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THE COVE DISCOVERY
LANDER COUNTY, NEVADA

February, 1988

By

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Presented at:
The 91st National Western Mining Conference
The Colorado Mining Association
February 19, 1988
Denver, Colorado

ABSTRACT

The Cove gold-silver deposit is located in Lander County, Nevada, approximately 30 miles southwest of the town of Battle Mountain. The deposit is in the McCoy Mining District which contains the McCoy gold-skarn deposit. Tenneco Minerals placed the McCoy gold-skarn deposit into production in early 1986. In late 1986, Echo Bay Mines purchased the precious metal holdings of Tenneco.

In early 1986, a stream-sediment survey revealed an anomaly with up to 72 ppb gold. Subsequent soil sampling defined an anomaly 2800 feet long and from 100 to 600 feet wide, ranging from 100 to 2,600 ppb gold. Dozer trenching exposed ore-grade rock over the entire strike length of the anomaly. Exploration drilling was started in January 1987; 25 shallow reverse circulation holes were drilled. The seventeenth hole hit 115 feet of mineralization averaging 0.119 opt gold. By the middle of March, 42 shallow exploration holes had been drilled. Development drilling began in late March.

The host rocks at the Cove deposit are the Triassic Favret, Panther Canyon, and Augusta Mountain Formations in ascending order. These formations are intruded by granodiorite to quartz monzonite dikes and stocks. Altered portions have been dated at 39.5 ± 1.5 m.y.b.p. (K-Ar).

The Cove deposit contains two ore zones: the upper zone is hosted by limestone of the Augusta Mountain Formation and the lower zone is hosted by conglomerate, quartzite (sandstone), limestone and dolomite of the Panther Canyon Formation, and limestone of the Favret Formation. In the upper zone the gold and silver mineralization is associated with argillization, jasperoid, iron oxides and manganese. Mineralization in the lower zone is associated with quartz, sericite, and pyrite.

The orebody measures at least 1,200 feet by 2,500 feet with cumulative thicknesses commonly 400 feet. As of December 1987, the discovery is estimated to contain 4 million ounces of gold and 250 million ounces of silver in 60 to 70 million tons grading 0.065 opt gold and 3.5 opt silver. This geologic inventory is preliminary and subject to change.

INTRODUCTION

The Cove gold-silver deposit is located in Lander County, Nevada approximately 30 miles southwest of the town of Battle Mountain, Nevada (Fig. 1.). The deposit is in the north-central part of the Fish Creek Mountains within the McCoy Mining District.

Gold was first discovered in the McCoy District in 1914 by Joseph H. McCoy (Vanderburg, 1939). From 1928 to the early 1930's, minor production was made from shallow underground workings. Total gold production was less than 10,000 ounces (Stager, 1977). The district was inactive until the mid 1960's when it was subsequently explored by Bear Creek Mining, Summa Corp., Houston Oil and Minerals Corp., Gold Fields and Tenneco Minerals. Tenneco began a detailed reevaluation of the McCoy deposit in the fall of 1984. The decision by Tenneco to place the deposit into production was based on a geological reserve of 280,000 ounces of gold (Kuyper, 1987). Subsequent exploration and development drilling of the McCoy skarn deposit, under the direction of geologist Bruce Kuyper, has more than doubled the mineable skarn reserves to 615,000 ounces of gold. In September 1985, Tenneco began development work on the McCoy gold-skarn deposit. The project is an open pit, heap leach mine. The first gold was poured in April 1986. Echo Bay Mines acquired Tenneco's precious metals properties in October 1986. The mining operation and district exploration started by Tenneco is continuing under the

ownership of Echo Bay Mines.

The Cove deposit was discovered in January 1987 and production will begin in February 1988. The deposit will start as an open pit, heap leach operation and will be converted into an open pit and/or underground mine with a 5,000 ton per day mill.

GEOLOGIC SETTING

The Cove gold-silver deposit is situated on the east flank of the Fish Creek Range. Surface elevations range from 4800 to 5500 feet. The deposit is approximately 1.5 miles northeast of the McCoy gold-skarn deposit. The Cove deposit is hosted by the Augusta Sequence of Triassic age. Three formations of the sequence are mineralized at the Cove. In ascending order they are the Favret, Panther Canyon and Augusta Mountain Formations.

The Favret Formation is a gray, locally silty limestone which is commonly fossiliferous. The base of the formation is not exposed. Exposed and drilled intervals are more than 200 feet in thickness.

Conformably overlying the Favret Formation is the Panther Canyon Formation. The Panther Canyon Formation is 700 feet in thickness and consists of a siliclastic and carbonate sequence of conglomerate, quartzite (sandstone), mudstone, limestone and dolomite. The formation is a distinctly coarsening-upward sequence of rocks. The top of the unit is conglomerate with chert and quartzite clasts up to 6 inches

in diameter.

The Augusta Mountain Formation conformably overlies the Panther Canyon. In the Fish Creek Range the Augusta Mountain is approximately 1300 feet in thickness, however, in the Cove area only the lower half is preserved. The formation consists of gray limestone with sparse, thin shale interbeds. The limestone is medium- to thick-bedded and locally fossiliferous.

The Triassic sedimentary rocks have been intruded by numerous felsic dikes and sills. The intrusive rocks are fine-grained with phenocrysts of feldspar, biotite and quartz. The intrusives are generally hydrothermally altered, ranging from sericitic to propylitic alteration with pyritization. The original composition of the dikes was probably granodiorite or quartz monzonite. A K-Ar age date on a biotite separate from one of the dikes yielded an age of 39.5 +/- 1.5 m.y.b.p. The dikes were generally intruded along northeast-trending, normal faults.

The Caetano Tuff overlies the Augusta Mountain Formation along an angular unconformity. In the Cove area the Caetano Tuff is up to 600 feet in thickness. The unit is a quartz latite, ash-flow tuff. The lower portions are locally non-welded and may include water-lain tuffs. The age of the tuff is 32-34 m.y.b.p. (Stewart and McKee, 1977).

The Caetano Tuff forms a prominent mesa which is characteristic of the Fish Creek Range in the Cove area. North-south normal faulting has displaced the Caetano Tuff and the underlying rocks along the eastern flank of the range.

EXPLORATION

In January 1986, Tenneco Minerals began the McCoy District exploration project which was designed to explore the Triassic rocks that host the McCoy gold-skarn deposit. This program is continuing under the ownership of Echo Bay Mines. The program consists of stream-sediment sampling, soil sampling, rock-chip sampling, and detailed geologic mapping. Exploration trenching using a bulldozer has been used successfully to inexpensively test various surface anomalies.

Approximately 500 stream-sediment samples were collected from the 8 square miles around the McCoy mine. Gold values ranged up to 34 ppm. A distinct stream-sediment anomaly was found from what is now known as the Cove deposit. A cluster of seven (7) anomalous stream-sediment samples are present in the Cove area. The samples contain from 15 to 72 ppb gold. Anomalous concentrations of silver, arsenic, mercury, antimony and thallium were also detected. Follow-up geologic mapping and rock-chip sampling revealed jasperoid, manganiferous limestone and a boulder-sized outcrop of altered felsic dike. Surface rock-chip samples of the jasperoid, manganiferous limestone and an altered felsic dike contained ore-grade gold mineralization.

Soil samples were collected over the altered area at the Cove in September and October 1986. A total of 147 samples were collected on a 100-foot by 200-foot grid. Samples were

collected from the B and C soil horizons. A distinct Au-Ag-As soil anomaly was found (Fig. 2.). The gold anomaly (+100 ppb) is 2,800 feet long and from 100 to 600 feet wide. Eight (8) of the samples contained from 1,000 to 2,600 ppb gold. The eastern portion of the gold anomaly has a coincident silver anomaly ranging from 1 to 213 ppm. The arsenic anomaly ranges up to 1,000 ppm and coincides with the gold anomaly. The soil survey revealed a classic, strong, coherent, geochemical "bullseye" which presented itself as an ideal drill target.

Bulldozer trenching of the soil anomaly was conducted in October and December 1986. Seven (7), shallow trenches were cut over the strike length of the anomaly. Each trench contained gold mineralization ranging from 0.01 to 0.10 opt. One trench had a horizontal width of 94 feet that averaged 0.035 opt gold. Silver mineralization was also discovered with widths of more than 100 feet and 1.0 opt.

The first exploration hole at the Cove was drilled on January 6, 1987, as part of a shallow, 25-hole, reverse circulation drilling program totalling 5,060 feet. Hole depths ranged from 95 to 385 feet. The holes were laid out along several north-south fences on 100-foot centers. The first hole encountered 110 feet averaging 0.024 opt gold and 0.92 opt silver. The highest assays from the hole were 0.138 opt gold and 6.53 opt silver. Of the first 25 drill holes, 23 had intersections of 5 feet of 0.017 opt gold or greater. By the middle of March, 42 exploration holes had been drilled to a maximum depth of 475 feet. Highlights of the exploration drilling include: COV-19 with 0-170 feet

averaging 0.167 opt gold, COV-35 with 0-85 feet averaging 0.513 opt gold and 1.4 opt silver, and COV-36 with 385-430 feet averaging 0.163 opt gold and 50.7 opt silver. On March 31, 1987, Echo Bay Mines announced the discovery of the Cove gold-silver deposit.

DEPOSIT GEOLOGY

The detailed geology of the Cove deposit is not known because of poor exposure at the surface, and limited core drilling (Fig. 3.). However, abundant geochemical data and preliminary alteration studies have yielded enough information to formulate a preliminary geological model for the deposit. This model includes an upper, oxidized ore zone and a lower, sulfide ore zone.

The upper Cove ore zone crops out at the surface and extends to a depth of approximately 400 feet (Figs. 4 and 5.). Laterally, the upper zone extends 800 feet by 1000 feet. It is entirely hosted by limestone of the Augusta Mountain Formation. Alteration of this unit has resulted in the formation of clay and sericite along fractures and within the more permeable beds. Locally, complete replacement of the carbonate to form jasperoid has occurred along bedding and along some structures. Abundant manganese has also been introduced into the rock, giving the clay and jasperoid a sooty brown appearance. Pervasive manganese alteration has occurred in the center of the upper zone, giving even the less argillized limestone a sooty

appearance. Gold and silver mineralization are associated with argillization and with penetrative manganese replacement. The upper ore zone is completely oxidized.

The lower ore zone is generally separated from the upper zone by 100 to 200 feet of barren rock, and extends to depths exceeding 1500 feet (the current limit of drilling). The lower zone is totally blind and not exposed at the surface. Laterally, the lower ore zone extends at least 1200 feet by 3000 feet. It is hosted by clastic and carbonate rock of the Panther Canyon Formation and by carbonates of the Favret Formation. During alteration of these units, base metal sulfides and pyrite were introduced into the host rock, filling fractures and partially replacing the host. This resulted in a fine stockwork of sulfide veins. Vein thicknesses range from hairline veinlets to greater than two feet in thickness. The average thickness is approximately 0.1 inches or less.

Ore minerals present in the veins include (in decreasing order of abundance) pyrite, sphalerite, marcasite, galena, chalcopyrite, stannite, pyrrhotite, +/- tetrahedrite-tennantite, +/- canfieldite (Ag_8SnS_6), +/- arsenopyrite, +/- digenite, +/- covellite, +/- chalcocite, +/- chatkalite ($\text{Cu}_6\text{FeSn}_2\text{S}_8$), +/- electrum. Pyrite is also commonly found disseminated throughout the host rock. Less commonly, arsenopyrite can also be found disseminated in the host.

The mineralogy of the gangue in the veins is not well documented. Visually, quartz, sericite, calcite and clay minerals can be recognized. Gold and silver mineralization

is associated with the disseminated sulfides and sulfide veins. The lower ore zone is completely unoxidized.

DEVELOPMENT

Drilling

As of December 31, 1987, approximately 240,000 feet of reverse circulation drilling in 275 holes, and 6500 feet of coring in five holes has been completed in the Cove deposit. Development drilling began in late March 1987, with two reverse circulation drill rigs operating one shift per day. Drilling was conducted on 100 foot-centers, concentrating mainly on the upper ore zone. In May, drilling operations were extended to two shifts per day in an effort to complete development drilling in a timely manner.

By late August, 1987, continuity of the lower ore zone had been demonstrated over a wide area. In October, two additional reverse circulation drill rigs with 1500-foot depth capabilities were added to the 24 hour per day drilling program. Drilling was then being divided between 400-foot-spaced, step-out holes in an effort to define the margins of the deposit, and holes on 100-foot centers designed to add to the proven reserves.

By December, 1987, two fences of holes on 400 foot centers had been drilled around the known mineralization. At this time, infill drilling on 150-foot centers (five spot pattern) was initiated. A fifth reverse circulation drill rig was added to the drilling program in December.

Core drilling has occurred sporadically throughout the development drilling project, and conventional circulation drilling for waste dump condemnation has been ongoing since September, 1987. Currently at the Cove, there are three conventional circulation drill rigs operating one shift per day, five reverse circulation drill rigs operating two shifts per day, and three core rigs operating two shifts per day.

Highlights of the development drilling include drill holes COV-235 (Fig. 4.) which had an intercept of 715 feet averaging 0.056 opt gold and 4.21 opt silver, and COV-248 which encountered 330 feet of mineralization averaging 0.319 opt gold and 5.28 opt silver.

Mining, Leaching, Milling and Reserves

Initial Cove production is scheduled to begin in February, 1988, from an open pit mine with the gold and silver recovered by heap leaching. The ultimate mine plan for the Cove deposit cannot be completed until development drilling is finished. However, a preliminary mine plan for the Cove deposit was completed in November, 1987. Pioneering work on the haul road system began in mid December, and limited mining operations began in early January. Full scale mining operations are scheduled to begin in early February at 50,000 tons per day. The first ore from the Cove deposit will go onto the leach pad in mid February, only one year and one month after the first exploration hole was drilled.

Metallurgical work and mill design are currently underway. Mill construction is scheduled to begin in 1988 with completion in 1989. The current plans call for a mill capacity of 5,000 tons per day.

Only a geological estimate of the reserves is possible at this time. As of December 1987, the geological resource is estimated to contain 4 million ounces of gold and 250 million ounces of silver. The estimated tonnage is from 60 to 70 million tons grading 0.065 opt gold and 3.5 opt silver. A final reserve estimate will have to come after the deposit is drilled out, and metallurgical work, and a mine plan are completed.

ACKNOWLEDGEMENTS

Appreciation is extended to the management of Echo Bay Mines for permission to present and publish this paper, particularly in light of the brief time since the discovery of the Cove. The continuous support and funding of the McCoy District exploration and exploration drilling are greatly appreciated by all who have worked on the project. Special acknowledgement is extended to Jeff Edwards, geologist, who helped collect the data leading to the Cove discovery.

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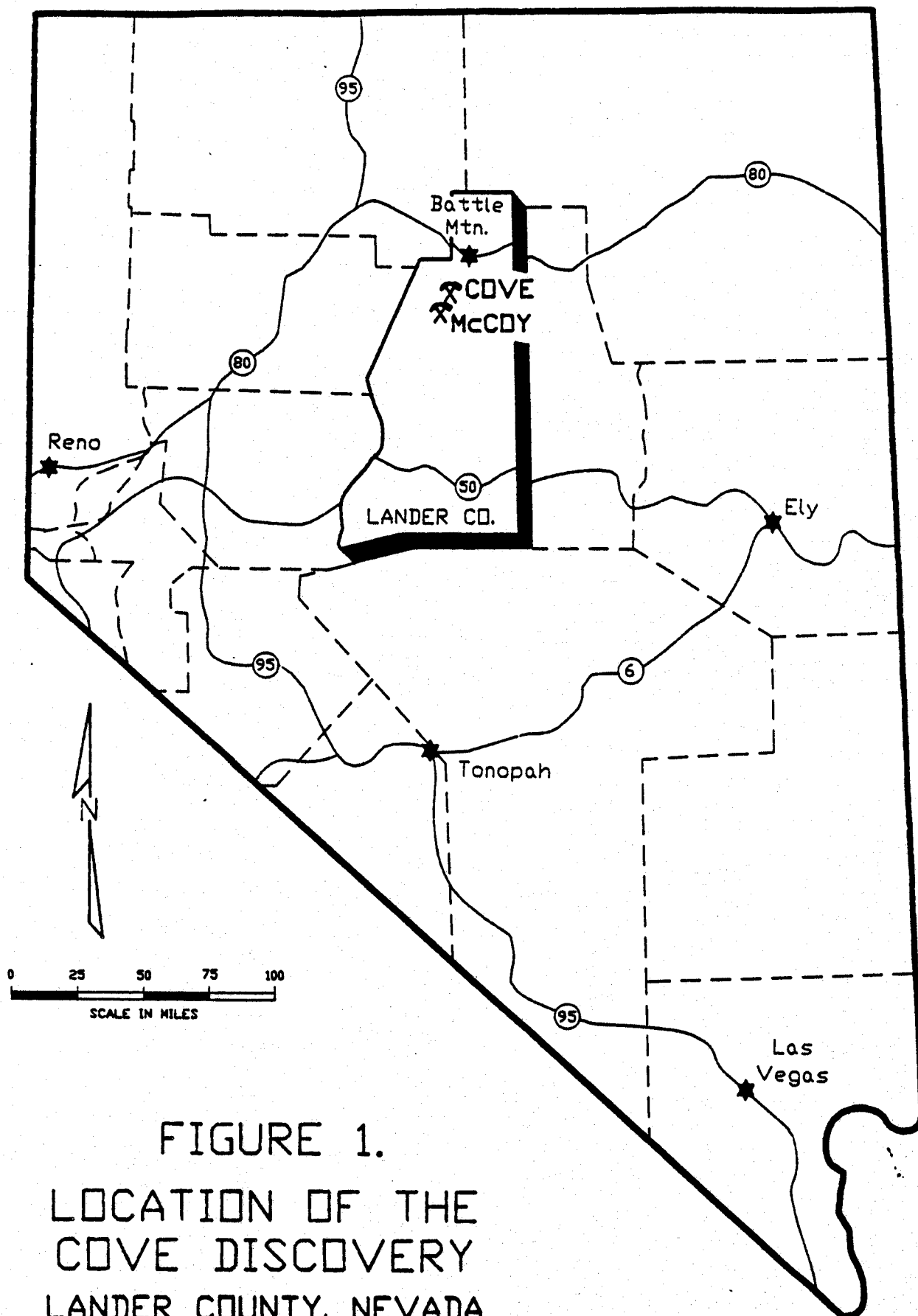


FIGURE 1.
LOCATION OF THE
COVE DISCOVERY
LANDER COUNTY, NEVADA

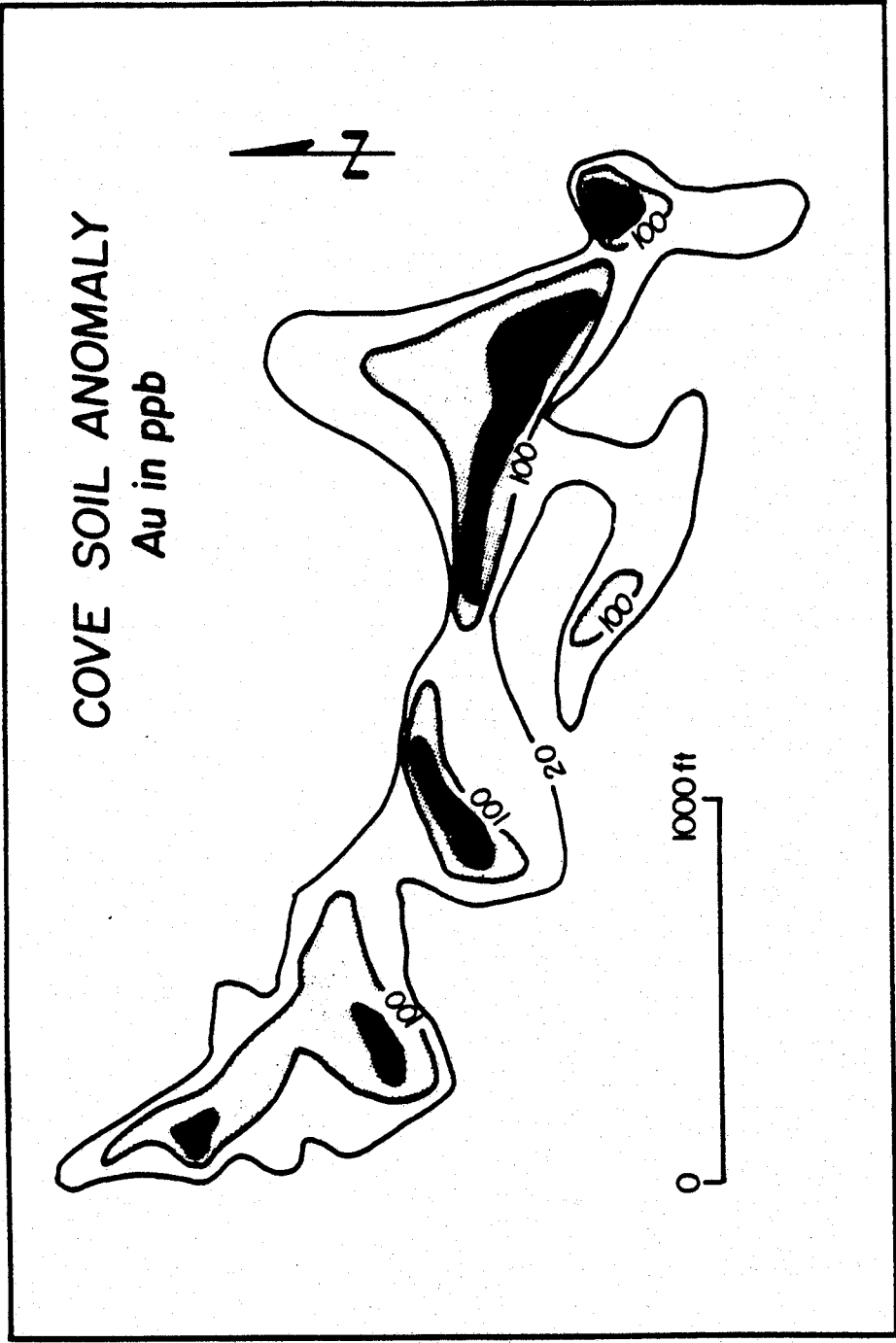


FIGURE 2. Cove gold soil anomaly. Black areas are from 500 to 2600 ppb gold.

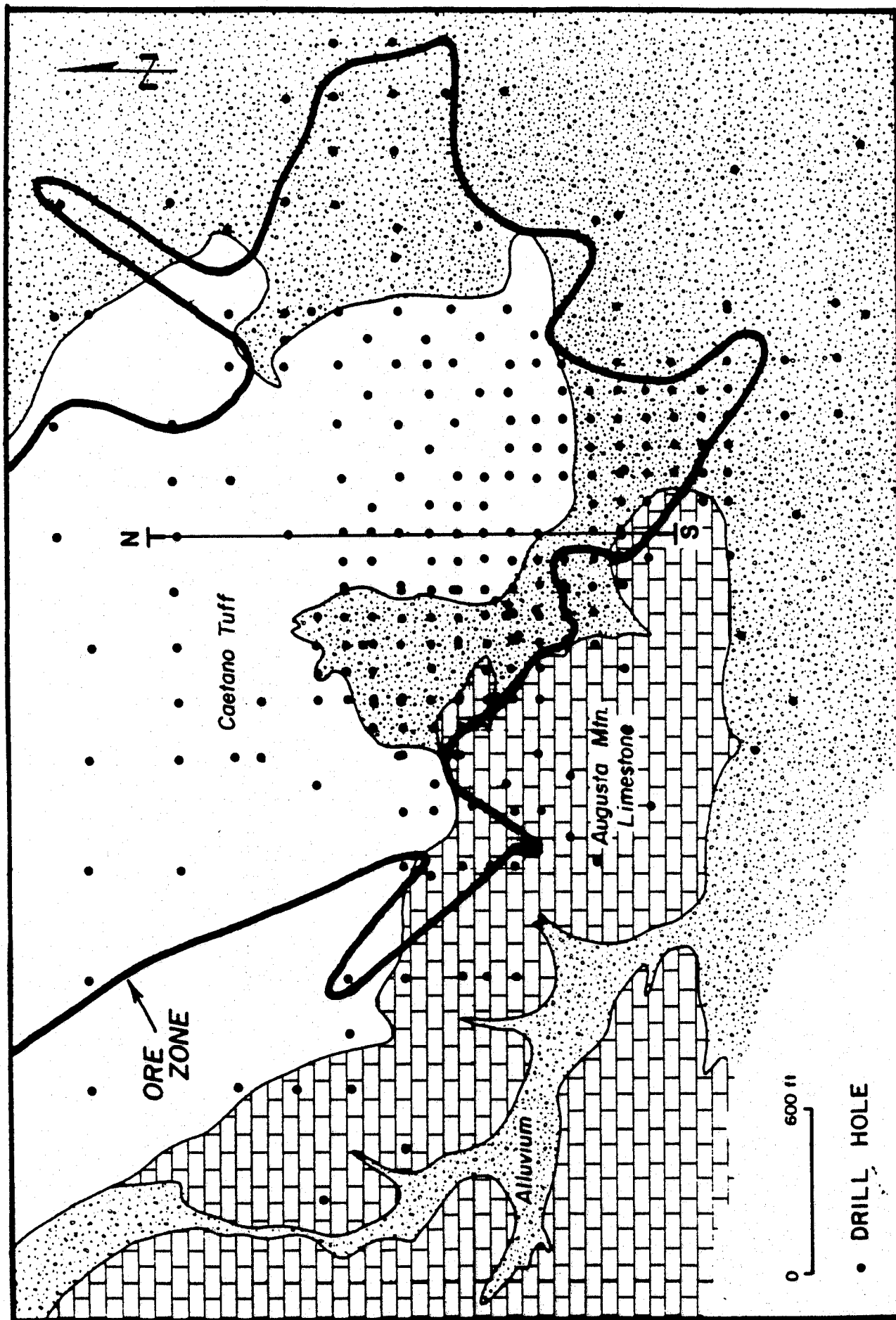


FIGURE 3. Geologic map of the Cove area, showing the surface projection of the ore zone (heavy black line). The ore zone outline is based on the 3.0 ft - opt equivalent gold, grade thickness contour.

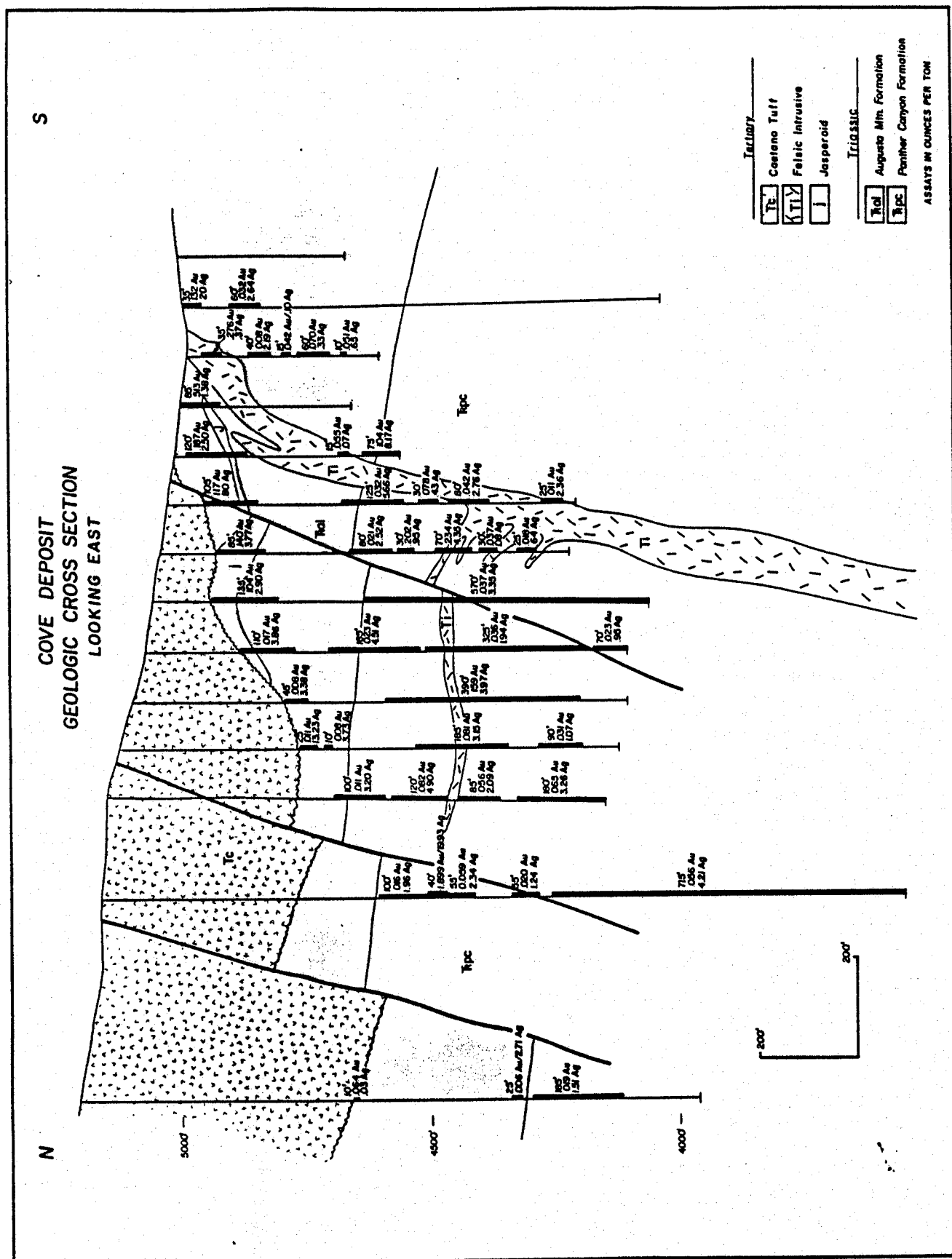


FIGURE 4. Geologic cross section of the Cove deposit, showing drill holes and mineralized intervals. See Figure 3 for location of cross section.

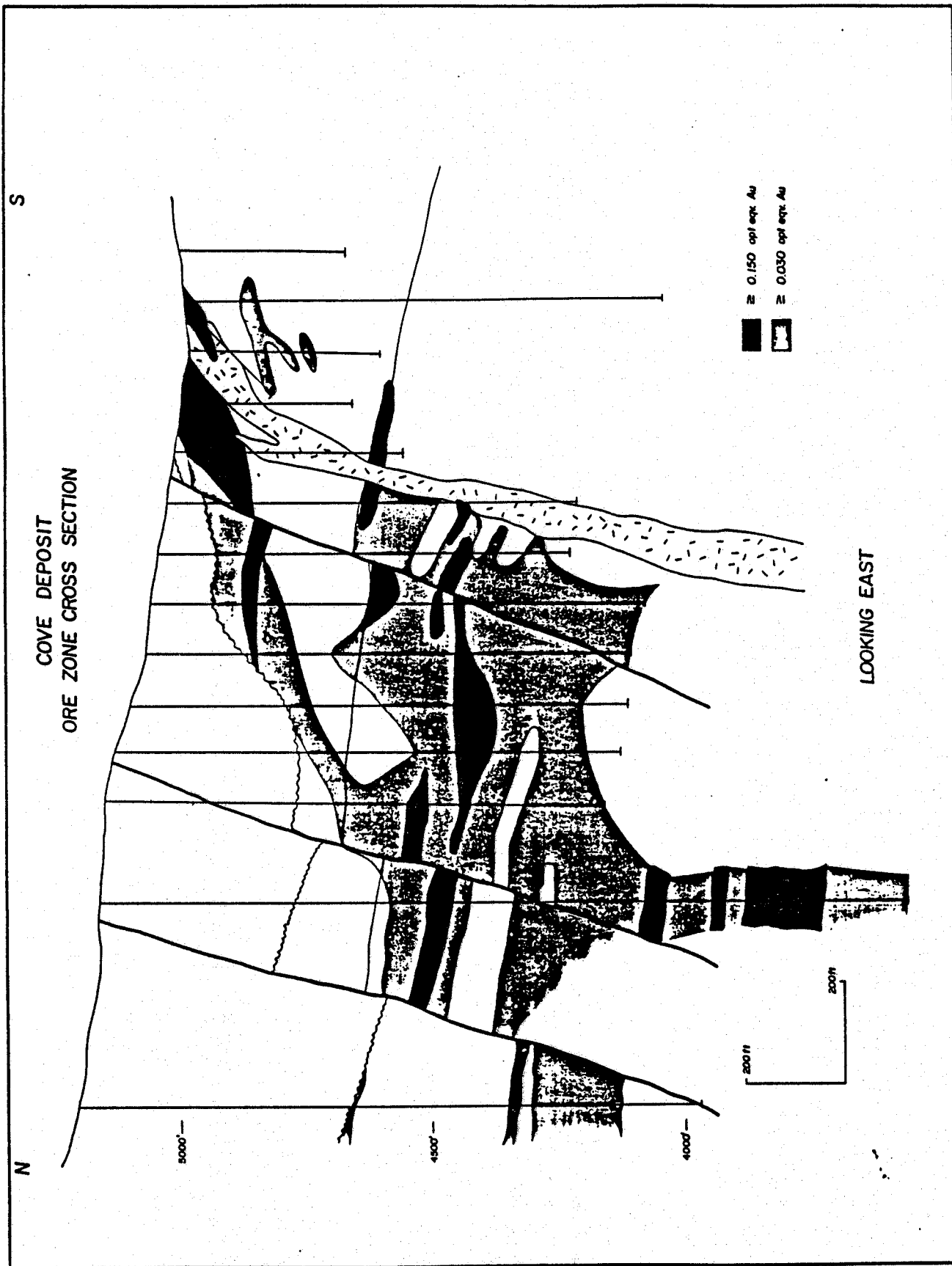


FIGURE 5. Ore zone cross section of the Cove deposit (same section as Figure 4.). Gold equivalency (eqv.) is calculated by converting silver to gold equivalent at a ratio of 55 to 1 (approximation of the typical silver-to-gold price ratio).