **S** = stable

Water erosion:
of Feature: **N** = none; **R** = rills; **G** = gullies; **S** = sheet wash
Storm Runoff: **C** = in contact with normal stream; **S** = near stream or gully, but only eroded during storm or flood; **N** = no storm/flood runoff erosion

Wind erosion: **N** = none; **D** = dunes; **B** = blowouts; **A** = airborne dust

Radiation Count: **N** = none taken; record value of reading if taken

Access deterents: **N** = none; **S** = sign; **F** = fence; **O** = other, explain in #84

Ratings:
Hazard: **E** = emergency; **1** = extreme danger; **2** = dangerous; **3** = potential danger; **5** = no significant hazard
Env. Deg.: **1** = extreme; **2** = significant; **3** = potentially significant; **4** = slight; **5** = none

Comments?: **Y** = yes; **N** = no

DRAINAGE/WATER SAMPLES

Adit/Shaft/Dump No./Other: Indicate Feature No. associated with water information; **0** = other, explain in comments

Flow (cfs): record seeps as 0.01 cfs (Rule of Thumb: a cfs= one full-blast garden hose)

Method of flow measure: **E** = estimate; **T** = bobber/stopwatch/x-section; **W** = weir; **D** = catchment; **F** = flow meter

Location of sample and flow: **A** = immediately adjacent to adit/shaft; **B** = below dump/tailings; **C** = immediately above confluence with receiving stream; **SW** = standing water in/on feature; **RU** = receiving stream upstream of feature; **RD** = receiving stream dowmstream of feature;

Evidence of toxicity: **N** = none; **A** = absence of benthic organisms; **W** = opaque water; **P** = yellow or red precipitate; **S** = suspended solids; **D** = salt deposits

Comments?: **Y** = yes; **N** = no