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7 Geology

This section provides an overview of the regional and local stratigraphy and structural geology, as well as the mineralization at the Copper Flat Mine Permit Area (Site). The information has been summarized primarily from the BLM Preliminary Final Environmental Impact Statement (PFEIS) for Copper Flat (1999), Raugust (2003), and SRK (2010).

7.1 Regional Geologic Setting

The Copper Flat Mine lies within the Mexican Highlands portion of the Basin and Range Physiographic Province. It is located in the Hillsboro Mining District in the Las Animas Hills, which are part of the Animas Uplift, a horst on the western edge of the Rio Grande valley (Raugust, 2003). The Animas Uplift is separated from the Rio Grande by nearly 20 miles of Santa Fe Group alluvial sediments, referred to as the Palomas Basin of the Rio Grande valley. To the west of the Animas Uplift is the Warm Springs valley, a graben that parallels the Rio Grande valley (BLM, 1999; Raugust, 2003). Further west, the Black Mountains form the backbone of the Continental Divide, rising to about 9,000 feet above mean sea level (amsl). The surface geology of the Copper Flat region is shown in Figure 7-1, and a schematic geologic cross section is shown in Figure 7-2.

Basement rocks in the area consist of Precambrian granite and Paleozoic and Mesozoic sandstones, shales, limestones, and evaporites. Sedimentary units that crop out within the Animas Uplift include the Ordovician Montoya Limestone, the Silurian Fusselman Dolomite, and the Devonian Percha Shale. The Cretaceous-age Laramide orogeny, which was characterized by the intrusion of magma associated with the subduction of the Farallon plate beneath the North American plate, affected this region between 75 and 50 million years ago (Ma). Volcanic activity during the late Cretaceous and Tertiary periods resulted in localized flows, dikes, and intrusive bodies, some of which were associated with the development of the nearby Tertiary Emory and Good Sight-Cedar Hills cauldrons (Figure 7-3); later basaltic flows resulted from the tectonic activity associated with the formation of the Rio Grande rift. Tertiary and Quaternary alluvial sediments of the Santa Fe Group and more recent valley fill overlie the older Paleozoic and Mesozoic units in the area. The regional stratigraphy of the lower Rio Grande Valley is summarized in Table 7-1 (BLM, 1999).

The geologic structure of the region is characterized by block and rift faulting (Figure 7-3). The Tertiary cauldrons associated with the earlier block faulting formed between 35 and 45 Ma. Rift faulting and associated north-south block faulting associated with continental extension and the formation of the Rio Grande rift began approximately 25 to 30 Ma. The Las Animas Hills are bounded by faults associated with rifting (Dunn, 1982). Continental extension continues to the present, as evidenced by north-south trending grabens represented by the Rio Grande and Warm Springs valleys.

7.2 Geology of Copper Flat Mine Site

7.2.1 Stratigraphy

As shown in Figure 7-4, the dominant geologic feature of the Animas Hills and Hillsboro district is the Copper Flat strato-volcano, a circular body of Cretaceous andesite that is 4 miles in diameter (Raugust, 2003). The andesite is generally fine-grained with phenocrysts of plagioclase (andesine) and amphibole in a groundmass of plagioclase and potassium feldspar and rare quartz. Some agglomerates or flow breccias are locally present, but the andesite is generally massive. Magnetite is a common association with the mafic phenocrysts, and accessory apatite is found in nearly every thin section (Dunn, 1984).

The strato-volcano is eroded to form a topographic low; the total depth of erosion is uncertain (SRK, 2010). To the east of the Site, this andesite body is in fault contact with Santa Fe Group sediments, which are at least

2,000 feet (ft) thick in the area. Near-vertical faults characterize the contacts on the remaining perimeter of the andesite body; these faults juxtapose the andesite with Paleozoic sedimentary rocks. Drill holes indicate the andesite is more than 3,000 ft thick. This feature, combined with the concentric fault pattern, indicate that the local geology represents a deeply eroded Cretaceous-age volcanic complex (Dunn, 1982).

The core of the volcanic complex is a Cretaceous-age quartz monzonite stock that intruded into the center of the andesite body. Known as the Copper Flat Quartz Monzonite (CFQM), this irregular-shaped stock underlies a surface area of approximately 0.25 square miles and has been dated to approximately 75 million years before present (Raugust, 2003; BLM, 1999; and McLemore et al., 2000). The monzonite crops out in only a few isolated areas, and the andesite at these contacts shows no obvious signs of contact metamorphism (Dunn, 1984). The CFQM is a medium- to coarse-grained, holocrystalline porphyry composed primarily of potassium feldspar, plagioclase, hornblende, and biotite; trace amounts of magnetite, apatite, zircon, and rutile are also present, along with localized mineralized zones containing pyrite, chalcopyrite, and molybdenite (McLemore et al., 2000). About 15 percent of the monzonite is quartz, which occurs both as small phenocrysts and as part of the groundmass; however, quartz is absent in some parts of the stock (Dunn, 1984).

Numerous dikes, mostly latite, radiate from the CFQM stock, some nearly a mile in length. Most of the dikes trend to the northeast or northwest and represent late stage differentiation of the CFQM stock (Raugust, 2003). Immediately south of the quartz monzonite, the andesite is coarse-grained, perhaps indicating a shallow intrusive phase. An irregular mass of andesite breccia along the northwestern contact of the quartz monzonite contains potassium feldspar phenocrysts and andesitic rock fragments in a matrix of sericite with minor quartz; this may represent a pyroclastic unit. Magnetite, chlorite, epidote, and accessory apatite are also present in the andesite breccia (Dunn, 1984).

The southwestern edge of the andesite body was intruded by the Warm Springs Quartz Monzonite pluton, which dates to approximately 73 Ma (Hedlund, 1974). Unlike the CFQM and the andesite, this monzonite body is not cut by the latite dikes (SRK, 2010), indicating that the dikes were emplaced prior to the Warm Springs Quartz Monzonite.

The Sugarlump Tuff (35 Ma) and the Kneeling Nun Tuff (34 Ma) unconformably overlie the local andesite flows. These tuffs erupted from the Emory caldera, and indicate that the Copper Flat volcanic/intrusive complex was buried during the Oligocene and exhumed during Miocene uplift (around 21.7 ±3.6 Ma) (Kelley and Chapin, 1997). Both the andesite and the quartz monzonite intrusions are cut by black, scoriaceous basalt dikes. These dikes remain unaltered, and appear to be associated with locally abundant Pliocene alkali basalt flows from around 4 Ma (Seager et al., 1984).

7.2.2 Structure

Three principal structural zones are present at the Site and surrounding area, the most prominent of which is a northeast-striking fault trend that includes the Hunter and parallel faults. In addition, west-northwest striking zones of structural weakness are marked by the Patten and Greer faults, and east-northeast striking zones are marked by the Olympia and Lewellyn faults. All faults have a near-vertical dip; the Hunter fault system dips 80°W, and both the Olympia and Lewellyn fault systems dip between 80°S and 90°S (SRK, 2010; Dunn, 1984). These three major fault zones appear to have been established prior to the emplacement of the CFQM and controlled subsequent igneous events and mineralization (SRK, 2010).

The CFQM emplacement is largely controlled by the three structural zones. The southern contact parallels and is cut by the Greer fault, although the contact is cut by the fault, and the southeastern and northwestern contacts are roughly parallel to the Olympia and Lewellyn faults, respectively. The elongate neck of the stock parallels the Hunter fault system. Whether there was movement along the fault zones before the emplacement of the stock has not been determined (SRK, 2010; Dunn, 1984).

Although the latite dikes strike in all the three principal fracture directions, most of the dikes strike northeast. A narrow zone of fault gouge commonly occurs along the contact between the dikes and the andesite, with the mineralization post-dating fault movement (Harley, 1934). The northeast fault zones contain a high proportion of wet gouge, often with no recognizable rock fragments. Underground exposures of the Hunter fault zone (in previously existing mine workings) material has the same consistency as wet concrete and has been observed to flow in underground headings. However, the material in the east-northeast fault zones contains only highly broken rock and little obvious gouge. The width of the fault zones in both systems varies along strike from less than a foot to nearly 25 ft in the Patten fault east of the Project. Despite intense brecciation, the total displacement along the faults does not appear to exceed a few tens of feet (Dunn, 1984). At the western edge of the Site, a younger porphyritic dike was emplaced in a fault that had offset an early latite dike, indicating that fault movement occurred during the time that dikes were being emplaced (Dunn, 1984).

Post-dike movement is evident in all the three principal fault zones, and both the Hunter and Patten fault systems show signs of definite post-mineral movement. Fault movement has smeared sulfide deposits and offset the breccia pipe as well as the zones within the breccia pipe. Post-mineral movement along faults has resulted in wide, strongly brecciated fault zones. Some of the post-mineral dikes have been emplaced within these fault zones (SRK, 2010; Dunn, 1984).

NMCC has mapped the pit area and diversion cuts in detail at 1 inch:40 ft (1:480) and has examined the pre- and post-mineral stress orientations in the andesites and CFQM. Findings indicate no significant difference in the stress fields before and after mineralization (SRK, 2010).

7.3 Description of the Ore Body

Copper Flat is an alkalic copper-gold mineralized breccia pipe, associated with and genetically-linked to an alkalic porphyry system. Copper Flat is situated along the eastern edge of the Cretaceous Arizona-Sonora-New Mexico porphyry copper belt, and, along with Tyrone, New Mexico, forms a linear mineralized feature known as the Santa Rita lineament (SRK, 2010; McLemore et al., 2000). Copper Flat is the easternmost and one of the oldest known porphyry deposits in the southwestern U.S. (Hedlund, 1974; Dunn, 1982; Titley, 1982). Analogous deposits include Terrane Metal's Mount Milligan, British Colombia deposit and the Continental breccia pipe located in the Central Mining district of New Mexico (SRK, 2010).

7.3.1 Structure and Model

Mineralization at the Site is concentrated in a breccia pipe within the CFQM stock (Raugust, 2003; BLM, 1999). The eastern portion of the breccia pipe is outside the outline of the main mineralization; however, the rest of the breccia pipe is higher grade than the surrounding CFQM, hosting nearly half of the copper at the Site, but only about one-third of the total resource tonnage (SRK, 2010). Drillholes spaced approximately 100 ft apart within the center of the deposit indicate the breccia pipe occurs as a single, continuous body, approximately 1,300 ft long by approximately 600 ft wide at the surface with the long axis perpendicular to the predominant northeast fracture direction. It is exposed in only a few places, but extends vertically to over 1,000 ft; veins of coarse pegmatitic material have been found at approximately 1,700 ft below ground surface (bgs) in one drillhole (Dunn, 1984).

Mineralized polymetallic quartz veins, commonly associated with the dikes that radiate outward from the central stock, have been the target of historical mining activities in the Hillsboro district. The breccia pipe zone has been cut by numerous, randomly oriented, irregular veins that are thicker and coarser grained than the narrow fracture-controlled veinlets in the surrounding stock.

Mineralization appears to have been contemporaneous with pipe formation (SRK, 2010). The lack of rock flour or gouge in the matrix suggests that brecciation was not the result of tectonic movement, while the apparent lack of appreciable movement between the fragments and the gradational contact between the breccia and the zone of stockwork veining indicate that an explosive mechanism was not the source of the brecciation. Likewise, the process of mineralization stoping described by Locke (1926), which would have resulted in appreciable downward movement and mixing of the fragments, is not supported by field observations. Thus the mechanism responsible for the formation of the Copper Flat mineralized breccia pipe appears to be autobrecciation resulting from retrograde boiling, a phenomenon that occurs when the pressure of the mineralizing hydrothermal fluid exceeds the confining pressure (Phillips, 1973). The matrix of the breccia, the irregular veins in the surrounding crackle breccias, and the open space filling in the breccias consist of hydrothermal minerals and part of the second stage mineralization occurred as replacement, which modified the original breccia texture (SRK, 2010).

Unlike most deposits in the southwestern U.S., Copper Flat shows very little supergene enrichment or the symmetrical and telescoped zoning of alteration types that is considered typical of most porphyry copper deposits. Instead, hypogene mineralization and alteration, including the formation of the breccia pipe, was the result of the final crystallization of the CFQM melt and related dikes (SRK, 2010).

The current model used by NMCC for further exploration at the Site is based on Richards (2003), who interprets the area as an eroded volcano. According to this model, mineralization occurred at similar depths to that found at El Teniente in Chile; since the Copper Flat breccia pipe now crops out at the surface, this assumption indicates that approximately 0.5 to 2 kilometers (km) of volcanic rocks have been eroded from the central zone of mineralization. Fluid inclusion work by Norman et al. (1989) and McLemore et al. (2000) suggest that the breccia pipe and veins formed at a depth of 1 to 2 km bgs and at temperatures ranging from 226° to 360°C.

7.3.2 Mineralization

During the early mining days, a 20- to 50-foot leached oxide zone existed over the ore body, but this material was stripped during the mining activities that occurred in the early 1980s. Most of the remaining ore is unoxidized and consists primarily of chalcopyrite and pyrite with some molybdenite and traces of galena and sphalerite. Appreciable amounts of silver and gold are also present (BLM, 1999; SRK, 2010). The proven and probable reserves are estimated at more than 50 million tons of ore with 0.45 percent copper (Hydro Resources, 2002).

The breccia consists largely of fragments of mineralized CFQM, with locally abundant mineralized latite where dikes exposed in the CFQM projected into the brecciated zone. Andesite occurs only as mixed fragments partially in contact with intrusive CFQM and appears to represent the brecciation of andesite xenoliths in the CFQM (Dunn, 1984). The matrix contains varying proportions of quartz, biotite (phlogopite), potassium feldspar, pyrite, and chalcopyrite, with magnetite, molybdenite, fluorite, anhydrite, and calcite locally common. Apatite is a common accessory mineral. Much of the quartz-feldspar matrix has a pegmatitic texture. Breccia fragments are rimmed with either biotite or potassium feldspar, and the quartz and sulfide minerals have generally formed in the center of the matrix (Dunn, 1984).

The andesite in contact with the CFQM, dikes, and veins is typically altered into one of three types of mineral assemblages: biotite-potassic, potassic, or sericitic alteration (Fowler, 1982). The highest copper grades are associated with the biotite-potassic alteration, which is characterized by hydrothermal biotite, potassium feldspar, quartz, and pyrite, and which occurs in veinlets and as replacement assemblages in the monzonite (McLemore et al., 2000).

The total sulfide content ranges from 1 percent (by volume) in the eastern part of the breccia pipe and the surrounding CFQM to 5 percent in the CFQM to the south and west (SRK, 2010). Sulfide content is highly variable within the breccia, with portions containing as much as 20 percent sulfide minerals. Sulfide mineralization is restricted to the CFQM and breccia pipe, and drops abruptly at the andesite contact. Minor pyrite mineralization extends into the andesite along the pre-mineral dikes (SRK, 2010; Dunn, 1984).

Pyrite and chalcopyrite are disseminated within the CFQM and also occur along fracture-controlled veinlets and as disseminations associated with mafic minerals. Typically, pyrite is more abundant than chalcopyrite in two areas (SRK, 2010):

- A narrow zone that surrounds and overlies the western end of the breccia pipe, which has the highest grade CFQM mineralization, characterized by abundant chalcopyrite in quartz-sulfide veinlets.
- Outcrops to the southeast of the breccia and south of Grayback Wash, where disseminated chalcopyrite is present with no associated pyrite.

Molybdenite occurs occasionally in quartz veins or as thin coatings on fractures. Minor sphalerite and galena are present in both carbonate and quartz veinlets in the CFQM stock (Dunn, 1984).

7.4 Geochemical Sampling

NMCC has hired a contractor to conduct geologic sampling to address the potential for geologic strata to create acid rock drainage, or degradation of the surface or groundwater quality, or cause a hindrance to reclamation. NMCC proposes the use of the following geochemical characterization program at Copper Flat.

An assessment of waste rock geochemistry is proposed to predict the potential geochemical reactivity of waste rock that will be exposed during the proposed mining operation, and to provide input into a future pit lake hydrogeochemical model. This assessment will also include characterization of ore-grade materials that will be processed and deposited as tailings in the tailings impoundment.

The material characterization described in this program will address mineralogy, bulk geochemical characteristics, and the potential of the waste rock and processed ore (tailings) to generate acid or net neutral drainage, as well as a prediction of future water quality that would result from precipitation contacting the material, and what influence this may have on groundwater, surface water, and pit lake quality at the site. As appropriate, the assessment may identify waste rock management measures that would mitigate or reduce future liabilities.

NMCC proposes a phased approach that will ensure that the geologic sampling program applied addresses all the regulatory objectives and requirements. The following is a general breakdown of each step.

7.4.1 Step 1: Data Review and Material Type Delineation

NMCC's contractor will review all data available from the previous and current exploration drilling programs, including the drill hole database, drill logs, assay data, and bulk element geochemistry. From this review, the main rock types, alteration types, and oxidation states identified by SRK in the late 1990's will be reviewed and modified as needed. The combination of these parameters will be used to define material types for the project that will be the focus of the characterization program.

The block model and proposed pit outlines prepared by NMCC and its contractor will also be reviewed to identify ore and waste zones within the proposed pit boundaries and ensure that the proposed sample suite is spatially representative (both vertically and horizontally) of waste rock and ore. The estimated tonnages of the waste rock and ore material types will be obtained from the block model in order to define the number of samples required to characterize each material type. The sampling program will focus on the main material types with more samples being collected from the material types with the greatest predicted tonnage. This characterization will include both ore- and waste-grade material.

7.4.2 Step 2: Sample Interval Selection

Several types of geologic material are available from the exploration drill programs for sampling including coarse rejects and half-split core from the core and rotary drilling. However, the core will be the preferred sample material. The half-split core material is currently being stored on-site in a sheltered area and oxidation of this material from weather is anticipated to be minor. A significant amount of the core material from the mineralized zones may have been mostly consumed for metallurgical testing; however, half-split core material should be available for most of the waste intervals. Therefore, the half-split core material from the waste intervals has been identified as the best material available for geochemical testing and will be targeted in the waste rock characterization portion of this sampling program. In addition, exploration drilling is currently ongoing in the expansion areas. This drilling presents an opportunity to collect additional samples for geochemical testing from rotary and core holes, provided the coarse rejects are properly stored prior to sample collection.

In the late 1990s, SRK collected 46 samples for Acid Base Accounting (ABA) testing, 59 for Net Acid Generation (NAG) testing, 1 for short-term leach testing, and 5 for humidity cell kinetic tests. In addition, 14 samples were collected from the historic tailings impoundment for static test analysis, and approximately 130 samples of waste rock and pit walls were collected for field NAG test and paste chemistry. These samples were characterized by lithology, alteration, oxidation, and absence/presence of sulfides. Samples were generated by collecting material from consecutive intervals within the same drill hole, and each sample consisted of a single material type as defined by rock type, alteration type, and oxidation state. These samples were submitted to certified laboratories in Reno, Nevada for sample preparation and laboratory testing.

Additional samples will be required for waste rock characterization in order to create a sample database that is vertically and horizontally representative of waste rock associated with the current project. In addition, ore-grade samples will need to be collected. Following the data review and development of estimated waste rock and ore volumes in Step 1, NMCC's contractor will select sample intervals from exploration drill holes to fill the identified data gaps.

NMCC's approach to sample selection is designed to ensure that samples with the end-member reactivity are sufficiently sampled to provide a comprehensive and representative understanding of the full range of geochemical characteristics for each of the material types. To this end, NMCC's contractor will focus on understanding the geological controls on the geochemical behavior of the different materials as the basis for sample selection. As additional mineralogical and geochemical data become available through sample analysis, these data will be combined with the previous data to define subsequent sample sets.

7.4.3 Step 3: Sample Collection and Field Screening

Samples will be collected by qualified geologists from consecutive intervals within the same drill hole and each sample will consist of a single material type as defined by rock type, alteration type, and oxidation state.

Once the main material types are delineated and sampled, a number of field tests can be performed to assess broad geochemical behavior of the identified material types and confirm the geological classification of the materials. Because these tests are inexpensive and quick, a significant amount of data can be collected quickly with minimal cost. By using the field screening to define a representative sample set, the "representativeness" of the sample set is more defensible and the number of samples selected for the more expensive static test suite can be minimized. This is in contrast to another commonly applied approach of selecting a set number of samples based on the predicted amount of waste rock, which usually results in an unnecessarily large sample set. This method also allows us to focus on materials that the initial geological work and testing indicate may be of concern, or which demonstrate an uncertain or highly variable geochemical behavior.

7.4.4 Step 4: Geochemical Test Work

Based on the geologic logging and field screening, a representative number of larger samples will be selected for standard static testing, including: multi-element analyses, acid base accounting (ABA) with sulfur speciation, Meteoric Water Mobility Procedure (MWMP), and Net Acid Generation (NAG). These static tests are intended to define the potential of a material to generate acid, buffer acid, and/or leach constituents under field conditions.

Based on the results of the field work and static testing, samples of material with an uncertain acid generation potential or leaching characteristics may be selected for kinetic testing. Because the static test work assumes that all minerals that have the potential to generate acid, buffer acid, or leach metals will react completely, they can only define the chemical/mineralogical potential of the rock and do not take into account reaction rates that will ultimately control whether the material will actually generate acid, buffer acid, or leach metals under field conditions.

The samples collected in Step 3 will be submitted to a certified laboratory for sample preparation and the first phase of static testing at Nevada certified laboratories as follows:

1. Whole rock analysis using four-acid digest and ICP analysis to determine total metal and metalloid chemistry for 48 elements (ALS Chemex Method ME-MS61).
2. ABA using the modified Sobek method (Memorandum No. 96-79) with sulfur speciation.
3. NAG test reporting final NAG pH and final NAG value after a two-stage hydrogen peroxide digest.
4. MWMP (ASTM D5744-96) with geochemical analysis of the leachate for applicable constituents.

This work will be supervised by NMCC's contractor at McClelland Laboratories of Sparks, Nevada with analysis by Western Environmental Testing Laboratory (WETLab) of Sparks, Nevada; ALS Chemex of Reno, Nevada; and SVL Laboratories of Kellogg, Idaho.

The first phase of geochemical testing will be completed to assess the range of reactivity of each of the material types and the results will be used to select samples for MWMP testing with geochemical analysis of the leachate for applicable constituents (Table 7-2). Samples demonstrating end-member reactivity, as determined from the first phase of static laboratory testing, will be selected for MWMP testing to provide a comprehensive and representative understanding of the leaching characteristics of the different material types associated with the Copper Flat deposit. It is estimated that 80 samples will be selected for static testing (Figure 7-5), of which 40 samples would be selected for MWMP testing. Mineralogical analysis will also be completed on about 20 samples to provide a better understanding of the influence geologic controls have on the geochemical behavior of the waste rock and ore.

As the additional MWMP and mineralogical data become available, they will be combined with the previous dataset to refine the preliminary geochemical predictions for each material type.

7.4.5 Step 5: Kinetic Testing Program

Based on the results of the static testing described above, any material types that exhibit uncertain or highly variable geochemical behavior will require further characterization using kinetic test methods to determine the rates and character of longer-term leaching. Based on the results of previous static testing and interpretation, representative samples will be selected for kinetic test work. Although the number of samples that will require kinetic testing will be based on the static test results, it is estimated that about 20 samples will be selected from the static test database for humidity cell testing (ASTM D-5744-96-7).

7.4.6 Step 6: Data Validation and Compilation

The geochemical data will be reviewed as it is received to ensure the quality of data and consistency in analyses. NMCC's contractor will then verify the quality of all data and confirm that no anomalies are related to laboratory error prior to interpretation and reporting. At a minimum, NMCC's contractor will utilize their internal standard data validation procedures, although guidance from other sources may also be considered (e.g., U.S. Environmental Protection Agency). All geochemical data collected as part of the static testing program will be compiled into a single database for evaluation.

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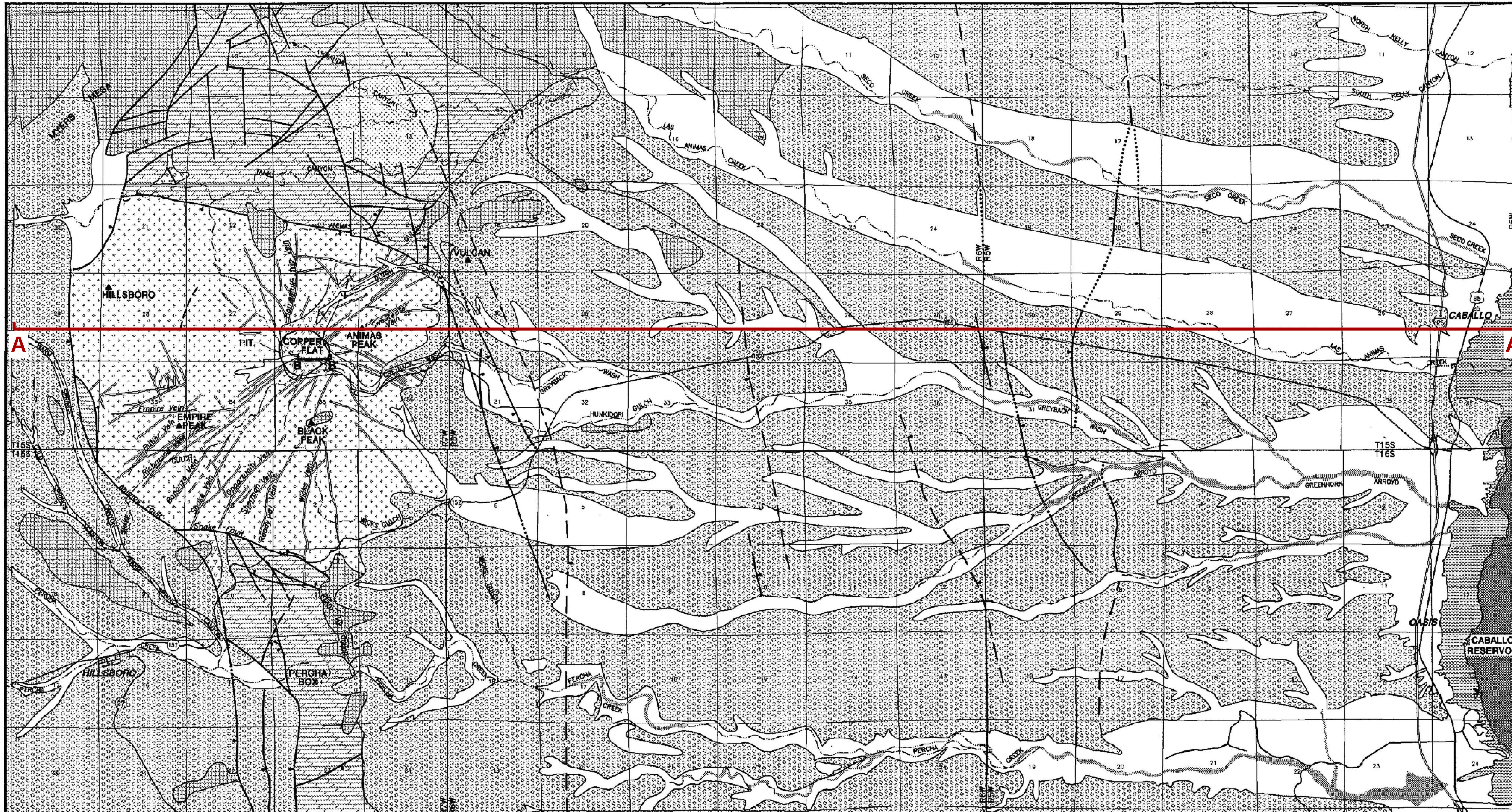
Figures



STRATIGRAPHY

TERTIARY - QUATERNARY	CRETACEOUS	PALEOZOIC AND PRECAMBRIAN
Quaternary Alluvium (Qvy+Qvo)	Late Cretaceous – Silicic Intrusives (Kll)	Paleozoic Siliclastic and Carbonate Sedimentary Rocks (pC through PM)
Tertiary Volcanics (TQb+Tv)	Cretaceous Latite – Andesite Intrusives (Kql+Kd+Kls)	
Tertiary Santa Fe Group (Tsfp+Tsf)	Andesite rocks near Copper Flat (Ka)	

LEGEND

NORMAL FAULT, BALL ON DOWNTHROWN SIDE; DASHED WHERE INFERRED, DOTTED WHERE BURIED.

CONTACT

A A' CROSS SECTION LOCATION

SOURCES:
(1) HARLEY (1934)
(2) SEAGER ET AL. (1982)
(3) HEDLUND (1977)
(4) ALMINAS ET AL. (1975)

NORTH

0 5,825 11,650
FEET

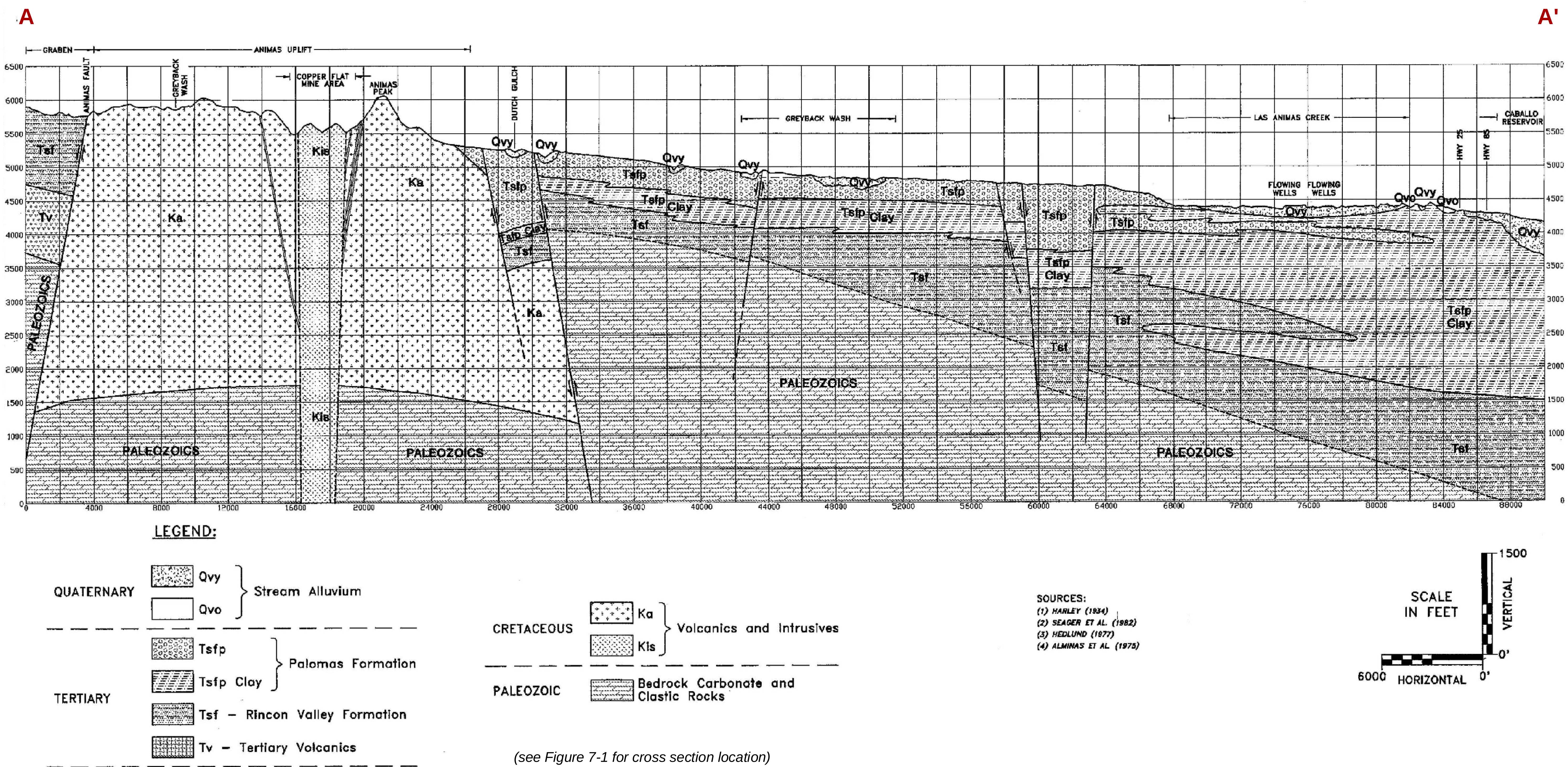
(see Figure 7-2 for cross section detail)

INTERA

from BLM, 1999

Figure 7-1
Regional Surface Geology
New Mexico Copper Corporation

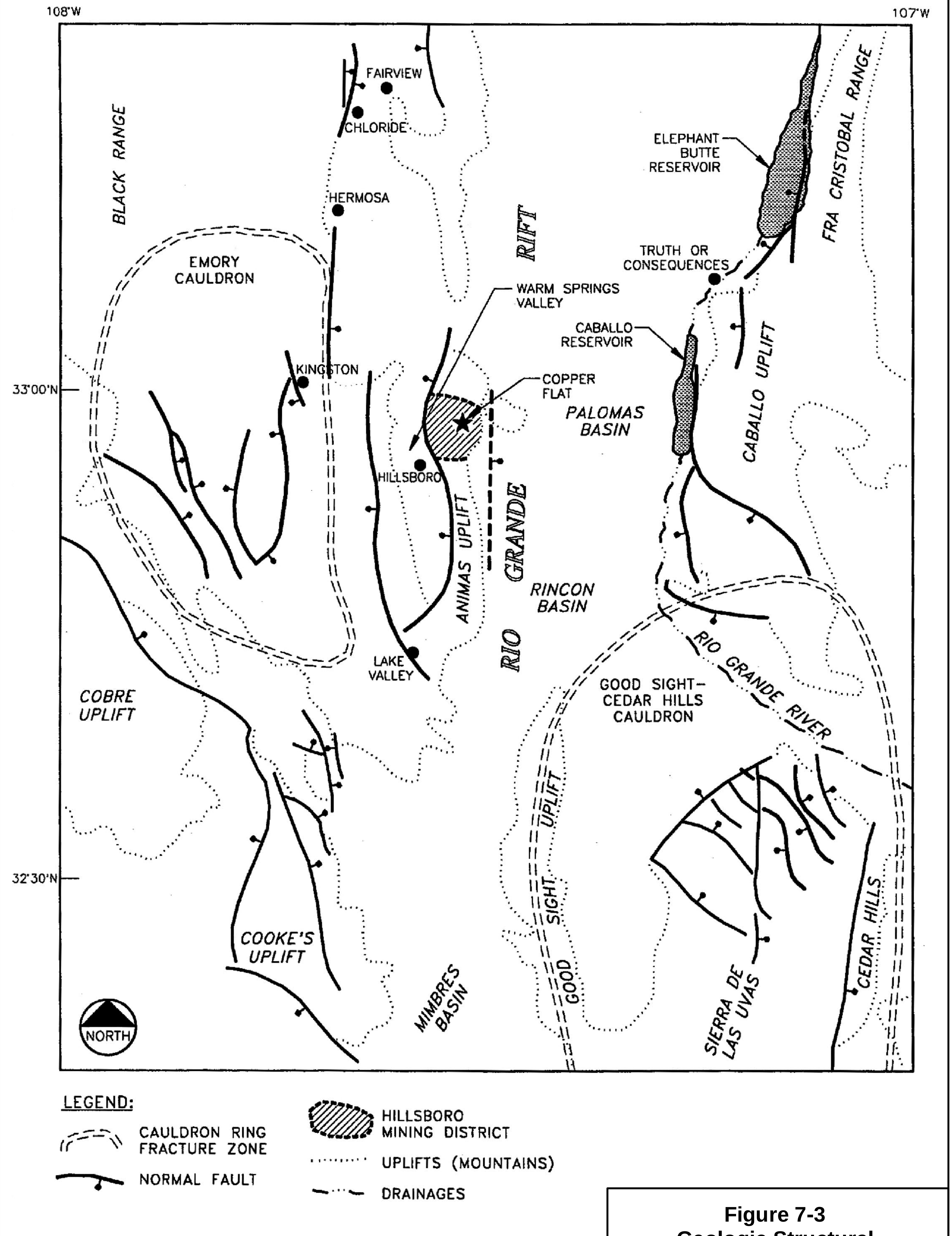
S:\Projects\NMC-001_New Mexico Copper Corporation\GIS\Maps\SAP_7-2010\7_geology\7-1_general_surface_geology.mxd 07/22/2010



(see Figure 7-1 for cross section location)

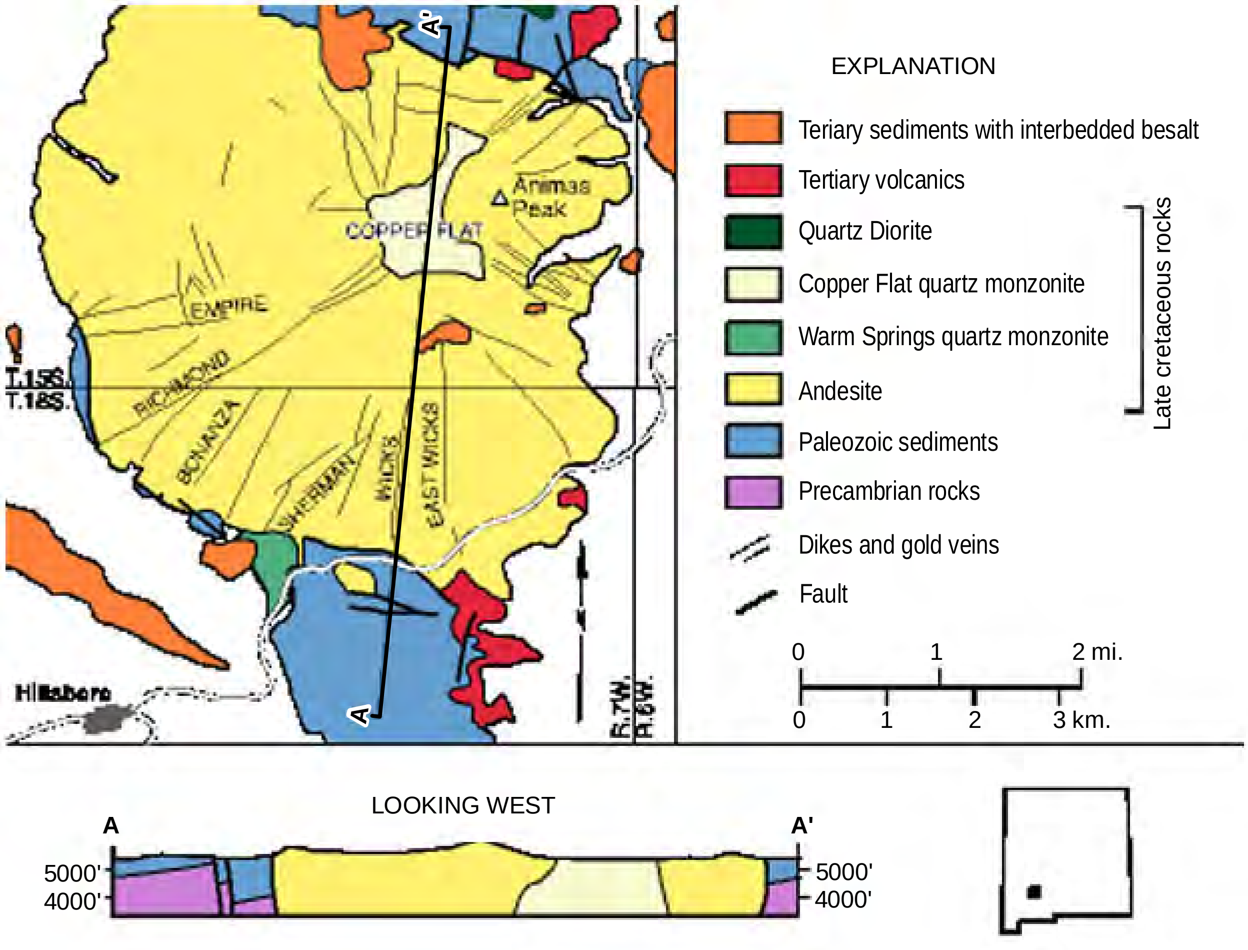
from BLM, 1999

Figure 7-2
Schematic Geologic Cross Section (A-A')
New Mexico Copper Corporation



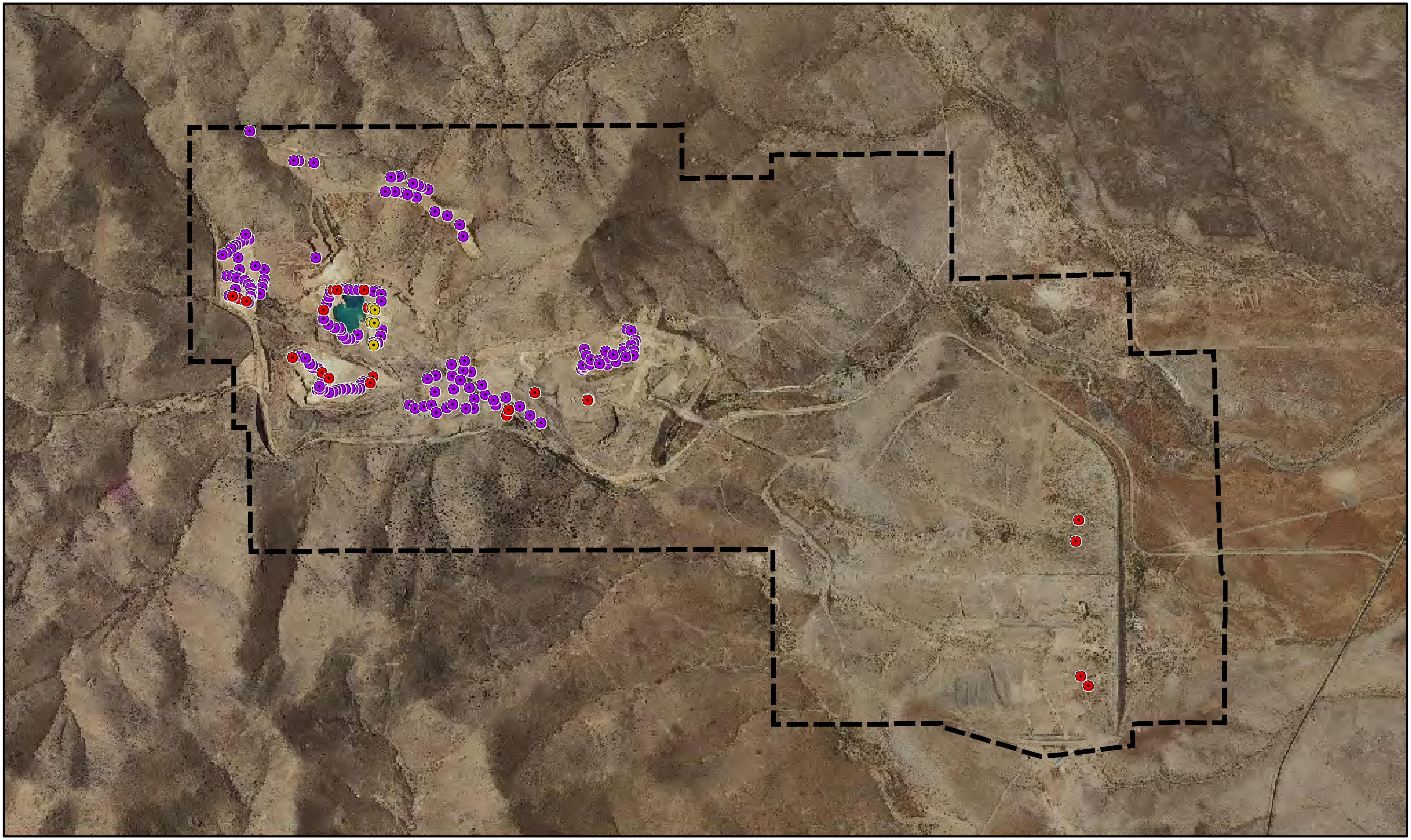
from BLM, 1999

Figure 7-3
Geologic Structural Features of the Region
New Mexico Copper Corporation



from McLemore et al., 2000; Dunn, 1982; Hedlund, 1985

Figure 7-4
Geologic Schematic of the Hillsboro Mining District, New Mexico
New Mexico Copper Corporation



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Mine Boundary:
Tom Reynolds
Samples:
SRK, 2010
Imagery Information:
-USGS 7.5-Minutes County DOQQ
mosaic Sierra County, 2009
Projection Information:
-New Mexico State Plane West, NAD 1927

0 1,000 2,000 4,000
Feet

Legend
- Proposed Mine Permit Boundary
- Surface Grab Sample
- Drillcore Sample
- 1997 Sample

Figure 7-5
Locations of
Geologic Samples
New Mexico Copper Corporation

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Tables

Table 7-1

Stratigraphy of the Copper Flat Area

Age	Geologic Unit	Thickness (ft)
Cenozoic	Pleistocene and Holocene valley alluvium	10–70
0–65 million years ago (Ma)	Pleistocene river, arroyo, and fan deposits	50–100
	Pliocene basalt flows, dikes, and plugs	50–200
	Upper Santa Fe Group fanglomerates (Palomas Formation)	300–100
	Santa Fe Group, Rincon Formation	1000–2000
	Tertiary volcanics	1000
Mesozoic 65–225 Ma	Quartz latite dikes Intermediate composition intrusive Late Cretaceous andesite dikes Late Cretaceous silicic intrusives **Copper Flat volcanic and intrusive (mineralization associated with emplacement)**	>3000
	Sandstone	
	Mancos Shale (not exposed)	300–400
	Dakota Sandstone (not exposed)	100–200
Paleozoic 225–570 Ma	Manazano Group sedimentary rocks. Abo Sandstone, Yeso Formation shales, sandstones, and gypsum deposits, and San Andres Limestone. Not exposed west of Rio Grande at Site.	1000–2000
	Pennsylvanian carbonate rocks including Syrena, Oswaldo, and Magdalena Groups, minor conglomeratic sandstone and cherty massive limestone.	400–1000
	Devonian and Mississippian carbonate rocks (Kelly Limestone, Lake Valley Limestone, Caballero Formation) and Percha Shale.	200–500
	Ordovician Montoya Group and Fusselman Dolomite.	250–600
	Cambrian-Ordovician Bliss Sandstone and El Paso Group Limestone.	500–700
Precambrian 570–1,500 Ma	Precambrian massive granite	

Source: BLM, 1999, Tables 3-1 and 3-2

Table 7-2

Proposed Analytical Parameters with Method Reporting Limits

Parameter	Method	Method Reporting Limit
Alkalinity, CaCO3 (Acidity)	SM 2320B	1
CO3, CaCO3	SM 2320B	1
HCO3	SM 2320B	1
Aluminum	EPA 200.7	0.045
Antimony	EPA 200.8	0.0025
Arsenic	EPA 200.8	0.005
Barium	EPA 200.7	0.01
Beryllium	EPA 200.7	0.001
Bismuth	EPA 200.7	0.1
Boron	EPA 200.7	0.1
Cadmium	EPA 200.8	0.001
Calcium	EPA 200.7	0.5
Chloride	EPA 300.0	1
Chromium	EPA 200.7	0.005
Cobalt	EPA 200.7	0.01
Copper	EPA 200.8	0.05
Fluoride	EPA 300.0	0.1
Gallium	EPA 200.7	0.1
Iron	EPA 200.7	0.01
Lead	EPA 200.8	0.01
Lithium	EPA 200.7	0.1
Magnesium	EPA 200.7	0.5
Manganese	EPA 200.7	0.005
Mercury	EPA 200.8	0.0001
Molybdenum	EPA 200.7	0.01
Nickel	EPA 200.7	0.01
Nitrate as N	EPA 300.0	1
Nitrite as N	EPA 300.0	1
pH (s.u.)	SM 4500-H+ B	--

Parameter	Method	Method Reporting Limit
Phosphorus	EPA 200.7	0.5
Potassium	EPA 200.7	0.5
Scandium	EPA 200.7	0.1
Selenium	EPA 200.8	0.005
Silver	EPA 200.7	0.005
Sodium	EPA 200.7	0.5
Strontium	EPA 200.7	0.1
Sulfate	EPA 300.0	1
Thallium	EPA 200.8	0.001
Tin	EPA 200.7	0.1
Titanium	EPA 200.7	0.1
Total Dissolved Solids	SM 2540C	10
Uranium	EPA 200.8	0.002
Vanadium	EPA 200.7	0.01
Zinc	EPA 200.7	0.01