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THE AURORA DISTRICT, MINERAL COUNTY, NEVADA

NEVADA GOLDFIELDS INC. RESERVES AND POTENTIAL:

A CRITICAL REVIEW

MARCH, 1989

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SUMMARY STATEMENT

This report represents a qualitative assessment of the validity of the Nevada Goldfields Inc. reserves in terms of geology, and the methodology used in the basic data acquisition process. In addition, the potential of the Nevada Goldfields Inc. property package and the entire Aurora District is evaluated in a preliminary manner. This study does not represent a thorough "audit" of the Nevada Goldfields Inc. data, and information may exist, elsewhere, which would alter the conclusions contained herein.

The general conclusions of this study are as follows:

1. The deposit model used by Nevada Goldfields Inc. for each of the deposits with "reserves" is straightforward and consistent with the available data.

   The "paper trail" concerning the geology and mineral distribution of the deposits is incomplete and confusing. The underlying geologic assumptions concerning gold distribution and continuity at scales ranging from individual samples to entire deposits are not well documented and, indeed, may not have been given much consideration.

   The Nevada Goldfields reserves at the Prospectus mine have a high probability of being inaccurate. The degree of error has not been determined, but careful analysis of the existing data set should provide adequate insight into the problem. Preliminary analysis indicates that the original "open pit" estimate was high by at least 10,000 ounces of gold. This over estimation is clearly due, in part, to what appears to be an unwarranted liberalism in the projection of ore blocks and the lack of adherence to any estimating rules. Some ore may be lost from the reserve due to pit design.

   An additional, and potentially important, source of error in the reserve is the probable introduction of unnecessary biases in many stages of the sampling procedure. These biases may well have contributed significantly to the apparent lack of correlation between the original estimate and the actual production-plus-remaining reserves. This apparent error in the Prospectus open pit ore reserve casts doubt on the reserves at the Juniata and New Esmeralda as well.

   Review of assay data indicates precision of the assay procedure is excellent. There is no indication from the data or personal interviews that any work has been done to verify the accuracy of the sample data.

   Production data is well documented and an adequate "paper trail" exists as a record of the production history. "Post Mortem" or planned vs. actual comparisons, on the other hand, are lacking.

2. There is excellent potential for additional economic ore discovery on the Nevada Goldfields Inc. property package. This includes both lower grade, heap leachable ore left by previous operators and new, surface and underground mineable ore bodies. Current information

indicates that there is limited potential for additional ore with depth below currently known ore bodies.

There is no discussion in any of the data in hand of the distribution of heap leachable "low grade" material in any of the ore bodies. None of the past mining operations considered grades suitable for heap leach operations and there is a good opportunity for these ores in previously mined areas. The experience of The Aurora Partnership on the East Humboldt vein strongly supports this conclusion.

No area, with the possible exception of the immediate vicinity of the Prospectus, Juniata and New Esmeralda ore bodies, has been adequately tested. However, the frequency of vein occurrence, and the frequency of ore occurrence on those veins, strongly indicates that ore bodies remain to be found in several areas of the Nevada Goldfields property. Current data on exploration at Last Chance Hill is encouraging and "step-out" exploration should yield additional ores on some of the known veins.

3. The potential of the entire Aurora District for the discovery of additional ores similar to those found in the past is very high. However, the level of geological knowledge is relatively low and the land status is complex. These factors will make discoveries away from the core properties more time consuming and expensive. This may negatively impact the fragile economics of any ores found.

Given the existence of both a mill and a heap leach facility the opportunities to exploit the previously uneconomic resources of the district are excellent.

Aurora is a one million ounce gold district with a fairly straightforward model of ore genesis. Vein type mineralization occurs over the entire district and ore has been mined from many of these veins. Many areas remain untested by anything other than surface sampling and very little modern, systematic, exploration has been done. Although the opportunity exists for many new ore bodies and incremental ores throughout the area the true potential of these ores cannot be realized unless one group can consolidate the entire district, or a significant part of it, under one mining system.

A final possibility that bears strong consideration is the potential for the occurrence of low grade high tonnage ore bodies similar to those at Borealis. An excellent case can be made for the concept that the only major difference between the deposits at Borealis and the veins at Aurora is that the known vent areas, (veins), at Aurora were not sealed for long periods of time, thereby allowing ore fluids to permeate large volumes of rock. The occurrence of this type of deposit somewhere in the district is quite likely.

There is a high probability that the potential of the district is in the .25 to .50 million ounce, (gold), range from multiple ore bodies.

Recommendations for additional geologically related activities if the project should proceed are:

1. A detailed review of the past production vs. the original estimate on a bench by bench basis should be made for the Prospectus open pit. This would help to determine the actual distribution of ore and the extent of the variance in estimated vs. actual ore production. The results should be used to develop a manual, cross sectional, geologic reserve of remaining ore which could then be used as the basis for a new mining reserve.

2. A concerted effort should be made to determine the validity, and inherent biases, of the various sampling methods. This data is essential to the accurate estimation of ore in place.

3. One of the most critical needs in the district is the discovery of additional ounces. This can only be accomplished thru a dedicated and consistent exploration program. The geologic studies that are required to provide some degree of predictability to the occurrence of ore in the pits and in the district are relatively inexpensive and rapid. They should, once a period of "catch-up" is over, be a part of the ongoing geological work of the resident geologists.

4. Structural control of mineralization is evident at all scales and detailed structural studies carried out in a practical manner will provide not only an excellent tool for refining ore geometries and locations in the known mines but an exploration tool of amazing power as well.

5. A strong effort should be made to develop a comprehensive district compilation. This work should be aimed at assembling the spatial relationships, in three dimensions, of all veins, mines, dumps, drill holes etc.. The compilation will provide the framework necessary for a more rigorous assessment of district potential as well as for long term production and exploration planning.

INTRODUCTION

At the request of Jack Devitt, Vice President Operations, Minerex Resources Ltd., David R. Shaddrick carried out a field and office review of the Aurora District. Special emphasis was placed on an evaluation of the Nevada Goldfields Inc. property and reserves. The goal of the project was threefold: First, to make an assessment of the quality of the Nevada Goldfields reserves in terms of the underlying geologic assumptions and methodology; Second to assess the geologic potential for additional gold ores on the Nevada Goldfields properties; Third, to provide an overview of the district in terms of potential for additional gold occurrences. Most of the data used in this report was provided by Canada Tungsten and Minerex and is included in the bibliography of Appendix 1.

DATA QUANTITY AND QUALITY

It is readily apparent from the extensive bibliography appended to this report that there has been a great deal written about this district and the history of it's development. The majority of the information on the individual properties is contained in private reports written for specific purposes. Throughout these reports terminology, place names and units of measurement as well as scientific and engineering rigor has been inconsistently applied.

A great deal of the Nevada Goldfields Inc. data deals with engineering and metallurgical studies which provide an extensive and adequate basis for operational analysis. For the purposes of this study, however, the most important data consists of geological descriptions and interpretations as well as the "how and why" of the data collection and analysis procedures. A good basic understanding of the general geologic framework of the district as well as several of the mines can be gained from review of a few of the many reports included in the data package. However, very little of the original geologic work has been documented. It is this work which should have produced the underlying geologic assumptions upon which the sampling and analysis procedures were based.

Much of the information used for the analysis of the Nevada Goldfields Inc. reserves was derived from conversations with Marla Osborne, who did or supervised most of the work, Tony Dorff, who is the current mine geologist and Wade Hodges, who did much of the Hanna work. Some procedural information and raw data related to phase one is included in the Condor Minerals Management Reports provided by Minerex Resources Ltd.. Most of the assay results and rechecks are included as well as the cross sections used in the reserve estimate following phase one. Much of the information pertinent to this analysis is summarized in Appendix 2.

A great deal of graphic data has been provided by Nevada Goldfields Inc. or was reviewed on the property. Many of the illustrations are confusing and difficult to use. For example, on some map sets similar information, ie. reserve blocks or assay plans, are variably based on different data formats. One will display actual assays, another will display only those above a certain cutoff and yet another will display composite values. These basic parameter changes are not clearly indicated and must be "ferreted out" much like solving a puzzle.

Data concerning the Aurora Partners property was not analyzed in detail except where it would aid in understanding the potential of the district. No qualitative assessment of the Aurora Partners data base was made for this project. Data on exploration activities is limited and consists of reports by Stan Reamsbottom on the Electra Northwest properties, a report by K. Schultz on the exploration potential of the Aurora district and discussions with operating personnel.

A great deal of time has been spent during the term of this project in an attempt to assemble a clear picture of the district and its various parts from the complex and diverse data sources available. Considerable additional information, in the form of reports and maps, clearly exists but was neither used nor available for this evaluation.

GENERAL GEOLOGIC SETTING

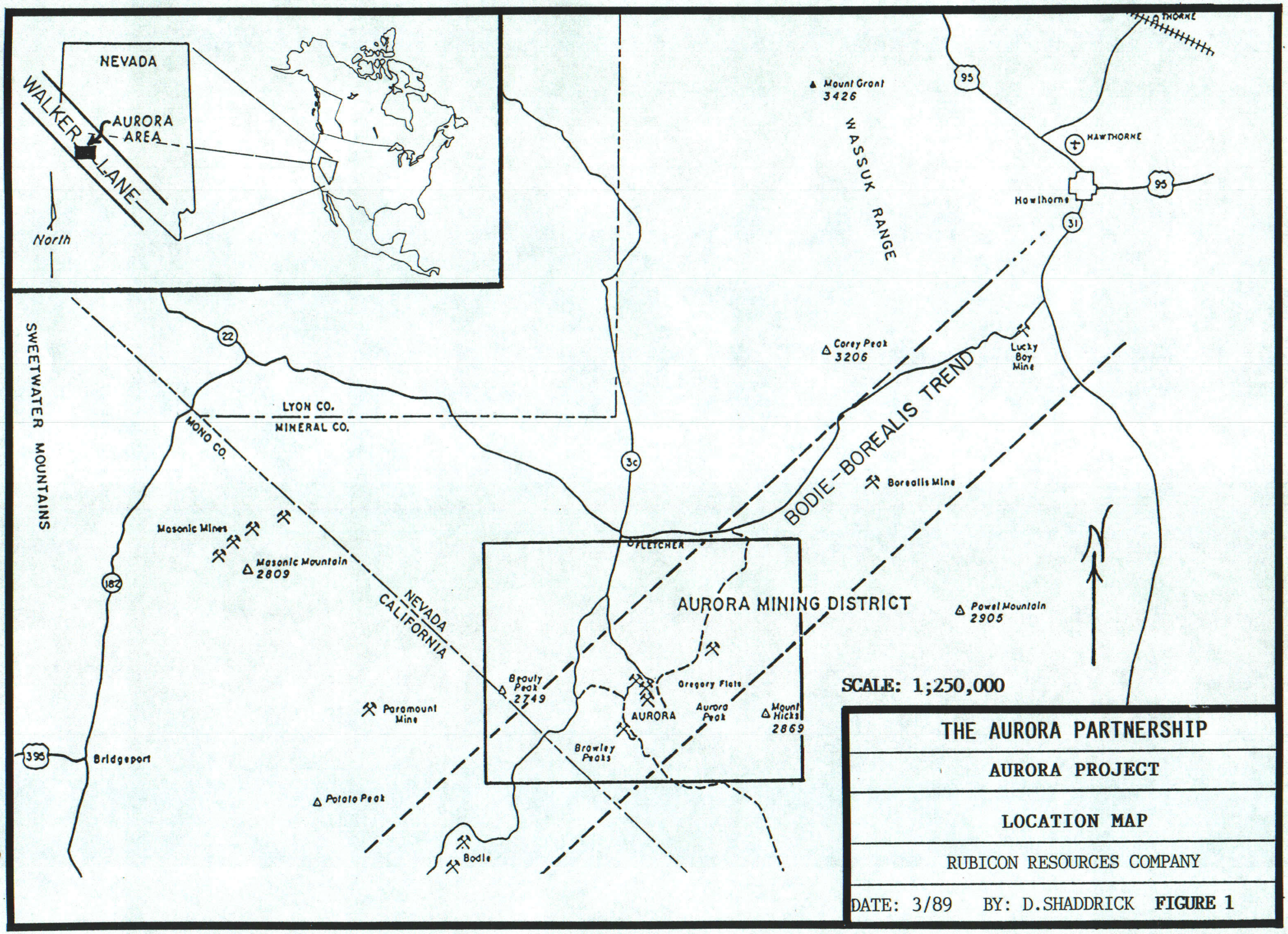
Aurora is a strongly mineralized gold district located within the Walker Lane structural Lineament of Western Nevada and Eastern California, Figure 1. The district lies within a region of important gold mineralization including the Bodie and Masonic districts to the west and the Borealis group of mines to the east. Two mines are currently active at Aurora and there are numerous inactive and generally inaccessible mines throughout the area.

The district is characterized by wide spread quartz, adularia veining within a sequence of andesitic volcanic rocks. Basement in the region consists of mesozoic (over 100 m.y.) metasediments and intrusive granites. Multiple pulses of andesitic and rhyolitic volcanic rocks were extruded onto the eroded basement over a period from approximately 15.5 m.y. to 7.8 m.y.. During this time period, at about 10.3 m.y. numerous gold bearing quartz veins were emplaced by episodic hot spring activity. Younger rhyolitic and basaltic volcanics were extruded over the preceding rocks from 5.3 to 0.25 m.y.. These relationships are summarized in Table 1.

TABLE 1: AGE RELATIONSHIPS IN THE AURORA REGION

MINE	MINERALIZATION	BASEMENT	HOST	COVER
BODIE	8.0-7.1 m.y.	100+ m.y.	9.4-8.6 m.y.	----
AURORA	10.0 m.y.	100+ m.y.	13.5-15.4 m.y.	0.25 m.y.
BOREALIS	11.0+ m.y.	100+ m.y.	19.0-13.0 m.y.	----

The Walker Lane structural lineament, Figure 1, is a wide zone of northwest-south east trending major structures. Within the zone, rotation has produced structural fabrics of widely varying orientation. At Aurora, the structural fabric is dominantly north-east to north. A broad upwarp running roughly northeastward through Bodie, Aurora and Borealis tends to mimic the internal fabric of the Aurora District. The upwarp has been dated as no older than 3.0 m.y. but may be in response to continued movement on an older structure which provided the deep access way for mineralizing fluids in all of the districts. This regional "trend" may or may not be real but the intra-district trends are



THE AURORA PARTNERSHIP

AURORA PROJECT

LOCATION MAP

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DATE: 3/89 BY: D.SHADDRICK **FIGURE 1**

clearly there and predictable enough to be used for exploration and mining.

THE AURORA VEINS

Variously mineralized quartz veins occur throughout the district and out under the younger volcanic cover. The general distribution of mapped veins is shown on Figure 2. For the most part, productive veins trend northeast-southwest but a few notable exceptions such as the Esmeralda in the southern portion of the district do occur.

DESCRIPTION OF VEINS The veins are, as in many deposits, really a series of veins, stringers, splays and horsetails. They were clearly emplaced in structurally active zones and there is evidence that structural activity continued throughout the period of vein emplacement. The veins range from a few inches to several tens of feet in thickness and are often continuous over several thousand feet. Cross faulting is common and has locally offset and complicated the vein traces, (Figure 3). Although there are minor differences between the various veins throughout the district, as a practical matter they can all be considered parts of the same system.

ORE SHOOTS Available data indicates that the ore shoots are long, narrow bodies with a limited vertical distribution. Boundaries of shoots within a vein range from sharp to gradational and no consistent trend has been observed. Although little information concerning oreshoot geometries is available in the data review of maps and conversations with operating personnel indicate that the high grade pods are indeed elongate down the dip of the vein. The actual rakes have not been determined but it is clear that they are near vertical. On the other hand it appears that the low grade oreshoots and the zone of mineralization in general is usually elongate in a horizontal direction with no discernable plunge or rake. Reports vary but Table 2 lists some of the generalized size parameters for the various mines.

TABLE 2: GENERALIZED SIZE PARAMETERS AND VERTICAL RANGES OF ORE SHOOTS

MINE	VERTICAL RANGE	HEIGHT	LENGTH RANGE	WIDTH RANGE
PROSPECTUS	80'-400'	+/-300'	+/-300'	up to 30'
HUMBOLDT*	30'(?)-600'	+/-500'	+1000'	10'-30'
JUNIATA	SURF-300'	OVER 300'	+/-150'	+/- 7'
LAST CHANCE HILL (Hodges)	SURF-90' (60'-120')	OVER 90' (60')	100'-200' (same)	16'-36' (same)
NEW ESMERALDA	SURF-150'	OVER 150'	----	18'

* NOTE: Based on leach grade continuity

Ore shoot distribution within a vein is strongly controlled by observable geologic features. Some level of structural control is evident, Figure 4, but very little data is available which might provide additional insight into this important subject. There is a strong indication that ore shoots occur

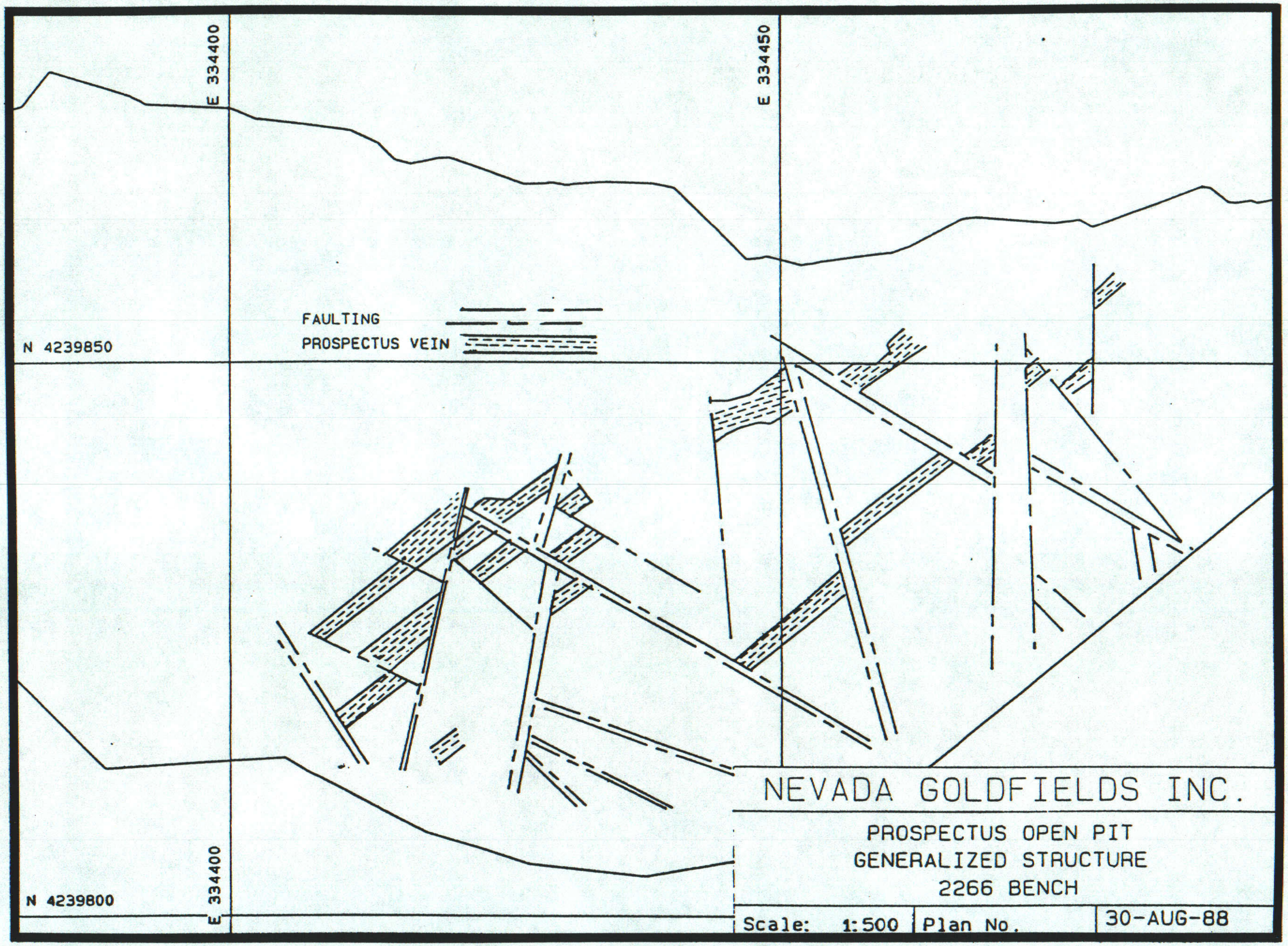


Figure 3. Detail of structural off-sets in veins of the Prospectus Mine, (Dorff, 1988).

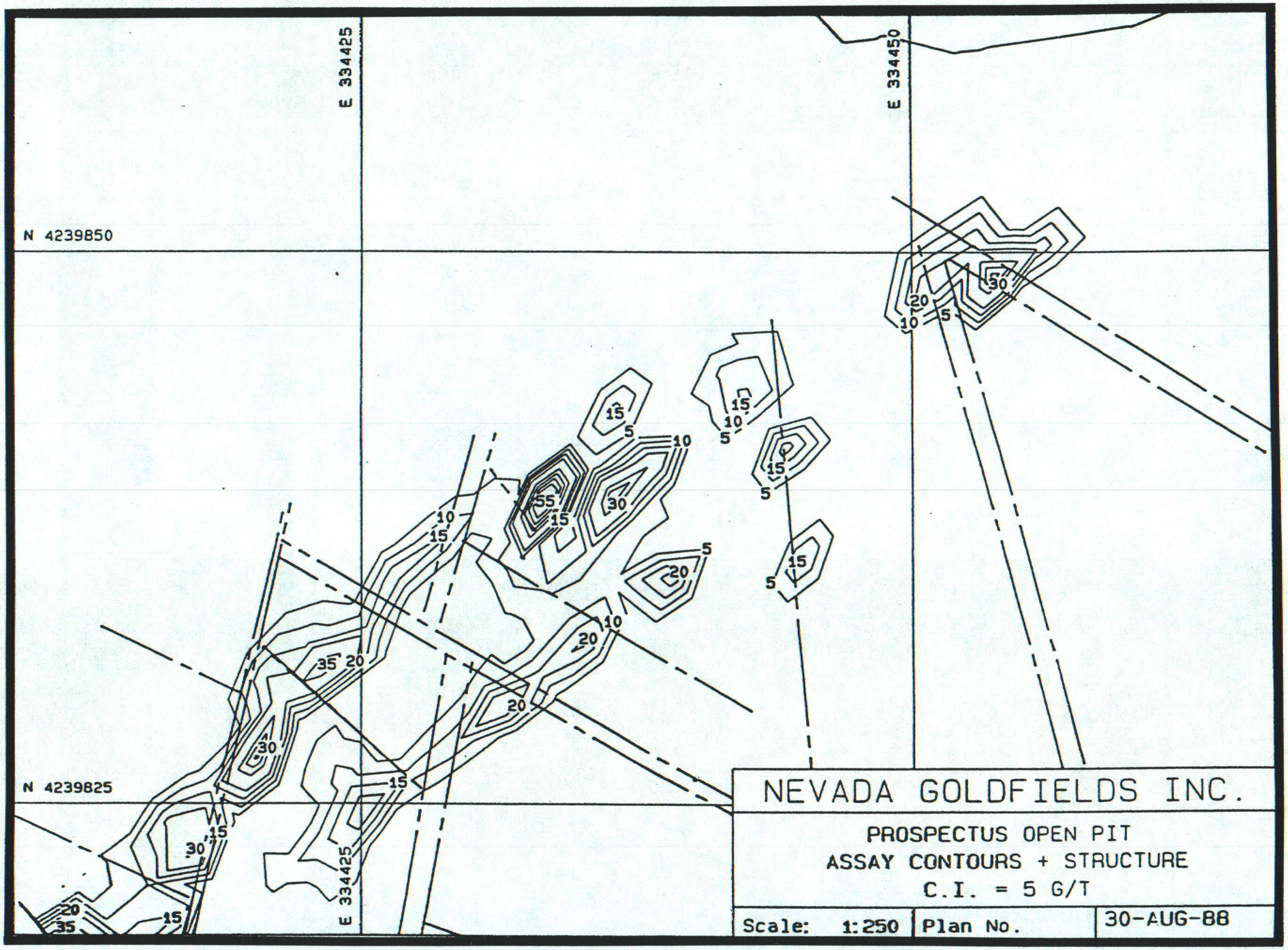


Figure 4. Detail of ore/structure relationships at the Prospectus Mine, (Dorff, 1988).

preferentially near the hanging wall of veins. However, ore shoots have been found in all portions, even occupying the entire vein and parts of the wall rocks.

There seems to be a distinct vertical range over which large scale mineralization occurs. Above and below this zone it appears that ore grade mineralization is confined to very small, (a few thousand tons), ore shoots. The larger ore shoots seem to range from 100' to over 500' in vertical dimension and continue along strike for over 1000'. The tops of ore shoots have been only occasionally exposed and blind ore shoots have been found by drifting and surface drilling.

The apparent frequency of ore occurrence, on a given vein, seems quite high. This impression is based on some of the old long sections and plan maps that indicate a high percentage of the developed vein was actually stoped for the high grade ores. No recent compilation of this type has been done but the current and projected mining on the Prospectus and the Humboldt supports this view.

Grades vary over small distances. Grade contours on bench plans at both the Prospectus and Humboldt pits indicates an elongate, irregular distribution of gold mineralization with many embayments and holes within the distribution, Figure 4. Based on experience from many other gold occurrences, it is probable that the distribution of gold in the Aurora veins is also highly irregular at much smaller scales. No data is available concerning the detailed sampling required to define small, (less than 10'), scale gold distributions in the veins.

The distribution of what might be called "heap leach grade" material within the veins has not been studied in any great detail. Contours on blasthole sampling at the Humboldt indicates that the shapes of low grade ore shoots should be similar to those of the high grade shoots. The low grade shoots should be larger overall, and generally, but not always, contain high grade shoots within them. They would, therefore, make larger targets for exploration. However, there is no evidence that the low grade material predictably haloes, or is in any other way spatially related to, the high grade shoots. Most commonly the different mineralization levels are associated but so erratically that reliable prediction is impossible.

All available data indicates that the size of gold particles within the ore shoots is small. There is no record of screen-fire analyses on any of the samples. This type of analysis could verify and quantify the question of gold particle size. In M. Osborne's thesis a photomicrograph shows grains of gold as large as .1 mm. and ranging downward. Grinding tests reported in the many metallurgical reports indicate optimum exposure of gold particles to leach solutions at less than 200 mesh, (75 microns). Data of this sort is extremely valuable in understanding the behavior of gold particles during the sampling process.

GENETIC MODEL FOR THE AURORA VEINS

All workers are agreed that this is a paleo-hot spring system. This model holds, more or less, for all of the known vein systems in the district. However, within this broad classification there is a great diversity of individual deposits. It is important to keep in mind that each vein probably acted as a separate vent with its own unique history. For that matter, different segments of a vein will have a different history. Significant geologic work has been done by a number of workers at Aurora in recent years. Although our understanding of the ore occurrence has been expanded greatly important questions remain.

A successful model will not only explain the observed features of an ore deposit but will provide a degree of predictability to the occurrence that can be used to increase the effectiveness of both mining and exploration.

The important features at Aurora that must be accounted for by any model include:

1. Apparent relationship of ore with faulting/fracturing and possible relationship to cross faulting. The veins have been emplaced in faults and fractures and are not replacement style silicification features.

2. Dominant occurrence of gold in quartz veins. Only limited mineralization in wall rocks and non-quartz bearing structures.

3. Occurrence of "open textures" such as vugs, cockscomb and poorly healed breccia and a decrease with depth of these features.

4. Apparent top of "high grade" ore just below the surface and a clearly defined bottom to most chutes.

5. The make-up and distribution of the alteration suite.

6. Apparent fine grain size of gold.

7. Episodic brecciation and banded quartz deposition and zonation of vein mineralogy in early barren, ore and late barren stages.

8. The occurrence of low temperature minerals such as adularia and acanthite.

Although there are many "chicken and egg" questions remaining, the following, proposed, general sequence of events at Aurora accounts for most of the facts and provides a framework within which to design exploration programs and geological procedures related to production.

1. Widespread faulting and fracturing providing both a "plumbing system" and a tap into a regional hydrothermal system. The area became a center of surface venting hot springs. Movement on these structures is on going throughout all subsequent phases. Individual hot spring vents opened, closed or shifted position through time.

2. Propylitic and argillic alteration of wall rocks begins and is on going intermittently through all subsequent phases. Alteration is controlled by permeability of wall rocks and rate of fluid movement through the vent.

3. Emplacement of quartz in open fractures. This stage produces the "early barren" phase of mineralization. Some fractures are sealed by this phase and some remain open and active.

4. Sealed structures develop a broad alteration envelope. Continued silica deposition produces a silicified core. Open fractures develop localized and erratic alteration patterns and continued barren quartz deposition.

5. Ore stage quartz emplacement begins. Open fractures are successively layered in regular bands and replacement textures. Sealed structures remain barren except where continued faulting shatters the previously silicified rock. This brecciates the core allowing deposition of ore stage quartz in stringers and stockworks over relatively broad areas. Cross faulting of single vents provides a fluid focusing mechanism resulting in high grade zones.

6. The sequence repeats with one or more stages missing or out of sequence.

The foregoing model indicates that there are two distinct but interrelated ore occurrences to be expected in the Aurora district. First, the veins and second, silicified stockworks in the andesites.

The critical parameter for a relatively large stockwork ore body is to have the vent sealed early and remain sealed for a long period time. This allows the silicification of much of the wallrock andesite, forming a brittle core. Only minor veining would result and that which was present would be primarily "early barren" quartz. Due to renewed movement on structures or an explosive over pressurization of the vent area some of these sealed, silicified areas will be reopened. This would cause shattering of the brittle rock and rapid boiling of fluids over a significant vertical range. Where this sequence occurred during one of the ore forming stages a Borealis style ore body would result.

<u>SIGNIFICANT UNANSWERED QUESTIONS</u> Although the foregoing model represents one explanation of the observed facts a number of alternatives exist and are strongly argued by some workers. Some of the questions that arise are:

1. Do the veins represent near surface expressions of a silica depositing hot spring system or do they represent the deeper "bonanza vein" portions of the system with Borealis style mineralization to be found in higher, now eroded, segments above?

2. Are the High grade ore shoots a product of supergene enrichment, a result of restricted boiling zones, control by flat structures or interaction of ground water with hydrothermal fluids or some other mechanism?

3. Will the veins grade to base metals with depth as in the porphyry related systems, simply disappear or they will persist to depth as gold/silver veins as in the mesothermal veins of California?

4. Is the Prospectus fault pre-, syn- or post-ore?

<u>POSSIBILITIES</u> The high grade pods may reoccur with depth if their apparent depth restriction is due to flat structures or a fluctuating ground water-hydrothermal fluid interface. On the other hand, if they are due to supergene enrichment or restricted boiling zones they will only occur in one zone.

Vein mineralogy and texture may provide tools that can be used to help predict where in the system a particular vein might be.

Structural analysis can identify specific intersections which may be favorable foci for mineralization as well as general orientations or ages of structures that will host ore while others do not.

There is potential for the occurrence of additional Aurora style mineralization throughout the district as well as for Borealis style mineralization in selected areas.

RESERVE ASSESSMENT

The primary goal of this project is the qualitative assessment of the Nevada Goldfields Inc. reserves. Reserves have been stated at varying levels of confidence for several areas within the property package. These are summarized in Table 3, (possible reserves have been left out).

TABLE 3. GEOLOGIC RESERVE SUMMARY: NEVADA GOLDFIELDS INC. PROPERTY

LOCATION	TONS	GRADE	CATEGORY	ESTIMATOR
Prospectus Surface	233,545	.193	PROV/PROB	N.G.I.
Prospectus Underground	30,092	.985	PROV/PROB	N.G.I.
Juniata	40,135	.273	PROB	N.G.I.
New Esmeralda	55,534 (43,320)	.153 (.139)	PROB (PROB)	N.G.I. (W.G.M.)
TOTALS	359,306	.262		

It is not the intent here to recalculate or verify the reserves stated by others. This assessment addresses the question of reserve quality and reliability from a geological perspective. To do this, the development process is looked at from several interrelated standpoints. First, the methods used to sample the deposit and the biases inherent in them. Second, the underlying geologic assumptions and the data which supports them. Third, the methods used to produce a geologic reserve model. Finally, since the property has been operating for some time, an attempt is made to reconcile the reserve data with the production data.

SAMPLING METHODS AND PROCEDURES The majority of the deposit has been sampled by angled reverse circulation rotary drilling. Reports indicate that some core had been drilled but no record of it remains. Surface sampling was all above the ore zone.

All of the drilling was wet, with occasional extreme water flows. Samples were variously caught and split using Jones splitters and later a wet splitter. The drill was not stopped and "cleared" between samples as a general rule. Retained sample size was approximately 5 pounds. A geologist was at the drill and samples were logged on site. The logging lacks detail in both geological and engineering data and is only of limited value in understanding the deposit. Sample interval varied from 2.5 feet to 5 feet and in areas judged not to be ore the 5 foot samples were composited to 10 or more feet. Drill spacing ranged from 25 feet to 100 feet with the majority of the intervals approximating 50 feet. Down dip vein penetrations are generally close to 50' but they are often irregular and in some cases the drill direction was parallel to the vein rather than across it.

Assaying was done at several commercial labs using 1 A.T. and 1/2 A.T. charges for a fire assay with A.A. finish. Earlier samples were run at the Hanna in-house lab.

All available details of the sampling procedure are listed in Appendix 2. Also, a discussion of the merits and problems of the various drilling techniques is included in Appendix 5.

Reverse circulation rotary drilling, if properly applied, is one of the best sampling tools currently available. In this particular instance the necessity of drilling angle holes, and the severe water flows, will have decreased the effectiveness to an unknown extent. Foreword planning and comparative studies can effectively account for most of the biases induced by less than ideal drilling conditions. These biases would be minimized in this case if the size of the gold particles in the sample were small enough to be contained within the gangue and were relatively evenly distributed throughout the sample.

In gold deposits it has been shown by numerous geostatistical studies and decades of practical experience that sample size is critical to the validity of a sampling program. In the absence of definitive studies it is accepted industry standard to collect a minimum 10 pound sample which has been shown over the years to be the best compromise between valid sample size and logistical considerations. The bias introduced by small sample size will also be minimized by small gold particle size a relatively homogenous distribution.

Assaying is as much art as it is science and each lab has its own built in biases. It is good practice to select a reputable lab and do all of the work there with some rechecks by outside labs. More importantly, a consistently documented sample and analysis procedure should be implemented in the early stages of the sampling. This appears to have been done reasonably well with respect to internal precision of the analytical procedure. Comparison of various labs, as expected, returned variable results which are all within acceptable limits. It is important to note that these rechecks were all on the same samples so no data was developed concerning the natural variability of the deposit or the variences induced by the various stages of sampling.

Condor Minerals Management presents data based on the numerous rechecks mentioned above and concludes there is no "nugget effect" in the Aurora ores. The data clearly indicates that the size distribution of the gold particles in the samples is limited. There remains some question of the quality and validity of the original samples used for the analysis. It is entirely possible that all of one particle size range was preferentially included or excluded from the sample. It would be informative to compare multiple splits from samples from the same area and samples collected by an alternative sampling method. If they returned consistent results the conclusion would be much better supported.

<u>GEOLOGIC ASSUMPTIONS</u> The foregoing discussion indicates that, at a bare minimum, an informal set of assumptions had been made concerning the character and distribution of the gold in the prospectus vein. In order to sample the deposit as it has been, and believe that sampling to be valid, it is necessary to assume the following:

1. The gold grains in the deposit occur over a limited size range and are uniformly much smaller than the majority of the cuttings produced by the drill. This allows nearly all gold to be contained in, and transported by, fragments of gangue.

2. The distribution of gold grains in the ore is uniform enough, at the scale of the drill hole, that the majority of the fragments recovered by the drill and the splitting process will contain a representative quantity of gold. Therefore, any size fraction or split of the cuttings will be representative.

3. The distribution of ore is fairly uniform over distances of greater than 5' across the vein, 50' down dip and 50' along strike. This means that the majority of each sample interval will be either all ore or all waste-not a blend. It also implies that the rock between the penetrations down dip and along strike will, for the most part, be the same as in the penetrations.

4. Gold particles are small enough and evenly distributed enough to be homogenized in each sample to the extent that compositing two samples will produce an average value.

5. Samples containing ore and waste represent the average of the two rather than one or the other or some indeterminate mix.

There is no indication in the data or in conversations with the various parties involved that any preliminary work was done to establish the validity of these assumptions.

In general these assumptions are valid for a hot spring related bonanza vein system. Gold grains are commonly small and evenly distributed in the ore. But these relationships are on the scale of inches not feet. Observations of the vein in the pit and underground indicate a tendency toward stringers and veinlets in many areas. Ore samples from wide veins display a banded or spotty distribution of ore in the rock on a scale of inches. Structural control at small and large scales is evident and gold grades vary significantly across structures.

In order to develop a valid sampling, the sample length and spacing must approximate, or be less, than the important breaks in continuity. Also, since there are always smaller breaks in continuity it is important to understand that many samples will contain some ore and some waste and that the resultant assay could be almost anything, EXCEPT a number representative of the average gold content of the block. Determination of what constitutes a major break in continuity requires some thought and knowledge of the deposit. The essential criteria is what material will be incorporated into the sample and its effect on the ultimate 15 or 30 gram sample that is actually assayed.

Finally, a failure to recognize samples that cross ore/waste boundaries can result in a significant misinterpretation of the tonnage by assigning the interval to all waste or all ore. In addition, internal dilution could be significantly higher than expected or worse yet, the ounces estimated to be in a volume of rock may not be there at all.

In a small system such as the Prospectus vein these assumptions can have dramatic effects on the viability of the entire operation.

ORE RESERVE CALCULATION METHODS There appear to be several generations of reserves by a number of groups and individuals. These are summarized in Appendix 4. Appendix 3 lists all of the conversion factors used to bring all of the reserve calculations to the same units. Each of these reserve estimates rely on the same basic data set and represent just slightly different approaches to projection and areas of influence. The critical ones are the Condor Minerals Management reserves of October 15, 1985 and the Nevada Goldfields reserve presented in the development plan of May 21, 1987. The Condor geologic reserve was made from new hand drawn cross sections following the completion of the phase one drilling program. The Nevada Goldfields Inc. reserve incorporates data from the phase two drilling program and was presumably done by in-house staff. All reserves seem to have been worked on by Marla Osborne and she seems to have been the primary worker for the final Nevada Goldfields Inc. reserve. She states that the reserve was done manually in cross sectional blocks, then digitized and entered into the SURPAC system. The computer was used to develop the composited bench plans used for the mining reserve. No dip or directional bias was built into the SURPAC geological model.

In all identified cases the cross sectional geologic reserves have been done on the basis of assays alone without the benefit of geology. Blocks are made by connecting intercepts with straight lines over what appear to be long distances in many cases. There is no indication of the development or use of formal estimating rules.

Cross sections are one of the best methods of developing a geological reserve in these types of ore bodies. The relationships of analytical, observational and interpretive data can be clearly displayed and modified. Geological insight can provide important weighting to the factual data and the development of ore outlines. Therefore, tonnages, can be made significantly more accurate than mere straight lines connecting numbers.

RECONCILIATION OF RESERVES AND PRODUCTION A cursory examination of the comparisons contained in the monthly reports by Tony Dorff indicates that an excellent correlation exists between estimated ounces in a bench and actual ounces mined, based on blasthole sampling. This is a paradox since Dennis Bergen's recent estimate of reserves indicates a severe shortfall when compared to total production and original estimate. This data is summarized in Table 4.

This type of post-mortem data is essential to the management of a mine and the rational utilization and updating of a reserve.

CONCLUSIONS Regardless of the geologic model used for the genesis of the Aurora veins the problem of mineral distribution at the scale of an ore reserve stays the same. In this case the system consists of a series of veins which are highly variable in thickness and continuity along strike and down dip. Within these veins gold occurs as small concentrations erratically distributed in small, pod-like clusters, Figure 4, Appendix 5. There is also a significant body of evidence indicating that variations of gold content are quite large even on a scale of inches.

TABLE 4. RECONCILIATION DATA-ORIGINAL RESERVE VS. CURRENT-PIT ONLY

ITEM	TROY OUNCES-GOLD	COMMENTS
ORIGINAL ESTIMATE	44,841	By Nevada Goldfields Inc. 5/21/87
PRODUCTION:10/88-2/89	7,404	Derived from Nevada Goldfields Inc. data and conversations with R. Dye
OUNCES REMAINING	37,437	This is what should be left in the pit and ready to be mined.
NEW ESTIMATE	12,317	2/89 estimate by Dennis Bergen based on Nevada Goldfields Inc. cross sections and pit plans.
SHORTFALL	25,121 (56% of original est.)	These ounces must be accounted for either by large inaccuracies in the original data base or in the method of calculating one of the reserves.

The intent of a geologic reserve is to describe the location and spatial distribution of mineralization as accurately as possible. This reserve will then serve as a basis for mine planning and the development of a mining reserve. The following comments reflect a qualitative assessment of the Nevada Goldfields Inc. geologic reserve and the techniques used to develop it.

The techniques used to generate the data base are generally acceptable and are common industry practice. However, the execution of the program seems naive and poorly thought out. There are many sources of error and bias which appear to result from a lack of consistency or technical discipline.

Using reverse circulation drilling for reserves on something that varies on so fine a scale as the Aurora veins must be approached with caution. In this case, there is no evidence of comparative data on reverse circulation drilling vs. core drilling or channel samples which might provide assurance of the validity of the method. Also, the post mortem comparisons of blast hole sampling vs. the reverse circulation sampling has not been done. A representative amount of gold probably got out of the hole but because of the arbitrary drilling directions and spacings we aren't sure what volume of rock that sample should represent. In addition, because of the questionable splitting and handling of the samples we aren't sure of the accuracy of the analytical results. The precision of the analyses seems to be well documented.

The underlying assumptions in the Nevada Goldfields reserve as discussed above are generally not supported by factual data. They do appear to some extent to be generally supported by subsequent production data. However, no one has really made the post mortem comparisons essential to evaluating progress and modifying operations.

The method of calculating the geologic reserve is good. There is some indication of liberal projections and there is no real geologic information to back it up. Once again, the post mortem comparison would answer the question of accuracy. One source of error that is probably not significant is ignoring the dip in the computer's geologic model, if this is even possible with SURPAC. Not telling the computer to search with a directional bias when compositing values for benches may cause the exclusion or addition of some ore blocks incorrectly.

The one small attempt at a post mortem comparison which is presented above yields a striking and very negative result. There is every chance that the shortfall can be accounted for but at this point the entire reserve picture is in grave doubt.

The foregoing comments tend to accumulate into a negative impression of the Nevada Goldfield's data base and the reserves developed from it. The comparison data casts significant doubt on the accuracy of the reserve and there are many questions concerning the validity of the sampling.

The Nevada Goldfields Inc. deposit is an epithermal vein system with significantly higher variances than other more disseminated types of deposits. For this reason, the risks related to sampling accuracy and reserves are higher than in many other deposits. These risk can be managed by good geology and proper procedure. There appears to have been a conscious acceptance of these increased risks in return for economy on the part of Nevada Goldfields Inc..

Discrepancies in reserves and concepts can be identified and often overcome during operations by a consistent program of mine geology and reconciliation of production data. There appears to have been a conscious decision on the part of Nevada Goldfields Inc. to economize at the expense of assurance.

POTENTIAL OF THE NEVADA GOLDFIELDS INC. PROPERTIES

Any discussion of potential must, by it's very nature, be subjective. In order to make the following discussion useful an attempt is made to deal within a consistent framework of definitions and concepts. Also, an effort is made throughout the discussion here and in the section on district potential, to deal with relatively high probability occurrences rather than new concepts.

The Aurora veins are, as discussed above, difficult challenges for mining. The risks associated with these operations are higher than in many other mining ventures. This implies something about the level of risk acceptance for companies willing to be active in this area. Throughout the following discussion a level of risk acceptance consistent with operations in this type of environment is assumed and is an integral part of qualitative assessments such as "high or low potential". It is important to state clearly that quantitative statements are highly speculative and judgmental. They are intended only to impart a sense of scale and do not represent a geological resource.

In addition to the assumption concerning risk acceptance, this assessment also assumes several other general conditions which strongly impact the viability of any body of mineralized rock. First, it is assumed that ore will consist of material potentially mineable by The Aurora Partnership and no rigorous attempt is made to distinguish mill grades from leach grades. Second, that the exploration programs expected to actually find these ores will be a systematic, on-going program with modest annual mapping, sampling and drilling. The exploration will be included within the scope of the mine operation, with only occasional input of additional money and manpower for special high yield projects. Third, that the potentials discussed will be multiple veins and small stockworks spread over a relatively large area requiring an extensive haulage system.

NGI controls approximately 4,400 acres of mixed patented, and unpatented land, Figure 2. Numerous veins have been identified on these lands many of which have produced significant ore tonnages in the past. The preliminary nature of this report as well as a lack of detailed district geology precludes the identification of specific areas of new potential. Rather, this assessment will deal first with the concepts and opportunities relating to the potential of the entire property package and, for that matter, the district as a whole. Finally, a discussion of the apparent potential of a few specific vein systems within the property package will be presented. These vein systems include the Prospectus, Juniata, New Esmeralda and the group of veins in the Last Chance Hill area.

GENERAL DISCUSSION Ore bodies to be expected with some degree of confidence are primarily vein type look-alikes of the previously mined ore shoots and larger versions of the lower grade silicified stockworks which have occurred in very small tonnages to date-notably in the Prospectus pit. There is little chance of finding anything on the Nevada Goldfields Inc. properties at Aurora which is significantly different than that which has been found in the past.

In addition to the veins with measured reserves the large Nevada Goldfields land position is considered to contain a significant potential for additional ores as extensions of known veins, newly discovered veins and new silicified stockworks.

It is concluded that the potential for finding additional ores within the NGI property package is excellent. This conclusion is based on the preceding discussion and the following positive system attributes:

1. The NGI property package is large and includes significant areas of permissive geology that have only been examined in a cursory manner.

2. The level of exploration maturity in the area is low and very little exploration has been done using modern, systematic, methods.

3. The available mapping indicates that quartz veins occur throughout the district.

4. It is clear from the pit and underground exposures that these vein systems are variously mineralized or barren along strike and down dip. Therefore, a lack of ore grade samples on one part of a vein bears no implications with respect to the occurrence of ore on other

parts of the vein. The converse is apparently not true.

5. The apparent frequency of ore occurrence in all developed vein systems seems, as a preliminary impression, quite high. This indicates a strong probability for the occurrence of additional ores on veins that have been shown to be mineralized, but have not been explored through their full extent.

6. The area has been broken into numerous blocks by what seems to be post ore faulting. Erosion levels vary quite a bit from block to block and it is unlikely that all ore bodies, or veins for that matter, are currently exposed. Its probable that blind veins and ore bodies occur.

7. Previously uneconomic ore grades can now be mined. The distribution of this lower grade material appears to be more widespread than the higher grade ores mined in the past. This presents the possibility for significant tonnages remaining in the previously mined veins as well as discovery of new ores.

On the negative side of the issue there are a number of factors which indicate caution in this assessment. Among these are the following:

1. Tonnages and contained ounces will be small as in the past. The probabilities of finding a major, high tonnage, ore body are low.

2. A significant body of evidence indicates that there is a depth limit to the mineable ore bodies in the Aurora District. If this is the case, the potential of the existing veins becomes severely limited with only small oreshoots continuing to any appreciable depth.

3. The distribution of lower grade material, both around old oreshoots and in unmined ones, is not understood. It is possible that only minimal amounts of this material occurs within the veins.

4. In any case, ore bodies will be spread out over a large area and require a significant haulage system.

5. Although ore guides which can be used as exploration tools clearly exist, they have not been developed to the point where they can increase the odds of discovery or provide predictability to the occurrence of ore.

6. The data set upon which this evaluation is based is extensive but severely lacking in the systematic compilation and geology required to develop an accurate assessment of potential. This work may well change the current view considerably.

In summary, it is considered reasonable to expect that, if the current view of the property package is accurate, an additional 60,000 to 100,000 ounces of gold could be found in multiple ore bodies located in, as yet, unidentified areas of the property. This does not include the potential of the specific areas discussed below.

PROSPECTUS VEIN SYSTEM The Prospectus vein system, Figure 5, has been traced more or less consistently over a strike length of approximately 1900 feet. It has been projected using limited data for another 1600 feet. Throughout this length it is offset by numerous faults, Figure 3. The veins have been intercepted by drilling down dip for over 300 feet and the structure, at least, persists below that. At present there is no known bottom to the mineralization. The strike length has been reasonably well explored over the exposed 1900 feet but only superficially over the western extension.

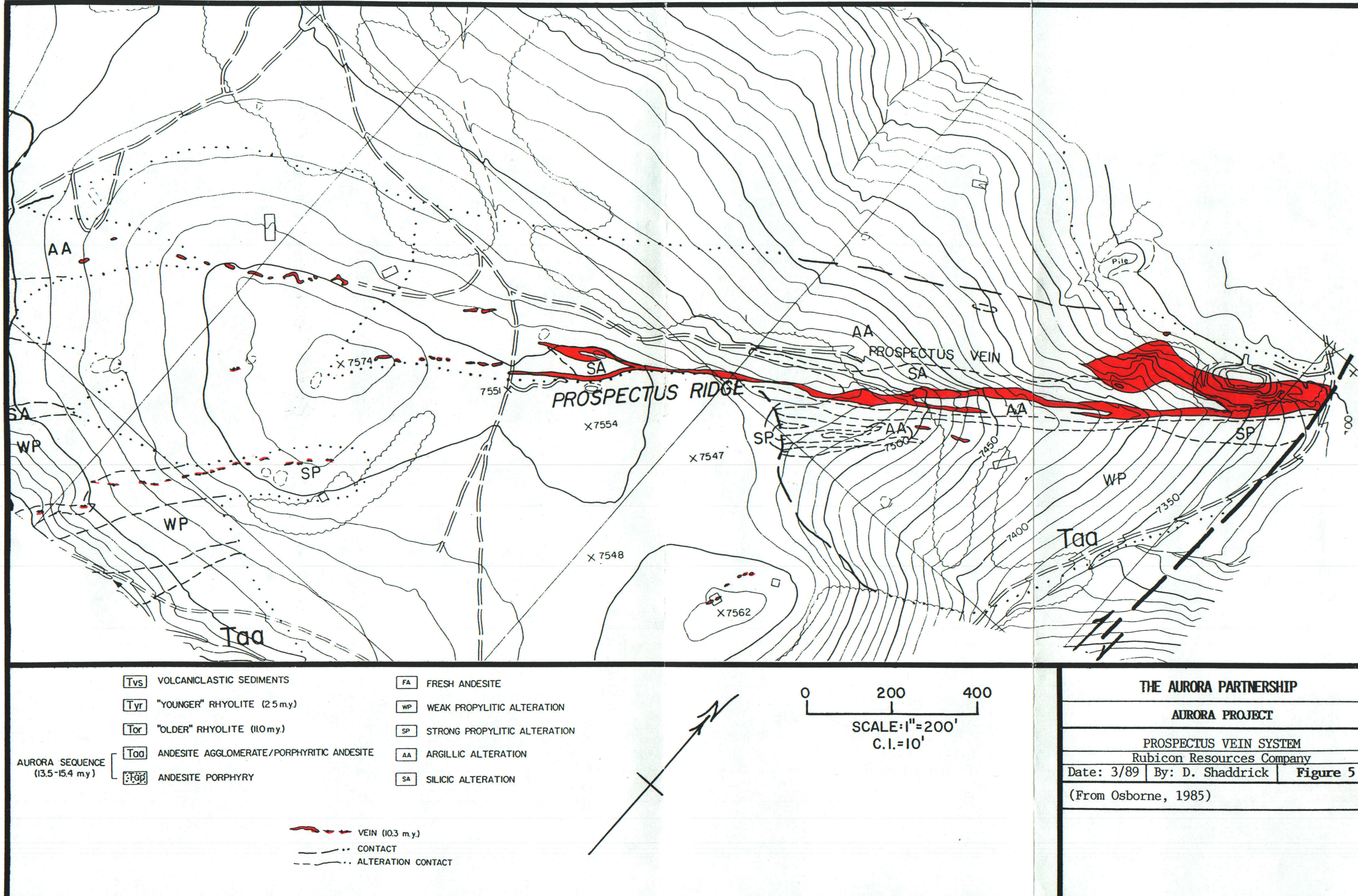
The potential of this system lies in the discovery of additional ore bodies along strike and down dip. Very little information is included in the data set concerning what may be called the Western Prospectus. Mapping and sampling indicates that the vein southwest of the current ore body is thin and discontinuous. This information can only tell us there is not an ore body exposed and sheds no light on the third dimension. The present level of knowledge in these systems leaves the question of blind ore bodies completely open. To the best of our knowledge, the structural setting and the alteration signature are similar to that of the East Prospectus ore body.

It is clear from the underground work that the volume of ore is decreasing with depth. The veins are becoming narrower and the ore bodies more discontinuous. The grade, on the other hand, is reported to be increasing and therefore the contained ounces are remaining constant. There is some chance for additional ores below the current reserve. This would be in smaller high grade ore shoots which will be difficult to find and will not add more than incremental ounces to the mineral inventory.

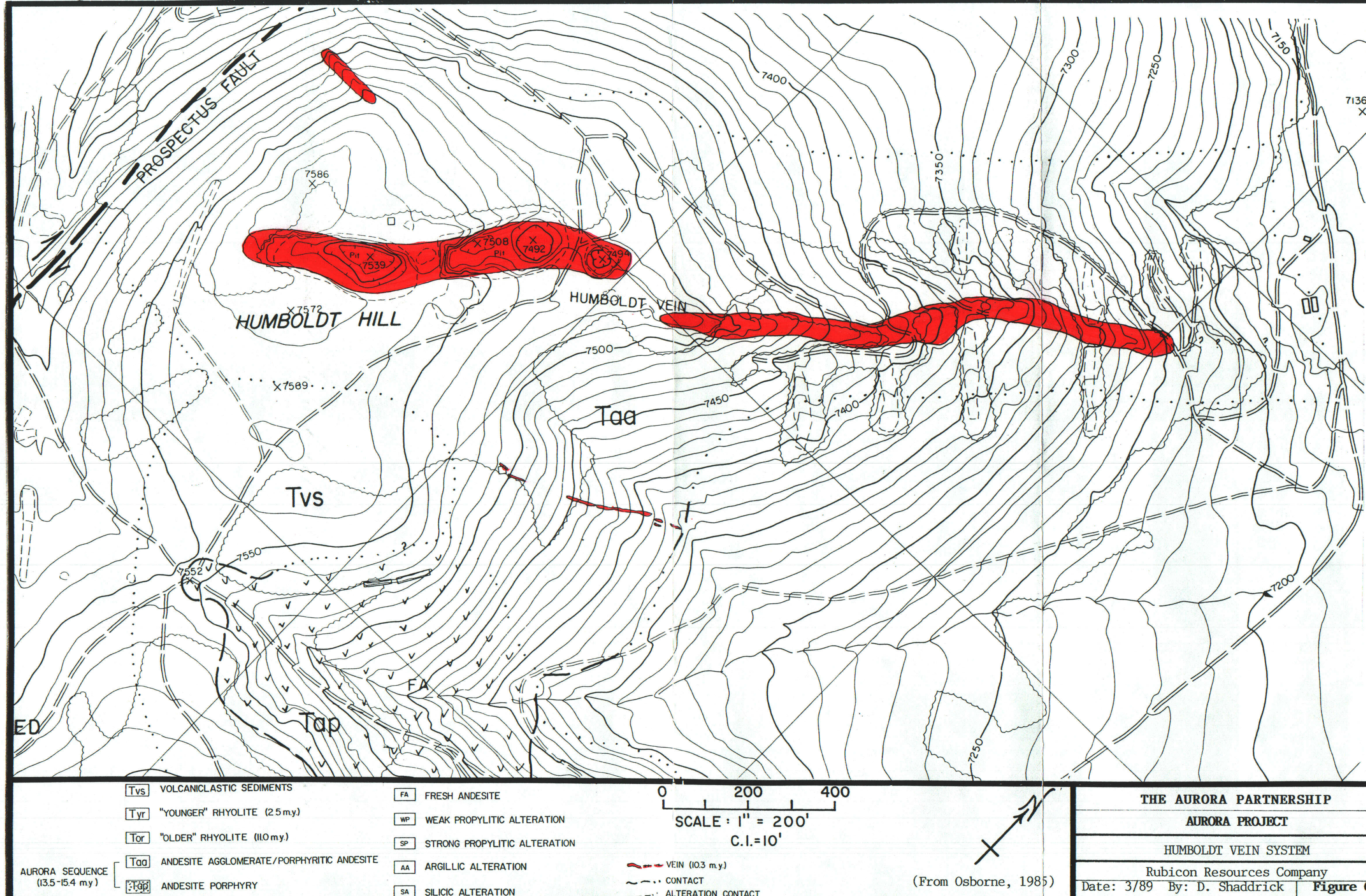
In summary, it is likely that the systematic, low intensity, program of mine geology and exploration that is required in any case, will add some ounces to the mineral inventory. The largest area of prospective ground on the system is to the west. If the system is indeed similar there is a good chance of identifying an additional 20,000 to 40,000 ounces there.

WEST HUMBOLDT (BELOW 400' LEVEL) Figure 6. This area is controlled by Nevada Goldfields Inc. and can be accessed via the old Humboldt adit currently being opened by them. The Aurora Partnership has identified significant ores in the upper portion, (above the 400' level), of the claim block and there is a good chance that it continues downward for some distance. Tony Dorff reports that the drilling they did last year under the 400 level did not encounter significant mineralization. There is no other information in hand but the drilling indicates that the bottom of the West Humboldt ore zone lies somewhere above the 400' level. This means that, at best, ore below the 400' level will be in small high grade shoots similar to those being encountered in the Prospectus decline. There remains, however, a good chance of finding an additional 5,000 to 15,000 ounces of gold in multiple small ore shoots.

JUNIATA VEINS The Juniata vein system consists of at least three separate vein clusters which have been identified as number one, two and three veins respectively, Figure 7. The system is exposed over a strike length of approximately 700 feet and has been mined/drilled to a depth of 400'. The current reserves are in remnants of old stopes and extensions of known



THE AURORA PARTNERSHIP
AURORA PROJECT
PROSPECTUS VEIN SYSTEM
Rubicon Resources Company
Date: 3/89 | By: D. Shaddrick | Figure 5
(From Osborne, 1985)



(From Osborne, 1985)

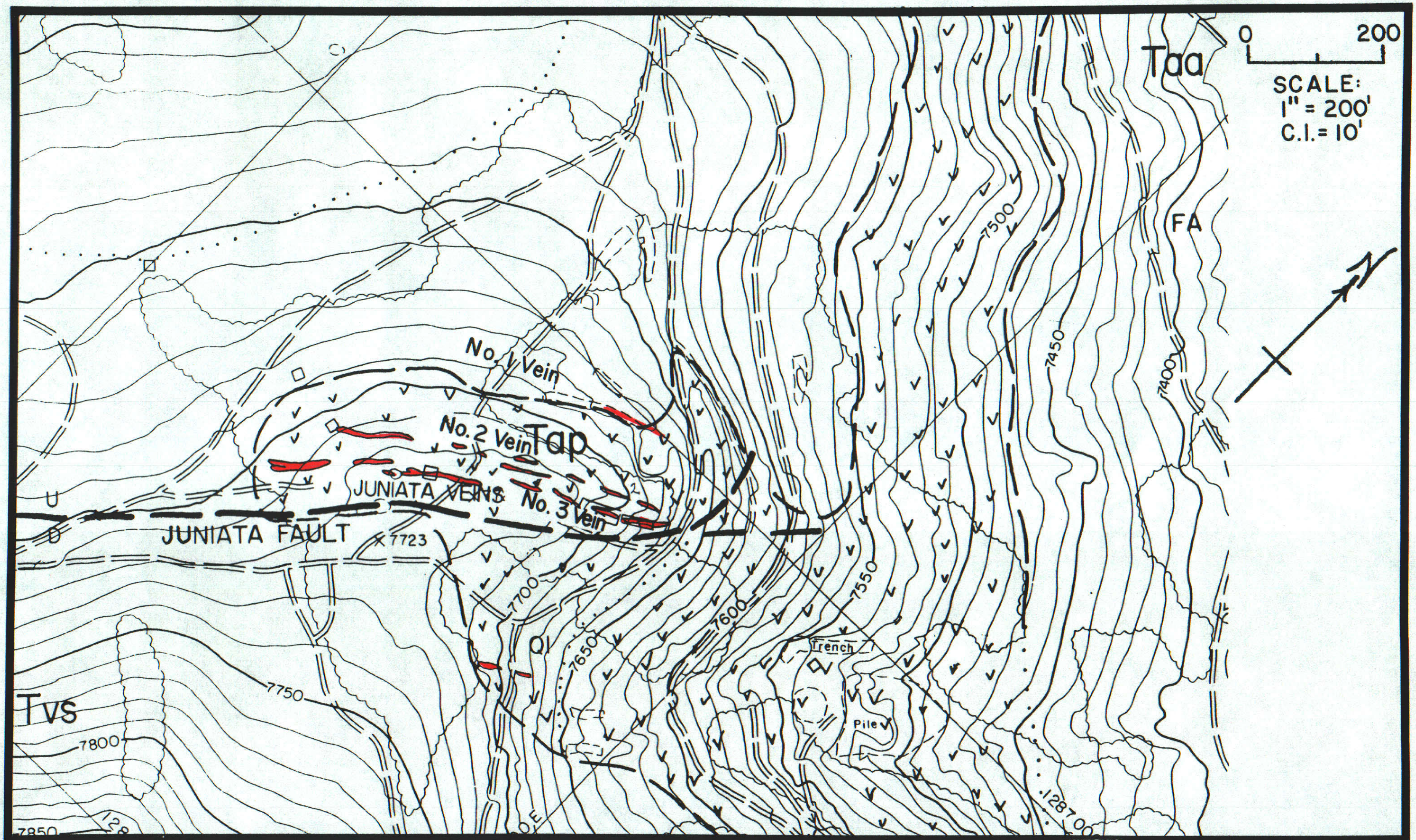
THE AURORA PARTNERSHIP

AURORA PROJECT

HUMBOLDT VEIN SYSTEM

Rubicon Resources Company

Date: 3/89 By: D. Shaddrick **Figure 6**



Tvs	VOLCANICLASTIC SEDIMENTS	
Tyr	"YOUNGER" RHYOLITE (2.5 my)	
Tor	"OLDER" RHYOLITE (11.0 my)	
Taa	ANDESITE AGGLOMERATE/PORPHYRITIC ANDESITE	AURORA SEQUENCE (13.5-15.4 my)
Tap	ANDESITE PORPHYRY	AURORA SEQUENCE (13.5-15.4 my)
FA	FRESH ANDESITE	
WP	WEAK PROPYLITIC ALTERATION	
SP	STRONG PROPYLITIC ALTERATION	
AA	ARGILLIC ALTERATION	
SA	SILICIC ALTERATION	

VEIN (10.3 m.y.)
CONTACT
ALTERATION CONTACT

(From Osborne, 1985)

THE AURORA PARTNERSHIP
AURORA PROJECT

JUNIATA VEIN SYSTEM

Rubicon Resources Company
Date: 3/89 By: D. Shaddrick **Figure 7**

veins, primarily the No. 1 vein, (the western part of the No. 1 vein is referred to as the "powder magazine stope"). There is little indication that additional reserves can be developed within the confines of the currently mined/drilled area. However, there are a number of untested vein extensions and with the complexity of the structure it is likely that exploration will identify new, potentially ore bearing structures. In addition, Condor Minerals Management Inc. mentions a "window", on strike, to the west of the Juniata veins where additional potential might exist.

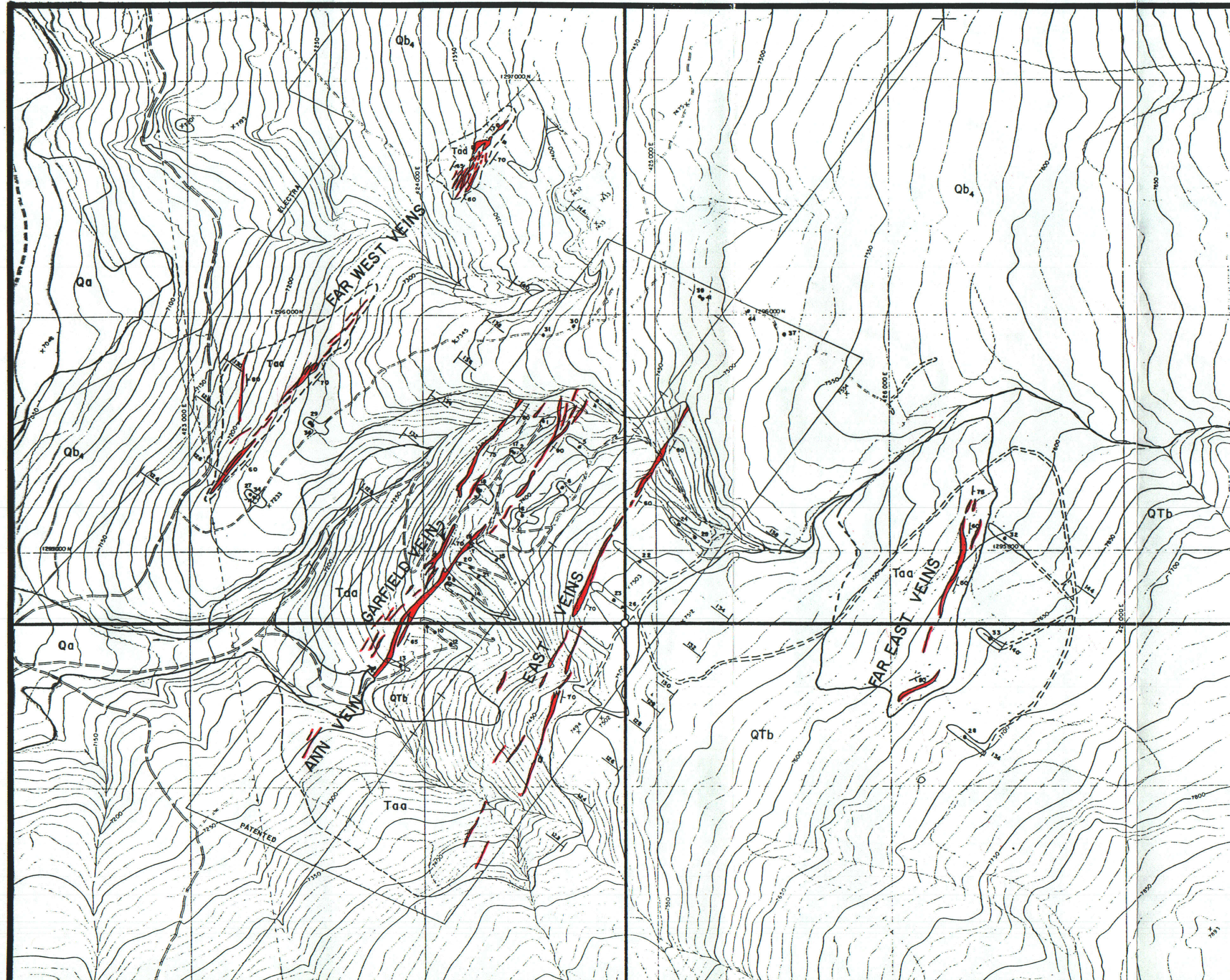
In summary, potential at the Juniata relies on extensions of the known, extensively mined, system. If the mineral system continues into these areas there is enough room for an additional 10,000 to 20,000 ounces of gold in multiple oreshoots similar to those mined in the past.

NEW ESMERALDA The New Esmeralda is about 2.5 miles northeast of the prospectus pit, Figure 2. It consists of a series of small windows in the .25 m.y. basalt flows within which multiple complex veins are exposed, Figure 8. Several systems have been identified and are referred to as the Ann, Garfield, East, Far East and Far West. Some reports refer to a "Hilda" vein but no location has been found. The veins are exposed over a strike length of 2,000' feet and all have been drilled to some extent. A total of 39 drill holes have been identified. The Ann and the Garfield veins have been extensively drilled over a strike length of 1,500' and these two complex structures contain the current reserves, Table 3. The Ann, the Garfield and the East veins have been offset to the north but not to the south. The others have not been drilled along strike beyond the vein exposures. All available information indicates that the system has been deeply eroded with only the lower part of the ore zone remaining. In the Ann and Garfield the mineralization is limited to the first 100'. Other areas are not ore bearing where tested so their erosion level is purely speculative.

Data from other veins in the district indicates that ore shoots occur at different places on adjacent veins. The eastern and western barren veins may well host ore shoots near to the limits of current exploration. In the case of the New Esmeralda veins, however, the added difficulty of the basalt cover reduces the chances of discovery and increases the required grade for a viable ore body.

In summary, the potential in the New Esmeralda area appears to be entirely in extensions of known veins under an unknown thickness of post mineral cover. If the mineral system continues in these veins it is likely that 10,000 to 25,000 ounces of gold could be found in multiple small oreshoots.

LAST CHANCE HILL AREA The Last Chance Hill area is a current exploration project for Nevada Goldfields Inc.. There are a number of veins in the area and a history of extensive past production, Figure 9. The bulk of the ounces produced at Aurora came from this area-from very high grade ore shoots. Information contained in the data set is limited but it and conversations with Tony Dorff indicate that the initial exploration at Last Chance Hill, in 1988, was quite encouraging with a number of good grade, (+/- .2 to .5 oz. au./t.), intercepts being encountered in the drilling. Available maps indicate numerous veins outcropping at the surface and the previous exploration has been either underground drifting or wide spaced drilling looking for a large ore body.

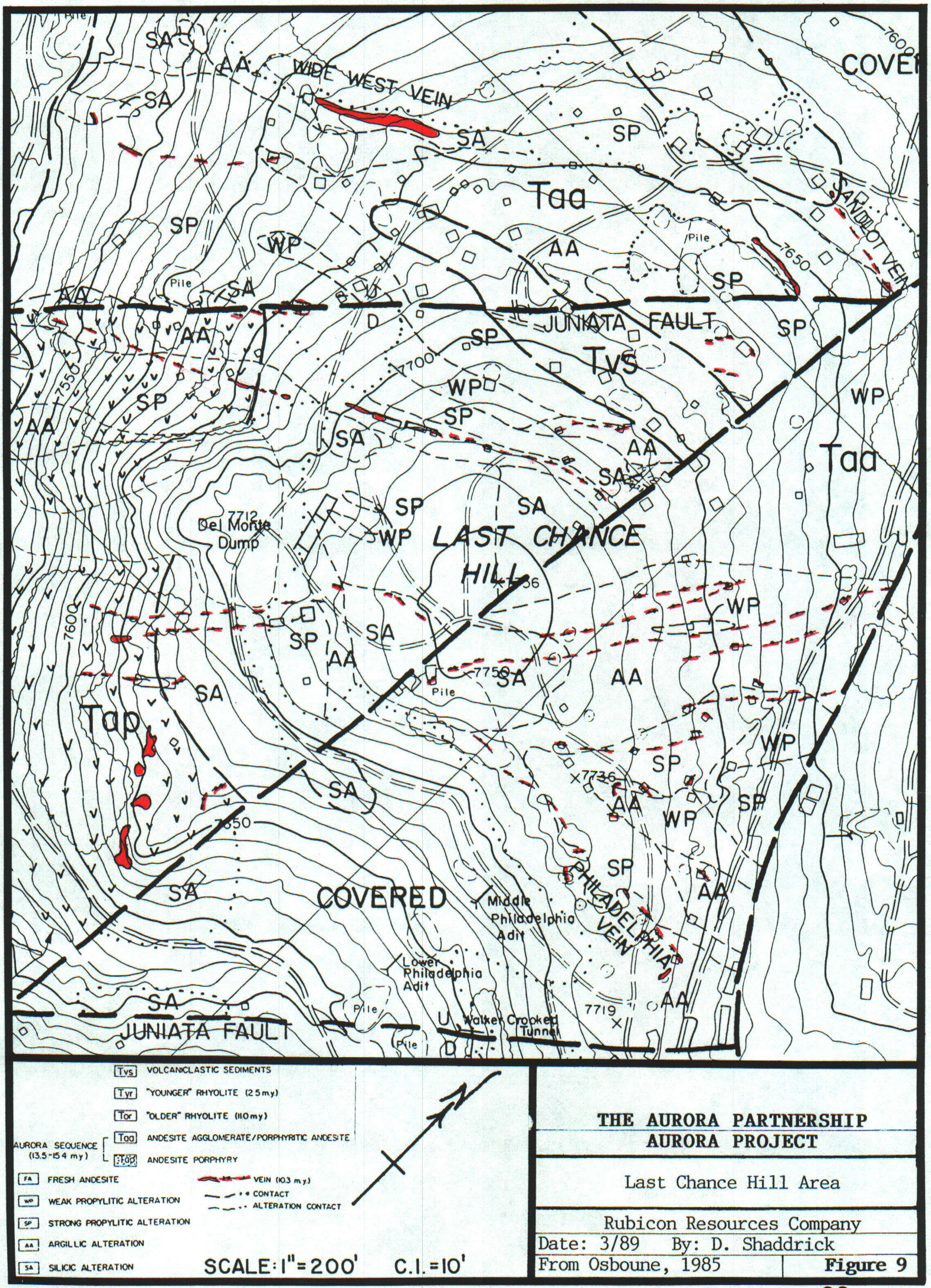


THE AURORA PARTNERSHIP
AURORA PROJECT

NEW ESMERALDA VEIN SYSTEM

Rubicon Resources Company

Date: 3/89	By. D. Shaddrick
From Siscon Data	**Figure 8**



THE AURORA PARTNERSHIP
AURORA PROJECT

Last Chance Hill Area

Rubicon Resources Company

Date: 3/89 By: D. Shaddrick

From Osboune, 1985 **Figure 9**

There is an excellent chance that there are new ore bodies to be found as well as a substantial amount of lower grade material left by the previous operators. If just one new shoot similar to the ones mined in the 1800's is found the contained gold could exceed 100,000 ounces.

In summary, the potential at Last Chance Hill appears to be in remnants around and beyond old workings and in newly discovered ore bodies in previously untested veins. Given the strength of the past mineralization and the large number of veins exposed in the area there is an excellent chance that exploration can identify between 45,000 and 100,000 ounces of mineable gold in multiple oreshoots.

DISTRICT POTENTIAL

GENERAL COMMENTS

The foregoing discussion concerning the potential of the Nevada Goldfields Inc. property package holds equally for the rest of the district. There is a large amount of permissive geology and exploration "room". For the same reasons as listed above, it is believed that there is an excellent opportunity for the discovery of additional ores similar to those mined in the past. In addition, on a district scale, increased potential exists for the occurrence of disseminated stockworks and replacements in the volcanic rocks or other hosts.

There are some additional problems which will have a negative impact on the viability of potential ores beyond the Nevada Goldfields Inc. properties. First, the current level of geological knowledge decreases rapidly outward from the core of the district. This will increase exploration costs and lead times. Second, the area outside the Nevada Goldfields Inc. property package is complicated by multiple property ownerships which will increase land acquisition and holding costs as well as royalty expenses.

CURRENT TARGETS

There are a number of identified areas in the district which have attracted the interest and attention of knowledgeable explorationists, (Figure 2). For the most part these areas do not yet represent ore targets and the information in the data set is too general to provide a sense of potential for these projects. The following brief comments represent impressions gleaned from the data and, in the case of the Doug target, a very brief visit.

<u>SILVER LINING/WEST HUMBOLDT GROUPS</u> This area is included in the mine operations of The Aurora Partnership and significant drill indicated and potential reserves have been identified. The Aurora Partnership data set was not reviewed in any detail and, therefore, these claims were not considered in this analysis.

<u>DOUG CLAIMS</u> This target occurs in what appears to be a small window in the basalt to the northeast of the New Esmeralda window. Brecciated quartz veins appear to cut a felsic intrusive(?). The country rock also appears to be brecciated in places. Outcrops are not wide spread and geologic mapping has not been completed. The extensive soil geochemistry and some geophysics have been completed on the area but no ore grade gold values have been found.

The country rock and the quartz veins at the Doug target are both quite dissimilar from those of the New Esmeralda area and the main Aurora District. The target does appear to be on trend but it is doubtful that ores occurring here would be geologically similar to those at Aurora. At present the information is far too sketchy to say anything more than "it's interesting".

<u>LAB AREA</u> This area reportedly contains hot springs related veins in Cretaceous granite. It seems there has been a lot of drilling in the area and no really good gold values have been recovered. Some of the data also indicates that the depth of cover might be excessive.

Again, this area is quite dissimilar to the main Aurora District and the geological information in the data set is not sufficient to make an assessment of potential.

RADICAL AREA This is the old Esmeralda, Radical, Utah etc area on Silver Hill. There has been quite a bit of activity and production from this area in the past. The geologic environment is essentially the same as the rest or the Aurora District. One intriguing difference is that the Esmeralda vein trends more north south than the usual trend off veins at Aurora.

The idea of intersecting structures in this situation is one that has a high probability of generating significant new ores if all else remains the same.

In summary, the Aurora District is a one million ounce district. Mineralization is widespread but occurs in relatively small ore bodies which do not provide obvious targets to cursory exploration. The potential of the district lies in the discovery of additional ores in previously mined areas as well as in new veins and stockworks. Given the strength of the mineral system and the relatively low level of exploration maturity it is quite probable that an additional 100,000 TO 200,000 ounces of gold can be discovered exclusive of the Nevada Goldfields properties.

Table 5 presents a summary of the potentials discussed in the preceding two sections. That these numbers should not be used as resource estimates is obvious but it must be restated here that they are based on very limited data and study, and are intended only to convey a sense of scale for the terms good, bad, high and low when used in reference to potential.

TABLE 5 AURORA DISTRICT POTENTIALS

AREA	POTENTIAL OUNCES (Au)
NEVADA GOLDFIELDS INC. PROPERTY-GENERAL	60,000 TO 100,000
PROSPECTUS	20,000 TO 40,000
WEST HUMBOLDT (BELOW 400' LEVEL)	10,000 TO 20,000
JUNIATA	10,000 to 20,000
NEW ESMERALDA	10,000 TO 20,000
LAST CHANCE HILL	40,000 TO 100,000
REMAINDER OF DISTRICT (DOUGS, RADICAL ETC.)	100,000 TO 200,00
TOTALS	250,000 500,000

A P P E N D I X   1

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A P P E N D I X 2

PROSPECTUS VEIN SAMPLING:

DATA AND PROCEDURES

PROSPECTUS VEIN SAMPLING-DATA AND PROCEDURES

GENERAL ROCK DATA

DENSITY: 2.6 grams/cubic centimeter (Metric Tons/Cubic Meter) = 12.406 cubic feet/short ton
ROCK TYPES LOGGED: Andesite, Rhyolite, Vein quartz, some alteration.
LOGGING QUALITY/COMPLETENESS: Logging is generally sketchy and lacking in detail.
GROUND CONDITIONS/OPENNESS: Wall rocks are generally tight-the vein is always open with abundant vugs and open fissures.
WET/DRY: All holes were wet for the majority of their depth.

SAMPLING DATA

TYPE DRILLING: Reverse circulation rotary.
CONTRACTOR:(unverified from M. Osborne) At first, for Hanna Mining- Drift Exploration, (Canadian Firm) then Lang Exploratory Drilling and finally Tonto Drilling.
SIZE OF BIT: Lang = 5 1/8", others unknown
TYPE BIT: Started with hammers to tricones when hammers wouldn't trip-then last two years,(Lang and Tonto), used just tricone.
SAMPLE INTERVAL: For Hanna-5' consistently. With Lang drilling 5' and 3' (or 2.5'?)'and with Tonto (Nevada Goldfields Inc.?) 2.5', 5' and 10' (composite?). Nevada Goldfields did not sample entire hole in phase one or two-just areas judged to be mineralized.
SAMPLING SYSTEM: Drift expl. and lang-open cyclone into Jones splitter. With Tonto-Inverted cone wet splitter
SPLITTING METHOD:Jones splitter or inverted cone wet splitter
SIZE OF FINAL SAMPLE: Five to ten lbs of wet sample
WET OR DRY: All wet
CIRCULATION PATTERN: Out bit, up outer tube-from Marla Osborne.
TYPE OF ANALYSES: F.A.-A.A.
SIZE OF FINAL CHARGE: In part 1 AT and some 1/2 A.T.
ASSAY LAB(S): Early samples to Hanna's lab in Minnesota. Later samples to Barringer, Legend and GSI in Reno.

MINERALIZATION

ORE HOST(S): Primarily vein quartz in the prospectus vein system. Lesser amounts in altered andesites and in quartz stockworks in the andesites between veins.
MINERAL DISTRIBUTION: Ore shoots are flat, elongate horizontally or vertically, with a pod like internal distribution of values which tends to mimic the pattern of the ore shoots in the vein.
GOLD PARTICLE SIZE: Not known-studies indicate "no nugget effect" and current information indicates very fine with a relatively uniform distribution at small scales, (inches).

ENGINEERING DATA

TONS REPRESENTED PER SAMPLE: 24 (Metric?) per Tony Dorff

DRILL SPACING AND SAMPLE SPACING: Approximately 50' both along strike and down dip. Sample length usually 5'-rarely 2.5'.

METHOD(S) OF RESERVE CALCULATION: First hand done cross sectional reserve then block model reserve in SURPAC using digitized sections. No dip or direction data was put into the surpac model, (Marla Osborne says she did the reserves).

GEOLOGIC MODEL USED: NONE

A P P E N D I X 3

CONVERSION FACTORS

CONVERSION FACTORS USED IN THIS REPORT:

1 METRIC TON = 1.1023 short tons;

1 SHORT TON = .9072 metric tons;

1 SHORT TON = 2000 avoirdupois pounds;

1 AVOIRDUPOIS POUND = 14.5833 troy ounces;

1 TROY OUNCE = 31.104 grams;

1 GRAM = .0322 troy ounces

1 GRAM PER METRIC TON (g/tonne) = .0292 troy ounces per short ton (oz/t);

1 TROY OUNCE PER SHORT TON (oz/t) = 34.2857 grams per metric ton (g/tonne);

1 PPM = 1 gram per metric ton (g/tonne) = .0292 troy ounces per short ton (oz/t);

1 GRAIN = .0001428 avoirdupois pounds = .0020833 troy ounces = .0648 grams.

1 METER = 3.281 feet

1 FOOT = .3048 meters

1 CUBIC METER = 35.315 cubic feet

1 METRIC TON /CUBIC METER = .031 short tons/cubic foot
= 4.772 cubic feet/short ton

APPENDIX 4

RESERVE SUMMARY AND COMPARISONS

TABLE 2. PROSPECTUS VEIN RESERVE COMPARISONS - English units (Metric units)

RESERVE (NOTE: minor variances due to rounding)	TONS short (metric)	GRADE AU oz/t (g/t)	AG oz/t (g/t)	CONT. OZ(Gm) AU oz. (Kg)	AG oz. (Kg)
Hanna 3/84 - INDICATED (Siskon data)					
SURFACE	113,850 (103,285)	.170 (5.829)	.38 (13.029)	19,355 (602)	43,263 (1,346)
UNDERGROUND	-------	----	---	------	------
TOTAL	113,850 (103,285)	.170 (5.829)	.38 (13.029)	19,355 (602)	43,263 (1,346)
Condor 5/85 - INDICATED (Siskon data)					
SURFACE	99,171 (89,968)	.175 (5.999)	.51 (17.486)	17,355 (540)	50,577 (1,573)
UNDERGROUND	37,557 (34,072)	.311 (10.663)	.70 (23.999)	11,680 (363)	26,290 (818)
TOTAL	136,728 (124,040)			29,035 (903)	76,867 (2,391)
Condor 7/85 - DRILL INDICATED (Siskon data)					
SURFACE	147,576 (133,881)	.147 (5.040)	.29 (9.943)	21,694 (675)	42,797 (1,331)
UNDERGROUND	25,376 (23,021)	.337 (11.554)	.90 (30.857)	8,552 (266)	22,838 (710)
TOTAL	172,952 (156,902)			30,246 (941)	65,635 (2,041)
Condor 10/85 - DRILL PROVEN AND INDICATED (after phase one drilling-27 holes) (Note: Golconda Management (USA) Inc. 12/18/85 simply duplicates this)					
SURFACE	179,550 (162,888)	.137 (4.697)	.341 (11.691)	24,598 (765)	61,227 (1,904)
UNDERGROUND	91,110 (82,655)	.286 (9.806)	.734 (25.166)	26,053 (810)	66,875 (2,080)
TOTAL	270,660 (245,543)			50,655 (1,576)	128,102 (3,985)

Nevada Goldfields Inc. 5/21/87 - PROVEN AND PROBABLE (after phase 2 drilling)

SURFACE	233,545	.193	.578	44,983	134,982
	(211,871)	(6.593)	(19.785)	(1,397)	(4,192)
UNDERGROUND	30,092	.985	2.956	29,656	88,969
	(27,299)	(33.740)	(101.238)	(921)	(2,763)
TOTAL	263637			74,639	223,951
	(239,170)			(2,318)	(6,955)

Watts, Griffis and McQuat 6/26/88 - PROVEN AND PROBABLE (after prod. of approx. 44,000 Metric Tonnes at 8.75 g/MT

SURFACE	201,390	.191	38,511
	(182,700)	(6.55)	(1,196)
UNDERGROUND	56,769	.566	32,168
	(51,500)	(19.38)	(999)
TOTAL	258,159		70,679
	(234,200)		(2,195)

A P P E N D I X 5

THE ROLE OF GEOLOGY IN THE DESIGN OF DRILLING PROGRAMS

By

David R. Shaddrick

Chapter 9

THE ROLE OF GEOLOGY IN THE DESIGN OF DRILLING PROGRAMS

David R. Shaddrick

Rubicon Resources Company
Reno, Nevada

Abstract. Ore reserves are based on sampling developed by drilling programs. Correct choices concerning the type of drill to be used, depth of drilling, hole orientation and sample spacing are not only critical to the accuracy of the ore reserve but to the cost in time and money of the project. Appropriate interpretation and use of geologic information can significantly enhance the ability to make these decisions effectively. Geologic characteristics of mineralized rock that affect drilling and sample quality include: rock quality, openness, water content, mode of gold occurrence, internal gold distribution and grain of mineralization. Each of these characteristics and sources of data about them are revuewed, then related to the various drill program options. Finally, some procedures for checking the validity and appropriateness of the selected options are reviewed.

INTRODUCTION

Ore reserves in a mineral deposit are based on sampling. Fundamental concerns are the validity and accuracy of the samples, the adequacy of the sample distribution and the cost in both time and money of the sampling program. In virtually all cases today ore reserves and the samples on which they are based are developed through drilling. A number of drilling options are available and an understanding of the diverse factors affecting their selection is important to the success of a project. Program design options are: The types of drills to be used; the individual hole design including depth and orientation of drilling; the sample spacing which includes the down hole sample interval and length as well as the spacing between holes.

It is the intent of this paper to address five points which are believed to be critical in the early exploration and development drilling of gold deposits. First, the characteristics of mineralized rock that affect drilling decisions. Second, the impact of drill selection on sample validity and program cost. Third, the effect of drill hole design on the accuracy of tonnage estimates as well as sample validity. Fourth, the impact of the sample distribution on the accuracy of the tonnage estimates. Fifth, some procedures available to provide assurance that the program design decisions have been made properly.

Sample preparation and analysis procedures as well as geostatistics will not be addressed in this discussion. Although critical, these topics would be more properly treated in separate papers.

CRITICAL CHARACTERISTICS OF MINERALIZED ROCK

The many geologic properties of mineralized rock can be reduced to six critical characteristics which directly affect the drilling decisions outlined in the preceding section. These critical characteristics are: rock quality, openness, water content, mode of gold occurrence, internal gold distribution and grain of mineralization. Early identification and ongoing monitoring of these characteristics are important to the ultimate success of the drilling program. Under normal circumstances acquisition of this data should not require special studies or extra expense. The necessary observations, measurements and interpretations can generally be made in the normal course of the exploration and prefeasability work. The following paragraphs describe each of the six critical characteristics and present a brief discussion of how they may be documented or inferred.

Rock Quality

In this context the term rock quality refers to the ability of a drill to penetrate the rock cleanly and effectively and to return a good sample. This can be hampered by the presence of fracturing, shearing or alteration which can cause blocking of bits, binding of rods and hole caving or swelling. In addition to a significant reduction in drilling efficiency, poor rock quality can severly reduce recoveries and sample quality with some drilling methods.

The best early source of rock quality data is geologic mapping of rock exposures. Features to be aware of include: fracture density and orientation, shearing, faulting, geologic contacts and alteration zones. It is often possible to project or infer the presence of geologic features into a drill site from surrounding rock exposures, underground workings, air photos and geophysical surveys. Rock quality will commonly vary quite a bit across a deposit so adequate logging of cuttings or core as drilling progresses is important to early identification and correction of problems.

Openness

This characteristic reflects the extent to which fluid circulation can be maintained during drilling. Circulation can be lost to open fractures, faults, contacts, vugs, caves, underground workings.etc. Drilling fluids including mud, water and air are necessary for the effective operation of the drill and with some drilling methods as the means of sample recovery. The relative openness or tightness of the rock is therefore of real importance to the ultimate effectiveness and cost of the drilling as well as the validity of the sampling.

In addition to geologic mapping,as discussed in the preceding section, specific information on the potential for open ground in a project area can be derived from several sources. Published stratigraphic studies generally mention the occurrence of caves or vuggy units and some rock types, limestones or breccias for example, are more likely to have significant openings than others. Drilling in areas of past underground mining is always a cause for caution. Unfortunatly, very little can be done in the way of preventative measures. Old mine maps can be of some help and they are commonly available, either from government publications or local miners. However, these are usually not accurate enough to provide any assurance and constant preparedness remains the most prudent course of action.

Water Content

The presence or absence, as well as the quantity, of water in rocks to be drilled are of concern in the design of a drilling program. With some drilling methods water can directly affect the quality of the samples received by causing artificial concentration or dilution. When air is being used as the drilling fluid small amounts of water can make drilling very difficult and large amounts can shut down the drill. Prior knowledge of potential water problems will allow a more informed drill selection as well as contingency planning for alternate drills or drilling fluids.

Initially, the potential for significant water in the project area is inferred from geologic data developed during the early stages of exploration. Knowledge of local stratigraphy, structure and hydrology is developed from reconnaissance mapping and review of published reports and water well data. Projection of this information into the project area can provide a basis for early planning but the actual water content of the rocks on a hole by hole basis can only be determined as the hole is being drilled. Once drilling begins, careful monitoring of drill progress will identify water problems in time to take appropriate corrective measures.

Mode of Gold Occurrence

This refers to whether the gold is firmly bound to the rock and therefore easily retrieved with the sample, or is loose and subject to being separated. Gold occurring in situations such as, oxidized fractures, highly altered rocks, or open, vuggy veins is subject to being broken loose by the action of the drill or the drilling fluids. Due to its high density, gold has a strong tendency to differentiate from other rock materials. In tight ground with good circulation characteristics, this can produce an irregular series of artificially concentrated and diluted samples. In open ground the majority of the gold can be lost yielding erroneously low sample values. Early identification of a sampling problem and appropriate corrective measures can save substantial time and money and in extreme cases can mean the difference between having a mine or not.

The mode of gold occurrence can only be documented by careful sampling. In areas where sampling problems are suspected, comparison of selective versus bulk samples can provide early clues to the potential for loss or concentration of gold. The most effective method of identifying and correcting for sampling problems due to loose gold is careful monitoring of the drilling. Cuttings or core should be logged daily and special samples of drilling fluids taken on a regular basis. Finally, in cases where it is suspected that gold is being lost an alternate sampling method should be used to twin some of the holes, either another type of drill, a trench or an underground drift.

Internal Gold Distribution

A gold deposit can be represented graphically by an imaginary surface defined as the boundary between ore and waste under a specific set of conditions. The internal gold distribution then refers to the spatial distribution of gold within this imaginary surface. This distribution is never homogenous, although it can appear to be when viewed at certain scales, just as a wall can appear smooth when viewed from a distance and rough when viewed more closely. Most often, when viewed at the scale of the entire deposit, the internal gold distribution appears as a cluster of pods. If a single pod is viewed at an even smaller scale, it in turn, appears to consist of a cluster of smaller pods. At any scale these pods have the geometric variables of size, shape, orientation and inter-pod spacing, each of which varies widely and independently of the others. The degree to which the internal gold distribution varies in each of these geometric variables affects both hole design and sample spacing. If these variables are not properly matched, either the sampling will not be adequate and the resultant ore reserve invalid or the deposit will be over sampled with a significant waste of time and money.

The internal gold distribution is displayed by contouring gold values in both plan and section. Prior to drilling, careful sampling of ore exposures in outcrops, trenches or underground workings can provide data on the variability of the gold distribution. Study of similar deposits can help to develop an initial sampling plan. The early stage of drilling is the most critical time for the development of gold distribution data and for modifying preliminary sampling plans.

Grain of Mineralization

Quite often, the pods that make up the internal gold distribution are elongated or flattened and oriented subparallel to each other, thereby imparting a grain to the distribution. This grain can be seen at a large scale in the orientation of ore shoots in a vein system and at a small scale in the orientation of mineralization along foliation, cleavage or bedding planes in many deposits. A grain can be present at any or all scales and is not necessarily sympathetic with the overall orientation of the deposit. The presence of a grain imparts a directional dependence to the variability of the gold distribution. In other words, the gold values will vary more in one direction than in another. When this occurs the variability will be greatest across the grain and least along it. This in turn affects the validity of the samples and if not identified and accounted for, can result in an invalid reserve or a significant waste of time and money in resampling.

A grain of mineralization is almost always a result of the local ore controls. A knowledge of what has caused the gold concentration at the particular scale of interest is, therefore, the best source of information on the presence and geometry of a grain. Geologic mapping of exposed mineralization can provide early data on possible small scale ore controls such as specific sedimentary beds, shear or fault zones, cleavages, foliations, etc. Selective sampling across and along these features can help document directional sampling characteristics. At a larger scale contouring of preliminary sampling in both plan and section, can help highlight a directional trend in larger pods or the deposit itself. Combining these contours with geologic mapping often helps to focus on deposit scale ore controls. As always, constant monitoring and testing in the early stages of the program are required for early identification of potential problems.

DRILL PROGRAM DESIGN

The end result of a drill program is a three dimensional array of samples. If done properly this array will accurately reflect the grade and tonnage of the deposit and will have been obtained at a reasonable cost in terms of both time and money. Significant errors occur when samples do not accurately reflect the volume of rock intended. These errors commonly arise from incorrect program design decisions such as: selecting an inappropriate drill for the job, taking non-representative samples or simply taking too few samples. The following paragraphs highlight some of the important program design options and some of the factors important in their selection.

Drilling Options

In most situations drill selection consists of a choice between core, reverse circulation rotary or standard rotary drilling. The fundamental question is: Which method will return the most appropriate sample with the best cost/time characteristics? It is seldom possible to accomplish all of the geologic, engineering and metallurgical goals with a single drill type. This will provide an opportunity to use another type of drill to test the primary drill selection.

<u>Core Drilling</u>. This is the most expensive and time consuming of the three drilling methods. It usually returns the best sample and has the added advantage of providing substantial pieces of solid rock for observation and testing. It is particularly appropriate for detailed studies of mineral distribution, geotechnical studies and metallurgical testing. In addition, it is the only really good method of drilling shallow angle, horizontal or up holes. Because of the ability to drill up holes core is the most commonly used underground exploration drilling method. Finally, core drilling is the only method not significantly hampered by excess water or loss of drill fluid circulation.

There are only a few, limited, situations where core drilling would not be appropriate from a sampling standpoint. These include: areas of broken ground such as open veins, shear zones and poorly cemented breccias, where the advantage of retrieving large pieces of rock is lost and good recoveries become difficult to achieve; and situations where the gold occurs in such a manner that the fluid flow necessary for core drilling will wash it away and invalidate the sample.

Because of the substantially higher cost per foot and longer drilling times, core should be used sparingly and only in those instances where its particular advantages are essential.

<u>Reverse Circulation Rotary</u>. This technique is significantly cheaper and faster than core drilling. The percentage of sample recovered, while generally not as high as core, is commonly quite good. The technique works well in broken ground and in situations where air or mud circulation is easily lost. Due to its good sample containment characteristics, reverse circulation rotary drilling is the preferred method in situations where gold values can be easily lost by separation from the surrounding rock.

Although reverse circulation drilling has, in recent years, become the method of choice in most cases, there are some specific situations where it would be inappropriate. First, and most important, in areas of tight ground with very good rock quality, it would be cheaper, faster and equally accurate to use standard or conventional rotary; second, in those instances where details of the gold distribution are critical to the accuracy of the ore estimate or for engineering purposes. In these cases core drilling would be the desired option. This is because the rotary drills tend to homogenize the sample over the sample length and small high grade zones or other distribution details can be obscured. Angle holes can be drilled with rotary drills and with care an adequate sample can be recovered but the quality decreases rapidly as the angle becomes shallower.

Standard Rotary. This method is the least expensive by a significant margin although the gap between standard and reverse circulation narrows each year. It is also normally faster than reverse circulation drilling. In areas of very good ground with few breaks or voids and good sampling characteristics this method is entirely satisfactory. Where angle drilling is required it is somewhat less desirable than reverse circulation drilling but with care the results from steeper angled holes can be quite good. As with reverse circulation drilling, standard rotary drills are not appropriate for shallow angle holes.

Drill Hole Design

Hole design consists of depth, angle and direction. The design question is: Will the hole cut the entire thickness of mineralization and sample a volume of rock that will be representative of the rock over the assigned area of influence?

In all cases hole depth should be sufficient to pass completely through the ore and into the surrounding waste. Because it is not uncommon for boundaries of gold deposits to be highly irregular it is also prudent to plan a number of deeper holes in selected areas across the deposit.

Selection of hole angle and direction is a matter of matching the hole orientation to the internal gold distribution. If no mineralization grain exists the variation in gold values will be the same in any direction and the hole angle and direction will make no difference to the validity of the sample recovered. If, on the other hand, a grain does exist at the scale of the drill hole the direction that the samples are taken becomes critical. In most situations, samples taken across the grain will be most representative and the hole orientation should be designed to approach that as closely as possible. Sampling along the grain is analogous to drilling down a vein and can produce completely biased results by sampling either all ore or all waste.

Sample Distribution

The sample distribution is a three dimensional array of sample points consisting of two elements: the spacing between holes and the down hole sample spacing. Although possible, a sample distribution with equal spacing for both of these elements is impractical. It is simply too expensive to make a drill pattern tight enough to match the down hole sample spacing or the down hole spacing broad enough to match the distance between holes. Additionally, tightening the drill hole pattern requires the addition of drill holes which is not only expensive but time consuming. Whereas, tightening the down hole sample density is much easier, faster and cheaper. Therefore, drill programs have a built-in directional bias with the down hole direction being significantly more appropriate for close spaced sampling.

In designing a drill program the question is: Will the sample distribution adequately reflect the variation of gold values so that the interpolation between sample points required for ore estimates is valid? A properly designed sampling program will include an adequate sample density in areas of high variability to insure the accuracy of tonnage and grade estimates but not waste time and money by unnecessarily sampling areas of low variability.

If no mineralized grain exists, the spacing of samples in all directions is determined by the scale of variations in the internal gold distribution. If gold values vary significantly over short distances a tight sample spacing will be required and vice versa. In most gold deposits a mineralized grain does exist. In these cases every attempt should be made to match as closely as possible the directional natures of both the gold distribution and the sample distribution. This is done by orienting the sample array such that the spacing between drill holes corresponds to the direction of least variability, and the down hole sample spacing corresponds to the direction of maximum variability, in the gold distribution. Even an imperfect match can save the cost of drilling a number of holes while retaining or even improving the accuracy of the sampling data.

ASSURANCE TECHNIQUES

Since the decisions and choices outlined above are commonly based on what is at best scant data it is essential that they be tested for validity early and monitored throughout the program. Also, since it is not uncommon for some of the physical characteristics to vary significantly over short distances, it is important to insure that the validation tests be done in several areas across a deposit. Common techniques for validating data and assumptions include: drilling twin holes, varying the hole design, trenching or drifting to expose the ore and changing sample spacing. The following paragraphs highlight some of the techniques that can be used to validate or confirm the data and assumptions discussed above.

Drill Selection

If the drill selection is not a clear cut case some of the required twin holes can be drilled using another type of drill. This should be done early in the program and the results critically compared. If rotary drilling is being used it is a good idea to drill some large diameter core for metallurgical testing and if planned properly this can serve the multiple purpose of checking the sample validity of the rotary drill and providing a wealth of data concerning the continuity, variability and physical characteristics of the rock. If core is being used without problems it might be helpful to try a few rotary holes to see if they could do the job as well.

Drill Hole Design

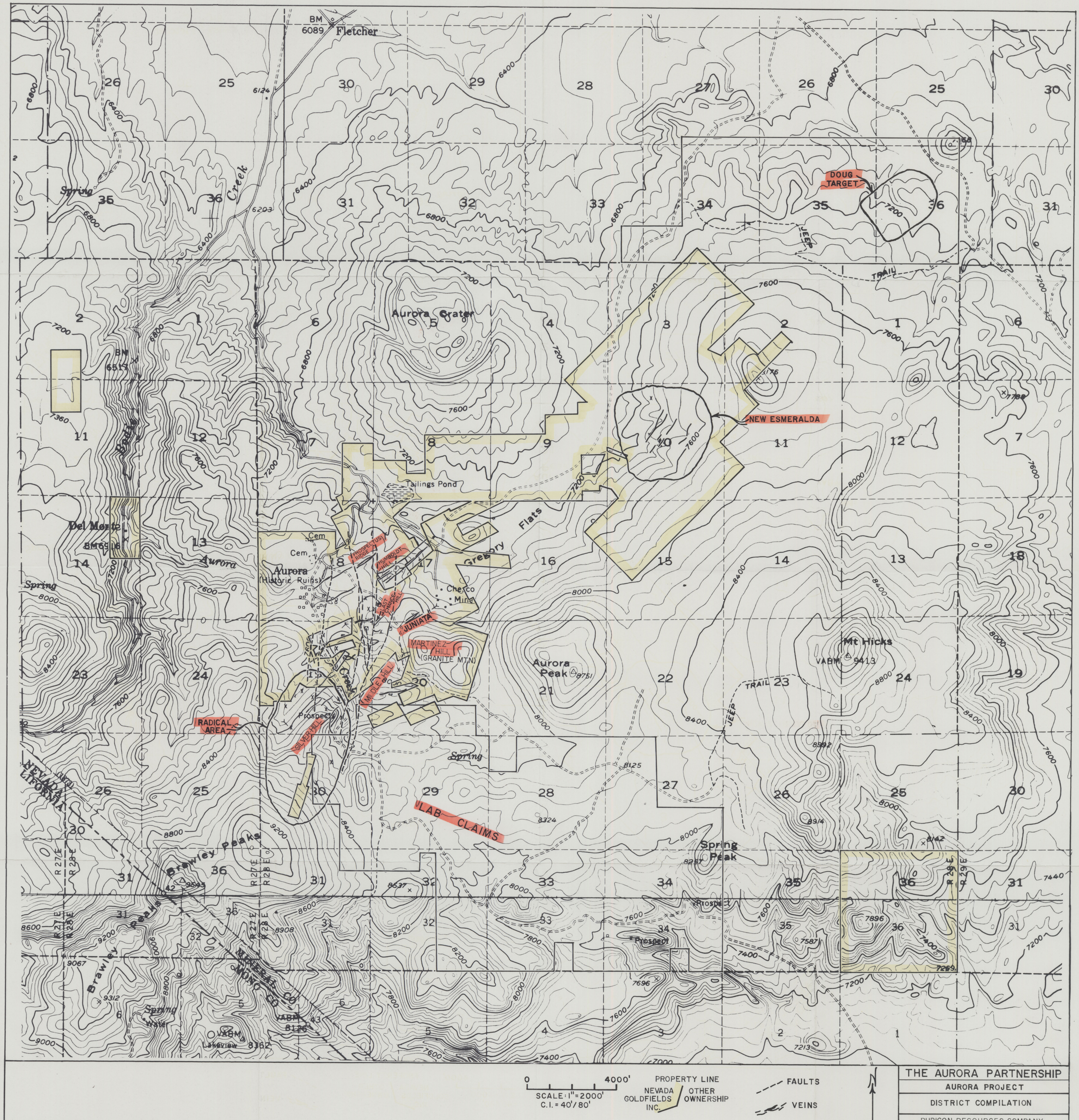
The validity of the hole angle and direction design can be checked by drilling check holes that cut the same rock from several directions and critically comparing the results. This should be done in several areas across the deposit. If at all possible a trench or drift should be made near some of the holes for detailed mapping and sampling. This information can confirm the basis of the original hole design or suggest changes. In addition information from trenching or drifting can greatly expand the data obtained from core drilling.

Sample Distribution

Continuity and variability data developed from core and trenching or drifting can be enhanced by drilling lines of closely spaced holes in selected areas. Also, the down hole sample interval should be reduced on a regular basis as an ongoing monitor of changes in the down hole variability. Sample maps and cross sections should be maintained and updated as assays are received in order to identify problems or opportunities as quickly as possible.

CONCLUSION

Knowing the geologic characteristics of a gold deposit and the use of this data in the design of a drilling program can significantly improve the validity of the resultant samples as well as the cost, in time and money, of the overall program. There are no pat answers or cookbook solutions to resolving such design questions as what type of drill to use or at what orientation and interval to take the samples. However, care and thought in the early design of a program, combined with ongoing review and modification, can help to avoid many potentially significant problems. The ability to recognize these problems early and correct them before they become critical can add an important incremnet of assurance to the final ore reserve.



THE AURORA PARTNERSHIP

AURORA PROJECT

DISTRICT COMPILATION

RUBICON RESOURCES COMPANY

DATE: 3/89 | BY: D. Shaddrick | FIG. 2

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