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COMMODITY If not obvious	Gold
NOTES 45 pp	Exploration report; geochemistry; geology; production; geochemical maps

Keep docs at about 250 pages if no oversized maps attached (for every 1 oversized page (>11x17) with text reduce the amount of pages by ~25)

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SURFACE AND DRILL HOLE GEOCHEMISTRY OF THE GILBERT PROJECT, NEVADA

L. W. Ashton

January, 1984

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SUMMARY

The Gilbert prospect may be divided into seven topographic areas that have distinct geochemical associations. These associations appear to indicate at least four alteration events, two of which had anomalous concentrations of Au and Ag.

Jasper Hill, Tungsten Hill, and the western area have Au as part of their geochemical signature. Of these three, only the western volcanic and sediment hosted area has the characteristic epithermal Au deposit geochemical signature.

The jasperoids, Palmetto gray limestone, Tertiary calcareous siltstone and Tertiary tuffs have similar anomalous concentrations of Au and Ag in both surface and drill hole rock chip samples. There does not appear to be the necessary "concentrating mechanism" for an epithermal Au deposit.

RECOMMENDATIONS

Regionally, Gilbert was part of (a) massive hydrothermal event(s) with multiple silicification phases, two of which carried anomalous gold and silver. Further exploration effort should focus on the geologic determination of whether or not favorable pressure, temperature and lithologic conditions for a disseminated gold deposit exist in the Monte Cristo Range.

INTRODUCTION

Located in the eastern part of the Monte Cristo Range in Esmeralda County, Nevada, 25 miles west of Tonopah, the Gilbert Prospect is an old silver mining district that had a short-lived boom in 1924. See Figure 1 for a location map. Total production from veins was small, 4465 tons - $104,960 (Albers and Stewart, 1972). In 1978, Anaconda began evaluation of the Mo-Cu porphyry potential of the property. Then in late 1981, the numerous jasperoids were recognized as favorable features of Carlin-type disseminated gold deposits. From 1982 to present, all work has been concerned with the newer target concept. Western District geologists J. Raney, G. Wilson and M. Zdepski have been involved with the collection of 522 soil, 1032 surface rock chip, and 1740 drill hole rock chip samples (Holes 8-35 minus 15, 16, 19) over the last five years. Reconnaissance stream sediment sampling was performed by the Geochemistry group as part of the 1981-2 Gold Generative program. Anne Fiedler processed the entire data base on the computer and generated all statistics and maps.

Geologically, the area is mainly underlain by volcanics and sediments of mid to late Tertiary age. There are also outcrops of a Jurassic quartz monzonite and the Ordovician Palmetto Formation, a dominantly black shale which locally contains abundant chert, limestone and siltstone. Thrusting and Basin and Range faulting have occurred. Known mineralization includes the Ag-Pb quartz veins in Palmetto Formation at the Carrie Mine (eastern part) and the Au quartz veins along the major western structure in both the Palmetto Formation and Tertiary volcanics. For more detailed discussions of the geology, see reports by G. Wilson (1979-80), J. Raney (1981) and M. Zdepski (1982-83).

SURFACE GEOCHEMISTRY RESULTS

Stream Sediment

During the 1981-1982 Gold Generative Geochemistry program, 89 stream sediment samples were collected from the Monte Cristo Range (Stanley et al., 1982, Ashton,

L. W., 1983). Summary statistics for the eleven-element suite are presented in Table I. The 90th percentile level was considered as anomalous to avoid mathematical biasing. Overall, the Monte Cristo Range appears to be a favorable environment for disseminated gold deposits. Using the statistical technique of factor anlysis to investigate element associations, the Range has a strong As-Hg-Au factor (See Appendix I for a discussion of statistics). These three elements are the typical association for a Carlin-type deposit. Four samples were taken in the project area and are also listed in Table I, with locations presented in Figure 2. Samples 3073 and 3361 reflect the known gold and silver mineralization of the Last Hope, Mammoth, Monte Cristo, and Gilbert veins with anomalous Au, Ag, As, Mo, Pb and Zn. Silver-lead mineralization at the Carrie Mine is evident in contaminated sample 4820 with highly anomalous Ag, Pb, Cu and Zn (maximums for the range), Mo and Au. The southernmost sample, 4810 has anomalous Au, Hg, Cu, and Mo which may reflect contamination from the Norman Mill and/or mineralization.

No single sample has the desirable triple Au-As-Hg anomaly characteristic of disseminated gold deposits. This may be partially due to the multi-composite sampling design and/or contamination. Because of this, Gilbert would not have been selected for follow-up in the stream sediment reconnaissance program.

Soil

From 1981 to present, 522 soil samples have been collected by Western District personnel. Earlier samples were analyzed by Bondar-Clegg Laboratory, Vancouver, British Columbia and later ones by Bondar-Clegg Laboratory, Lakewood, Colorado with the element suite changing over time. All data are listed in the raw data listing in the separate data book. Laboratory standards were not included in the batches; therefore, no specific assessment of accuracy or precision may be made. Arsenic was found to be high in some drill hole batches and very high As values are suspect. See Appendix III for further discussion.

The soil data exhibit some variance due to different sample preparation procedures. All soils were sieved by Western District personnel to obtain the +80 - -35 mesh size fraction. Then at Bondar-Clegg, some of the samples were sieved again to obtain the -80 mesh size fraction, while others were crushed to -100 mesh. Resieving generally lowered the analytical values, sometimes to below detection level. Overall, Ag, Hg, and Ba appear unaffected because of the variance due to analytical error. Cu, Pb, Zn, Au and As were affected variously, partially dependent on parent rock type. For the -80 treatment, Sb was reduced to below detection level in the majority of samples. See Appendix II for further discussion.

The soil means and standard deviations divided by mapped parent rock type are presented in Table II. The epithermal suite - Au, Ag, As, Hg and Sb was determined for every sample with base metals for selected samples. The soils formed from volcanic rock are a distinct population with lower elemental means except for Hg, which is elevated. Since all jasperoids were originally Palmetto formation, the similarity of elemental means among the other three parent rock types is expected.

In 1981, three soil variability tests (30 samples) were collected in the Palmetto formation at the Castle Peak Mine, a Hg occurrence four miles south of Gilbert (L. W. Ashton, 1983). The overall means in ppm were:

Au	Ag	As	Hg	Sb	Cu	Pb	Zn
.012	.5	30	.469	8	27	15	51

Overall, the Gilbert Palmetto soils contain about twice as much Au and Pb and are enriched in Ag, As, Cu, and Zn relative to those at Castle Peak. Minimally, these data reflect the known mineralization of the gold and lead-silver veins at Gilbert.

The soil raw data along with symbolic Z-scores based on lithology are presented in plates 1-10. Z-scores are standard deviation levels with a level of 1 or greater considered anomalous. See Appendix I for a discussion of statistics. Because of the additional variance in the soil data, interpretation was based on the rock chip geochemistry. Generally, the soils and the rocks present the same spatial elemental patterns. Differences appear to be the result of dissimilar ground coverage, soil formation processes, and the laboratory problem.

Rock Chip

From 1979 to present, 1032 rock chip samples have been collected by Western District personnel. Earlier samples were analyzed by Bondar-Clegg Laboratory, Vancouver, British Columbia and later ones by Bondar-Clegg Laboratory, Lakewood, Colorado with the element suite changing over time. All data are listed in the raw data listing in the separate data book. Laboratory standards were not included in the batches; therefore, no specific assessment of accuracy or precision may be made. The documented high bias for As values for some drill chip batches cast doubt on any extremely high As values.

The rock chip means and standard deviations by lithology are presented in Table III. There are 25 different lithologies, but the various units of the mid-late Tertiary tuffs, quartz monzonites, Gilbert tuffs, and mid-Tertiary ignimbrites were grouped together for summary purposes. Since the Palmetto formation would be the likely host rock for a Carlin-type deposit, these facies were not lumped. Original lithology, color, alteration type, structure present, pre-jasperoid type rock, and field notes are listed by individual sample in the raw data listing. Overall, the elevated levels of Au, Ag, As, Sb, Hg, Pb, Mo and Cu reflect minimally the known mineralization in the district.

H. G. Ferguson (1927) theorized that there were two different periods of mineralization: (1) a Mesozoic event resulting in the Ag-Pb quartz veins in the Palmetto formation at the Carrie Mine, and (2) a Tertiary event resulting in Au quartz veins in both the Palmetto formation and the Tertiary volcanics. The jasperoids (all originally Palmetto) appear to show evidence of both periods by having the overall maximum Ag and Pb means, and then the highest Palmetto group Sb and As means along with an Au mean of .116 ppm. This data suggests that the pervasive silicification was the result of more than one event. Ferguson believed the Ag-Pb veins were related to the intrusion of the quartz monzonite. AMCO sampling reveals maximum As, Sb, Cu and Mo means with elevated Ag, Pb, Hg and Au means for the quartz monzonite implying strong alteration. The monzonite itself being altered would place the Ag-Pb mineralization at a later time than the Mesozoic. The model concept would also change from the veins being a late stage differentiate of a magma to the quartz monzonite-Palmetto contact being a geochemically reactive area.

Plates 11-25 present the surface rock chip sample locations and posted raw element data with symbolically coded Z-scores by lihtolpgy. Z-scores are standard deviation levels with a level of one standard deviation regarded as anomalous. See Appendix I for a discussion of statistics. All threshold values are high because of the known mineralization in the district.

Gilbert can be divided into seven geochemically distinct topographic areas. See Figure 2 for sample locations and Figure 3 for a summary schematic diagram. Each area did not have a complete element suite and some areas had no base metal determinations at all. An element is included in the major association if more than 10 samples were anomalous in the area. Minor associations have 5-10 anomalous samples.

The Jasper Hill area has the most Au and Ag anomalies (34 and 26 respectively) with other major elements being As, Hg, F, Mo and Zn and minor elements Cu, Mn, Sb and W. This area is interpreted as having been affected by both the known mineralizing events plus one alteration event. In the field, a quartz sericite alteration around veins is observed plus two sets of cross-cutting quartz veins. One geochemical signature appears to be the distal, more mobile elements from the Ag-Pb vein event and the other, the Au event itself. As indicative of the Ag-Pb event, the quartz monzonite has, in order of abundance, anomalous F, Mn, As, Mo, Zn, Cu, W and Au. The jasperoids and Palmetto show effects of both mineralizing events. The jasperoids have greater than fifty percent more anomalies than the Palmetto in Cu, Hg, Zn, Mo and Ag; more in Au and As, equal in W, and less in Mn and Sb. This abundance pattern gives a general idea of what elements were enriched in the silicic alteration for both events. Because remobilization of elements from the Ag-Pb event probably occurred during the Au event, the two events are not geochemically distinct.

While the rock chip samples show evidence of both mineralizing events, there is no surface expression of an epithermal Au event. Anomalous Au, Ag, and As are part of the geochemical signature from both mineralizing events. The jasperoids are the most enriched rock type in these elements, but not to an economic degree; the Palmetto too shows enrichment. The jasperoids have the most Hg anomalies but the least Sb anomalies. The Palmetto has equal amounts of both element anomalies. Spatial zonation of any of the elements is not apparent. In general, the base metal and W anomalies suggest this area was at a deeper and/or hotter part of a hydrothermal system than what is postulated for a Carlin-type deposit.

The Tungsten Hill area has the second most Au and Ag anomalies (12 and 16 respectively). The other major elements are Hg, As, Sb and W with minor elements being Mn, Pb, Cu, F, Zn, Ba and Bi. Compared to the Jasper Hill area, the large decrease in Au and As anomalies, smaller decrease in Ag anomalies, the increase in W anomalies, and the presence of Pb and Bi anomalies suggest that effects of the Ag-Pb mineralizing event are much stronger in this area with no evidence of the Au event. The Palmetto has greater than fifty percent more anomalies than the jasperoids in all elements. The large increase in Hg and Sb anomalies with the presence of Ba anomalies is interpreted as being the result of another alteration silicification event. The quartz-sericite alteration and cross-cutting quartz veins are observed in the field. The quartz monzonite and jasperoids are enriched with Hg and Sb with the Palmetto having the Ba anomalies.

The surface samples of this area do not have the geochemical signature of an epithermal Au event. The Au and As anomalies appear to be mainly associated with the Ag-Pb vein event. The presence of Pb and Bi anomalies, absence of Mo anomalies and decrease of F anomalies along with element zonation suggest that this area was closer to the source of the Ag-Pb event than Jasper Hill. Au, As, Zn, and Mn cluster on the northwest with Pb and Ag on the northeast and southwest Bi is on the northeast, W southeast and F to the southwest. As Tungsten Hill is about a mile and a half west of the Carrie Mine, the Ag-Pb system appears to have been quite extensive with more than one vent or source. The other alteration event is characterized by the Ba, Sb and Hg anomalies. Zonation is also present with these elements. The Hg and Sb surround the Ba in the center of the hill. Sequencing of events cannot be established from the data available.

No other areas have Au as a major anomalous element and only the volcanic-hosted and southwest area has Au as a minor anomalous element. Sb and Hg are the major anomalous elements but no base metal analyses were done in this area. Alunite from here has been dated at 7.4 million years establishing this as contemporaneous with the dated Tertiary Au veins. There is no field evidence of any other silicification event. Anomalous Au, As, Sb and Hg are present in the northern volcanics and also in the southern Palmetto calcareous siltstone. This sedimentary rock is of a favorable lithology for a Carlin-type deposit. The volcanic-hosted and southwest area have the most potential for an epithermal Au deposit.

Of the other four areas, three have Ag as an anomalous element. The Carrie Mine area has As, F and Ag as major elements and W, Mn, Cu, Ba, Zn, Mo, Bi and Pb as minor elements. Both mineralizing events appear to have affected this area. Au was close to being a minor anomalous element with four anomalies instead of the requisite five in the Palmetto and quartz monzonite. Generally, the jasperoids carried very few of the anomalies except for Ag and As. This data implies that this area was the farthest from any of the silicification/mineralizing sources. As compared to Jasper Hill, the presence of Bi and Pb, increase in W and decrease in Mo suggest the source of the Ag-Pb vein event was closer than the Au event. The quartz monzonite and Palmetto are equally enriched in the base metals. The reduced level of anomalies and lack of zonation indicate little potential for any disseminated gold mineralization.

Hill 6968 has Ag and As as minor anomalous elements with Hg, Sb and Ba, the majors. No base metal determinations were made in this area. The jasperoids have more of the anomalies than the Palmetto. Effects of the Ba-Sb-Hg silicification event are dominant with some distal signature of one of the mineralizing events. The As anomalies are to the north and the Ba-Ag to the south. This separation is more suggestive of the Ag-Pb vein event. Nothing in this area implies any mineralization potential.

The Black Mammoth vein area from which Au was produced has As and Ba as the major anomalous elements with Ag, Cu and Hg, the minors. The tuffs have the majority of the As anomalies while the Palmetto has the most Ba. Hg and Ag are split evenly between the two rock types with Cu split between the Palmetto and the quartz monzonite. There does not appear to be any geochemical signature of the known Au vein mineralization. This may be due in part to the sporadic sampling of this area.

The last area, the "Great White Jasperoid" and south is barren of any precious or base metal anomalies. Hg is the major anomalous element with minor Ba and F. This may represent a fourth silicification event, or a more distal effect of the Hg-Sb-Ba event.

DRILL HOLE GEOCHEMISTRY RESULTS

Only the complete lithologic and assay data from holes 8-35 excluding holes 15, 16 and 19 will be considered in this section (1740 samples). The other drill holes have various missing data. Bondar Clegg, Lakewood performed most of the analyses. Laboratory standards were included in the 1982 and 1983 batches. Details on accuracy and precision may be found in Appendix III. Analytical error was about 16% for Au, 22% for Ag less than 5 and 10% for higher Ag, 30% for Sb less than 15 and 10% for higher Sb. Arsenic had about 12% analytical error for the earlier part of 1982. Then during winter 1982 - 1983, the error rose to 36%. Arsenic values within report 53-211 and 53-

216 were definitely inconsistent. Three blanks (Sn 312179, 312207, 312208) had As values of 23 ppm, 530, and 420 ppm respectively. A selected 38 samples from batches 53-211 and 53-216 were re-analyzed by Tucson Analytical Laboratory (details in Appendix III). Of the 38, 16 had values that dropped from the hundred's range to the ten's range (Batch 53-216). The Bondar Clegg mean for the 16 samples was 321 ppm As and Tucson's 37 ppm As. A further examination of earlier reports revealed possible errors occurring as early as March, 1982. Any extremely high As values should be regarded as suspicious.

The elemental means and standard deviations for the drill hole data by lithology are presented in Table IV and a raw data listing by drill hole in the data book. The only statistically significant differences between the surface and drill hole samples are that Ag has higher values in the surface jasperoids (mean 4.6 ppm vs. 2.0 ppm) and As has higher values in the drill hole chips of Palmetto white limestone (mean 157 ppm vs. 86 ppm). The Jasper Hill surface jasperoids with a mean of 6.3 ppm Ag are responsible for the difference which is expected as the Carrie Mine is located in this area. No drill holes are near the Carrie. The As difference may be in part a reflection of laboratory error. However, "biased" sampling of the white limestone accounts for the majority of the difference. Surface samples were from all over the property, but the drill hole samples are just from Jasper Hill which is very anomalous in arsenic.

Using the same technique of anomaly cluster analysis by the already designated surface topographic areas, the Jasper Hill area again has the most Au and Ag anomalies (34 and 24 respectively) with As as a major element association. Compared to surface data, Sb changed from a minor element to a major element mainly because of the increase in anomalies in the jasperoids. Without any base metal determinations, no further enhancement of interpretation is possible. The drill hole data are consistent with the surface data: there appears to be the Au overprint of two mineralization events with no economic Au concentration.

The volcanic-hosted and southwest area has the second most Au anomalies (15). Incomplete data for the northern drill hole volcanics is responsible for the disappearance of Sb and Hg as major elements and the appearance of As as a minor element. The jasperoids and the Palmetto calcareous siltstone carry the majority of gold anomalies as expected from surface data. However, the high Au intercepts of DH 34 (1.850 ppm highest) do not appear in DH 35, 200 feet away. No elemental zonation is apparent from hole to hole. While the lithologies are more favorable for a Carlin-type deposit, there is no suggestion of any concentrating mechanism to form such a deposit.

The next area to have Au as a minor element is Hill 6968 with Ag and As as major elements which is a change from the surface minor As and Ag and no Au association. The change is the result of the greater amount of Palmetto black siltstone drilled (172 samples) rather than surface sampled (15 samples). The drill hole Au mean of .065 ppm, Ag mean of 2 ppm, and As mean of 223 ppm for this rock type appear to be the distal effects from one of the mineralizing events. Without any base metal analyses, which event cannot be determined.

The Tungsten Hill area still has anomalous Au and Ag but the elements dropped from the major association to the minor. The Palmetto siltstone still has most of the Ag anomalies, but the quartz monzonite has most of the Au. These data are consistent with those of the surface data in that only the effects of the Ag-Pb mineralizing event are indicated with the Au-Ag anomales decreasing with depth and the Au anomalies appearing in the quartz monzonite.

The last area with complete drill hole information Black Mammoth vein has Ag changing from a minor to major element. This change resulted from the black siltstone being encountered in drilling but not in surface sar surface sampling, there is no geochemical signature of the Au vein event.

Limited mineralization potential is inferred because the surface ar samples being geochemically indistinguishable. As is already known, the intercepts are sporadic and small which are consistent with surface e: surface base metals were analyzed, the geochemical associations sugge: deeper conditions than those postulated for a Carlin-type deposit. The c not disagree with this. No base metals were determined in the volc southwest area which surfically appeared to have potential for an epither The drill hole data had some anomalous Au, but no concentrating mech for an ore deposit appears to be present. The current geochemical rocl does not indicate an epithermal Au deposit in any of the sampled areas.

CONCLUSIONS

The surface rock chip data present the fullest picture of the geochemistry at Gilbert. Topographically, the prospect can be divided into seven geochemical provinces based on major (greater than 10) and (greater than 5) minor lithologic elemental anomaly clusters. All provinces were affected by massive multiple phase silicification, two phases of which carried anomalous Au and Ag. One of these Au-Ag phases was the dated Tertiary episode that formed the known Au producing veins and the other was the distal effects of an episode that formed the known Ag-Pb producing veins of the Carrie Mine. There also appears to be a Ba-Sb-Hg rich episode Hill 6968 and possibly, a Hg-Ba-F rich episode (Great White Jasperoid). However, these two areas may also represent different erosional levels of the same episode.

The Jasper Hill area with the most Au and Ag anomalies appears to have been affected by silicification from both mineralizing events and at least one barren event. The only other area to show evidence of the Tertiary Au event is the volcanic-hosted and southwest area. Surficial sampling of the actual Au vein area appeared to show effects of the base metal mineralizing event. Tungsten Hill with the second most Au and Ag anomalies also seemed to have been affected by silicification associated with the base metal mineralization episode and at least one barren episode.

The stream sediment, soil, surface rock chip and available drill hole data do not suggest an epithermal Au deposit in any of the sampled areas. In the middle to eastern part of the project area, only Jasper Hill appears to show strong evidence of the Tertiary Au event but the geochemical associations suggest conditions hotter and/or deeper than those postulated for a Carlin-type deposit. The volcanic-hosted and southwest area has definite evidence of the Tertiary Au event, but no concentrating mechanism necessary for an ore deposit apparent in the southern sediment hosted portion. The northern volcanic area cannot be evaluated at this time as drill hole data are not complete.

Regionally, Gilbert was part of (a) massive hydrothermal event(s) with multiple silicification phases, two of which carried anomalous gold and silver. Further exploration effort should focus on the geologic determination of whether or not favorable pressure temperature, and lithologic conditions for a disseminated gold deposit exist in the Monte Cristo Range.

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APPENDIX I

Statistics

The mean, standard deviation, and z-score are all descriptive statistics in that the actual sample is described. The mean is a measure of central tendency. The standard deviation is a measure of dispersion or the amount of scatter about the central point. The z-score is a ranking of the scatter that an individual sample represents. Z-scores are normalized measures with means of 0 and standard deviations of 1. Since z-scores are dimensionless, this measure can be used to make comparisons between variables.

The t-test is an estimation of whether two groups of samples were drawn from the same parent population or not. Some variation between the two groups is expected due to the natural variability of the population. For small groups (n .30), the groups' standard deviation may not be reflective of that of the parent population. The t statistic measures the group variation. The actual value of t then is compared to a probability table of t's for the particular number of samples. This table gives the probability of the variation being large enough to indicate two parent populations.

Factor analysis is a data reduction method where factors are linear combinations of the original variables. These factors are weighed proportionally to the amount of total variance among data are mainly the results of some underlying regularity (common determinants in the data). The determinants will not only account for observed relations in the data but will be smaller in number than the original variables. Each variable may still retain some variance that is unique and not accounted for by the factors.

The two steps in factor analysis are the preparation of the correlation matrix and extraction of the initial factors. The correlation and factor matrices for the reconnaissance Monte Cristo stream sediments are presented in Table V. The factors extracted were the principal components or exact mathematical transformations of the original variables. The coefficients in the factor matrix represent both correlation coefficients and regression weights. For example, in Table V, the correlation between Factor 1 and Cu is .82, and between Factor 2 and Pb -.26. In terms of regression weights, the variable Cu could be totally expressed as (.82 x Factor 1) - (.26 x Factor 2) - (.10 x Factor 3) + (.11 x Factor 4) + (.06 x Factor 5) -(.32 x Factor 6) - (.20 x Factor 7) + (.22 x Factor 8) + (.10 x Factor 9) - (.13 x Factor 10) - (.16 x Factor 11). The factor coefficients are used with the normalized input variables to calculate factor scores for each sample. For example, a Factor 1 score would be (.82 x Cu) + (.84 x Pb) + (.86 x Zn) + (.56 x Mo) + (.72 x Ag) + (.25 x Mn) x (.23 x Fe) + (.25 x F) + (.21 x As) + (.22 x Hg) + (.32 x Au). Whether a score is positive or negative depends on the combination of all components. These factor scores can then be plotted to detail where the effects of a particular factor are strong or weak.

Since the input variables are geochemical element values, the common determinants most likely will be the effects of geochemical processes. These processes could either be active in the past (rock formation, mineralization) or could be presently active (supergene mobility of elements). The more variance that a factor accounts for, the more dominant that factor is.

The factor that is usually most dominant is associated with the overall geochemical nature of the samples. Here Factor 1 is the major association of Cu-Pb-

Zn and the minor associaiton of Ag and Mo. Generally, it is not possible to predict a priori which processes will be represented in the factors. Once the variables most associated with the factors are known, it can be inferred which process is represented. Factor 2 is the major association of Au, As and Hg which is the typic geochemical signature of epithermal gold deposits. However, this factor does not necessarily indicate mineralization, as this could just be alteration. Factor 3 is the strong association of Fe and Mn which would seem to be supergene processes active in the modern environment.

Appendix II

Soil Sample Preparation Procedures

The results of the crushing of the soil samples to -100 mesh were compared to the resieving to -80 mesh by the statistical technique of the Student's t-test. This method compares the means of two groups and estimates whether these groups could have been sampled from the same parent population. See Appendix I for a more detailed statistical discussion. Table VI presents the probability of Student's t for all elements by mapped rock type. When the probability is less than .10, the resieved -80 mesh soils cannot be considered as from the same population as the crushed -100 mesh soils. The elemental means for both groups are then presented.

For the jasperoid parent rock type, all elements but As, Ag, Hg and Ba are unuseable. While the mean differences may be legitimate because of spatial location, the change due to sample preparation procedure is an unquantifiable variable that cannot be ignored. The limy Palmetto soils were the next most affected, then the silty Palmetto, with the volcanic soils, the least affected. Selected data from these groups might be useable. However, since jasperoid soils are present throughout the project area, the task of separating the seemingly unaffected data is too time-consuming for the possible benefit derived.

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Appendix III

Laboratory Accuracy and Precision

Drill Hole Rock Chip Samples

Three different laboratory reference materials were submitted with the 1982 drill hole rock chip samples. Two were prepared from selected 1979 Summitville drill hole samples (Hole 5 - interval 45 and Hole 6 - interval 10) by Skyline Laboratories, Denver and one from a Gilbert drill hole sample (Hole 16 - interval 85) by the Western District sample preparation facility. All were ground to -200 mesh, blended and split. Data relating to accuracy and precision are presented in Table VII with raw data listed in the data book.

Overall Au and Ag accuracy and precision appears within acceptable limits. Since the Au expected values for the Summitville materials were determined with a different sample size and analytical technique than what was used with the routine drill hole samples, a direct Au comparison cannot be made. However, the smaller sample size having a higher mean is to be expected as is the lower standard deviation for the lower fire assay - AA reference compared to the fire assay standard deviation and the higher standard deviation for the higher fire assay - AA reference. The fire assay - AA method is more precise for lower Au contents (1 ppm or less) and fire assay, more precise for higher Au contents.

The As and Sb accuracy cannot be evaluated directly as there are no expected values. Sb has acceptable precision but As does not. The Bondar-Clegg original As values along with the Tucson reanalyses for batches 53-211 and 53-216 are presented in Table VIII. The two laboratories data for Bondar-Clegg batch 211 and the first part of batch 216 are fairly consistent. However, the Bondar-Clegg data for the last part of batch 216 is definitely in error. The Tucson laboratory re-checked their values and these lower values would be more consistent with the lithologic data.

Re-examining all the As values from Bondar-Clegg laboratory batches reveals other "runs" of high analyses for most of the batches. The reference materials are not always placed in or near these high "runs" and thus cannot indicate the extent of possible laboratory errors. The drill hole variability test data (L. Ashton, 1983) also documented definite problems with erratic As falues. The 1983 field season precluded any further investigation of this As problem. In general, any As value over 200 ppm should be regarded as doubtful.

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Drill Hole Rock Chip Samples

Three different laboratory reference materials were submitted with the 1982 drill hole rock chip samples. Two were prepared from selected 1979 Summitville drill hole samples (Hole 5 - interval 45 and Hole 6 - interval 10) by Skyline Laboratories, Denver and one from a Gilbert drill hole sample (Hole 16 - interval 85) by the Western District sample preparation facility. All were ground to -200 mesh, blended and split. Data relating to accuracy and precision are presented in Table VII with raw data listed in the data book.

Overall Au and Ag accuracy and precision appears within acceptable limits. Since the Au expected values for the Summitville materials were determined with a different sample size and analytical technique than what was used with the routine drill hole samples, a direct Au comparison cannot be made. However, the smaller sample size having a higher mean is to be expected as is the lower standard deviation for the lower fire assay - AA reference compared to the fire assay standard deviation and the higher standard deviation for the higher fire assay - AA reference. The fire assay - AA method is more precise for lower Au contents (1 ppm or less) and fire assay, more precise for higher Au contents.

The As and Sb accuracy cannot be evaluated directly as there are no expected values. Sb has acceptable precision but As does not. The Bondar-Clegg original As values along with the Tucson reanalyses for batches 53-211 and 53-216 are presented in Table VIII. The two laboratories data for Bondar-Clegg batch 211 and the first part of batch 216 are fairly consistent. However, the Bondar-Clegg data for the last part of batch 216 is definitely in error. The Tucson laboratory re-checked their values and these lower values would be more consistent with the lithologic data.

Re-examining all the As values from Bondar-Clegg laboratory batches reveals other "runs" of high analyses for most of the batches. The reference materials are not always placed in or near these high "runs" and thus cannot indicate the extent of possible laboratory errors. The drill hole variability test data (L. Ashton, 1983) also documented definite problems with erratic As falues. The 1983 field season precluded any further investigation of this As problem. In general, any As value over 200 ppm should be regarded as doubtful.

TABLE I

Summary Statistics - Stream Sediment

Monte Cristo Range (89 samples)

Elements (ppm)

Statistic	Cu	Pb	Zn	Mo	Ag	Mn	Fe	F	Au	Hg	As
Mean	18	19	55	2	.3	490	16000	480	.004	.197	18
Stnd Deviation	7	14	31	2	.2	154	4000	105	.012	.786	16
90th Percentile	24	24	67	3	.4	650	20000	630	.005	.130	30
Maximum	70	138	276	10	2.0	1090	30000	800	.100	5.001*	110

* Maximum Detection Level 5.000 ppm Hg

Gilbert

Elements (ppm)

Sample	Cu	Pb	Zn	Mo	Ag	Mn	Fe	F	Au	Hg	As
3073	18	24	57	.2*	.2	490	13000	400	.005	.030	22
3361	20	29	82	2.0	.4	485	17000	550	.001*	.120	39
4810	25	15	49	4.0	.2	377	14000	370	.005	.145	7
4820	70	138	276	5.0	2.0	530	14500	550	.020	.065	9

* Below Detection Level 2.0 ppm Mo, .005 ppm Au

TABLE II

Summary Statistics - Soils

Mapped parent rock-type

Elements (ppm)	Volcanic n=113		Palmetto Limestone n=157		Palmetto Siltstone n=178		Jasperoid n=74	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Au	.004	.013	.029	.068	.027	.033	.033	.040
Ag	.3	.2	1.0	1.2	.8	.7	.7	.7
As	15	9	50	69	44	34	37	34
Hg	.298	.718	.123	.233	.109	.090	.149	.161
Sb	5	8	4	7	4	5	8	10
	n=113		n=153		n=140		n=36	
Cu	21	14	46	35	34	18	30	20
Pb	18	28	52	60	29	23	30	22
Zn	56	10	185	153	78	69	80	40
Ba	827	90	1060	313	1110	286	1010	223

$\bar{x}$ mean
sd standard deviation

TABLE II

Summary Statistics - Soils

Mapped parent rock-type

Elements (ppm)	Volcanic n=113		Palmetto Limestone n=157		Palmetto Siltstone n=178		Jasperoid n=74	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Au	.004	.013	.029	.068	.027	.033	.033	.040
Ag	.3	.2	1.0	1.2	.8	.7	.7	.7
As	15	9	50	69	44	34	37	34
Hg	.298	.718	.123	.233	.109	.090	.149	.161
Sb	5	8	4	7	4	5	8	10
	n=113		n=153		n=140		n=36	
Cu	21	14	46	35	34	18	30	20
Pb	18	28	52	60	29	23	30	22
Zn	56	10	185	153	78	69	80	40
Ba	827	90	1060	313	1110	286	1010	223

$\bar{x}$ mean
sd standard deviation

Table III

Summary Statistics - Surface Rock Chips

Rock Types: / ELEMENT (ppm)	Jasperoid x̄	Jasperoid sd	Jasperoid n	Palmetto Siltstone x̄	Palmetto Siltstone sd	Palmetto Siltstone n	Palmetto White Limestone x̄	Palmetto White Limestone sd	Palmetto White Limestone n	Palmetto Black Siltstone x̄	Palmetto Black Siltstone sd	Palmetto Black Siltstone n	Palmetto Gray Limestone x̄	Palmetto Gray Limestone sd	Palmetto Gray Limestone n
Au	.116	.209		.049	.098		.025	.097		.061	.117		.152	.325	
Number of Epithermal Analyses			336			209			115			76			19
Ag	4.6	7.1		2.6	5.4		1.5	4.6		2.5	4.9		3.7	6.8	
Number of Samples			337			221			119			77			20
As	285	292		178	203		87	140		243	262		254	354	
Hg	1.480	1.890		.881	1.150		.171	.491		.679	1.240		.777	1.530	
Sb	60	97		45	68		12	44		33	50		13	22	
Cu	34	44		32	37		39	152		38	36		70	87	
Number of base Metal Analyses			83			106			79			24			13
Pb	236	911		68	132		111	555		34	56		52	73	
Zn	48	88		31	78		112	311		52	88		204	236	
Mo	14	29		9	24		5	4		9	9		20	31	
Ba	1140	1470	102	1460	1160	151	763	986	80	1540	882	35	594	1060	12
Mn	167	111	30	109	144	106	517	744	79	83	100	24	1030	1110	13
F	272	221	30	375	211	107	401	285	79	598	277	27	210	160	13
Bi	BDL	4	68	2	5	106	BDL	BDL	79	BDL	BDL	24	BDL	BDL	13
W	10	7	83	11	9	106	3	3	79	12	9	24	11	33	13

Rock Types: / ELEMENT (ppm)	Palmetto Calcareous Siltstone x̄	Palmetto Calcareous Siltstone sd	Palmetto Calcareous Siltstone n	Tertiary Tuff x̄	Tertiary Tuff sd	Tertiary Tuff n	Quartz Monzonite x̄	Quartz Monzonite sd	Quartz Monzonite n	Gilbert Tuff x̄	Gilbert Tuff sd	Gilbert Tuff n	Ignimbrite x̄	Ignimbrite sd	Ignimbrite n
Au	.363	.500		.147	.618		.089	.191		.009	.025		1.940*	7.520	
Number of Epithermal Analyses			8			98			35			22			19
Ag	3.8	4.0		.3	.7		4.2	12.3		.4	.7		8.4*	23.2	
Number of Samples			8			98			76			22			20
As	181	139		78	168		342	348		26	75		129	230	
Hg	1.790	2.050		1.010	1.360		.864	1.410		.150	.136		.271	.462	
Sb	37	38		31	52		65	161		7	5		10	12	
Cu	---	---		---	---		91	124		---	---		---	---	
Number of base Metal Analyses									64						5
Pb	---	---		---	---		173	388		---	---		---	---	
Zn	---	---		---	---		120	259		---	---		---	---	
Mo	---	---		---	---		19	33		---	---		2	1	
Ba	---	---		697	815	38	1070	537	25	233	295	19	933	574	6
Mn	---	---		---	---		174	179	64	---	---		---	---	
F	---	---		---	---		371	173	64	---	---		525	348	5
Bi	---	---		BDL	0	30	2	7	64	---	---		BDL	0	6
W	---	---		---	---		7	9	64	---	---		---	---	

x̄ = mean
sd = standard deviation
n = number of analyses

Note: less than five analyses are not included in this table.

BDL = Below Detection Level of 1 ppm Bi.

*Mathematical biases from Au outlier sample 301555, Ag outlier sample 293018.

Table IV

Summary Statistics - Drill Hole Rock Chips

ROCK TYPE

Element (ppm)	Jasperoid			Palmetto Siltstone			Palmetto White Limestone			Palmetto Black Siltstone			Palmetto Gray Limestone			Palmetto Calcareous Siltstone			Quartz Monzonite		
	$\bar{x}$	sd	n	$\bar{x}$	sd	n	$\bar{x}$	sd	n	$\bar{x}$	sd	n	$\bar{x}$	sd	n	$\bar{x}$	sd	n	$\bar{x}$	sd	n
Au	.124	.236	294	.056	.081	130	.042	.103	27	.055	.181	483	.050	.323	490	.145	.201	38	.059	.159	218
Ag	2.0	3.1		2.2	7.7		.9	1.7		1.7	3.1		.7	1.8		.9	1.1		.6	.9	
As	280	303		190	216		157	198		193	244		114	211		83	61		195	271	
Sb	57	69		52	138		13	29		31	47		8	25		19	8		10	17	
Hg	3.8	1.4	16	-	-		2.5	1.7	5	-	-		-	-		-	-		.237	.348	34

$\bar{x}$ = mean
sd = standard deviation
n = number of analyses. Au, Ag, As, Sb all have the same n.

Table V

Factor Matrix
Monte Cristo Range
Stream Sediments (104 samples)

Correlation Matrix

	Cu	Pb	Zn	Mo	Ag	Mn	Fe	F	Au	As
Pb	.70									
Zn	.63	.67								
Mo	.40	.25	.52							
Ag	.59	.77	.57	.05						
Mn	-.02	.10	.21	.15	.00					
Fe	.12	.01	.24	.09	-.02	.69				
F	.26	.01	.20	.18	.08	-.07	.12			
Au	.10	.16	.13	.13	.08	.13	.06	.02		
As	.06	.04	-.02	.22	-.05	.20	-.01	.02	.53	
Hg	-.06	.01	.13	.32	-.04	.08	-.11	.02	.54	.55

Factor	Eigenvalue	Percent of Variance Accounted For
1	3.32	30.2
2	2.17	19.7
3	1.67	15.2
4	1.15	10.5
5	.85	7.8
6	.53	4.9
7	.46	4.2
8	.28	2.5
9	.22	2.0
10	.21	1.9
11	.14	1.3
		100.0

Table V, cont'd

Factor Matrix

Factors

	1	2	3	4	5	6	7	8	9	10	11
Cu	.82	-.26	-.10	.11	.06	-.32	-.20	.22	.10	-.13	-.16
Pb	.84	-.26	-.15	-.31	-.00	-.03	.06	-.10	.05	-.19	.24
Zn	.86	-.12	.10	.09	-.18	.25	-.01	-.01	-.35	-.03	-.07
Mo	.56	.26	.01	.47	-.57	-.08	-.08	-.14	.13	.15	.05
Ag	.72	-.37	-.18	-.33	.22	.10	.22	-.01	.10	.29	-.06
Mn	.25	.34	.80	-.22	-.04	-.01	.21	-.19	.11	-.13	-.14
Fe	.23	.13	.89	.01	.16	.01	-.15	.24	-.01	.12	.15
F	.25	-.04	.01	.77	.54	.07	.15	-.10	.03	-.04	.03
Au	.32	.68	-.20	-.21	.32	.15	-.44	-.17	.03	.03	-.03
As	.21	.78	-.18	-.08	.13	-.46	.20	.00	-.17	.07	.03
Hg	.22	.78	-.30	.03	-.11	.33	.21	.27	.11	-.08	.00

Table VI

Resieved vs. Crushed Soil Samples

Probability of Students' T

Elements

Mapped Parent Rock Type	Cu	Pb	Zn	Ag	As	Hg	Au	Sb	Ba
Jasperoid	.06	.01	.09	AE	.69	AE	.04	.00	AE
Limy Palmetto	.18	.00	.00	AE	.02	AE	.27	.00	AE
Silty Palmetto	.73	.17	.65	AE	.02	AE	.81	.01	AE
Volcanic	.46	.80	.99	AE	.57	AE	.34	.00	AE

When t is less than .10, resieved are different than crushed, underline.
AE means within analytical error.

Means (ppm) for underlined elements

	Cu	Pb	Zn	As	Au	Sb
Jasperoid -80	24	20	68		.016	BDL*
-100	34	36	88		.037	10
Limy Palmetto -80		25	100	34		BDL
-100		53	193	55		5
Silty Palmetto -80			53			3
-100			38			5
Volcanic -80						BDL
-100						6

BDL = Below Detection Level

TABLE VII

Accuracy and Precision

Drill Hole Rock Chips

Accuracy

	Au (ppm)		Ag (ppm)	
	SV5-45	SV6-10	SV5-45	SV6-10
Expected (1 assay ton sample fire assay)	.583 ± .206	2.673 ± .103	4.2 ± .2	14 ± 1
Actual (10 gram sample fire assay with atomic absorption finish)	1.017 ± .204	2.977 ± .422	4.3 ± 1.1 atomic absorption	16 ± 2

Precision

Reference	Au			Ag			As			Sb		
	$\bar{x}$	sd	cv	$\bar{x}$	sd	cv	$\bar{x}$	sd	cv	$\bar{x}$	sd	cv
SV5-45 (14 samples)	1.017	.204	.20	4.3	1.1	.26	313	38	.12	88	9	.10
SV6-10 (21 samples)	2.977	.422	.14	16	2	.13	101	12	.12	7	2	.33
GLB 16-85 (24 samples)	.257	.035	.14	1.1	.2	.18	540	194	.36	14	4	.29

$\bar{x}$ = mean
sd = standard deviation
cv = coefficient of variation = sd divided by $\bar{x}$

TABLE VIII

Bondar-Clegg Laboratory - Lakewood

vs

Anaconda Analytical Laboratory - Tucson

Arsenic Values - Drill Holes GLB 34 and 35

Bondar-Clegg Report 53-211 | GLB 34 | 140 - 180 feet

Sample Number	TAL	B-C
312069	340	330
312070	77	50
312071	87	63
312072	63	45
312073	94	62
312074	38	23
312075	14	8
312076	287	160

Bondar-Clegg Report 53-216 | GLB 34 | 340 - 405 feet

Sample Number	TAL	B-C
312113	42	36
312114	20	21
312115	14	12
312116	32	31
312117	56	66
312118	40	50
312119	309	50
312120	87	123
312121	53	52
312122	81	119
312123	65	118
312124	52	73
312125	77	98

GLB 35 340 - 405 feet

Sample Number	TAL	B-C
312200	29	240
312201	33	320
312202	29	78
312203	40	59
312204	26	140
312205	23	345
312206	63	540
312207	BDL	530
312208	BDL	420
312209	99	420
312210	77	290
312211	47	490
312212	38	330
312213	22	590
312214	22	27

(*) BDL = Below Detection Level - 10 ppm

Laboratory Reference Materials

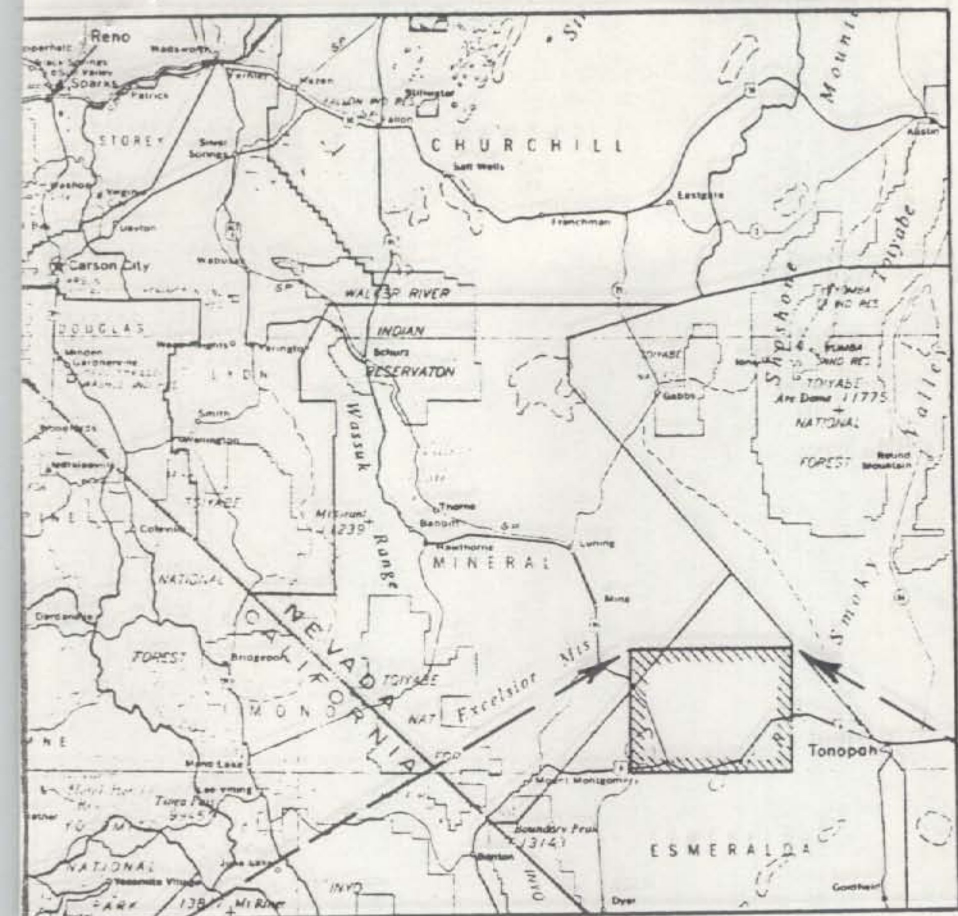
(All Elements in ppm)

Sample Number	Au	Ag	As	Sb	Bondar-Clegg Report	Reference Material
301904	2.440	18.0	119	7	52-685	SV6-10
301905	2.380	13.0	105	8	52-692	SV6-10
301906	2.100	15.0	120	8	52-736	SV6-10
302282	2.985	16.0	96	8	52-828	SV6-10
302350	3.200	16.0	117	13	52-845	SV6-10
302375	.920	4.4	310	92	52-845	SV5-45
302400	3.200	14.0	85	15	52-888	SV6-10
302426	.980	3.5	340	97	52-888	SV5-45
302450	.930	3.7	370	89	52-888	SV5-45
302474	2.995	14.0	80	8	52-888	SV6-10
302501	.930	3.6	340	88	52-888	SV5-45
302524	3.175	14.0	78	7	52-888	SV6-10
302549	.970	3.6	340	89	52-888	SV5-45
302571	3.250	15.0	100	6	52-898	SV6-10
302596	1.060	3.9	250	89	52-898	SV5-45
302625	3.700	19.0	99	5	52-942	SV6-10
302649	.900	4.2	350	86	52-963	SV5-45
302673	3.000	19.0	100	6	52-963	SV6-10
302852	1.040	4.4	310	77	52-1092	SV5-45
302878	3.350	17.0	96	7	52-1092	SV6-10
302903	.850	4.4	310	93	52-1157	SV5-45
302954	.940	4.2	350	90	52-1157	SV5-45
302972	3.400	15.0	99	5	52-1157	SV6-10
302996	1.080	4.0	310	89	52-1157	SV5-45
303028	2.500	18.0	117	7	52-685	SV6-10
303029	3.025	17.0	114	8	52-726	SV6-10
303030	2.750	16.0	109	4	52-743	SV6-10
303032	.955	3.8	265	85	52-828	SV5-45
309276	2.150	15.0	105	8	53-109	SV6-10
309326	3.220	15.0	90	5	53-126	SV6-10
309351	.260	1.2	480	9	53-180	GLB16-85
309376	.240	1.3	500	11	53-180	GLB16-85
309401	3.100	15.0	103	7	53-197	SV6-10
309429	3.400	15.0	82	7	53-197	SV6-10
309451	.235	1.6	590	13	53-197	GLB16-85
309476	.230	1.2	510	11	53-197	GLB16-85
309501	.960	4.7	300	100	53-197	SV5-45
309526	.350	1.1	495	9	53-197	GLB16-85
309552	1.720	8.1	240	62	53-197	SV5-45
309576	.250	1.2	690	11	53-197	GLB16-85
309635	.295	1.3	490	15	53-196	GLB16-85
309651	.300	1.3	510	18	53-196	GLB16-85
309677	.315	1.2	520	13	53-196	GLB16-85
309751	.235	1.3	600	10	53-217	GLB16-85
309776	.205	1.1	495	19	53-223	GLB16-85
309801	.250	1.1	600	17	53-230	GLB16-85
309851	.225	1.2	590	15	53-230	GLB16-85

Laboratory Reference Materials
(All Elements in ppm)
Continued - Page 2

309881	.230	.9	600	16	53-222	GLB16-85
309903	.250	.6	600	15	53-222	GLB16-85
309926	.240	.8	700	17	53-222	GLB16-85
309951	.250	.9	515	16	53-222	GLB16-85
309976	.245	.8	600	14	53-222	GLB16-85
309999	.275	.8	700	14	53-222	GLB16-85
312024	.250	1.0	700	14	53-222	GLB16-85
312052	.250	1.1	440	8	53-211	GLB16-85
312099	.205	1.3	1000	10	53-211	GLB16-85
312152	.320	1.2	22	24	53-216	GLB16-85
312178	.270	1.2	10	23	53-216	GLB16-85

Figure 1

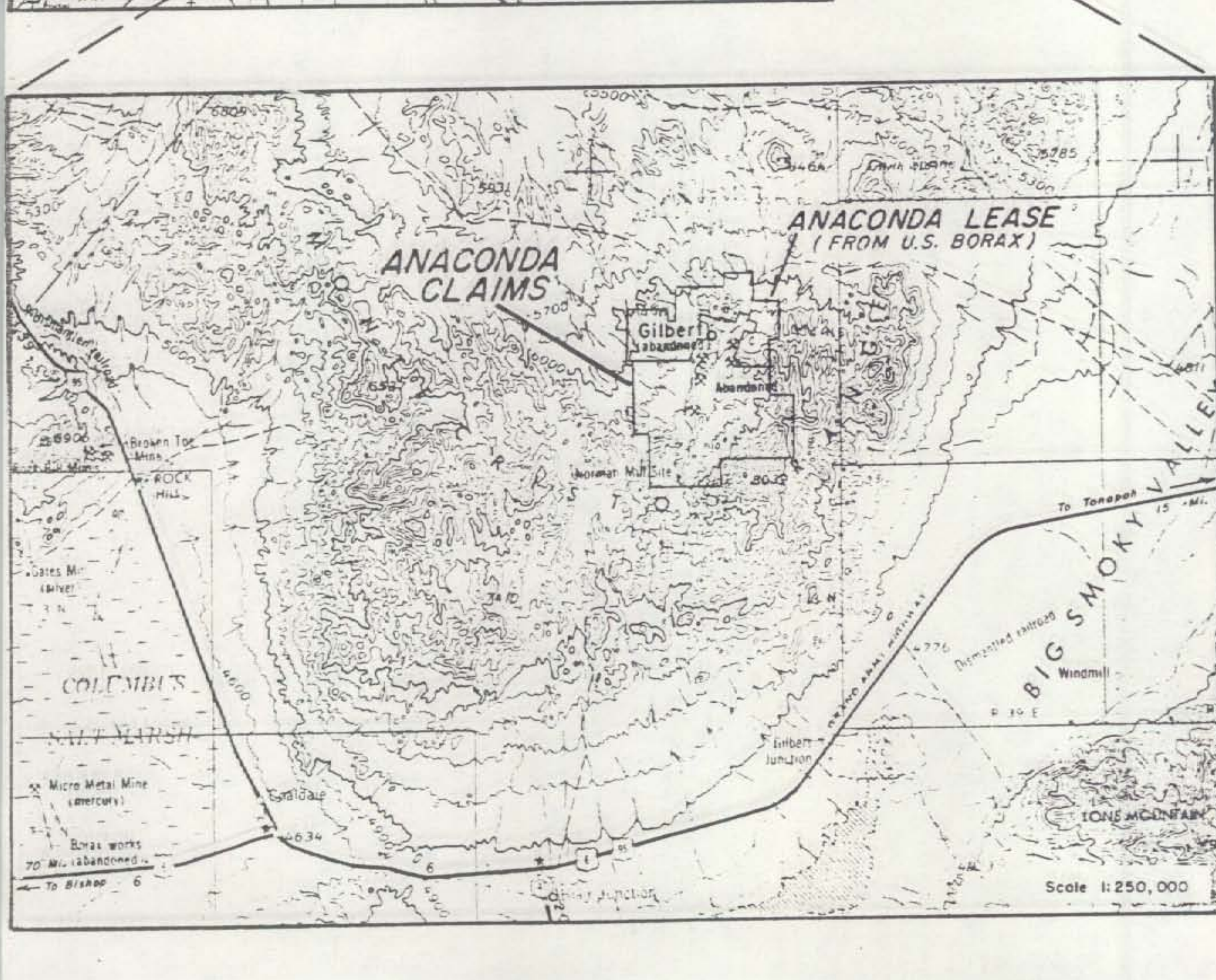


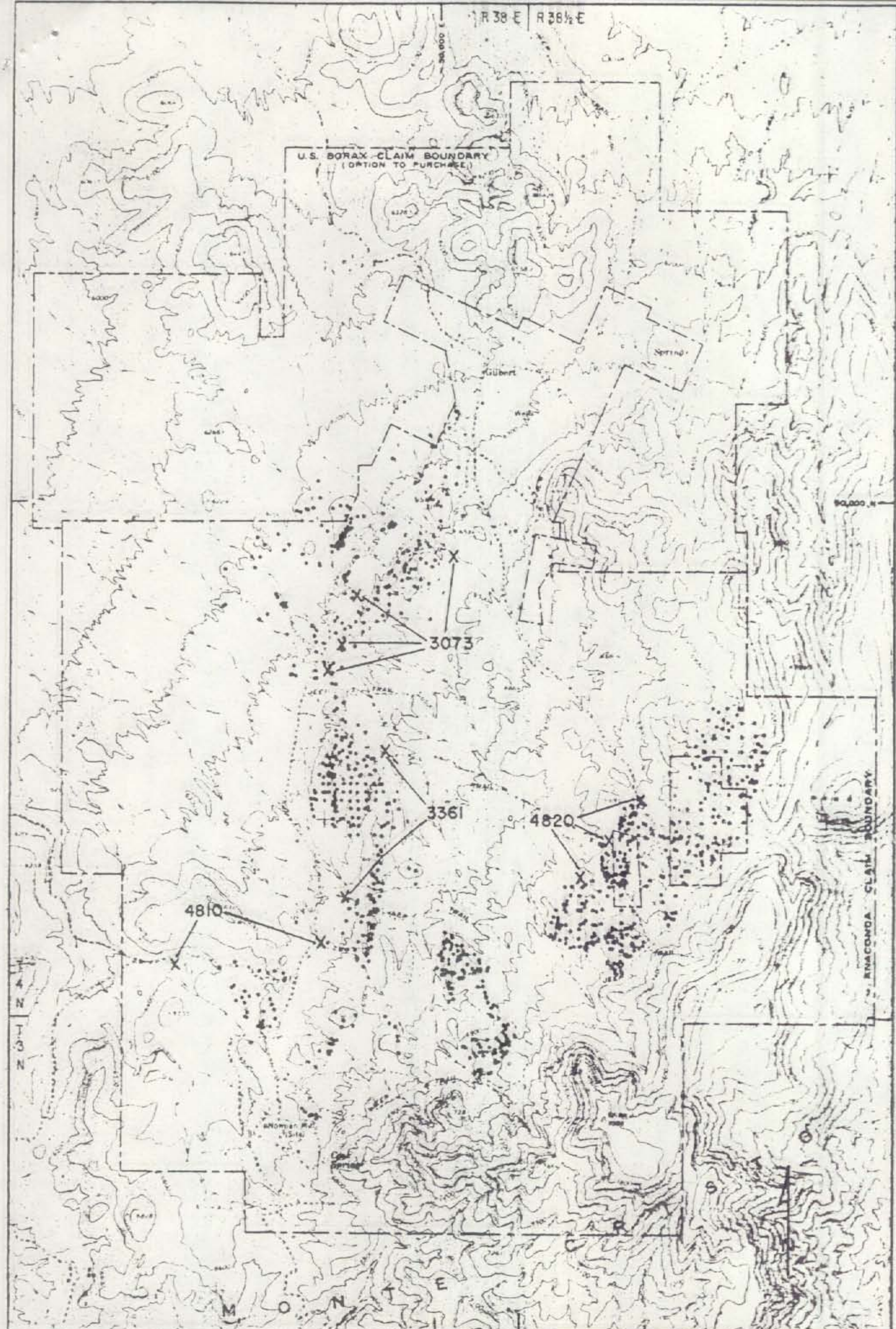
LOCATION MAP

GILBERT PROJECT

ESMERALDA COUNTY, NEVADA

— MARCH, 1982 —





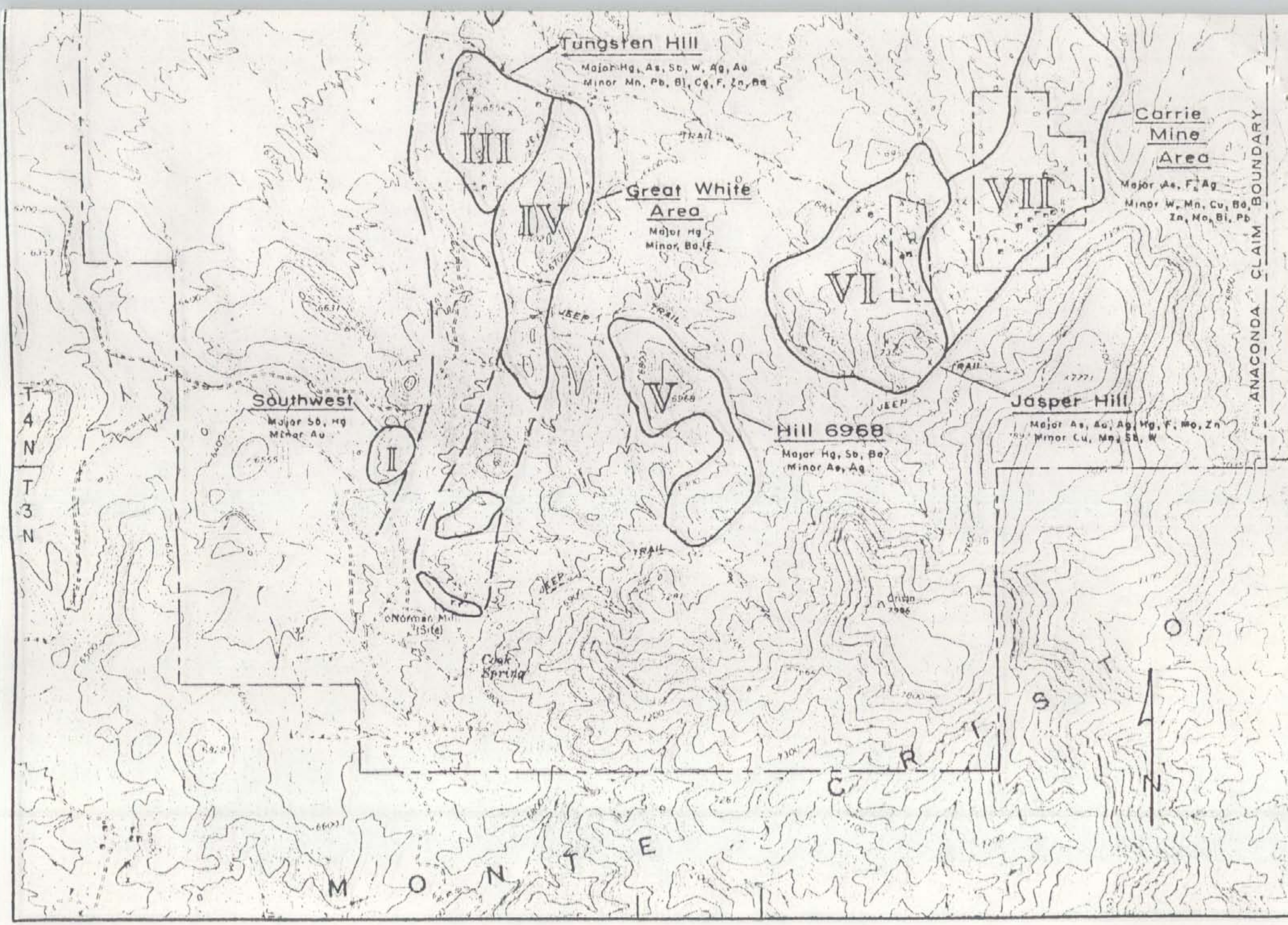
SCALE: 1" = 2000'

• - ROCK CHIP X - STREAM SEDIMENT

GILBERT PROJECT

ESMERALDA COUNTY, NEVADA

— Figure 2 —



2000 0 2000 4000

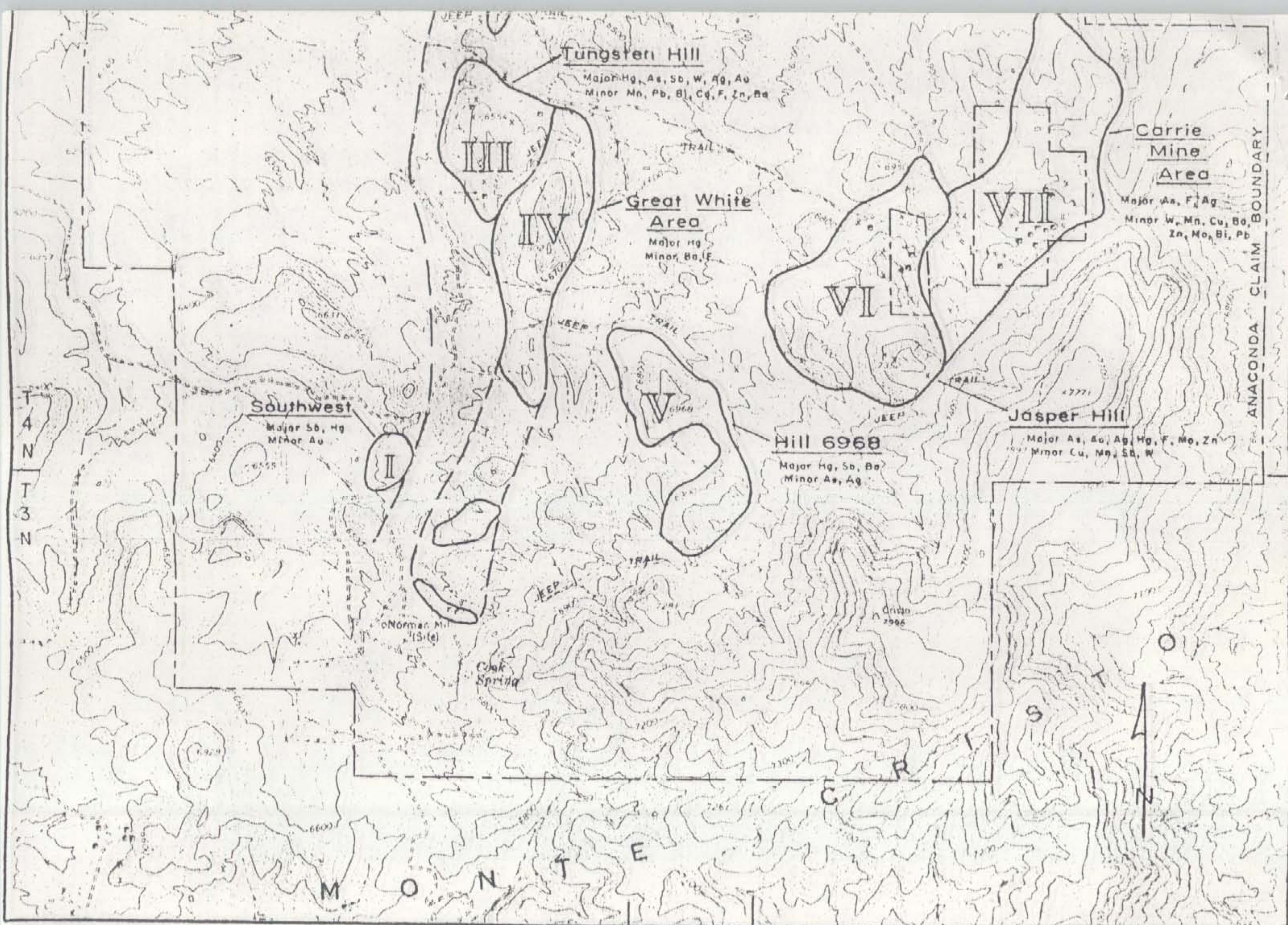
SCALE: 1" = 2000'

GEOCHEMICAL REGIONS

GILBERT PROJECT

ESMERALDA COUNTY, NEVADA

— Figure 3 —



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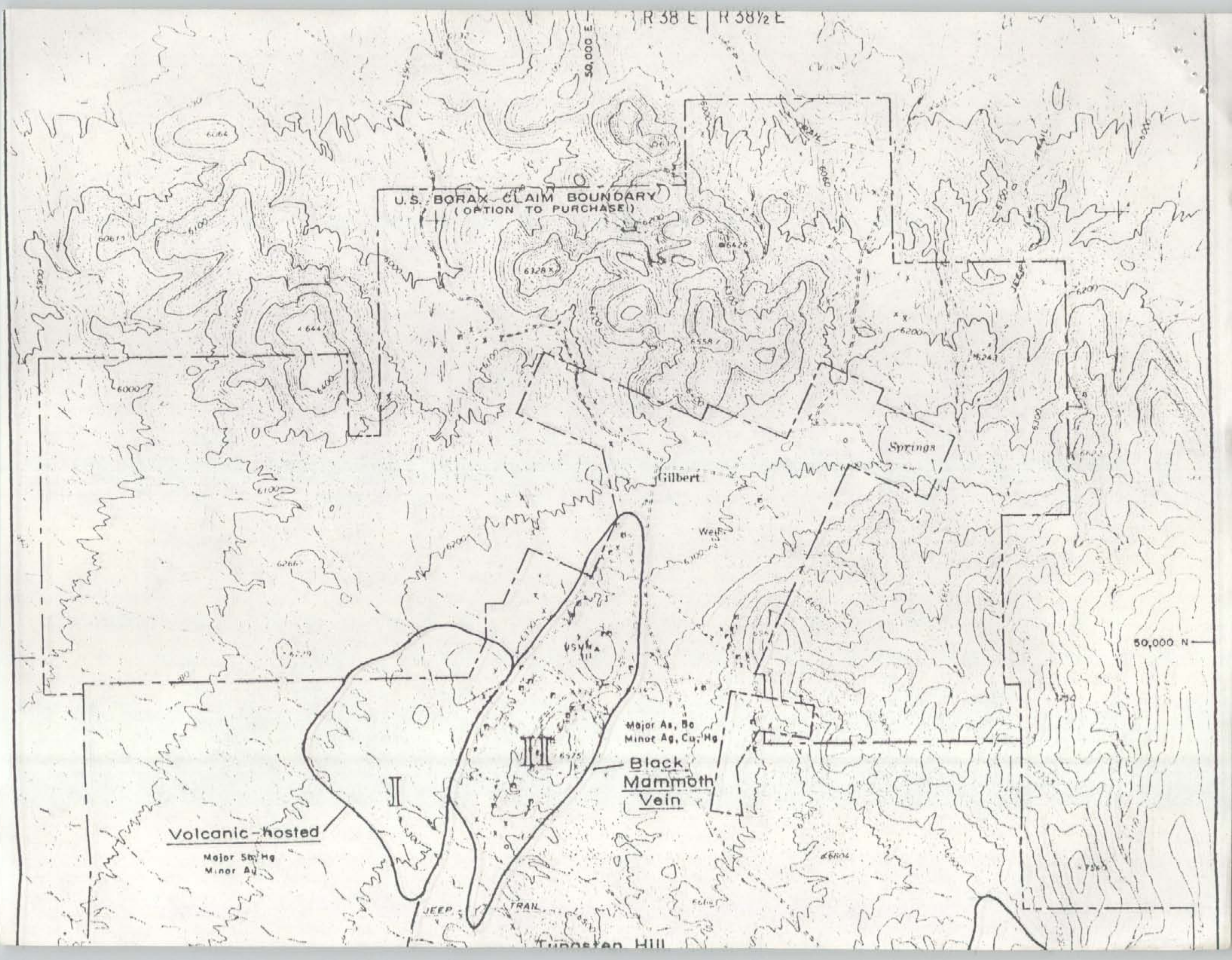
SCALE: 1" = 2000'

GEOCHEMICAL REGIONS

GILBERT PROJECT

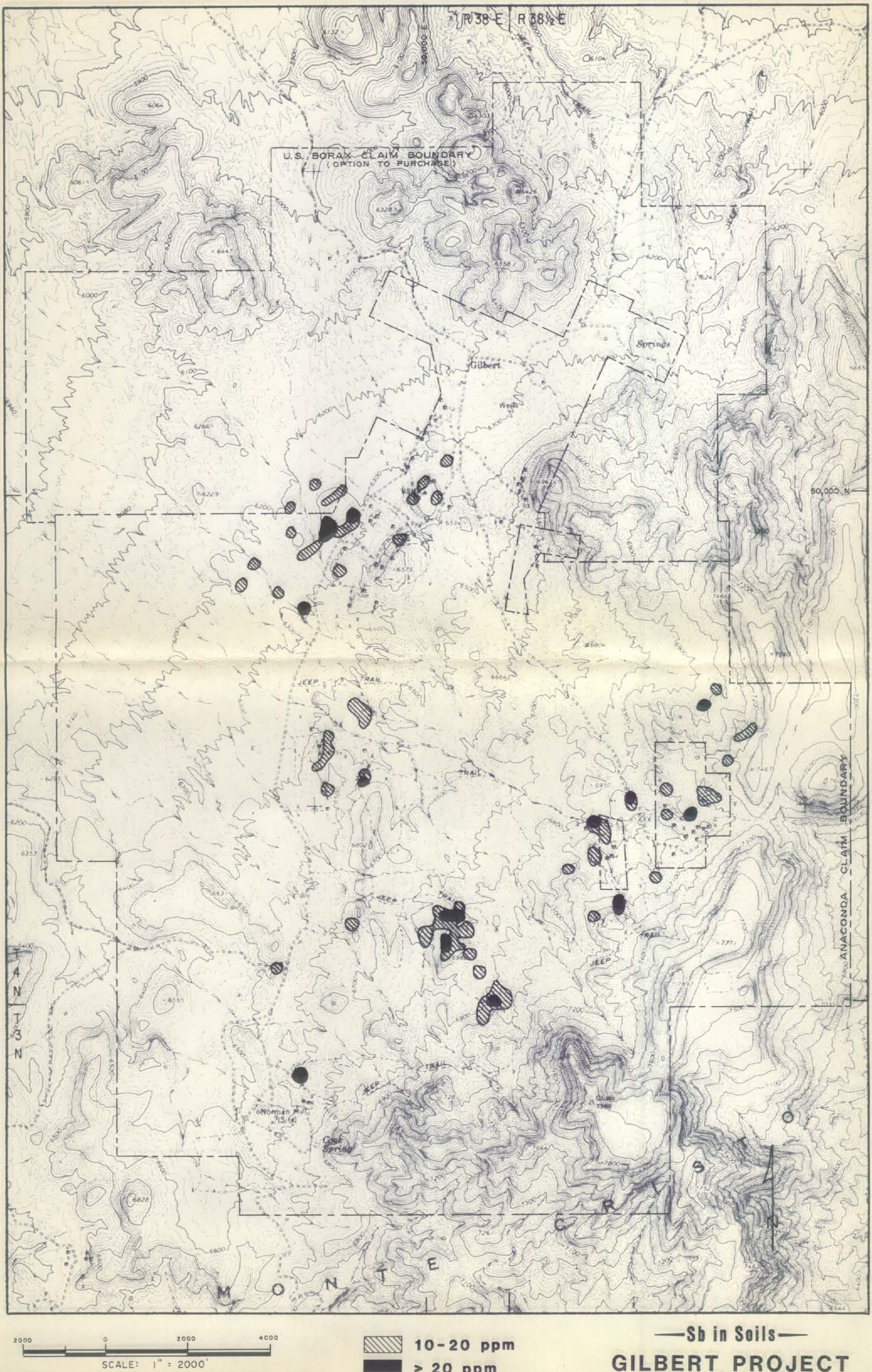

R 38 E
R 38½ E
50,000 E
U.S. BORAX CLAIM BOUNDARY
(OPTION TO PURCHASE)
Springs
Gilbert
Well
50,000 N
JEEP TRAIL
Major As, Ba
Minor Ag, Cu, Hg
Black
Mammoth
Vein
II
I
Volcanic-hosted
Major Sb, Hg
Minor Au
Tungsten Hill

2000 0 2000 4000

SCALE: 1" = 2000'

GEOCHEMICAL REGIONS

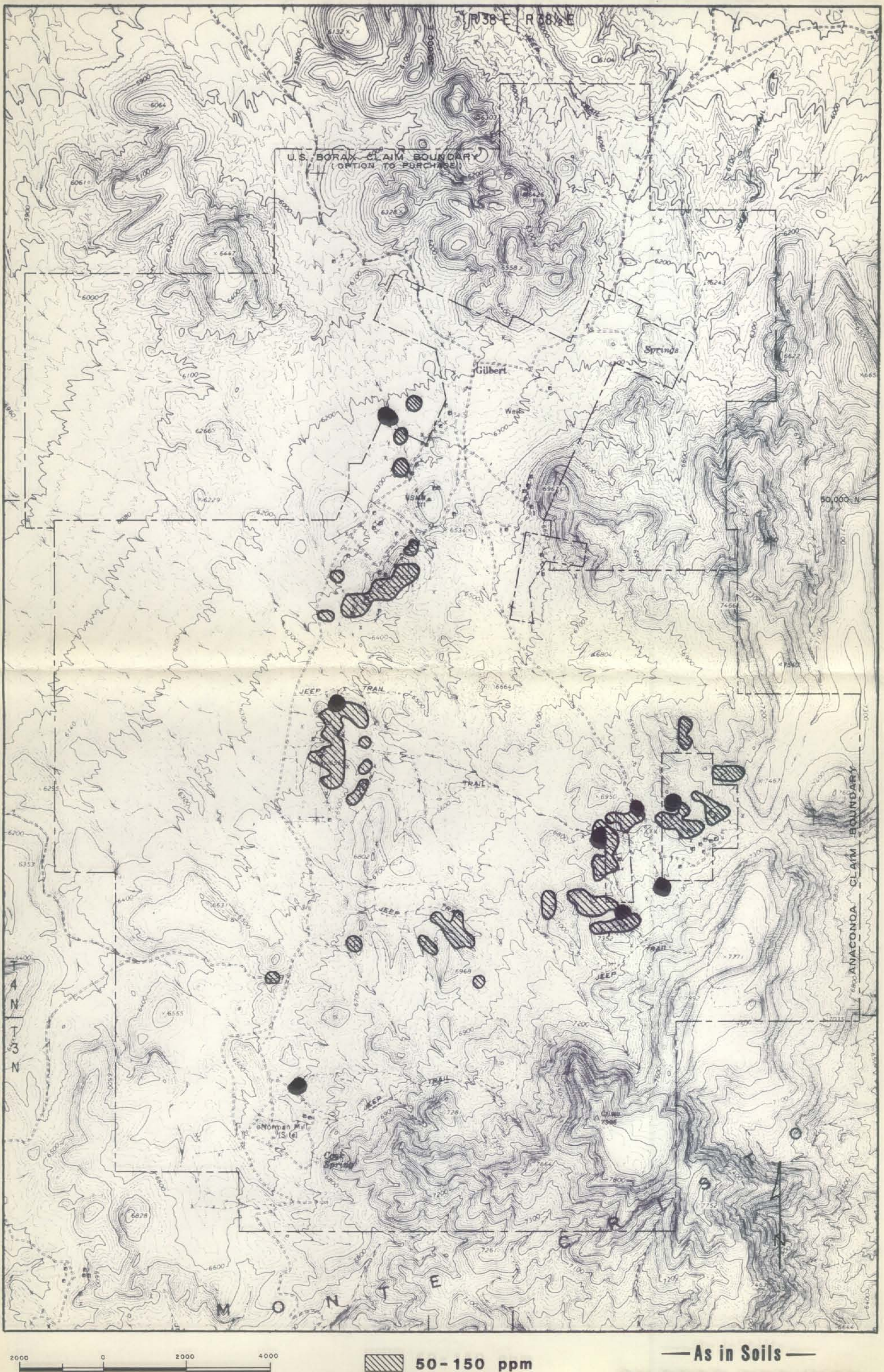
GILBERT PROJECT
Esmeralda County, Nevada



—Sb in Soils—

GILBERT PROJECT

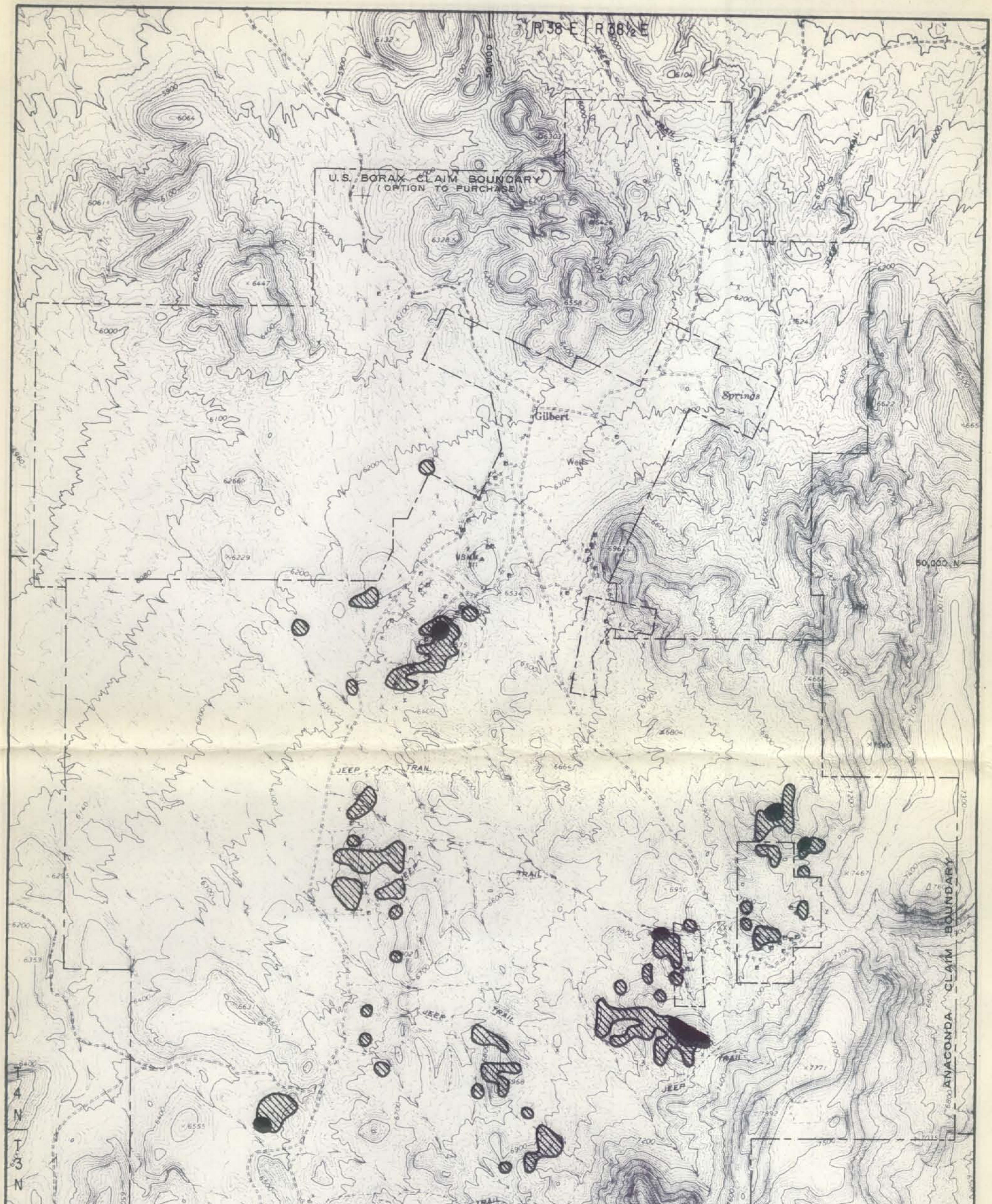
Esmeralda County, Nevada



—As in Soils—

GILBERT PROJECT

Esmeralda County, Nevada



2000 0 2000 4000

SCALE: 1" = 2000'

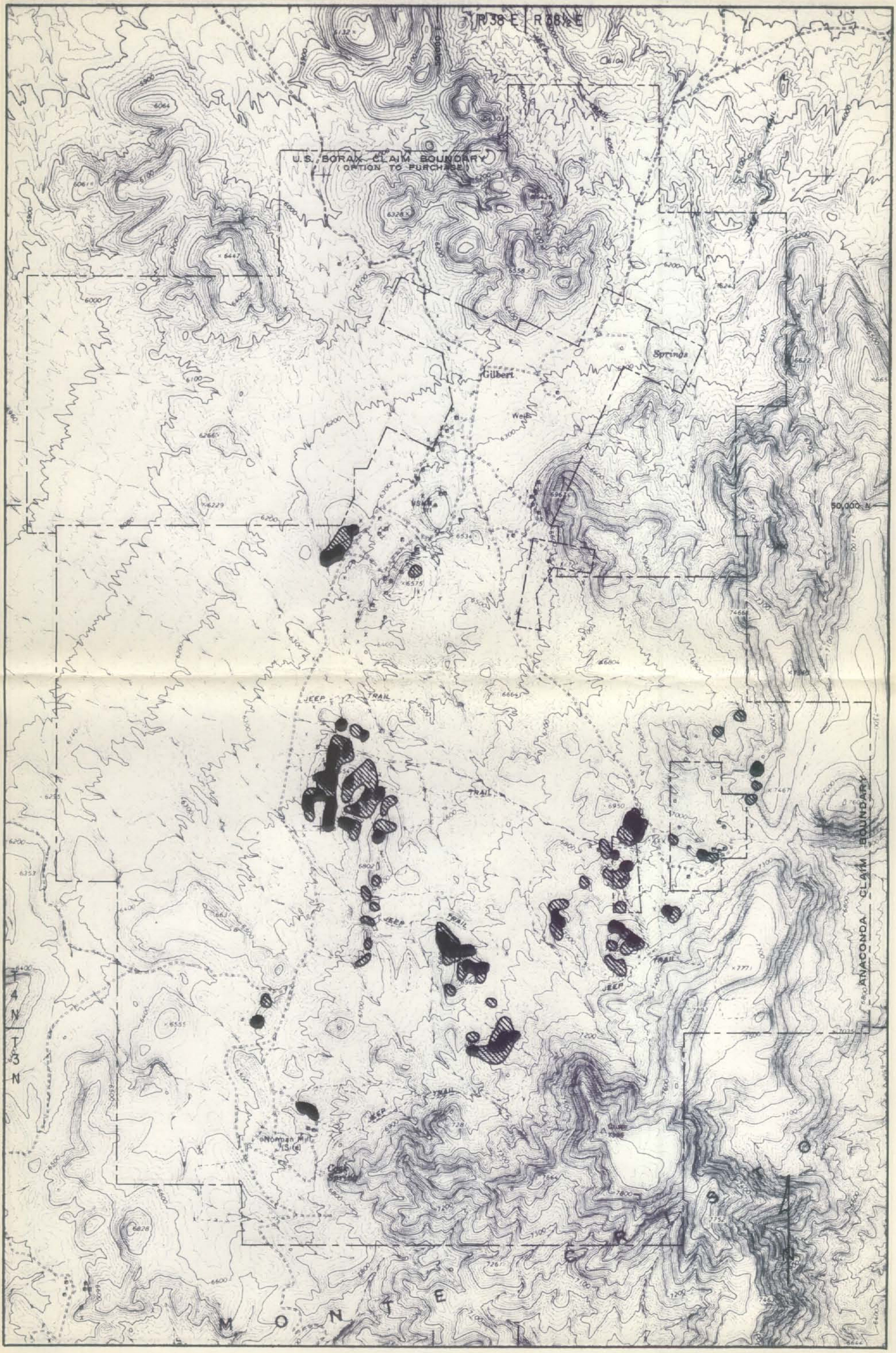
> .03 ppm

> .15 ppm

—Au in Soils—

GILBERT PROJECT

Esmeralda County, Nevada

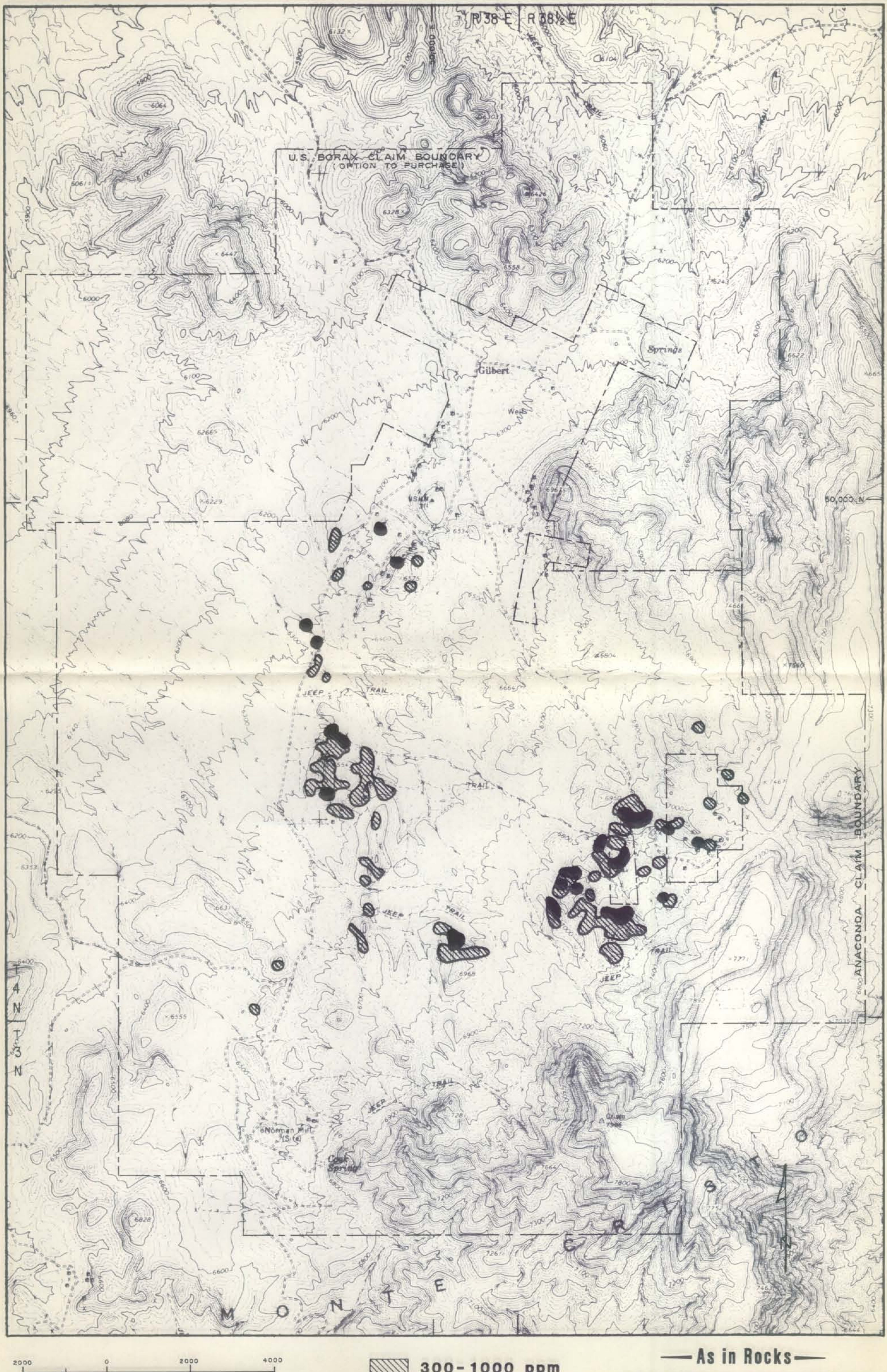


SCALE: 1" = 2000'

50-100 ppm
> 100 ppm

—Sb in Rocks—

GILBERT PROJECT
Esmeralda County, Nevada



2000 0 2000 4000

SCALE: 1" = 2000'

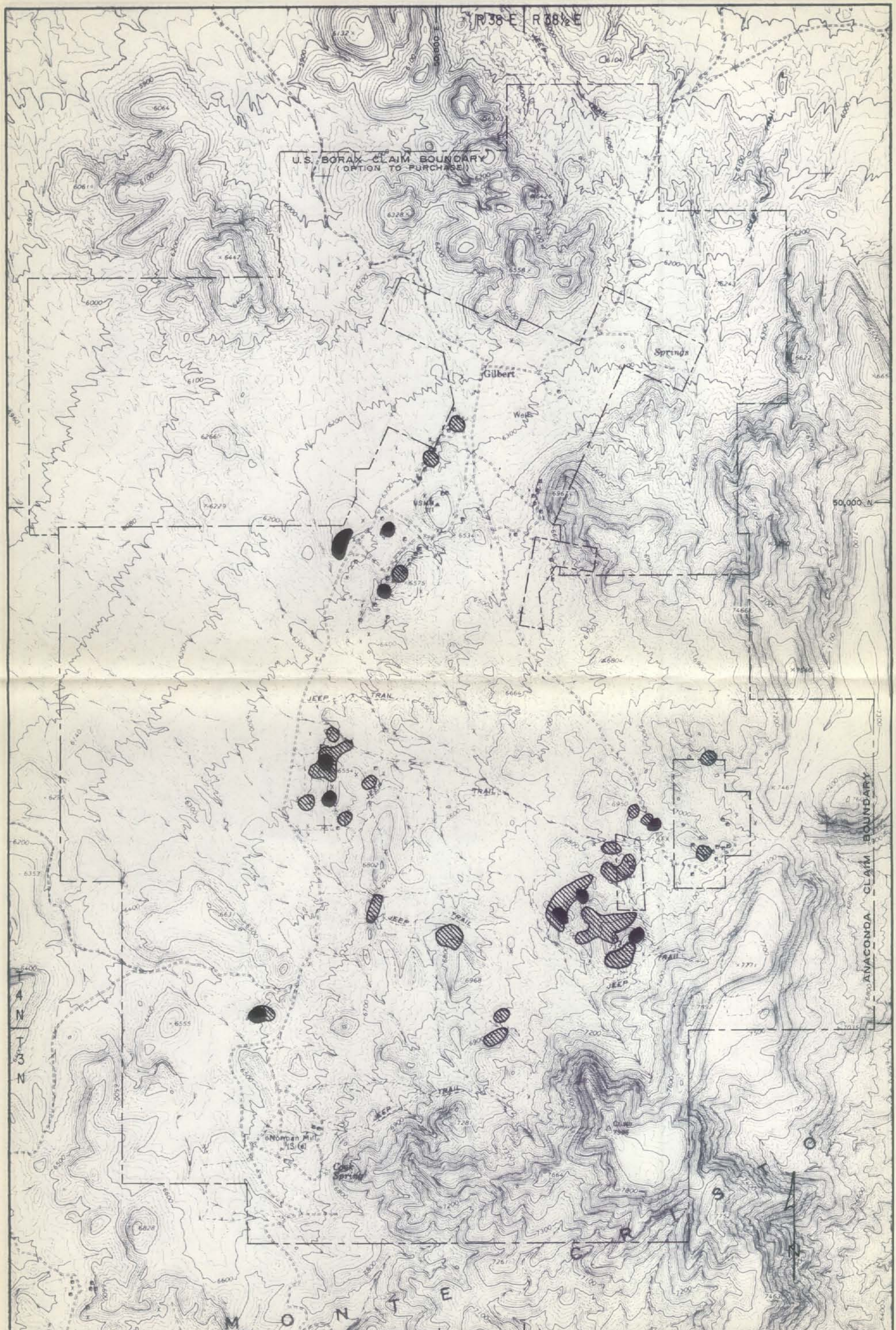
300-1000 ppm

> 1000 ppm

—As in Rocks—

GILBERT PROJECT

Esmeralda County, Nevada



2000 0 2000 4000

SCALE: 1" = 2000'

.2 - 1.0 ppm

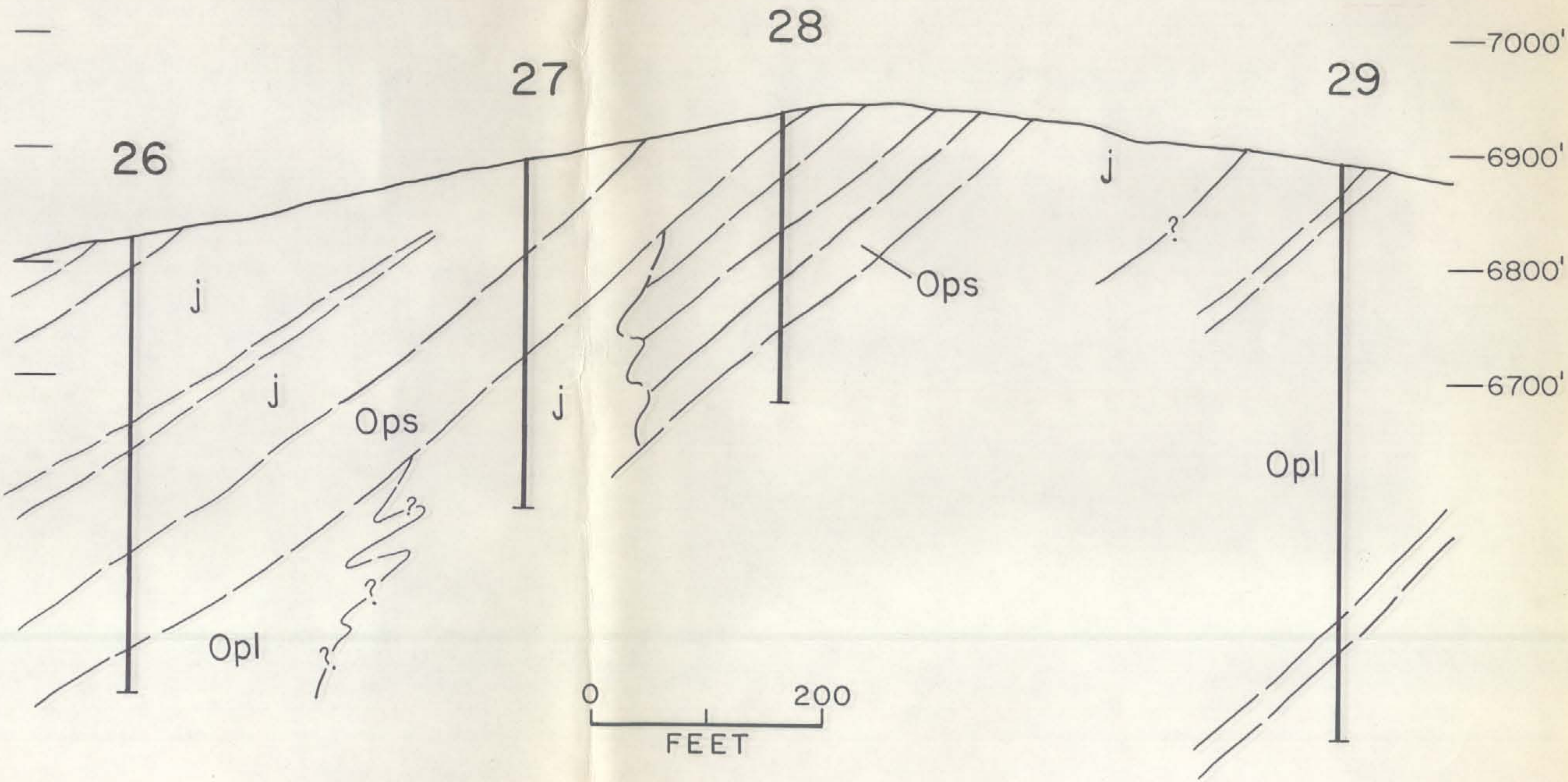
> 1.0 ppm

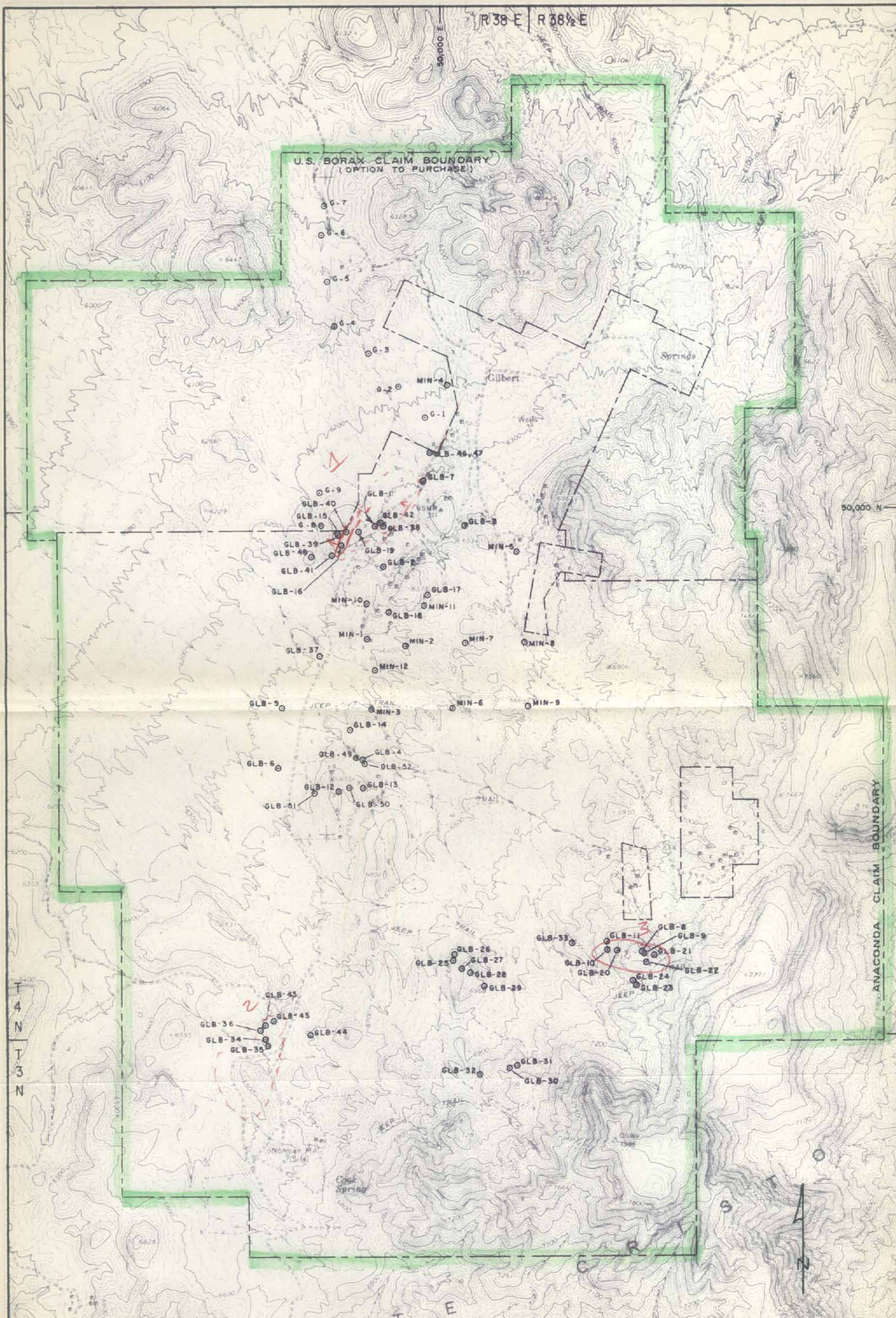
—Au in Rocks—

GILBERT PROJECT

Esmeralda County, Nevada

GILBERT – LOOKING NE





2000 0 2000 4000

SCALE: 1" = 2000'

DRILL HOLE LOCATIONS

GILBERT PROJECT

ESMERALDA COUNTY, NEVADA

Schedule A