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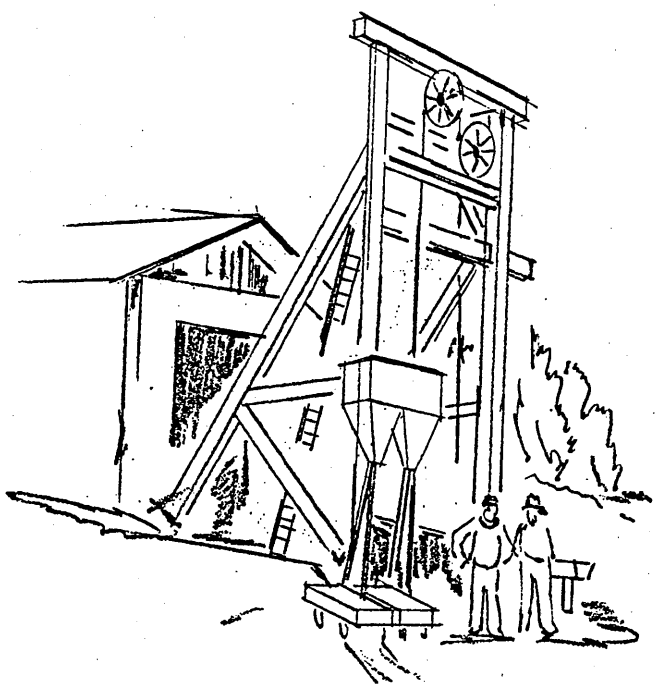
ADMMR
ORO GRANDE
Yavapai Co.
File 3

ORO GRANDE AND WEAVER CREEK

Arizona, U.S.A.

GEOLOGICAL OBSERVATIONS
and
PRELIMINARY ASSESSMENT
of
PLATINUM AND GOLD POTENTIAL



Report prepared for

INCO LIMITED

by

Fischer Geological Consulting Associates Ltd.

January 1991
Peter Fischer, PhD

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INTRODUCTION

GENERAL

In August 1990, Inco Limited commissioned Fischer Geological Consulting Associates Ltd. to conduct a field examination of the Oro Grande and Weaver Creek properties in Arizona, USA.

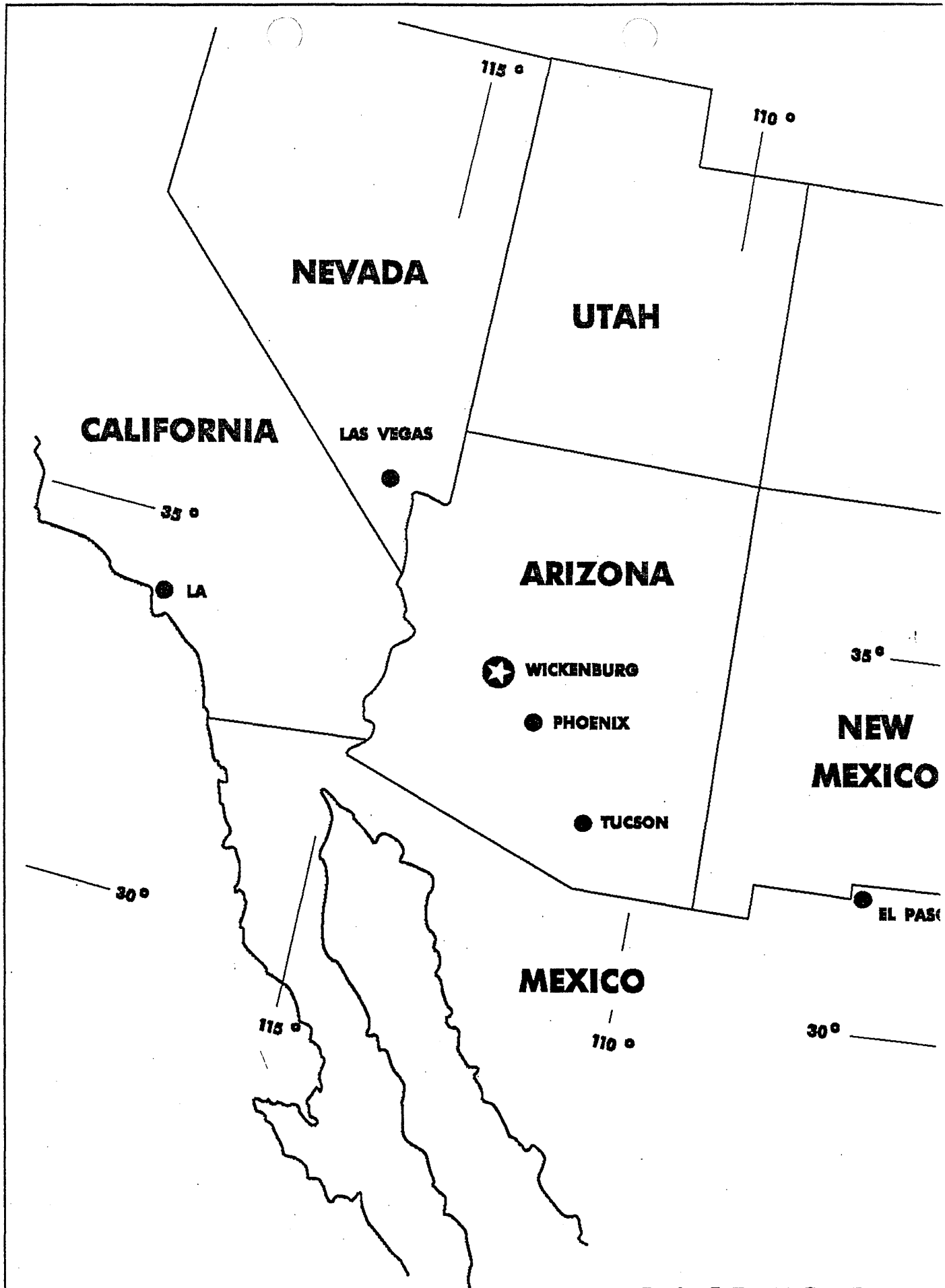
Field work was conducted from August 18 to August 29, 1990, approximately 3 days were used for travelling and introduction. The time distribution in the field was as follows:

- 5½ days Oro Grande, mapping, sampling.
- 2 days Weaver Creek, sampling.
- 2 days reconnaissance mapping, sampling.

10 days of evaluation and reporting followed in September through December.

The objective of the study was to investigate the favourability of the geological framework of the Oro Grande property for platinum group element (PGE) mineralization and of the Weaver Creek property for placer type gold deposits (See Appendix E). The emphasis of this present study was <u>not</u> to assess the economic potential of the Oro Grande Mine but to find out whether the geological setting was favourable for PGE mineralization.

The scope of the field work was to record lithological data during a few days surface mapping and sampling. During the evaluation petrographic methods were used almost exclusively. Chemical follow-up is restricted to 25 samples collected by R. Tenbergen and P. Fischer from Oro Grande and Weaver Creek. The samples are grab samples mostly without petrographic control and thus carry limited weight as samples representative of the mineralization. Previous assay results by Global were to be ignored for the purpose of this study.



LOCATION M

FIGUI

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MILS

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Oro Grande

Plate 1 of 12

Follows In Plate

Summary —

PROPERTIES

The Oro Grande and Weaver Creek are two separate mining properties located about 4 and 8 miles respectively north and northwest of the town of Wickenburg, Yavapai County, Arizona (Fig. 2). The Oro Grande Property consists of 9 patented lode mining claims surrounded by 1000 acres of unpatented lode mining claims, located in Section 24, T8N, R5W, Yavapai County, (Map #1).

The Weaver Creek property consists of Sections 34 and 35, T9N, R5W, Yavapai County.

The mining rights of both properties are managed by Global Platinum and Gold Inc. (GLOBAL) in a joint venture agreement with McFarland & Hullinger, both firms are Utah based. GLOBAL optioned the mining rights of the Oro Grande property from Mr. and Mrs. Lamont who have their residence on the patented portion of the property. The mining rights of approximately the eastern half of the property was promised by Mr. Lamont (verbal agreement) to a local friend.

ORO GRANDE

HISTORY

The Oro Grande mine was discovered in the 1870's and has been intermittently worked until the 1940's primarily as a gold mine. Around 1900 it was one of the richest gold mines in the Black Rock district of Arizona. A few essential points about the mine are listed here, additional information is contained in a collection of old newspaper clippings reports and letters in Global's possession.

- In 1904 the mine is reported to have produced 8600 t of ore averaging 0.27 opt Au.
- Bullion shipped from Oro Grande was penalized by the mint in California for its Pt and Ag content. The owners had to sign a waiver for the Pt content of the ore.
- A 340 ft. shaft and several hundred ft. of drifts were completed prior to 1910.
- Only a small, stoped portion of the Linear Breccia Zone was mined between surface and the 300 ft. Level.

Mining, stoping and drifting was probably controlled by the presence of coarse visible gold in drifts, i.e. not by drilling and assaying. The shape of the stopes as interpreted from poor copies of old level plans, is roughly circular with a diameter of 100-150 ft. and a steep easterly to south-easterly plunge.

Some very high Au grades of approximately 2000 opt are reported near the surface (15 ft. below surface) under diorite blocks suggesting a possible damming situation for hydrothermal solutions.

The distribution of visible gold is probably inhomogeneous along the linear breccia zone as judged from the pattern of the underground drifts, i.e. it is probably high in the stoped portion and decreases toward the northeast.

Drilling was limited to approximately 5 short holes (100-300 ft/length) within the mine (prior to 1940?). A 700 ft. water well for the Lamont residence and several unrecorded <100 ft. holes near the house were drilled in "diorite" within the last few years.

GLOBAL'S work since 1987.

Global conducted considerable sampling and assaying programs (>800 samples) in the last 3 years. Samples were taken mostly from surface and to a minor degree from underground without, however, keeping good records of locations, lithology and size of the samples. The samples were analyzed using a variety of analytical techniques and a number of laboratories (Global's report, 1988), including some well reputed labs specializing in PGE analyses. According to these lab reports highly anomalous, commonly ore grade PGE and minor Au levels occur in a variety of rock types which include the quartz rich breccia ore and "dioritic" host rocks.

Several major North-American Mining companies, including ACNC, are said to have investigated the property and to have turned it down after failing to duplicate Global's high PGE values.

It is emphasized that in Global's compilation of their analytical work there exists a wealth (hundreds) of anomalous high grade PGE analyses which are extremely unlikely to be produced by "salting" and therefore should be taken seriously. Although the scatter of PGE values is extreme and in some cases even the order of magnitude is in question, certain metal ratios are impossible to be manufactured and therefore are considered to reflect natural samples. Inhomogeneity of PGE distribution is considered as one of the major reasons for the wide scatter of values.

GEOLOGY

Previous Geological Work

Previous geological work on the Oro Grande Property is restricted to the studies by Post (1983) who did work on an unfinished thesis and by Kurtz (1987) who worked as a consultant for Global. Their findings are summarized as follows:

The basement is made up of northeast trending Precambrian schists and amphibolite (1.4-1.7 b.y.) interpreted as metasediments and metavolcanics. The schists were intruded by a diorite-gabbro pluton. Late Proterozoic pegmatite-aplite and associated tourmaline dike suite cut the schists. NE trending, late Cretaceous-early Tertiary microdiorite and NW trending rhyolite dikes cut the Precambrian basement.

The mineralization occurs in a series of fault-controlled epithermal quartz-carbonate-limonite-Au veins that cut the schist and the diorite. They show brecciation and multiple space filling episodes with early quartz and late Fe-rich carbonate. Strong oxidation occurred in near-surface ores.

The description of the mineralized structure by Kurtz points out that the principal ore body occurred in highly oxidized ore near the southwest end of the brecciated zone. The ore shoots between surface and the 200 ft. level indicate an irregular shape tens of feet wide. Ore consists of brecciated country rock cemented by limonite, carbonate and coarse, glassy quartz with free gold in limonite. Low grade Au ore occurs in the drifts northeast of the stope.

At the 100 ft. Level two types of ore are observed:

a) Oxidized, limonitic breccia ore, mainly in stopes, and

b) quartz-pyrite cementing sericitized breccia.

Kurtz suggests the mafic Precambrian rocks could be the source of the PGE. He suggests hydrothermal transport for PGE as a widely recognized alternative and points out that the combination of major structures and mafic rocks in a porphyry copper system could provide the essential elements for epithermal Au-Cu-PGE veins. The Goodsprings Pt-district appears to lie along the same major crustal boundary.

In summarizing the previous geological work on the Oro Grande property the following becomes apparent:

- Work done on the property has so far been of a general nature. No systematic, well documented mapping, sampling or petrography has been done on the host rocks or the ore zone by recent workers or the Arizona Geological Survey.

- No major mining company nor the Arizona Geological Survey has shown serious interest in the PGE potential of the property in spite of Global's findings.

- No mineralogical work using microprobe or SEM has been done by anyone on natural ore samples.
  All probe and SEM work so far was performed on metal beads produced by smelting and thus appear open to problems of sample homogeneity.

- Consistency of some PGE metal ratios of Global's strongly scattered assay results strongly suggests natural samples and not manipulation of homogeneity.

REGIONAL GEOLOGICAL FRAMEWORK

The area of the Oro Grande property is situated on one of the major lineament zones of the North American continent (Fig. 3). The north-northwest trending zone is outlined by the northern Texas Lineament and the southern Caltam Lineament, the former a dextral, the latter a sinistral transverse fault. Between them lie a series of pull-apart basins. The age of these structures is Jurassic to Laramide, their length is > 1000 km, the width of the basins is approximately 300 km. To the north of the lineament lie a number of relatively stable blocks, the Colorado Plateau and the Burro and Diablo platforms.

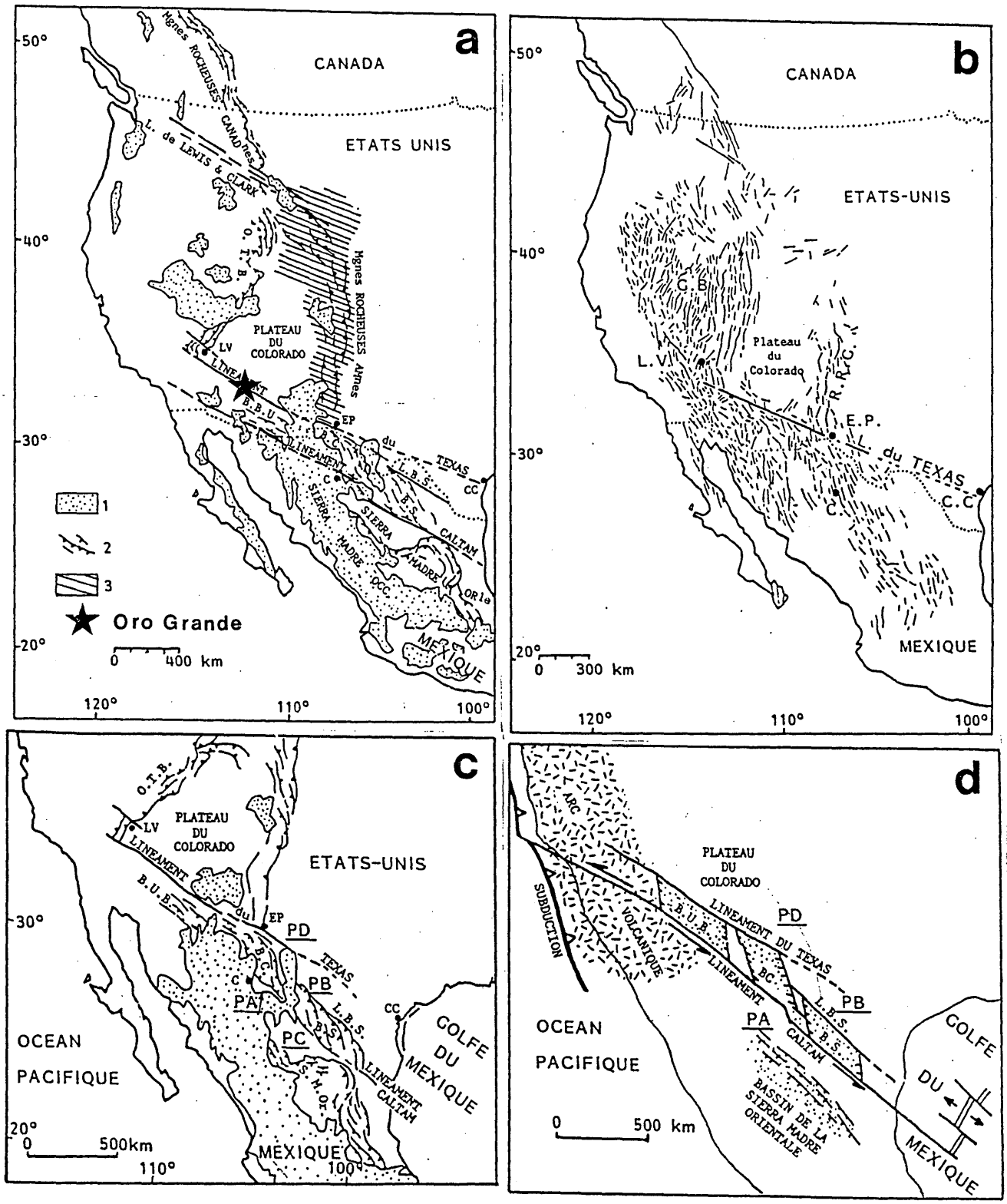
In the more immediate vicinity of Wickenburg this lineament shows up as a series of parallel, low-angle, normal faults that produce a pattern of Precambrian schists and granites alternating with Cretaceous volcanics and granites.

The Oro Grande property is located in a small Precambrian window (horst?) approximately 10 x 2 km in size which is overlain to the north by Tertiary volcanics to the south by Tertiary or Pleistocene gravels.

The Weaver Creek property is located in a possibly down-faulted area west of the Hassayampa River filled with Tertiary and Pleistocene gravels.

FIGURE 3

Schematic Structural Map of Southwestern North America.
Illustrating the location of the Oro Grande property on the Texas lineament (from Tardy, Blanchet, & Zimmerman, 1989).



a) *Major Transverse lineaments of the Western Cordillera.*
b) *Relationship between the Texas Lineament and the distribution of late, Cenozoic Basin and Range extensional faults.*
c) *Major laramide structures controlled by the Texas & Caltam Lineaments.*
d) *Late Jurassic-Neocomian pull-apart basins along the Caltam & Texas transform faults.*

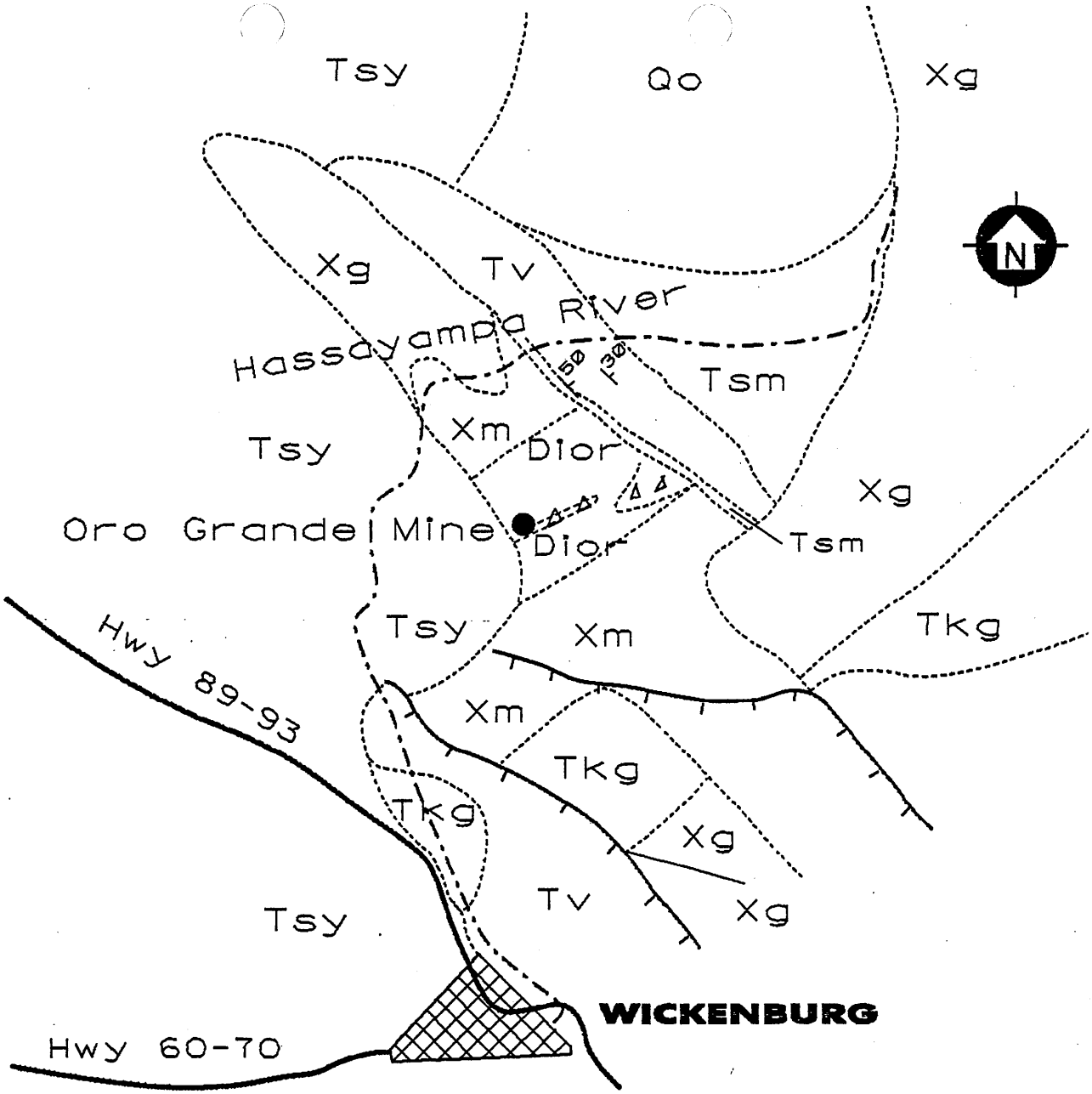
There are limitations to this study. The objective was to assess the favourability of the geological framework for PGE mineralization. The methods used are adequate for meeting this objective but are inadequate for clearly defining and judging the economic potential of the Au-PGE mineralization. This means that the assayed sample suite is not suited to serve as a basis on which a final decision on the property should be made. No follow-up sampling was done.

All samples are controlled i.e. sampling, shipping and analyzing was tightly controlled by Inco or P. Fischer.

LOCAL GEOLOGY

Field work on the Oro-Grande property concentrated on an area ~ 2 km in size surrounding the mine. This includes the area of the diorite-gabbro and a minor portion of its envelope of northeast trending schist and the north-northeast dipping Tertiary cover to the north (Fig. 4). A manganese mine of the 1940's occurs 2-4 km to the west, probably in Precambrian schists.

Observed lithologic features suggest a highly complicated, multi-stage intrusive, deformational and hydrothermal history of the mafic and minor ultramafic rocks. The interpreted sequence of events as interpreted from observed structures and contact relationships is tabulated in Table 1. Due to the limitations of this study Table 1 has only the character of a temporary field classification and should be updated by future work.



LEGEND

- Qo Alluvium

TERTIARY

- Tsy Sedimentary Rocks (Pliocene-Miocene)
- Tsm Sedimentary Rocks (Miocene-Oligocene)
- Tkg Granitoid Rocks
- Tv Volcanic

PROTEROZOIC

- Xg Granitoid Rocks
- Xm Metamorphic Rocks (Schist)
- Dior Diorite
- Breccia in Diorite

SYMBOLS

- Low angle normal fault
- Geologic contact
- River
- 50 Strike and dip of bedding

NOTE:

Geology from Reynolds 1988, Geology of Arizona with added personal observations.

SIMPLIFIED SCHEMATIC GEOLOG
map of the ORO GRANDE AF
near WICKENBURG, ARIZON.

Scale 1:93,750 FIGURE

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Oro Grande

Plate 2 of 12

Follows In Plate

Summary —

Table 1

Oro Grande

PRELIMINARY, INTERPRETED SEQUENCE OF GEOLOGICAL EVENTS

(Recent to Precambrian)

	Intrusive	Deformation
Hydrothermal Events:		
Alteration		
Oxidation, hematite/limonite		
Sericite, chlorite, tourmaline, carbonate.		
Veining		
Quartz II, coarse, euhedral with pyrite & gold?		
Fracturing, dilation		D5
Quartz I, fine grained, pyrite? Au?		
Platinum Group Minerals?		
Intrusion of porphyritic quartz diorite	I 4	
Uplift? Faulting? Shearing?		D4
Breccia event (gas blow-out?)		
Uplift? a) Green breccia (older)		D3
b) Red breccia (younger)		
Intrusion of felsic dykes	I 3	
? Ultramafic dykes, sills?		
Metamorphic overprint of diorite/gabbro		D2
Intrusion of diorite/gabbro	I 2	
Disruption, incorporation of ultramafic rocks at depth, intrusive transport?		
Metamorphism of mafic volcanics to produce schists and gneisses		D1
Intrusion of ultramafics at depth	I 1	
? Concentration of PGE?		
Deposition of mafic volcanics and minor felsic sediments.		

In the following a summary of outcrop and petrographic observations are presented to supplement the information and further explain the information of Table 1 and Figure 5.

LITHOLOGIES

"Schist"

Precambrian "schists" are the oldest rocks on the property and were encountered as the host rocks of the diorite intrusion at the eastern and western margin of the mapping area. Lithologies observed are amphibolite, minor biotite gneiss and amphibole gneiss of intermediate and felsic composition.

Textures include banding at a scale of 0.1 to 1 metre (Photo 1) fine grain size, strong schistosity and banding, that suggest strong metamorphic and tectonic overprinting. The trend of the foliation is northeast, dips are steep, mostly to the southeast. Contact relationships between "schist" and diorite are poorly known but probably include interfingering as well as rafts of amphibolite being enclosed in the diorite-gabbro (Photo 2).

Diorite-Gabbro

The area mapped as "diorite" extends approximately 1 km along the direction of foliation and approximately 2 km across the foliation.

The "diorites" are mostly meta-hornblende-gabbro and show a complex history of deformation and alteration.

For reasons of consistency the name diorite will be used here. The compositional range extends from relatively rare leuco-quartz diorite to mafic hornblende gabbro and ultramafic hornblendite with hornblende gabbro as the most common type. Of these types only hornblendite has been separately mapped.

The mineralogy of the mafic rocks is dominated by dark green hornblende and plagioclase. (Photomicrographs 1 to 4). No pyroxene or olivine was seen. Minor constituents are quartz, sphene and apatite, common accessories are opaques, Fe-oxide/hydroxide and leucoxene. Hydrothermal alteration minerals as epidote, carbonate and sericite are wide spread, tourmaline is locally abundant. (Photomicrographs 7,8,9,15,16).

The textures of mafic rocks are metamorphic. No igneous textures were observed. Most outcrops show massive character and/or weak foliation. Banding or layering was not observed. The nature of ultramafic bodies is unknown at present but phase layering is not excluded as a possibility.

Plagioclase is anhedral and forms a mosaic which serves as matrix for commonly larger grains and clusters of hornblende. Foliation is common (Photomicrograph 2) but seems stronger in the vicinity of the Linear Breccia zone (Photo 4).

Mafic and ultramafic inclusions, schlierens and large clusters of hornblende crystals are common in a dioritic and gabbroic matrix, their abundance varies strongly (Photos 3,4,5,6), their size ranges from centimetres to decimeters. Poorly defined inclusions/rafts of fine grained, hornfelsic material are thought to represent partly assimilated wall rocks (schist). Superimposed events include brecciation, local shearing, veining and alteration (see below).

The chemistry of rocks from the diorite area is poorly known and is based mainly on analyses of 14 drill chip samples (Table 2). The levels of elements characteristic for mafic rocks (Ni, Cu, Co, MgO, Cr_2O_3) are that of gabbros and mafic gabbros but are not typical for diorite. All samples are anomalous in Pt with abundances ranging from <0.15 to 1.8 ppm (see chemistry, below).

As indicated by the above lithologic features the "diorite" area is made up of a variety of mafic to ultramafic rocks with textures that suggest more than one stage of intrusion and a high grade metamorphic overprint. These events were succeeded by brecciation and hydrothermal alteration.

Ultramafic Rocks

Occurrences and ultramafic rocks were seen scattered throughout the diorite area but their abundance is low (estimated at 1-2%). Their genesis is at present unknown due to poorly exposed contact relationships. In outcrop, ultramafics are mostly massive, coarse, dark green hornblendite with variable amounts of feldspar-bearing matrix between large (1-2 cm) hornblende crystals (Photo 8). In thin section (Photomicrograph 11 to 14), the rocks display large, stubby, metamorphically textured hornblende or in places light green actinolite (after hornblende) with minor poikilitically enclosed plagioclase. Accessories are large, euhedral apatite, disseminated opaques, locally tourmaline (up to 20% in sample OG-43, Photomicrograph 15,16).

A PGE-bearing ultramafic occurrence near the Linear Breccia zone has a different character and is interpreted as a fault zone. The outcrop displays (Photo 7 OG-10) about 80% cm-dm size ultramafic inclusions (cm-dm size) in a matrix of mafic hornblende gabbro. The faulted part of the outcrop appears to consist of fine grained amphibole and chlorite. It is a soft, strongly fractured, altered, carbonate-rich ultramafic rock.

The nature of larger (10-50m) ultramafic bodies is not established; the small bodies (cm-dm) are clearly inclusions. Large bodies might represent disrupted phase layers, inclusions or younger dikes. At present preference is given to the interpretation of large inclusions or layers rather than younger dikes. In other words, they are thought to be older, integral parts of the complex, mafic intrusive.

The chemistry of the ultramafic rocks is poorly represented by present analyses (Table 2). Key elements for the recognition of ultramafic rocks are at levels characteristic for pyroxenite and both analyzed samples are platiniferous:

MgO 12 - 15%, Ni 400 - 500 ppm vs. low Cu 40 ppm,

Cr_2O_3 1500 ppm, Pt 1.87 ppm and 0.33 ppm.

Felsic Dikes

Abundant felsic, aplitic dykes cut the dioritic area. Their thickness ranges from 1 to 5 m, their trend is mostly northwest; their estimated abundance in the diorite area is between 2 and 10%. The rocks are white, coarse, massive quartz-feldspar aplite locally affected by brecciation (Photo 9), fracturing and epidotization (Photomicrograph 23). Brecciated samples show an isotropic, probably glassy groundmass.

Breccia Zones

General

Two breccia zones which are thought to outline a substantial Cretaceous-Tertiary subvolcanic vent system were mapped within the diorite area and are outlined on Map 1A:

- Linear breccia Zone.
- NE Breccia Zone.

The two zones differ from each other. The Linear Zone appears to have a heterogeneous internal structure, whereas the NE-Zone seems to be homogeneous. In the following a brief description of the framework is followed by a description of breccia types. Both zones were known to previous operators since the Linear Zone has been mined and both zones are trenched at the surface.

Linear Breccia Zone

This zone hosts the Oro Grande Mine and has a length of >500 m, a width of 10 to 40 m and a northeast trend (Map 2A). The eastern wall rocks vary from fractured, massive diorite-gabbro, at the northeast end (Photos 19,20), to inclusion-bearing mafic-ultramafic hornblende gabbro and faulted amphibole-chlorite schist near the shaft (Photo 7).

Underground the eastern contact is reported in old descriptions as having an irregularly shaped, east dipping contact.

The western wall rocks at the northeast end (adit) are foliated diorite with oriented ultramafic schlieren parallel to the contact (Photo 21).

NE Breccia Zone

The NE-Breccia Zone occurs in the northeast part of the diorite area, has a funnel shape widening to the north and disappears under a cover of younger Tertiary sandstone and tuff. Its eastern contact appears to coincide with the east contact of the diorite area. The west contact is poorly outlined due to lack of mapped outcrop and might extend farther to the west, possibly join up with the Linear Zone. In contrast to the Linear Zone there seems to be no shearing or ultramafics along the contacts. Locally a red breccia is cutting a green breccia (OG-77, Photo 17) suggesting that the hydrothermal stage following the brecciation proceeded in more than one stage.

The following types of breccia have tentatively been distinguished in both breccia zones and vaguely outlined:

a) Heterolithologic Breccia
b) Monolithologic, Angular Breccia
c) Greisen (?) - Breccia

a) Heterolithologic Breccia

This type occurs both in the Linear Zone, possibly east of breccia type b), and in the NE-Zone. Megascopic characteristics are heterolithologic fragment population and rounded fragment shape. Lithologic types of fragments include diorite, gabbro, fine grained mafic rocks as fine grained quartz diorite, aplitic felsite, altered diorite. Fragments have a rounded shape, their size is cm to dm (Photos #11 to 20). Common concentric alteration zoning is visible. Inter-fragment matrix constitutes 30-50% consisting approximately 1/2 of mm-cm size mafic fragments in a groundmass of chlorite and carbonate and 1/2 of crystalline quartz, minor carbonate and disseminated, limonitized euhedral pyrite. The breccia is massive, there is no orientation of fragments i.e. the breccia is not considered to be the result of faulting.

Microscopic Characteristics of fine grained, limonitic, quartzose breccia matrix show

- multistage quartz veining associated with multistage, colloform Fe-oxide and hydroxide deposition (Photomicrographs 29 to 40).
- fine, platy morphology of quartz.
- rare, opaques other than hematite and goethite.
- rare pyrite relicts in hematite-goethite pseudomorphs.
- small (3-30 microns), highly reflecting isotropic grains of yellowish-white and white colour are interpreted as possible electrum or platinum group minerals and rare yellow native gold specks are observed (Photomicrographs 41-50).

This breccia type is interpreted as the result of a high pressure gas "blow-out" which was followed by one or several hydrothermal phases.

b) Monolithologic Breccia

This type was observed only in the Linear Zone at the adit and underground, 100 ft Level, in the drift northeast of the shaft. The distinction between this type and the heterolithologic breccia is not well established. Megascopic characteristics are angular, local fragments of diorite and gabbro, decimeter to metres in size, variable amounts of coarse quartz matrix with accessory pyrite and carbonate. At the adit the mafic fragments and matrix are oriented at a high angle to the trend of the zone (Photo 32, 33). At the 100 ft Level, near the ventilation shaft, the matrix is characterized by a low quartz content and 5 - 10% large (mm - cm) euhedral, oxidized pyrite cubes.

Microscopic characteristics are high alteration of foliated, mafic fragments (diorite, gabbro) and evidence of a post-alteration, metasomatic overprint. Fine grained feldspar and quartz mosaic appears to overgrow the altered feldspar-amphibole assemblage (OG-13).

Interpretation

A different mechanism than for type a) breccia is thought to be responsible for type b) breccia. Transverse faulting along the Linear Zone in addition to an earlier gas blow-out is proposed as a likely mechanism. This interpretation is supported by the fault gouge at the eastern breccia contact at the adit and by the orientation of quartz veins normal to the trend of the zone which would result in distension fractures.

c) Greisen (?) - Breccia

This type is observed only in the Linear Zone, mainly around the old shaft, stope area and the bull-dozed breccia outcrop near the ore stockpile. Most of Global's ore stock pile and many of Global's assays probably belong to this type. Its distinction from type b) is not well established and based on only 2 samples of each type.

Megascopic characteristics of samples OG-11, 12, (100 ft Level pillar) are red colour, soft, limonitic, micaceous character. Reported to contain coarse gold. Panned sample showed several specks of gold. Samples OG-100 A, B, (stockpile) show red, limonitic, quartz-rich breccia with altered mafic rock fragments in 10-30% quartz matrix. There is evidence of at least 2 stages of quartz veining separated by a fracture event.

Microscopic characteristics show metamorphic relict texture with chlorite, sericite, and muscovite overprinted by younger, metasomatic quartz (and feldspar?) mosaic with disseminated micron size, unidentified opaques.

Partial silicification of sericite and chlorite in highly altered rock fragments, limonite impregnation of phyllosilicates and evidence of several stages of fracturing (distension?), deposition of quartz, and Fe-oxide is seen in stock pile ore (Photomicrographs 17,29,35,36).

Although field observations are very limited there is evidence of a higher degree of alteration, with stronger quartz impregnation, porphyroblastic muscovite multistage distension than in other breccia types. The greisen breccia is interpreted as the possible roof portion of an underlying pluton. The presence of gold is established by superficial panning; the presence of electrum or platinum group minerals is suspected.

Porphyry

Several small, dyke-like intrusions of feldspar porphyry were observed in the NE-Breccia Zone. This rock type intrudes the breccia and is thought to be related to an assumed pluton underlying the Oro Grande diorite area and its breccia. In outcrop the porphyry appears to form 10-metre size dykes or plugs. The texture is massive, distinctly igneous and porphyritic. A fine grained (0.1 - 0.5 mm grain size) matrix of feldspar and quartz with 10 - 20% acicular Femags hosts scattered 1 - 2 mm boxy feldspar phenocrysts. The feldspar porphyry was seen only in the NE-Breccia Zone. It is fractured but not brecciated and is considered as the youngest rock within the diorite area.

HYDROTHERMAL EFFECTS

Evidence of hydrothermal overprint onto mafic rocks is abundant over a large area and supports the model of a porphyry system. Observed alteration features are tentatively classified into the following 4 types:

1. Halo

   A halo of several hundred (> 500 m?) metres diameter around the two breccia zones seems to exist. It is characterized by abundant fracturing and stockworks of epidote, carbonate as well as partial alteration of feldspar by sericite and tourmaline. Total replacement of mafic rocks by epidote or carbonate is locally seen at a metre scale (Photomicrographs 24,25).

2. Quartz and Tourmaline Veins

   A northeast trending zone 700 x 200 m with a strong concentration of metre-thick, quartz veins and tourmaline veins (luxullianite) occurs in the centre of the diorite area, west of the Linear Breccia Zone. The trend of the veins is mostly northeast. The zone is parallel to, and 300 - 450 m west of, the Linear Breccia Zone and is interpreted to represent a fracture and vein system peripheral to the more central breccia vents.

3. Breccia Zones

Hydrothermal effects in the two breccia zones are variable and summarized as follows:

Partial to complete alteration of mafic rock fragments to sericite, chlorite, carbonate (propylitic?) ± goethite with local pyrite impregnation. Filling of interfragmental space with pyrite, carbonate, Fe-oxide, minor chlorite and coarse, vuggy, late-stage quartz. Quartz and Fe-oxide show multi-stage deposition separated by distensional brecciation.

4. Greisen (?) Breccia

The intensity of hydrothermal effects is considered highest in the area near the stopes and pillars described in a few samples as greisen and silica-flooded red breccia. Characteristics are several stages of quartz, porphyroblastic muscovite and secondary quartz or feldspar (albite?) mosaic. Au values are said to be highest in this type.

STRUCTURE

Only little structural information was collected and is marked on Maps #2B and 2C. It appears that the structures that control Au and PGE values are essentially the breccia and fracture systems related to a large prophyry system preceded or succeeded by a fault along the east side of the Linear Zone. A summary is as follows:

The foliation of schists and diorite trends northeast to east-northeast and dips steeply southeast. The trend of felsic dikes appears to be mostly northwest. Quartz and tourmaline veins have a preferred northeast trend and vertical to steep dips.

Faults and shears observed have a preferential northeast trend and steep dip. A northeast fault-gouge delineates the eastern contact of the Linear Breccia Zone at the adit and in platiniferous ultramafics near the house and shaft (OG-10). A number of fractures, faults, and slickensides observed in the 100 Level drift have a preferred moderate (40-50°) southeasterly dip.

A strong uplift of the diorite areas is interpreted from the steep (40 - 50°) northern dip of Tertiary bedded sandstone overlying the Precambrian schist and diorite area. The sandstone shows distinct cm to dm scale bedding which is likely to be produced only in horizontal or sub-horizontal original attitude of the bedding. The present steep dip of the sandstone bedding can therefore only be the result of tilting caused by strong Tertiary and Quaternary uplift of the southern part of the area i.e. of the southern part of the Oro Grande property which hosts the old mine.

CHEMISTRY

24 samples of Oro Grande were analyzed by Inco. The results are listed in Appendix D and are summarized below in Table 2 with additional comments. The samples are grab samples that poorly represent the variety of host rocks and ore at Oro Grande. 19 samples represent natural rocks or mixtures of rocks, 5 samples represent a variety of materials such as sands and magnetic fractions. Petrographic control is minimal. Table 2 summarizes major elements and some of the more essential minor and trace elements arranged by rock type. Comments are as follows:

Diorite Gabbro (A)

14 drill chip samples representing diorite-gabbro are mostly a mixture of diorite and of aplitic dykes as observed from alternating green and pink cuttings at the drill. The relative abundance of the two types are unknown but felsites are assumed to be at least 20%.

The average major oxide composition of "diorite" corrected for 20% granitic material would indicate a gabbroic composition:

SiO_2 40 - 50%, Al_2O_3 10 - 13%, MgO 6%, Fe 5 - 6%.

If aplitic rocks represent ~30 - 40% of the drill chips the average composition of "diorite" rocks would be similar to Group B, i.e. of ultramafic. Several minor elements and their ratios are indicative of mafic to ultramafic rocks. The Ni/Cu ratio, although strongly variable due to felsic dikes, is 2:1 to 3:1 typical for rocks as pyroxenite. Some Ni/Co ratios of approximately 6/1 is 5 times as high as that of most gabbros. Cr_2O_3 levels of 300 to 700 ppm are 2 to 3 times that of gabbros and approaches the levels typical for ultramafic rocks. Zn with levels of 100 - 140 ppm is slightly high for a mafic rock but might indicate the outer, Zn-rich portion of a hydrothermal halo.

Pt is by far the most abundant of the precious metals, exceeding the abundances of Au, Pd and even Ag. Pt abundances range from 160 to 1840 ppb (0.16 to 1.84 ppm) with an average of approximately 400 ppb. The abundance of Pd is consistently below that of Pt, the Pt/Pd ratio is a very favourable one of > 10/1.

Ultramafic Rocks (B)

3 samples of possible ultramafic rocks previously called "diorite" represent hand samples of rocks without petrographic control but are not mixtures of different rock types as the samples represented by Group A.

Comments made for the diorite-gabbro group (A) apply to a large degree also for this group. Key-indicator elements as MgO, SiO_2 and Fe show levels typical for mafic gabbro and pyroxenite.

Minor elements also indicate affiliation with an ultramafic parentage: Ni/Cu ratio of 10/1 and Cr_2O_3 abundance of approximately 1500 ppm.

Pt abundances of 330 to 1870 ppb (0.33 to 1.87 ppm) which exceed the abundances of Au and Pd are highly anomalous and the high Pt/Pd ratio of > 10/1 is very favourable.

Breccia-Ore (C)

2 samples of breccia ore and greisen reflect, by their major oxide composition, the high content of quartz, and muscovite/sericite (Al_2O_3 18%) and Fe-Oxide content. Minor elements show slightly higher Cu and lower relative Ni in contrast to "diorite" samples.

Of the precious metals Pt is the most anomalous one with levels of 170 and 2240 ppb (0.17 and 2.24 ppm). Au levels (0.37, 0.34 ppm) are similar to, or lower than, Pt levels. Au/Ag ratios of 1/3 to 1/7 are typical for many vein type gold deposits..

Miscellaneous Samples (D)

The major and minor element chemistry of various surface sands, magnetic fractions etc is considered less meaningful than that of complete rock samples. Pt abundances are, however, as anomalous as in samples of other rock types (Groups A - C) and exceed the abundances of Pd, Au and Ag.

Summarizing the analytical results of the reconnaissance sample suite it is apparent that:

a) The host rocks of the Oro Grande Mine are more basic than diorite i.e. they are of gabbroic and ultramafic (pyroxenitic) composition.

b) Pt abundances in most samples are highly anomalous by a factor of 10 to 200 compared to background values in mafic rocks (<1 to ~50 ppb) and in ultramafic rocks <1 to ~100 ppb, (Crocket, 1981).

c) Pt/Pd ratios are ≥ 10/1 i.e. highly favourable. This means that the PGE are highly fractionated in favour of Pt. This Pt/Pd ratio is higher than that of the Merensky Reef, Bushveld, S.Africa.

MINERALIZATION

General

Mineralization at Oro Grande consists of historically established and visible gold mineralization and of newly established, highly anomalous platinum values in breccia ore and adjacent mafic-ultramafic rocks.

Au, Ag

Historical

Au mineralization is historically established. 8600 t of 0.27 opt Au were mined prior to 1904 from two closely spaced stopes near the shaft. The stopes outline a steeply east-plunging ore body of 30 - 50 m diameter between surface and approximately 100 m depth (300 ft level). Its down-plunge extension seems open, its southwestern extension is reported to be cut off by faulting at some distance southwest of the shaft. The stopes are thought to coincide with quartz rich greisen breccia.

Very high Au grades of approximately 2000 opt are reported near surface (15 ft depth) in soft, clay rich material under large "diorite blocks". This setting indicates a realistic possibility of dammed up, auriferous, hydrothermal solutions.

Present Study

No systematic sampling was done to outline the mineralization and to determine its grade. Observations and collected data are as follows:

Visual

Visible gold was seen;

a) in greisen ore from underground (OG-11). Several specks of visible gold were seen after a fast panning process of a ~0.5 kg sample.

b) in well water. The deposition of metallic gold was observed when water of the well of the Lamont residence was run over a mercury-coated metal sheet for 1-2 minutes. Au is assumed to be carried in colloidal form in appreciable quantities. The well is approximately 700 ft deep and is drilled in "diorite" within approximately 50 m of the old stopes.

ANALYSES

Inco gold assays of ore and rock samples range from <0.017 - 0.34 ppm, the content of a metal prill (Global) is 1.8 ppm.

Au and Ag abundances of samples are listed in Table 2, and summarized, by rock type, as follows:

Rock Type	Sample	ppm			
		AU		AG	
		Range	Avg.	Range	Avg.
Group A Mixture of Diorite- Gabbro and Felsics	1 - 14	<0.017-0.034	<0.0.2	<0.014-0.011	<0.03
	24	0.33		0.03	
Group B Mafic-Ultramafic	19,21,23	<0.017	<0.017	0.065-0.22	0.013
Group C Breccia Ore	18, 22	0.34 - 0.37	0.35	1.15 - 286	2.0
Group D	15, 16, 17	<0.017 - 0.03	0.02	0.07 - 0.14	0.1
Prill	25	1.8		4.45	

PGE

Highly anomalous Pt values were found in several rock types including mafic and ultramafic rock as well as breccia ore in the vicinity of the old shaft. The anomalous samples are derived from an area approximately 50 x 150 m in size, from surface to a depth of 30 m (100 ft). The miscellaneous samples, magnetic fractions of surface sands, come from a larger area. The total size of the bedrock area anomalous in Pt is not known, i.e. has not been delineated.

Visual

No platinum group minerals have been identified as part of this study. In polished section, under oil immersion, 448x magnification, a number of micron-size, highly reflecting opaque particles have been observed which in part might represent PGMs or alloys and should be checked with a microprobe or a SEM.

Assays

Inco PGE assay results are tabulated in Table 2, and are summarized by rock type as follows:

Rock Type	Inco #	ppm				
		Pt		Pd		
		Range	Avg	Range	Avg	Rh
Group A Mixture of Diorite-Gabbro and Felsic Dykes	#1 - 14	<0.16-1.84	0.4	0.014-0.04	<0.017	
Panned Drill Chips	#24	0.23		0.17		
Group B Mafic-Ultramafic	#19, 21, 23	0.33-1.87	0.94	<0.014	<0.017	
Group C Breccia Ore Greisen	#18, 22	0.17-2.24	1.20	<0.014 - 0.065	<0.039	0.1
Group D Miscellaneous Samples Surface Sands Magnetic Fractions	#15, 16, 17	0.18-0.30	0.22	<0.014 - 0.068	<0.03	0.16
Prill	#25	17.71		2.67		

The above Inco assay results of grab samples show that all samples are highly anomalous in Pt. Three samples contain almost, or slightly more than, 2 ppm Pt. The prill containing 17.7 ppm Pt was produced by Global from an unknown amount of rock material without Inco control but shows a very favourable Pt/Pd ratio of 6.6:1. The Pt/Pd ratio of most samples is from 5 to >10 i.e. is very favourable.

Rhodium is present in abundances above the detection limit in 2 samples: 0.1 ppm in Breccia ore and >.16 ppm in the magnetic fraction of surface sand.

GENETIC MODEL

Based on the above data base the following genetic model is proposed for the Oro Grande Au-Pt mineralization:

A Precambrian metamorphic, mafic assemblage was intruded by a mafic-minor ultramafic complex. This complex is assumed to have differentiated at depth into mafic and ultramafic phases. PGE are assumed to have pre-concentrated at depth in the ultramafics. The complex is thought to have a 2- or 3-stage igneous history overprinted by high grade metamorphism that might include plastic deformation by rolling. The location of the property on the Texas Lineament, one of the major crustal breaks of the continent, increases the likelihood of an assumed major ultramafic source at depth.

The development of a major, Cretaceous-Tertiary pluton below the mafic complex gave rise to a major subvolcanic porphyry system that started with a gas blow-out followed by a prolonged period of hydrothermal activity which persisted through periods of continued uplift, multi-stage distension, brecciation associated with continued fluid supply.

Prolonged upward flow of hydrothermal solutions from the pluton transported metals to form the Au-Ag deposit and also is thought to have leached PGE from PGE-enriched ultramafics at depth and deposited them, together with Au, in the highly fractured breccia zones and its adjacent faulted, mafic-ultramafic host rocks.

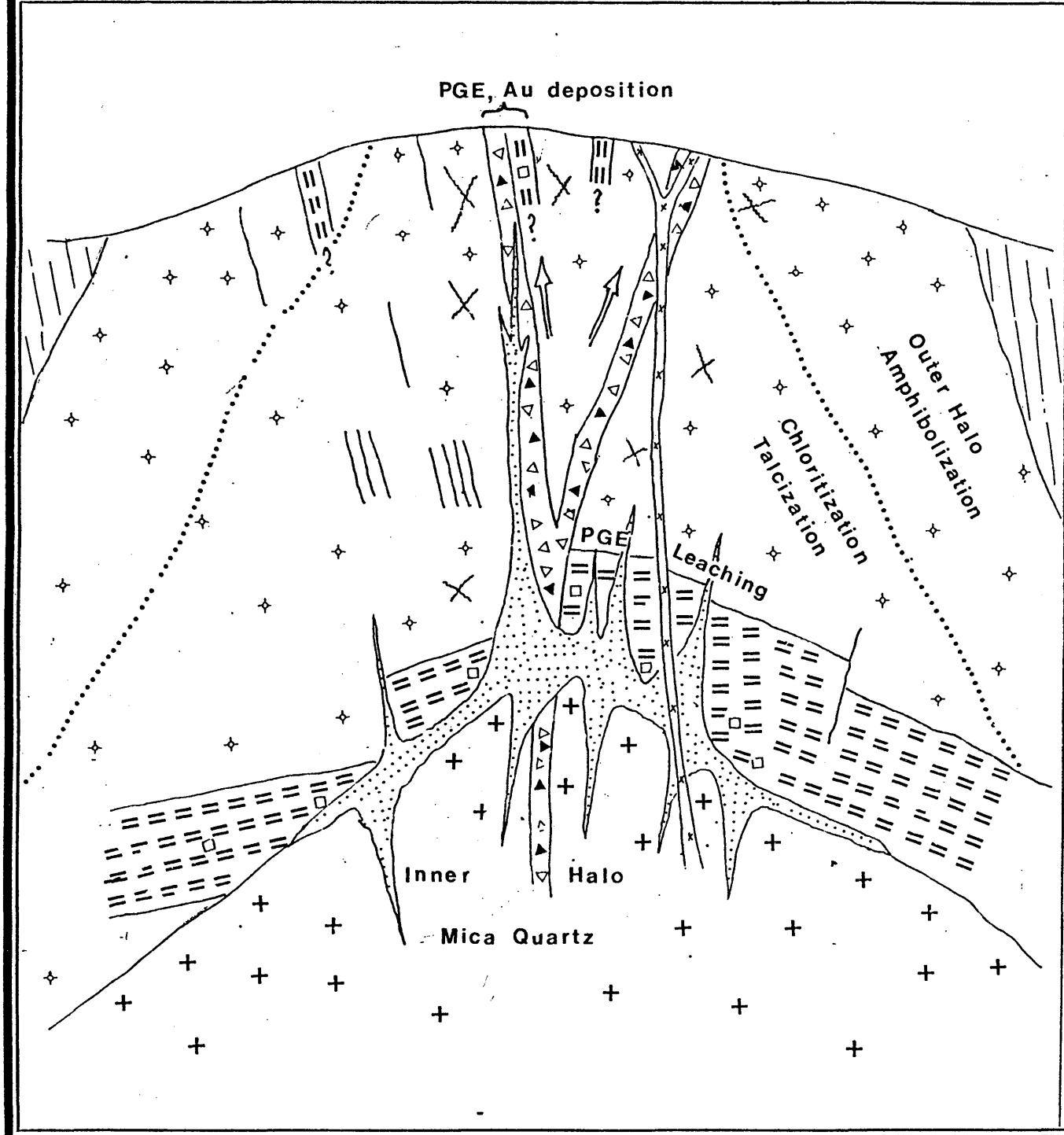

Figure 6

SCHEMATIC GENETIC MODEL ORO GRANDE

illustrating proposed Au and PGE concentration in zoned, epithermal greisen breccia zone overlying PGE bearing ultramafics at depth and a granite pluton.
(Modified after Taylor, in STRONG, 1981)

Not to scale.

LEGEND

- Porphyry
- Greisen / Upper limit of greisenization
- Hydrothermal solutions
- Quartz, tourmaline veins, stockwerk
- Fractured zone
- Breccia. Multiphase fracturing, distension and hydrothermal phases. deposition of PGE, Au
- 'Diorite'. metamorphic basic intrusive rocks
- Granite pluton
- Ultramafic with PGE concentrations
- Schist

Hydrothermal transport has been established in several PGE deposits as the New Rambler deposit in Wyoming, in some younger parts (dykes) of the Bushveld Igneous Complex and at Rathbun Lake, Ontario (Macdonald, 1987). Temperatures of ~335°C postulated at New Rambler for the mobilization of PGE are well within the range of 250 - 400°C reported from convective prophyry systems.

CONTAMINATION

Two kinds of man-made materials were visually identified both of which represented phenomena in Global's report that were difficult to explain. They are interpreted as follows:

1. Smelting products of previous mining operations.
2. Air-borne metal globules from Mr. Lamont's foundry operation.

None of the two types of contamination is believed to be intentional i.e. to represent "salting".

1. Smelting Products

   Particles interpreted as products of previous small scale smelting operations, probably by miners on the property, were collected with a hand magnet from surface debris around the shaft. The particles are approximately 0.1 - 3 mm in size, are highly magnetic, rusty and silvery in colour when scratched. They resemble a number of larger samples previously collected by Mr. Lamont, and a sample previously submitted to Inco for study.

   Reflected light observations of polished grain mounts show two major groups of materials:

   a) Sulphide matte.

   b) Metallic Fe (?) alloys interbanded with minor Fe-oxides.

   A summary of the morphology and internal structures of the particles as documented in Appendix C (Photomicrographs 51 to 56) is as follows:

   a) Sulphide Matte

      Globular, spherical shape, 0.1 - 1.5 mm in size. Colour cream to yellow and pinkish. High reflectivity, isotropic and anisotropic. Obviously different types of composition. The internal structure of anisotropic material shows skeletal growth of radially oriented crystals. Matte is commonly rimmed by type b material.

b) Fe(?) Alloys and Fe-Oxide

This material forms rims around sulphide matte and also occurs as flow-banded fragments consisting of 2 alternating materials:

1. Highly reflecting, isotropic material interpreted as metallic iron or alloy.
2. Low-reflecting, blue grey and brownish grey, in part anisotropic material with internal reflections interpreted as Fe-oxide and Fe-hydroxide.

2. Air-Borne Metal Globules

Small, spherical metallic globules previously reported to occur in natural rock samples were found, by stereomicroscope inspection of Mr. Lamont's rock collection, to adhere only to the outside of the samples. No such globules were seen on freshly broken rock surfaces of the same samples. The obvious explanation is that the globules originate from Mr. Lamont's foundry operation which is located only a few metres from the table on which the samples have been stored for months. Air borne transportation over a few metres is highly likely.

SUMMARY AND CONCLUSIONS

A short field examination of the Oro Grande property followed by petrography and assays of some grab samples was conducted to evaluate the favourability of the geological settling for PGE mineralization. The results are encouraging.

The property is located on one of the major lineaments of the N-American continent, i.e. on a deep crustal break which, as in other parts of the world, is accompanied not only by sialic volcanism but probably also by mafic-ultramafic (ophiolitic) magmatism at depth.

The property is underlain by Precambrian mafic schists and an intrusive composed of a wide range of dioritic to ultramafic, mostly gabbroic rocks that show a complex igneous and metamorphic history. The mafic intrusive rocks do not seem to be layered. The nature of ultramafic bodies is not resolved. They might be layers, inclusions or plugs.

The mafic intrusive is brecciated, metasomatized, hydrothermally altered and veined by what is interpreted as the effects of a major, unexposed Cretaceous-Tertiary pluton which also is interpreted to have uplifted the southern part of the property, i.e. the mine area.

Two breccia zones exist within the mafic intrusive:
The first is the previously known NE-trending Linear Zone that hosts the old Oro Grande mine the other the newly outlined NE-Zone that, in plan, has a funnel shape widening to the northeast and disappears under overlying Tertiary sandstone and volcanics. The breccia zones are not tectonic breccias but interpreted to represent gas explosion breccias. The breccias show a certain internal variability. Three sub-types are tentatively identified, all of which have a matrix variously enriched in quartz, pyrite, limonite and carbonate. The highest degree of alteration, namely metasomatic quartz and porphyroblastic muscovite associated with higher Au-grades seems to occur in a greisen-type breccia near the shaft and old stopes.

Multiple fracturation alternating with multiple deposition of quartz, Fe-hydroxide and pyrite is evident from petrography and indicates long periods of distension associated with continued hydrothermal fluid supply. Rare micron size Au particles and unidentified, highly reflecting opaque grains suggest possible PGE minerals.

Key indicator elements and ratios of chemical analyses indicate that most of the host rocks east of the Au-ore zone are not dioritic but gabbroic to pyroxenitic and have some distinct ultramafic affinities. Of the precious metals Pt is the most abundant Pt values mostly exceed the levels of Au and Pd. All samples are highly anomalous in Pt with abundances ranging from 0.1 to 2.2 ppm. Pt:Pd ratios are consistently high, (5 to > 10), similar to, or higher than, those of the Merensky Reef in South Africa which has a Pt:Pd ratio of 1:03 to 3.

Au values in mafic rocks are mostly < 0.014 ppm (i.e. less than Pt values.) Only in one sample of breccia ore a Au value of 0.35 ppm was assayed. Au mineralization seems historically to be concentrated in the stope area i.e. in the portion with the highest interpreted hydrothermal overprint (greisen). Visual gold was observed in panned greisen and in well water.

Low grade Pt-mineralization occurs not only in the Au-breccia ore but also in the mafic-ultramafic wall rocks to the east. No PGE minerals have been identified. The size of the area highly anomalous in Pt is not known.

The genetic model proposed for the Oro Grande Au-Pt mineralization includes the following:

- Favourable position on one of the major lineaments of the continent and potential association with ultramafic intrusions at depth and concentration of PGE in a differentiated body.

- A complex intrusive and metamorphic history of the mafic intrusion that is

exposed.

- The existence of a Cretaceous-Tertiary pluton underlying the Oro Grande property is indicated by two gas(?) - breccia zones, by multistage hydrothermal fluid supply associated with multistage distension, in the breccia zones, by hydrothermal alteration of adjacent mafic-ultramafic host rocks, by strong uplift and young porphyry dikes or plugs.

The genetic model postulates the leaching of PGE by pluton-related hydrothermal fluids from unexposed, PGE-enriched ultramafics into the high-level, exposed, Linear Breccia zone and its mafic-ultramafic host rocks. The absence of PGE concentrations in ultramafic rocks in the surrounding area is not discouraging since the concentration of PGE in a hydrothermal vent area would necessarily require PGE-depletion elsewhere.

In conclusion: The Oro Grande property is a Pt-Au occurrence in a previously unrecognized and favourable setting. It has unquestionably highly anomalous Pt values and very favourable Pt/Pd ratios in several rock types in a brecciated, hydrothermally altered, mafic complex which is presumed to be underlain by a younger pluton. The property deserves serious attention.

These encouraging conclusions were reached on the basis of only 5-1/2 days of field observations and sampling and on the basis of Inco's assays of 24 grab samples that were collected in an unsystematic manner by R. Tenbergen and to a minor extent by P. Fischer. These encouraging conclusions ignore Global's much higher PGE assay results.

There is no evidence of any "salting" attempts by Global. Global's earlier high-grade assay results may show a strong scatter, even the order of magnitude of PGE levels is in question but certain metal ratios are virtually impossible to be manufactured by salting and therefore the assays are considered to reflect natural but inhomogeneous samples.

RECOMMENDATIONS

In light of the encouraging geological findings and strongly anomalous Pt values in a variety of rocks, it is recommended that a proper, systematic sampling and analytical program be conducted on the Oro Grande property. Sampling should start with the immediate mine environment and should include the platiniferous, faulted ultramafic wall rocks to the east. Sampling by drilling is advisable in light of the postulated hydrothermal vent and feeder system, the unexposed pluton and considering the lack of any information below 150 m depth.

WEAVER CREEK

INTRODUCTION

General

The Weaver Creek property is a placer gold property jointly owned by Global and McFarland & Hullinger.

The property consists of 2 sections (square miles), #34, #35, T9N, R5W, Yavapai County, Arizona (Map 1). Road access is adequate, the property can be reached from the highway by approximately 7 km good gravel road and a poor jeep road of 1.5 km. The property was briefly operated in the last few years as a placer operation without much success probably due to low grades, very fine gold and improperly designed extraction procedures.

The tailings and machinery of the placer operation are located approximately 4 km south east of the Weaver Creek property. The objective of the present work was to assess the potential of the property for a profitable placer gold operation. The scope was restricted to 2 days of sampling and lithological and geomorphological observations. A few widely spaced samples were collected to represent the auriferous gravel deposits (Map 3A). Only 1 sample has been analyzed so far by Inco. There was less emphasis on the evaluation of the Weaver Creek property, that on that of the Oro Grande property.

Sampling

A total of 17 locations were sampled, several consisting of 3 or 4 samples. Most samples were reduced to approximately 1/10 of their weight by a fast panning process, which probably resulted in the some loss of fine gold together with the silicate clay fraction. These unpanned samples should be assigned a greater significance during the evaluation.

Geological Framework

The area of Weaver Creek is part of a large system of fluvial fans that originate from the mountain ranges 5 - 10 miles north - and northeast from Weaver Creek and which contain dozens of gold occurrences and in part rich, previous gold mines. The drainage pattern (Tertiary to Quaternary) is distinctly southward and is interpreted as a filling of a 20 - 30 km size basin in the greater Wickenburg area. At a basin scale this setting appears to have important similarities with the paleo-setting of the Witwatersrand, S. Africa ("Rand"). As at the "Rand", a subsiding basin was filled with high energy fluvial deposits. At the "Rand" the auriferous paleo placers are at the "mid-fan", high energy parts of fluvial fans that were deposited near the basin margin during and after periodic uplifts of the basin rim.

Around Wickenburg a similar basin setting for Tertiary-Quaternary fluvial deposits is likely as indicated by the positioning on a major lineament and by geomorphologic evidence.

RESULTS

Geology

With the exception of a prominent granite hill in the southwest corner of the Weaver creek property all of the 2 square miles are underlain by fluvial gravel deposits of Cenozoic age. Observations during 2 days of field work consist of

a) geomorphological
b) lithological, and
c) miscellaneous observations

a) Geomorphological Observations

Based on land forms, colour and relative elevations 3 types of fluvial deposits are interpreted to exist as illustrated in Map 3B and Section 2.

Type 1) Oldest (Tertiary?) fluvial deposits which form the hills and gentle slopes. They are interpreted to be part of a partly eroded, 10 km size fan. This type is thought to underlie type 2 and 3 and to be hundreds or over 1000 m thick.

There is little lithologic information available due to lack of good exposures. Sample #WC-8, 9, 10, 11, 14.

Type 2) Younger, terraced valley filling. (Quaternary?) These are bedded fluvial deposits which fill older, erosional valleys (Type 1). Morphologically they are sharply off-set from Type 1 by their horizontal surface, reddish colour and crudely bedded character. Form 5 - 10 m vertical banks. This type is assumed to be underlain by Type 1, thickness assumed to be a few tens of metres and to represent reworked older material (Type 1?). Panned samples show minor visible gold. Sample WC-1, 4, 5, 12, 13, 15, 16.

Type 3) Recent creek bed. This is the source of Global's 1987 "ore" for their placer operation. Thickness unknown but assumed to be < 1 to 10 m (?). Probably represents reworked type 2 material. High magnetite content (2 - 10%), forming common 1 x 10 m black magnetite streaks in the creek bed. Weakly auriferous (panning). Sample #WC-2, 3.

b) Lithological Observations

Lithological observations of well exposed, 5 - 10 m high, vertical gravel banks of type 2 material expose crudely bedded, matrix - supported, generally unsorted, high energy fluvial deposits. (Photos 24 - 33)

Crude stratification at a scale of 0.5 to 2 m is indicated by variations in large boulder population, rare cross bedding, coarse sandy layers and discontinuous, harder, calcareous "caleche" beds at various levels (Russel Twiford's interpretation that there is only one marker "caleche" horizon seems unrealistic).

The boulder population consists of ~50% white granite, 25% Precambrian, mafic gneisses and intrusives and 25% Cretaceous-Tertiary volcanics, white vein quartz is uncommon. Most boulders are well rounded, their sizes vary strongly from <0.1 to 0.4 m diameter.

The matrix consists of unsorted material of similar lithologic types as the boulders. The finest grain sizes include considerable clay-size, silt to fine sand fraction, as well as medium to coarse sand. Several percent of magnetite are common.

From the above observations the Type 2 fluvial deposits are interpreted as high-energy, unsorted, braided stream deposits that filled wide valleys in a partly eroded, older fan-blanket (Type 1).

3 c) Miscellaneous Observations

Panning, Weaver Creek.

Panning of recent creek sediments (Type 3) taken below high energy, erosional portions of the creek bed, showed:

- high abundance of magnetite,
- common (4 to 20) very fine specks (<0.1 mm) of gold from 0.5 to 1 kg sand.

Panning of material from the vertical banks (Type 2) showed also some gold specks but less than from Type 3.

Tailings Pile

Heavy mineral concentrate (mainly magnetite) produced by a watchman from Weaver Creek tailings was smelted in a small operation and produce yellowish prills that are said to be high in Au but also in PGE. Assays (1989) prills by Alpha Research Corp., Henderson, N.V., show 100 - 200 opt Au, 5 - 30 opt Pt. The concentration factor of the heavy mineral concentrate relative to the tailings head grade is unknown but can be assumed to be between 100:1 to 1000:1.

Assays

Only 1 sample collected by P. Fischer from Weaver Creek was assayed by Inco (recalculated to ppm)

		ppm				
Field #	Inco #	Pt	Pd	Rh	Au	Ag
WC-2-90	#20	<0.15	<0.014	<0.086	<0.017	0.086

This assay result is discouraging but the relatively higher Pt maximum value of 150 ppb versus 17 ppb Au is difficult to explain and more analytical work is suggested.

Economic Geology

At this point the economic potential of the property is considered to be unknown. Visible gold is present in recent creek sands but is very fine. No high grades should be expected for a short term mining operation from accessible surface deposits judging from Global's recent placer operation. However, without knowing what the Au grades are no judgement can be passed on the property.

A long-term, regional approach might, however, be very interesting. Since, to my knowledge, no systematic regional, drill based evaluation of the area and of a probable alluvial basin has been made by anyone for large scale gold placers such an approach is thought worthwhile. For a long term, regional approach the following factors might have significance for this or other parts of the Alluvial deposits in the Wickenburg area:

Regional

1. Basin stratigraphy, Cretaceous to recent.
2. Outline of paleo-fans, especially mid-fans and the head of fans.

Local

1. Determination of Au-abundance in gravels type 1,2,3 on surface and by drilling 1 or 2 holes.
2. If encouraging grades should result from step 1 the outlining of tonnages in conjunction with gravel stratigraphy might be necessary.

Conclusions

Two days of sampling and minor panning at Weaver Creek have established the presence of visible gold in recent creek sands (Type 3) and in older, crudely stratified gravels (Type 2). The Au-grades are at present unknown but are probably low. Global's previous placer operation is said to have had a poor (20-30%) gold recovery due to very fine grain size of gold. For a long-term, regional approach the chances of a large placer deposit are considered promising.

Recommendation

A short-term approach, before dropping the Weaver Creek property, it is recommended to:

a) analyze all samples collected.

b) perform on-site panning of larger samples and analyze the concentrates,

c) drill 1 or 2 holes to bedrock from one of the hill tops and from the gravel terrace (Type 2) to intersect the various types of fluvial deposits and learn about their Au-grades.

A long-term approach would include research of the Cenozoic stratigraphy, and compilation of published and unpublished data from water wells in order to outline possible, deeper seated, auriferous fans between Wickenburg and the mountains to the north that host Au-deposits.

RECONNAISSANCE SAMPLING

Two days of reconnaissance mapping and sampling was performed along roads. The objective was to:

a) get an impression of the setting of other Au occurrences.

b) see and sample the outcrops around the Vulture Mine, a rich gold mine between 1863 and 1900.

The location of the reconnaissance samples is marked on Figure 2, their lithology is listed in Appendix A.

Most of the lithologies encountered along the Vulture Mine Road south of Wickenburg and along the Castle Hot Springs Road east of Wickenburg are Cretaceous and Tertiary volcanics with minor granite.

Au-occurrences were seen in 3 types of geological environments:

1. Precambrian mafic amphibolite/amphibole gneiss, and fissile intermediate(?) schist cut by quartz veins.
   Location: Vicinity of Vulture Mine, 3 outcrops within 500 m of shaft. Sample numbers R9 to R12.

2. Precambrian massive granite cut by quartz veins, with minor pyrite.
   Location: Congress Mine, dump. Samples R-20.

3. Tertiary, felsic to intermediate lava. Fractured, with red clay alteration. Hydrothermal alteration over a possible vent.
   Location: Small, operating open pit mine beside road, Castl Hot Spring Road. Sample R-13B.

LIST OF REFERENCES

CROCKET, J.H., 1981:

Geochemistry of the Platinum Group Elements. In: CIM, Special Volume 23, p. 47 - 64.

GLOBAL PLATINUM AND GOLD INC. 1989:

The Oro Grande Mining Project. A venture of Global Platinum and Gold Inc., Wickenburg, Arizona. Unpublished compilation of previous work.

KURTZ, J.P., 1990:

Geological summary of the Oro Grande Mine, Wickenburg, Arizona. Unpublished report for Global Platinum and Gold Inc., addressed to F. Puskas, Inco., August 4, 1990.

MCCALLUM, M.E. et al., 1976

Platinum metals associated with hydrothermal copper ores of the New Rambler Mine, Medicine Bow Mountains, Wyoming. Econ. Geol., 71, p. 1429 - 1450, 1976.

MCMILLAN, W.J., PANTELEYEV, A., 1981

Porphyry copper deposits. Geoscience Canada, 8, 2, 1981.

POST, M.K., 1983

Geology of the Oro Grande Mine. Unpublished, preliminary report, 1983.

ROWELL, W.F.; EDGARD, A.D., 1986:

Platinum group element mineralization in a hydrothermal Cu-Ni sulphide occurrence, Rathbun Lake, Northeastern Ontario. Econ. Geol., 81, p. 1272-1277.

STRONG, D.F., 1981

A model for granophile mineral deposits.
Geoscience Canada, 8,4, 1981.

TARDY, M., BLANCHET, R., ZIMMERMAN, M., 1989

Les lineaments du Texas et Caltham entre Cordilleres Americaines et Sierras Madres Mexicaines: Nature, origine et evolution structurale.
Bull. Centres Rech. Explor. - Prod.
Elf Aquitaine, 13, 2, 219-227.

APPENDIX A

(1)

1. ORO GRANDE

2. WEAVER CREEK

3. RECONNAISSANCE SAMPLING

SAMPLE LIST
AND
TABULATED OBSERVATIONS FROM
OUTCROPS AND PETROGRAPHY

Abbreviations: SM = Stereomicroscope
PM = Petrographic Microscope

SAMPLE #	OUTCROP	PETROGRAPHY
OG-1-90	Diorite, inclusion bearing, foliated. Inclusions mafic, aligned, fine grained. Matrix quartz - diorite, coarser than inclusions. Cut by sheared felsic rock, and quartz vein and limonite.	1a. 1b. (SM) Mafic inclusions. Feldspar, 25% chlorite (flaky), 1% opaque (limonite). Alt: Feldspar white, altered. Chlorite after amphibole? Structure: Strongly factured, crumbly. 1c. (SM) Felsite. Silicified diorite? Zoned, quartz increase over centimetre. Chlorite, epidote, hematite/limonite. Carb. Quartz vein, limonite. Vuggy. Web-type limonite in quartz (pyrite?) Thin phyllosilicate stringers.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-2-90	Diorite. Faulted, brecciated, strongly fractured. Impregnated by coarse grained quartz - carb. - limonite (pyrite) vein, trend ~N-S, 1-1.5m. thick. Felsite dyke ~110/90.	2a. (SM) Diorite Medium grained, heterogeneous. Amphibole streaks. Small, equant opaque. ALT: Feldspar saussuritized. 2b. (SM) Quartz vein, fractured. Quartz, carb. 10% limonite. (after pyrite?) anhedral. Quartz fractured with limonite and phyllosilic (chlorite?) filling. 2c. (SM) Quartz - Carb. vein. Coarse grained, grey, fractured. Fracture filled with minor carb. ~5% chlorite(?) Carb. brown dense & opaque. (1% Fe-oxide: limonite (after pyrite), cubes. 2d. (SM) Quartz - Carb. vein. Coarse grained. Quartz, carb. intergrown at millimetre - centimetre scale. Brown, hard carb. & limonite. Cut by thin opaque veinlets. Centimetre quartz - limonite (?) network/webbing in carb. (after pyrite?)

SAMPLE #	OUTCROP	PETROGRAPHY
OG-3-90	Diorite. Breccia. Rounded diorite cobbles in matrix of crumbly diorite? Local red staining. Heterolithologic fragments, no preferred orientation, fragments in part rounded.	3a. (SM) Diorite fragment: Weak foliated, medium grained, altered. Quartz? 10-20% chlorite. Opaque (limonite after pyrite?) in discontinuous cross cutting microveinlets. ALT: Limonite, serictie?, carb. OG-3 (Petrographic, Microscope, Transmitted Light) Classification: Highly altered quartz/diorite(?) Min: Major: Sericite, chlorite (30%) Minor: Quartz 5-7% Accessory: Opaque, apatite, Fe-hydroxide Texture: Medium grained relict texture, foliated. Finely disseminated opaque and red Fe-hydroxide in phyllosilicates. Alt: Strong sericite pseudomorph after feldspar. Disseminated fine Fe-hydroxide. (limonite) 3b. (SM) Diorite - Breccia? or altered quartz-diorite. Millimetre - centimetre feldspar - rich fragments or relicts. Matrix: Feldspar → serictie, quartz, chlorite (3-5%) opaque. Massive, no fabric. Interpret: Breccia?, or selectively altered quartz-diorite? Fragment and matrix similar except for relative abundance of disseminated limonite, vuggy texture, porphyroblastic(?) opaque (pyrite to limonite)
OG-4-90	(20 N of OG-3) Similar to OG-3-90. Diorite - breccia, heterolithologic. Fragments angular to rounded, no preferred orientation. Fragments locally concentrically zoned (alteration). Matrix: Smaller fragments, limonite.	NO SAMPLE

SAMPLE #	OUTCROP	PETROGRAPHY
OG-5-90	Diorite, foliated, inclusion bearing Fol. 045/805E. Oriented decimetre size, - more mafic portions (inclusions) in coarser, more felsic diorite matrix. Fresh, unaltered. Minor jointing 150/65SW Minor hematite and clay vein 060/90.	5a. (SM) Diorite. Unaltered, foliated, heterogeneous composition. A minor, felsic matrix appears to host mafic schlieren, rafts. Contacts between the 2 varieties are sharp gradational Metamorphic rock. Felsic type ~ 20% amphibole Mafic type ~ 50-60% amphibole. 5b. (SM) Diorite - Gabbro, fresh medium grained, foliated, unaltered. Mafic variety ~ 50-60% oriented amphibole/hornblende. feldspar. Accessory leucoxene. Millimetre size felsic blotches (feldspar - quartz?) 5c. (SM) Diorite Unaltered, foliated, Centimetre thick more felsic band in mafic diorite/amphibole-gneiss. 5d. (SM) 1-2 centimetres hematitic, altered diorite. Texture in part preserved. ~20% millimetre limonite wide veinlets. Carb - rich. Interpret: Former Carb. - pyrite vein?
OG-6-90	Leuco - granite dyke cutting diorite. Raft of diorite enclosed in dyke. Contact 100/70N. 20 centimetre quartz vein and hematite (pyrite?) with silicified halo in diorite.	6. (SM) Leuco granite, medium grained, aplitic, white. Feldspar, quartz (35%), no Femags. ~1% limonite. Massive no foliation.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-7-90	Brecciated diorite, matrix of coarse grained quartz - pyrite (-limonite). Quartz 2 stages, a) white b) Grey, euhedral & pyrite Pyrite euhedral, to 4 centimetres diameter.	7a. (SM) Massive limonite (after pyrite?), fine network of quartz, large (centimetre) relicf textures of former pyrite cubes. OG-7 (PM, Reflected Light) Classific Fe-oxide breccia ore. Min: Several phases of Fe-oxide and Fe-hydroxide. Hematite, goethite? 3 different phases: Blueish grey, anisotropic (hematite?) White grey anisotropic (Fe-oxide?) Greenish-grey. (goethite?) Texture: Very fine intergrowth of 3 Fe-oxide phases. Colloform structures common. Breccia texture. Evidence of multistage fracturation and in filling with gangue. (quartz)
OG-8-90	Diorite, weakly foliated, rubbly. Cut by 5-10% quartz veins, epidote veins. In part limonite. (after pyrite?)	8. (SM) Diorite - fresh. Min: Feldspar, (quartz?), ~25% amphibole. Mafic patches (inclusions:) 60-70%. Texture: Blotchy, medium grained, 1-3 millimetre, weakly foliated. Mafic inclusions.(?) Alt: Unaltered. Feldspar white, weak saussuritized. Epidote veins (1-3%), <=2m- 1% disseminated limonite (after pyrite)
OG-9-90	Diorite with 15-20 m wide zone which is brecciated, in part sheared (3-5m) and cut by centimetre-decimetre wide quartz - pyrite/limonite-carb. veins. Trace Cu - staining. (malachite, chrysocolla) PS 9a at Inco, Sheridan Park, for probing.	9a. Massive limonite ore with quartz. Quartz as matrix between limonite (pyrite) areas, as thin webbing. Euhedral crystal filling vugs. Altered host rock fragments,(wall rock?). 9a. (PM, Reflected Light, PS given to Inco) Classific: Fe-oxide ore, gangue. Small specks of unidentified, highly reflecting minerals. PGMs?

SAMPLE #	OUTCROP	PETROGRAPHY
		9b. (SM) Quartz (white), fractured. Fractures filled with limonite. a) dark-brown/black, hard. b) Red, soft, with phyllositic, soft, light green 9b. (Petrographic, Microscope, Transmitted Light) Classific: Quartz-carbonate rock. Vein, showing multistage quartz-crystallization. Mineralogy: Major: Quartz 80-85% Minor: Carb. 10-15% Accessory: Fe-hydroxide (<1%), Serictie 1-2%, chlorite <1%. Texture: Quartz matrix with patches of coarse grained carb., minor serictie-chlorite host rock fragments. Red Fe-hydroxide (limonite) as very fine disseminations. (10-20 microns) and irregular lines. Morphology of quartz: Mostly micro-crystalline, cherty. Serveral generations, uncertain age sequences. 1. Fragments of coarse clear quartz. 2. Cherty, microcrystalline quartz, with tabular, quartz-platelets on which 10-100 micron quar5z grains crystallized normal to platelets. Hosts limonite globules. Older generation? Hosts carbonate patches. 3. Coarse, euhedral quartz. Young? 4. Carbonate, vuggy, coarse grained, filling vugs. 3. Coarse, euhedral quartz. Young? 4. Carbonate, vuggy, coarse grained, filling vugs. 9b. (PM Reflected Light) Classific: Minor Fe-oxide, small (3-3 microns) specks of unidentified highly reflecting minerals. (AU? PGM?)

SAMPLE #	OUTCROP	PETROGRAPHY
		9b. (SM) Quartz (white), fractured. Fractures filled with limonite. a) dark-brown/black, hard. b) Red, soft, with phyllositic, soft, light green 9b. (Petrographic, Microscope, Transmitted Light) Classific: Quartz-carbonate rock. Vein, showing multistage quartz-crystallization. Mineralogy: Major: Quartz 80-85% Minor: Carb. 10-15% Accessory: Fe-hydroxide (<1%), Serictie 1-2%, chlorite <1%. Texture: Quartz matrix with patches of coarse grained carb., minor serictie-chlorite host rock fragments. Red Fe-hydroxide (limonite) as very fine disseminations. (10-20 microns) and irregular lines. Morphology of quartz: Mostly micro-crystalline, cherty. Serveral generations, uncertain age sequences. 1. Fragments of coarse clear quartz. 2. Cherty, microcrystalline quartz, with tabular, quartz-platelets on which 10-100 micron quar5z grains crystallized normal to platelets. Hosts limonite globules Older generation? Hosts carbonate patches. 3. Coarse, euhedral quartz. Young? 4. Carbonate, vuggy, coarse grained, filling vugs. 3. Coarse, euhedral quartz. Young? 4. Carbonate, vuggy, coarse grained, filling vugs. 9b. (PM Reflected Light) Classific: Minor Fe-oxide, small (3-3 microns) specks of unidentified highly reflecting minerals. (AU? PGM?)

SAMPLE #	OUTCROP	PETROGRAPHY
		9c. (SM) Quartz, vuggy, sugary, porous, and minor limonite. Previous carb?
OG-10-90	2m high, dozed cliff 50 m WNW of house. Altered, tectonized, soft, mafic and ultramafic rock, in part diorite. 5-10 m SE of breccia ore-zone (Oro Grande workings).	10a (SM) Inclusion bearing fresh diorite. Min: Feldspar, 25% amphibole, quartz?, accessory leucoxene-sphene. Texture: medium grained, porphyritic, heterogeneous, ultramafi - inclusion bearing. Interpret: Complex intrusive history, at least 2 stages: 1) Ultramafic, hornblendite as inclusions and amphibole blotches. 2) Felsic diorite, disrupting ultramafic, incorporating it as inclusions. 10a PM, Transmitted Light Classific: Fresh meta - quartz - diorite. Min: Major: Plagioclase 70-80%, amphibole 15-20%. Minor: Quartz 5%, epidote 2% Accessory: Sphene 1%, opaque, apatite. Texture: Grain size 0.5 - 2 millimetre. Massive, metamorphic character. Plagioclase occurs as anhedral grains, forming a mosaic, amphibole as scattered prisms and anhedral 0.2 - 1 millimetre grains. Locally amphibole forms 1 centimetre clusters. Quartz as small grains interstitial to plagioclase. Sphene forms subhedral porphyroblasts(?). Amphibole clusters in part poikiloblastic. Alt: Weak. Mostly fresh. Comment: Well preserved metamorphic texture of quartz-diorite.

SAMPLE #	OUTCROP	PETROGRAPHY
		10b (1) Ultramafic fault - breccia several lithologies, altered, soft, fractured, crumbly, carb. - nil. Altered Diorite. Fine grained - medium grained,slightly foliated variable grain size. Structure: Crumbly, fractured at millimetre scale, --30% brown carb veins. Alt: Femags (amphibole) → chlorite and carb? Feldspar mostly soft sericite?, white. Some hard, fresh feldspar. Carb in 5% in microfractures. 10b (2) Ultramafic? Highly altered soft, green limonitic chlorite-schist. Min: Chlorite (amphibole) ~90%. Feldspar? Quartz? veinlets. Carb, limonite. Text: Medium grained - coarse grained, massive. Locally millimetre - 1 centimetre - relict crystals of chlorite pseudomorph after amphibole: Interpret: Probably ultramafic, altered hornblendite, texturally well preserved, not diorite. 10c Highly altered diorite, red brownish, soft, relict texture. Min: 30% chlorite, ~70% serictie(?) after Pyrite? Text: Medium grained (~1 millimetre), weak foliated. Alt: Strong, Amphibole → chlorite, Feldspar to serictie (?), soft. 10d (SM) Felsic dyke, fine grained., foliated, light buff, aplitic. Min: Feldspar, quartz, (40-50), Accessory limonite, hematite, serictie. Text: 0.5-1 millimetre grains, weak foliated. Scattered spots of limonite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-11-A-90	Surface, Ore stockpile west of house. Red, quartz-rich, limonitic breccia ore.	11. (SM) Highly altered diorite? Min: Clay/serictie. Limonite 10%. Chlorite 10-20%? Quartz? 2-4%. Text: Relict texture: 1 millimetre grain size, foliation. Limonite (after pyrite?) restricted to ~1/3 of sample. (with quartz i.e close to a quartz vein?)
OG-11-B-90	Underground, 100 ft. Level, pillar ~ 3m SW of shaft. Highly altered, red, soft, clay-rich rock. (Said to be Au-rich)	11. (PM, Transmitted Light) Classific: Greisen? Min: Major: Sericite 20-30%, Feldspar 50%, Quartz 20%. Minor: Opaque 1-3% Accessory: Leucoxene Text: Grain size 0.1 - 0.3 millimetre. Foliated, metamorphic. Metamorphic feldspar mosaic, minor quartz, enclosing oriented muscovite/sericite flakes. Scattered opaque patches. 0.1 - 0.3 millimetre (Fe-oxide?) and fine limonite disseminated. 11. (PM, Reflected Light) Classific: Disseminated Fe-oxide. Min: Major: Hematite Minor: Goethite? Texture: Scattered hematite patches (10-200 microns hosted by gangue. Abundant red internal reflections.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-12-90	Underground, 100 Level, ~10m NE of shaft. Brecciated altered diorite. Common limonite pseudomorphs after pyrite.	12. (SM) Highly altered diorite? Min: Serictie/clay after feldspar? and amphibole? Chlorite? 10-20%. Limonite after pyrite? 5% Quartz in vugs. Text: Medium grained, massive relict texture 1 millimetre. Disseminated limonite (pyrite), 0.5 - 1 millimetre) 2 millimetres quartz vein. Centimetre - vugs euhedral quartz in open spaces (between fragments?) Vugs: Quartz, light green chlorite, pyrite → pseudomorph. 12. (PM, Transmitted Light) Classific: Highly altered diorite? Disseminated opaques. Min: Major: Sericite 85-90% Minor: Quartz 5-10% Accessory: Opaque 2-3%, apatite. Texture: Fine grained, felty sericite has replaced all feldspar, amphibole(?). Large sericite porphyroblasts?. Quartz appears secondary, not as a relict. Scattered, disseminated porphyroblastic opaque (Fe-oxide after pyrite?) Alt: Strong. Sericite, quartz replace all previous minerals. Interpret: Greisen? Protolith difficult to determine due to high degree of alteration.
OG-13-90	Underground, 100 Level, at bottom of ramp (& ladders). Brecciated, altered diorite with quartz matrix and disseminated pyrite.	13. (SM) Brecciated diorite, partly altered, and disseminated pyrite. Min: Feldspar, 10-20% chlorite/amphibole, limonite, 3-5% pyrite. No carb. Texture: Foliated, brecciated, feldspar - (quartz?) rich areas, little chlorite. Disseminated pyrite (→limonite) Vugs centimetre size, quartz, with euhedral pyrite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-13-90		13. (PM, Transmitted Light) Classific: Highly altered diorite? Min: Major: Serictie 70-75% Minor: Chlorite 10%, feldspar 10%, quartz 3-5%. Accessory: Opaque 1-2%, apatite trace. Texture: Foliated relict texture: Oriented chlorite flakes in fine grained felty sericite matrix. Secondary, fine grained mosaic feldspar, quartz indicating post-alteration meta-somatism (greisen?) Disseminated opaque (Fe-oxide after pyrite?)
OG-14-90	Drill-hole chips, panned. Lithology on surface: Diorite. Depth: 75-90 ft. Weight: 28 lbs. panned to ~300 grams.	14. (SM) Rock chips. Feldspar, amphibole, biotite, quartz? diorite chips.
OG-15-90	Brecciated felsic intrusive. Massive. Fragments centimetre-decimetre size, closely packed. Matrix ~10%, silica, carb? Colour light grey, locally slightly rusty.	15. (SM) Felsic breccia. Monolithologic, leucogranitic fragment. Fragment: Medium grained, leucogranite, feldspar, quartz, trace chlorite. Texture: Angular fragments, closely packed. Matrix: Silica, trace limonite/hematite. 15. (PM, Transmitted Light) Classific: Brecciated felsic dyke? Min: Major: K-feldspar, quartz 30-40%, plagioclase. Minor: -- Accessory: Serictie, chlorite, opaque all trace. Text: Fragment size < 1 millimetre to > 1 centimetre. Grain size of felsite 0.1 - 1 millimetre. Texture of felsite massive. Anhedral microvein, perthite, quartz. Quartz appears to replace feldspar (silicification?)

SAMPLE #	OUTCROP	PETROGRAPHY
OG-15-90 Con;t.		15. Breccia matrix: Closely packed, randomly oriented, angular feldspar, quartz-fragments, with a trace of dusty Fe-oxide. In places minor isotropic (glass?) ground mass. <1% sericite between feldspar and quartz clasts. Comment: Not a tectonic breccia but interpreted as possible gas explosion breccia.
OG-16-90	Diorite, weak foliation 040/80SE with ~5% centimetre-decimetre size mafic inclusions.	16. (SM) Quartz diorite, fresh. Medium grained, 0.5 - 1 millimetre grain size. Slightly heterogeneous distribution of amphibole. Min: Feldspar, ~20-30% amphibole, ~5% quartz. Text: Fine grained, medium grained blotchy, metamorphic? Alt: Fresh, unaltered, feldspar ip pink.
OG-17-90	Felsic dyke. Aplitic, white, coarse grained, massive, locally granophyric, locally tourmaline.	17. (SM) Aplitic dyke. Medium grained-coarse grained, 1-10 millimetres grain size. Feldspar, 30-40% quartz, 1-3% magnetite, black.
OG-18-90	Strongly foliated amphibole gneiss. Foliated 055/60SE.	18. (SM) Amphibole gneiss fine grained foliated. Min: Amphibole 50-60%, feldspar 40-50%. Text: Fine grained (0.1-0.5 millimetre grains), foliated. Alt: Fresh or weak altered, soft, crumbly. Feldspar → serictie?
OG-19-90	Altered diorite-porphyry. Massive, medium grained, Acicular Femags, amphibole limonite after pyrite? Comment: Igneous texture of diorite unusual: Mostly foliated, metamorphic.	19a (SM) Diorite, moderately altered, massive. Min: Feldspar, ~ 15-20% amphibole, ~5% limonite after pyrite? Text: Massive, medium grained, acicular Femags, scattered 1-3 millimetres limonite after pyrite(?) 19b (SM) Epidote rich (>50%), fractured rock.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-19-90 Con't...		19b (PM, Transmitted Light) Classific: Brecciated, epidote rich meta diorite? Min: Major: Epidote ~90% Minor: Amphibole 5-10 Accessory: Quartz 1-2 Texture: Medium grained, epidote rock, scattered, pale amphibole. (actinolite?), accessory quartz in interstices Strongly fractured, in part breccia texture. Scattered small opaque grains. Comment: No trace of protolith, totally obscured by meta somatic overprint. Brecciation after epidote - alteration.
OG-20-90	Fractured diorite, cut by 20-30% decimeter - m thick breccia stockwork zones: quartz - carb - limonite.	
OG-21-90	Old shaft, dump. Diorite, medium grained, strongly fractured, slightly brecciated. Impregnated by disseminated pyrite, limonitic alteration zones (centimetre).	21a (SM) Foliated fresh diorite, medium grained and disseminated fresh pyrite. Min: Feldspar (white), 30% amphibole, 3-5% pyrite. Text: Foliated, oriented amphibole. Pyrite in fracture, ≤1 millimetre carb veins. 21a (PM Transmitted Light) Classific: Altered diorite, disseminated pyrite. Min: Major: Serictie, chlorite 20-25% Minor: Pyrite 5-8%, carb. 10-20% Accessory: Apatite 1-2%, leucoxene, quartz 1%. Texture: Medium grained 0.5 - 2 millimetre grain size, foliated sericite and carbonate matrix (after feldspar), oriented chlorite stringers. Scattered apatite. Large (0.5 - 2millimetre) pyrite grains associated with carb. - quartz veins.

SAMPLE #	OUTCROP	PETROGRAPHY
		21b (SM) Felsite, granite, massive. Feldspar, 30% quartz, 5-7% amphibole, 1-2% disseminated limonite (pyrite?) 21c (SM) Felsite, fine grained weak foliated, white reddish feldspar, quartz, trace limonite. Cut by limonite vein (py?). Impregnated by dusty limonite. 21d (SM) Felsite? altered, impregnated by vuggy quartz (millimetre - centimetre), limonite after pyrite? (~10-20%) Min: (rock) Feldspar, ~20% quartz, ~5-10% chlorite or sericite
OG-22-90	Brecciated diorite and quartz carb. - limonite stockwork matrix. - Lithic fragments commonly rounded, decimetre size.	22 (SM) Red Breccia centimetre size fragments- a) diorite, strongly altered b) granite/felsite, foliated, 25% quartz, ~15% oriented biotite/amphibole. Matrix: Red, quartz, trace carb. ~5-10% limonite after pyrite. ~3-5% white-light green chlorite or sericite. Interpret: Foliated quartz-rich rock as fragments unusual. Possibly silicified foliated diorite?
	O/C Rock types, as fragments: a: medium grained diorite b: Fine grained felsic intensive, red breccia & stockwork c: Fine grained - mafic amphibole gneiss.	22 (PM, Transmitted Light) Classific: Min: Major: Plagioclase 40-50%, quartz 20%, sericite 20%. Minor: Opaque 10%, K-feldspar Accessory: Apatite: 1-2% Texture: Medium grained - coarse grained, cut by quartz to opaque veins. Large (0.5-4 millimetre) plagioclase, in part replaced by sericite. Some large K-feldspar(?) enclosing quartz blebs. Amphibole(?) replaced by sericite. Quartz and opaque (Fe-oxide) impregnate rock with veinlets and along feldspar grain boundaries. Alt: Moderate. Plagioclase ~ 1 preserved Fe-oxide and quartz impregnation.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-23-90	Brecciated, altered diorite, with stockwork of quartz, carb., limonite. Fragment: massive diorite, foliated diorite.	No sample taken
OG-24-90	Foliated (075/55SE) Intermediate - felsic amphibole biotite gneiss, fine grained, banded.	24 (SM) Intermediate - felsic amphibole- biotite - gneiss, fine grained, banded. Min: Feldspar, 10-20% quartz, 15% biotite, 10% amphibole, trace limonite. Texture: fine grained, foliated, millimetre feldspar - quartz segregation. //s.
OG-25-90	Faulted, foliated mafic amphibole gneiss, or diorite. Cut by felsic dyke ~100/90. Foliated 055/60SE. Fault 080/705. Feldspathic diorite hosts mafic/ultramafic inclusions. Faulted, rubbly.	No Sample
OG-26-90	Strongly fractured, altered, carb.-veined massive diorite. Cut by 0.5 m quartz vein and limonite, 055/80SE. Diorite in part sheared, platy.	26a Quartz vein. 2 generations of quartz: a) white, fractured. b) clear, grey. Filling sub parallel fracture in white quartz. Carb. fracture filling with minor limonite. 26b (SM) Highly altered fine grained amphibole - gneiss, foliated. (1) Min: Feldspar? (red, flaky → serictie?) amphibole, biotite -70%. Text: Fine grained (0.2 - 0.5 millimetre), foliated. Alt: Soft, altered. 26b Altered granite? or diorite? Fresh feldspar, quartz? 30% (2) amphibole, chlorite.
OG-27-90	Diorite, medium grained, massive. Cut by centimetre - thick quartz - carb. limonite vein 310/45/NE. Felsite dyke, 1 m.	27 (SM) Quartz Diorite. Medium grained, massive. Min: Feldspar, 30-40% amphibole (biotite), ~3% quartz. Texture: Medium grained (1-2 millimetre), blotchy amphibole, slightly subophytic.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-28-90	Subcrop, local blocks: Feldspathic hornblendite, mafic gabbro, coarse grained, massive.	28 (SM) Feldspathic hornblendite, fresh Min: 70% amphibole, 20-30 % feldspar, 5% epidote, Accessory quartz? Texture: very coarse grained, blotchy, massive. Very large (0.5 - 2 centimetre) amphibole (hornblende) in matrix of fine grained, epidotized diorite. Centimetre size of leucocratic feldspar-patches (white). Interpret: Intrusive breccia? Coarse grained hornblende could be xenoliths. 2-stage intrusive history. Porphyroblasts?
OG-29-90	Heterogeneous hornblende-gabbro. Cut by white quartz-diorite.	29a (SM) Coarse, porphyroblastic or xenolithic hornblende gabbro. Similar to 28. 50% amphibole, ~50% feldspar. 1 centimetre amphibole crystals in fine grained diorite matrix. 29b (PM, Reflected Light) Classific: Feldspathic hornblendite. Min: Major: Hornblende 80% Minor: Plagioclase 10-15% Accessory: Apatite 2-3%, epidote 1-2%, carb 0.5%. Texture: Coarse grained, massive, metamorphic. Large (2-20 millimetre) hornblende grains of subhedral shape in a matrix of medium grained. (0.5-1 millimetre) equant hornblende with interstitial plagioclase. Scattered 0.2 - 0.5 millimetre apatite grains enclosed in hornblende. Metamorphic carb. interstitial to hornblende. Comment: Metamorphic fabric. 29c Coarse grained, white leuco - diorite. (dyke cutting 29A, 29B,) Feldspar (white), 5% amphibole, trace limonite. Grain size, 2 - 10 millimetre. Massive.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-30-90	Brecciated diorite. Cut by 2 quartz-carb.-limonite veins.	30a (SM) Diorite, altered, strongly fractured, crumbly. Feldspar (mostly white, fresh), 25% Femags (chlorite? after amphibole? Texture heterogeneous: coarse grained with fine grained band. Alt: Weak to moderate. Feldspar >50% fresh, amphibole completely replaced by soft chlorite? (brown) and limonite? 30b (SM) Carbonate vein with minor quartz. Colors red and brown, sharply delineated (2 generations?)
OG-31-90	Rubbly subcrop. Texturally heterogeneous hornblende gabbro.	31 (SM) Coarse hornblende gabbro, fresh, massive. Feldspar 50 60%, amphibole 40-50%. Texture coarse grained, massive. Coarse grained (5-10 millimetre) amphibole crystals in finer grained diorite matrix. Cm. size pink, leucocratic patches. Comment: 2 stage intrusive? a) mafic - ultramafic, coarse grained. b) leucocratic diorite (+K-feldspar?)
OG-32-90	Bull-dozed adit, ~30 m x 2 m good outcrop across breccia ore zone and host rock diorite. Host rock: Strongly fractured, in part altered diorite. Ore zone: Brecciated, quartz-carb-limonite (pyrite) rich zone. Width: 10-15 m. Trend. NE-SW, Bordered by NE-SW Sheared, faulted zones ~2 m wide. Quartz veins and rock fragments oriented normal to trend of breccia zone.	32a (SM) Diorite, fresh, foliated feldspar, amphibole 40%, trace limonite. Texture medium grained, foliated, metamorphic (?), not igneous. Alt: Feldspar fresh, amphibole fresh. Trace epidote, limonite. Cut(?) by brown, fine grained, slightly foliated carb. zone with minor chlorite. 32b (SM) Diorite, weakly altered. Feldspar (pink), amphibole (to chlorite, 20%) 3% epidote. Texture: Medium grained (1 millimetre) weak foliated. Alt: weak. Feldspar fresh, amphibole in part to chlorite? 32c (SM) Breccia. 2-4 cm. thick veins with coarse euhedral quartz (a) and 10% limonite, minor phyllosilicate. Minor chrysocolla. Wall rock fragment, 5-10 cm: Felsic, granite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-32-90 Con't...		32c (PM, Transmitted Light) (a) Classific: Coarse grained quartz - limonite stockwork, minor talc? Min: Major: Quartz ~80% Minor: Fe-oxide (limonite) 5-10% talc(?) 10% Accessory: Carb trace Texture: Quartz mostly very coarse grained (1-20 millimetre) euhedral, to a minor degree fine grained mosaic. In part finely intergrown with Fe-oxide. In some places very fine grained quartz is nucleating on skeletal Fe-oxide (after pyrite?) Opaque (Fe-oxide?) is dark red, translucent. - Fills interstices between euhedral quartz. - shows common, fine concentric rings, intergrown with cherty quartz. - Forms dendritic intergrowth with quartz. Talc (?), bright green colour. As millimetre size patches, intergrown with quartz, and opaque. Quartz is replacing talc(?) Brownish feldspar, 30% quartz, 5% limonite patches (after py?) 0.5 - 1% leucoxene(?) Texture medium grained (1 millimetre), massive, intrusive. 32c (SM) Coarse grained quartz vein and limonite, vuggy, ~5% open (b) spaces. Quartz millimetre-centimetre, i.p. euhedral. Interstices: Red limonite and quartz, in part with concentric zoning or: - webby - with black hematite (mt?) - with trace Cu-silica (chrysocolla) - No carb 32c (SM) Altered diorite cut by cm quartz veins. Diorite limonitic, (c) soft, medium grained relict texture Fe-stained phyllosilicates after feldspar, amphibole. Disseminated opaque (limonite) No carbonate.

SAMPLE #	OUTCROP	PETROGRAPHY
		32d (SM) Feldspar hornblendite/mafic hornblende-gabbro, coarse grained, massive, ~fresh. . ~80% hornblende, ~20% white feldspar, ~3% epidote, trace limonite. Texture coarse grained, massive, and blotchy. Feldspar appears to replace amphibole. Amphibole 5-10 millimetres, platy. 32d (PM, Transmitted Light) Classific: Feldspathic hornblendite. Min: Major: Hornblende ~70%, plagioclase 20-25%. Minor: Epidote 5%. Accessory: Apatite <1%, opaque, sphene 1%, sericite. Text: Coarse, massive, metamorphic. Large, stubby, platy hornblende, randomly oriented. Anhedral plagioclase interstitial to hornblende. Scattered sphene, apatite grains. Small opaque grains disseminated in hornblende, probably leucoxene and Ti-oxide. Alt: Weak. Trace sericite. 32e Red, altered, carb-rich, ultramafic hornblendite(?). Relict texture preserved, medium grained, amphibole (?). ~50-60% fine grained, red carb (?). Disseminated opaque (limonite after pyrite?) 32e (PM, Transmitted Light) Classific: Limonite - impregnated ultramafic. Min: Major: Sericite, actinolite, Fe-oxide (limonite 20%) Minor: -- Accessory: Apatite 1%, quartz 1-2%. Texture: Sericite (and talc?), impregnated with abundant fine limonite, pseudomorph after large amphibole (?). Fairly well preserved cleavage outlining large (0.5 - 3 millimetre) stubby former crystals. Minor quartz associated with limonite-filled fractures.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-33-90 Outcrop and Local Subcrop/Float	Diorite, massive, medium grained, crumbly, strongly fractured. Rare centimetre-decimetre mafic/ultramafic inclusions. Tourmaline float.	33a (SM) Gabbro, weakly altered. Feldspar, 30-40% amphibole, 5% quartz. Texture heterogeneous: Fine grained (0.2-0.5 millimetres) with medium grained-coarse grained leucoxene-dioritic patches, and quartz. Altered, weak: Feldspar 1/10 - 1/5 to epidote. 33b (SM) Quartz Diorite, weakly altered, cut by millimetre thick tourmaline - quartz veins. Feldspar, 20% amphibole, 5% quartz, trace limonite. Texture medium grained (1-2 millimetres), massive to weak foliated. Fractured. Weak - moderately altered. Feldspar 1/2→epidote. 33b (PM, Transmitted Light) Classific: Epidote-rich, feldspathic diorite. Min: Major: Plagioclase, epidote 30%. Minor: Amphibole 5-10%, sphene 1-2%, tourmaline 3-5%. Accessory: Apatite, quartz 1%. Texture: Medium grained (0.5-2 millimetres), massive, metamorphic texture. Anhedral plagioclase. Porphyroblastic, epidote, patchy, large amphibole. 2 millimetre tourmaline vein. 33c (SM) Ultramafic hornblendite cut by epidote vein ~ 95% amphibole, 1-2% limonite, 1-2% feldspar?, 1-2% epidote in rock. Texture medium grained (1-3 millimetre) massive. Permeated b abundant hair-line rusty veinlets. One 2 centimetre epid vein, sharp contacts.
0G-34-90	Diorite, medium grained, slightly foliated, texture inhomogeneous. Cut by centimetre epidote veins.	34a (SM) Diorite, Feldspar, 30% amphibole - chlorite, carb, epidote. Texture medium grained. (1-2 millimetre), massive. Cut by ~5% millimetre carb. veinlets. Alt: Weak feldspar ' fresh, amphibole fresh. carb. veinlets, thin epidote veinlets.

SAMPLE #	OUTCROP	PETROGRAPHY
		34a (PM, Transmitted Light) Classific: Metadiorite, epidote - carb. veined. Min: Major: Plagioclase, chlorite 25-30% Minor: Epidote 5%, carb 1-3%, quartz 1%. Accessory: Opaque 1%, apatite, sericite. Texture: Massive, medium grained, 0.2-2.0 millimetre, metamorphic, veined. Plagioclase anhedral, equant, generall 0.5-1 millimetre. Annealed(?) patches with fine grained (0.1-0.3 millimetre) plagioclase. Patchy chlorite with disseminated opaque, carb, epidote. Epidote, carb, trace quartz as veinlets, stringers. Comment: Considerable metamorphic and hydrotherm overprint. 34b (SM) Epidote rock/vein. Strongly epidote-altered diorite? 80% epidote, 10-20% amphibole, 1-2% limonite, <1% leucoxene. Texture massive, fine grained. Vague 1-2 millimetre relict texture (amphibole), relict leucoxene/sphene. Scattered pyrite altered to limonite. 34b (PM, Transmitted Light) Classific: Epidote rock, metasomatised diorite? Min: Major: Epidote 95% Minor: Amphibole 3-5% Accessory: Opaque 1%, leucoxene Texture: Massive, fine grained, vague breccia textures. Fine grained massive epidote matrix hosts scattered amphibole crystals (relicts?) A few scattered opaque and leucoxene grains. Fracturing and in places brecciation outlined by very fine grained epidote - mylonite zones with fragments.

SAMPLE #	OUTCROP	PETROGRAPHY
0G-35-90	Diorite, fine grained, slightly fractured, massive. Cut by epidote veins, tourmaline veins and quartz veins.	35a (SM) Diorite, fine grained. Feldspar, 30-40% amphibole, trace opaque. Texture fine grained, massive, scattered coarse grained white feldspathic blotches. Alt. weak, feldspar grey, fresh, minor epidote. 35b Diorite and 10% black tourmaline(?) 35c Quartz vein. (Subcrop), 10-20 centimetre thick. White, massive quartz, disseminated. 1% limonite after pyrite. Cut by ~2% tourmaline and epidote veinlets. Fractured. 35d (SM) Altered fine grained quartz - diorite porphyry?(Dyke?) Feldspar, 10-15% amphibole, 10-20% quartz?, 3-5% limonite (after pyrite). Texture massive, medium grained (0.5 - 1 millimetre), acicular amphibole. Scattered limonite after pyrite. Alt. moderate. Feldspar → sericite, amphibole → chlorite. 35d (PM) Transmitted Light Classific: Altered dyke. Porphyry? Min: Major: Feldspar 65-75%, chlorite 15-20%. Minor: Quartz 5-10%. Accessory: Opaque 2-4%, sericite. Texture: Fine grained (0.1-0.3 millimetre), massive, igneou texture. Feldspar lathy and anhedral, interlocking. Chlorite acicular, minor blotchy. Opaque are 1-3 millimetre size, poikilitic patches.
OG-36-90	Diorite, massive to weakly foliated., minor amphibole - rich clusters. Rare centimetre feldspar - epidote veins.	36a (SM) Diorite, fresh. Feldspar, 20-25% amphibole. Texture medium grained (1-2 millimetre), weak foliated, homogeneous. Blotchy, not igneous. Alt: Fresh, feldspar trace sericite? 36b (SM) Aplite vein, brecciated, altered. Feldspar (white), quartz, 20% epidote, 2% limonite, staining & disseminated pyrite → limonite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-36-90 Con't...		36b (PM, Transmitted Light) Classific: Fractured, epidote-veined aplite. Min: Major: Feldspar (plagioclase, albite)? Minor: Epidote 20%. Accessory: Opaque 1-2%, sphene. Texture: Massive, medium grained (0.2 - 2 millimetre). Mosaic of anhedral plagioclase. Cut by network of epidote-filled fractures at millimetre intervals. Scattered opaques, sphene.
OG-37-90	Diorite, massive, weak fracturing, ~5% mafic/ultramafic inclusions, minor epidote veins.	37 (SM) Leucoxene-diorite, (granodiorite?) Feldspar, 5-10% amphibole. Texture massive, medium grained (1-3 millimetre) Alt: Fresh. (weak saussuritized)
OG-38-90	Diorite, weak foliated. Cut by 0.5 - 1 m quartz vein, trend 340/60 NE	38a (SM) Diorite-Gabbro, Fresh. Feldspar, 40-50% amphibole, trace limonite (after pyrite). Texture medium grained (0.5 - 1 millimetre), foliated, blotchy, large feldspar. Metamorphic texture. Scattered 0.2 millimetre limonite (pyrite) Alt: Weak: ~1/10 epidote (feldspar) 38b (SM) Quartz vein. Massive, white. Minor tourmaline filled fractures, minor limonite patches (pyrite?)
OG-39-90	Diorite, massive and banded. With quartz vein, ~ 5 m ultramafic zone. Foliation 060/~90.	39a (SM) Feldspathic hornblendite. Amphibole 90%, feldspar 10%, trace carb, trace limonite (pyrite) Texture medium grained, 1-2 millimetre, weak foliation, thin stringers of leucoxene. Alt: Fresh amphibole, feldspar. 39b (SM) Quartz vein and limonite. Sub-parallel fractures filled with: a) red, soft limonite b) black, webby limonite/hematite (after pyrite?) trace carb. 2 directions of fracture?

SAMPLE #	OUTCROP	PETROGRAPHY
OG-39-90 Con't...		39c (SM) Shear banded feldspathic diorite & quartz veins. Banding centimetre scale. Feldspar (white) 40%, quartz 40-50%, amphibole 5-10%. Texture: Shear banding, elongation (Augen shape) of feldspar, of small amphibole patches. 39d (SM) Diorite-Gabbro, fresh, foliated. Feldspar 50-60%, amphibole 40-50%, epidote 2-4%, quartz? Texture medium grained, heterogeneous, blotchy, weak foliation. Large (1-2 millimetre/amphibole crystals in finer grained feldspar amphibole (quartz?) matrix. Scattered large (2-3 millimetre) white feldspar. Cut by millimetre-centimetre, slightly epidote-altered veins.
OG-40-90	Diorite, massive, crushed, strongly fractured, in part breccia. Carb. veining, Epidote-alteration. 40B 20 m SW of 40A: Fractured diorite.	40a (SM) Gabbro altered? Feldspar, 50% amphibole/chlorite, accessory epidote, leucoxene ~5%, carb. Texture medium grained, weak foliated, Texture diffused by alteration. Alt: Feldspar fresh, in part to epidote, carb. Amphibole i.p. → chlorite, carb.
OG-41-90	Diorite, Fault zone, 050°. Sheared, fractured, carbonate-cemented, slightly limonitic.	41 (SM) Diorite, fine grained, brown-red, diffuse texture. Feldspar (→carb. serictie?), amphibole 20%?, >10% carb., limonite. Texture medium grained-fine grained, strongly foliated, sheared strongly aligned (foliated), gently folded phyllositicates, leucoxene.
OG-42-90	Diorite, strongly fractured, rubble. Epidote-rich, with 2 m wide ultramafic zone (42B), trend 040°.	42a (SM) Leuco-Diorite, medium grained, pink and green. Feldspa 70%, amphibole 15%, epidote 15%. Texture medium grained, weak banding. Centimetre pink feldspar patches and amphibole-rich bands with epidote. 3% millimetre epidote veins.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-42-90 Con't...		42a (PM, Transmitted Light) Classific: Recrystallized, epidote-veined leuco diorite. Min: Major: Feldspar (albite?) Minor: Chlorite & amphibole 15%, epidote 10-15%. Accessory: Apatite, opaque. Texture: Medium grained (0.1-0.3 millimetre), recrystallized, metasomatic? Cut by epidote veins. Matrix: Mosaic of anhedral, equant feldspar (mostly albite with disseminated 0.1-0.2 millimetre epidote. Scattered 0.3 - 1 millimetre blotchy amphibole-chlorite and epidote. Checkerboard albite twinning common, seems to replace plagioclase. Comment: Albite metasomatism? Protolith diorite? 42b (SM) Ultramafic hornblendite, medium grained,green-grey. 95% amphibole, trace limonite, ~3-5% magnetite. Texture medium grained ~1 millimetre, massive. Disseminated opaque (magnetite?) and brownish specks (limonite) 42b (PM, Transmitted Light) Classific: Ultramafic hornblendite. Min: Major: Amphibole - Chlorite 10%. Accessory: Opaque ~1-2%. Texture: Medium grained, massive, metamorphic texture. Randomly oriented, stubby, patchy, pale amphibole and chlorite flakes. Felty texture. Disseminated. Opaque, 0.1-0.3 millimetre.
OG-43-90	Foliated mafic amphibolite to feldspathic hornblendite, fine grained. Foliated 045/90 In part ultramafic? Foliated fine grained diorite?	43a (SM) Feldspathic meta-hornblendite, fine grained hornblende-gabbro? Amphibole 70-80%, feldspar 20-30%, 1-2% magnetite. Texture fine grained-medium grained, 0.5-1 millimetre, weak foliated, homogeneous.

SAMPLE #	OUTCROP	PETROGRAPHY
		43a (PM, Transmitted Light) Classific: Feldspathic meta-hornblendite. Min: Major: Hornblende 65-70%, plagioclase 30-35%. Minor: Accessory: Sphene 1%, apatite, opaque trace. Texture: Medium grained (0.2-1 millimetre), weakly foliated metamorphic. Hornblende as weakly to randomly oriented stubby and patchy grains with interstitial fresh plagioclase. 43b Feldspathic, hornblendite, Hornblende 70%, minor tourmaline, feldspar. Texture medium grained, weak foliated, homogeneous. Texture metamorphic not igneous. Feldspar in part acicular, interstitial to acicular, recrystalized amphibole. Scattered magnetite. 43b (PM, Transmitted Light) Classific: Feldspathic, tourmaline-rich hornblendite. Min: Major: Hornblende 70%, tourmaline 20%. Minor: Plagioclase 3-5%. Accessory: Apatite, sericite. Texture: Medium grained (0.5 - 3 millimetre), massive, metamorphic. Weakly oriented stubby and acicular hornblende intergrown with tourmaline and anhedral, interstitial plagioclase. Tourmaline seems to replace hornblende. 43c Diorite, Feldspar, 20% amphibole. Texture medium grained (1-2 millimetre), foliated. Prismatic amphibole. Alteration weak. Feldspar mostly fresh, weakly saussuritized. Trace limonite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-44-90	Diorite with ~3 m band (dyke? inclusions?) of ultramafic, 3 m aplite dyke, ~1-2 m tourmaline rock (vein) Trend of veins, bands ~040° Local rubble: quartz-limonite veins.	44a Coarse tourmaline rock. 44b (SM) Ultramafic hornblendite ~95% amphibole (actinolite), 2-4% non-magnetic black opaques. Texture: massive, medium grained, 1-2 millimetres. Metamorphic texture. Alt: None. Amphibole. Fresh. Amphibole i.p. radically Structured. 44c (SM) Aplite, coarse grained, white Feldspar, 25-30% quartz, 3-5% sericite/chlorite. Texture coarse grained, massive, slightly fractured. 44d (SM) Quartz - limonite vein. 90-95% quartz, white, 5% red limonite, trace carb. Texture massive quartz, fractures with limonite, minor carb. filling. 44e (SM) Fractured, brecciated quartz vein, + limonite, carb. Quartz 80-90%, limonite and carb. 10-20%. Texture: Breccia. (m size quartz fragments in soft, brown matrix of limonite, clay (chlorite?) carb. 44f (SM) Tourmaline - quartz vein. Tourmaline ~ 50%, quartz ~50% Texture: coarse grained (5 millimetre), intergrown. Quartz is matrix.
OG-45-90	Altered diorite, crumbly. Inclusion - bearing. Centimetre scale feldspar - quartz - segregations or veins. Weak foliation 050/~90.	45 (SM) Altered Diorite, weakly magnetic. Epidote 80%, limonite 20%. Texture: medium grained (1 millimetre), massive, blotchy. Alt: Strong. Complete replacement of feldspar by epidote, amphibole by brownish limonite.
OG-46-90	Diorite, weak foliation, fine grained.	46 (SM) Hornblende Gabbro Feldspar ~ 50%, amphibole ~ 50%. Texture: fine grained (0.5 - 1 millimetre), weak foliation, with 1 centimetre stringers rich in feldspar. Alt: Fresh feldspar, amphibole.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-47-90	Limonitic quartz vein	47 (SM) Quartz vein. Fractured, brecciated, + limonite. 2 generations of quartz. a) old, white, brecciated. b) younger, clear quartz, cementing clasts of a) and red limonite.
OG-48-90	Diorite, gabbro medium grained. Massive. Moderately fractured.	48 (SM) Hornblende-Gabbro weak foliation, weakly altered. Non-magnetic. Feldspar 60%, amphibole 40%. Texture medium grained (1-2 millimetre), weak foliation, blotchy. Metamorphic. Alteration weak. Feldspar ~1/10 → epidote.
OG-49-90	Diorite, Gneissic, banded. Strongly variable texture fine grained to coarse grained. With minor mafic - ultramafic inclusions.	49 Hornblende-Gabbro, fresh, weak altered, non-magnetic. Feldspar 50%, amphibole 50%, accessory epidote (feldspar), leucoxene. Texture medium grained (1 millimetre), blotchy, coarse feldspar patches. Alteration weak, saussuritized patches. Thin epidote veinlets.
OG-50-90	Old trench. Red, faulted, brecciated carb.-altered rock, (quartz rich) Felsic gneiss? Brecciated. Quartz - limonite vein?	50a (SM) Limonite-veined carb. (quartz rock) 30% red limonite in fractures in carb.-rock (vein?) Minor (10%) quartz. Breccia-vein? Fault? 50b (SM) Red, soft limonite matrix hosts ~40% millimetre-centimetre quartz fragments? Brecciated quartz-vein?
OG-51-90	Diorite, fractured, in part brecciated, rusty. With 3-4 m wide zone: Heterolithologic breccia cemented by limonite. Carb. matrix. Fault: 055/70SE	51 (SM) Diorite, altered, brecciated? Feldspar (sericite), 30% Femags, 5% pyrite→limonite, 5% quartz, 1% leucoxene (no carb) Texture: Different diorite fragments? Strong, sharp variation i. grain size, texture. Stringers of euhedral, coarse grained pyrite + 5% euhedral quartz. Alt: Moderate, feldspar → sericite?, amphibole → chlorite?, vuggy. (no carb)
OG-52-90	Fault - Breccia in quartz diorite porphyry, strongly altered. Matrix carb, limonite. 52A W part of outcrop.	52a (SM) Breccia fragments. Fine grained felsic, quartz-rich rocks, feldspar fresh, 30-40% quartz, + disseminated pyrite→limonite. Matrix: coarse grained quartz, phyllosilic (sericite, chlorite?) + limonite. No carb.

SAMPLE #	OUTCROP	PETROGRAPHY
		52b (SM) Quartz-diorite - porphyry. Feldspar, quartz? 10-15% amphibole. Texture fine grained - medium grained, massive, acicular amphibole. Scattered 0.5 - 1 millimetre phenocrysts of feldspar (+quartz?), i.p. zoned. Scattered rusty spots - limonite after pyrite?
OG-53-90	Porphyritic quartz - diorite	53 Porphyritic quartz - diorite. Feldspar, 25% amphibole, ~10-20% quartz, trace limonite. Texture: fine grained-medium grained, massive, acicular and blotchy Femags. Scattered feldspar phenocrysts 1-2 millimetre Fine grained white feldspar - quartz - matrix.
OG-54-90	Porphyry, cut by >15 m wide stockwork of fault breccia, veins, carb., limonite (pyrite). Size of rock fragment decimenter - m , shape angular to rounded.	54 (SM) Porphyritic, felsic quartz - diorite. Feldspar, quartz(?) 10-20%?, amphibole 20%, limonite 5%. Texture: fine grained, (0.1-0.5 millimetre), massive, porphyritic, scattered 1-2 millimetre feldspar phenocrysts in fine grained matrix. Dusty red limonite impregnation. Alt: Weak, hard, fresh, disseminated red limonite.
OG-55-90	Diorite, cut by ~50%, m-wide, randomly oriented limonitic breccia veins. Breccia: Coarse grained. quartz-carb-limonite (pyrite) matrix. Fragments: Heterolithologic, decimentre size, shape angular to round. Diorite, granite.	55a (SM) Granite, weak altered. Feldspar, 25% quartz, 3% limonite (+ serictie?) Texture medium grained (1-2 millimetre), weak foliation, equant feldspar in quartz matrix. Disseminated 0.2-0.5 millimetre pyrite replaced by limonite. 55b (SM) Quartz - diorite porphyry Feldspar, 30% quartz, 15% amphibole + chlorite, <1% limonite (pyrite) 1% leucoxene/sphene. Texture fine grained (0.2-0.5 millimetre), massive - weak foliation. Scattered 0.5-1 millimetre feldspar phenoxts. Alt: Unaltered, fresh feldspar. Disseminated magnetite.
OG-56-90	Gabbro, cut by randomly oriented limonitic carb., breccia veins. Quartz veins fractured, with limonite and chlorite(?) filling.	56a (SM) Hornblende - Gabbro, altered. Feldspar, 40-50% amphibole/chlorite, 1-2% limonite. Texture: medium grained (1 millimetre), massive, blotchy. Alt: Weak - moderate. Feldspar mostly fresh, amphibole→chlorite, limonite impregnated along fracture, and → amphibole.

SAMPLE #	OUTCROP	PETROGRAPHY
		56b (SM) Feldspathic diorite, altered, white-rusty Feldspar ~80%, Femags→limonite 20%. Texture medium grained (1-2 millimetre), weak foliation, limonite-filled fractures. Alt: Moderate feldspar white, soft (→sericite?), amphibole replaced by limonite.
OG-57-90	Brecciated diorite, crumbly, altered	57 (SM) Diorite to Gabbro, various textures, and compositions. Feldspar, amphibole (20-60%), limonite, carb. (2-5%). Texture fine grained - medium grained (0.2-1 millimetre), massive and foliated. Strongly fractured, thin veins. Scattered pyrite→limonite . Alt: Moderate. Feldspar i.p. fresh, → sericite. Amphibole → chlorite, carb., limonite impregnated.
OG-58-90	Porphyritic Quartz - Diorite. Dyke? Trend 010/90° Massive, medium grained, fresh. Sharp, prismatic Femags.	58 (SM) Porphyritic quartz - diorite, fresh, massive. Feldspar, 15-20% amphibole, 20-30% quartz? 1% leucoxene, sphene. Texture igneous, fine grained, massive, porphyritic. 1-2 millimetre feldspar phenoxts. Acicular femags (amphibole) very fine grained feldspar - quartz matrix. Alt: None. Fresh feldspar. Comment: None-metamorphic, igneous rock.
OG-59-90	Foliated diorite, medium grained, fractured. Fol 060/65SE	59 (SM) Diorite, foliated, weakly altered. Feldspar, 20% amphibole, 2% epidote, trace limonite. Texture medium grained (1-3 millimetre), foliated, strongly aligned amphibole. Fine, sub-parallel fractures foliated. Alt: Weak: Feldspar generally fresh, reddish(saussuritized?) o. limonite - impregnated. Trace epidote.
OG-60-90	Foliated intermediate gneiss, foliated, cut by several m-thick felsic dykes. >4 m thick brecciated felsite with carbonate matrix.	60a (SM) Felsite. Feldspar quartz (40%?) Accessory sericite, epidote, opaque. Texture: Fine grained distinctly foliated. Alt: Unaltered, fresh. Comment: Felsic gneiss? Metamorphic rock, not a dyke. 60b (SM) Intermediate biotite - amphibole gneiss, altered. Feldspar, 25% biotite and amphibole, 5% quartz. Texture: Fine grained (0.3-0.5 millimetre), foliated, fractured. Scattered 0.5 millimetre quartz-rich eyes. Alt: Weak, feldspar soft. Fractures with carb.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-61-90	Diorite (amphibole gneiss?) Strongly foliated, altered, crumbly. Fol. 05/60SE Cut by 2 felsic dykes.	No Sample Taken
OG-62-90	Diorite - Gabbro, weak foliation, fractured. Cut by centimetre-thick aplitic dykes.	62 (SM) Diorite-Gabbro, medium grained, weakly altered, weakly magnetic. Feldspar, 30-40% amphibole, 1% magnetite. Texture: Fine grained-medium grained (0.5-1 millimetre), weak foliation, blotchy. Disseminated magnetite grains. Rare fractures & carb. Alt: Weak. Feldspar mostly fresh, trace epidote.
OG-63-90	Diorite, medium grained, altered, crumbly, soft, locally limonitic. Cut by 10 centimetre felsite dyke 020/90.	63 (SM) Diorite, altered, various textures, weakly magnetic. - medium grained, feldspathic, foliated ~5-10% amphibole; 10-20% epidote, 1-2% disseminated pyrite → limonite. - fine grained mafic, hard, soft, green, rusty, ~20-30% amphibole & chlorite, foliated. Amphibole - gneiss?
OG-64-90	Diorite, with inclusions of foliated, mafic amphibole gneiss. Altered, soft, crumbly 30% m-scale limonitic zones. Fol 060/60SE	64 (SM) Diorite, variously altered, medium grained, massive. - Feldspar, 15% amphibole, feldspar mostly fresh. Fractured at cm scale. - Medium grained, massive, moderately altered, fractured, crumbly. - 3 cm. thick carbonate vein-filling? White soft. - Enclosing ~5% <1 millimetre fresh feldspar grains. With magnetite amphibole crystals.
OG-65-90	Gabbro, medium grained, massive, fresh, slightly fractured, with inclusions.	65a (SM) Hornblende - Gabbro, medium grained, fresh/weak altered, hard. Non-magnetic. Feldspar, 40-50% amphibole. Texture medium grained (1-2 millimetre), blotchy, massive to weak foliation. Alt: Weak Feldspar ~1/4 → epidote, amphibole fresh.
	Quartz vein, 0.5 m, 040/50SE	65b (SM) Quartz - carb. vein. Slightly limonitic. Quartz, 5% carb, 1-3% limonite, trace chalcopyrite. Texture: Massive, coarse grained quartz, in part 1 centimetre, normal to contact. Thin fractures //vein, filled with carb and limonite. Scattered, fresh chalcopyrite specks isolated in quartz.
OG-66-90	Diorite with fine grained inclusions, Strongly fractured. (centimetre scale)	66 (SM) Diorite, Xenolithic. Feldspar, 25-30% amphibole, 5% epidote, 1-2% quartz, 0.5% leucoxene. Texture: medium grained (1-2 millimetre) weak foliation. Contains long rafts of fine grained inclusions. (hornfelsic?) Contact diorite to inclusion metamorphic, not tectonic.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-67-90	Diorite-Gabbro foliated, with fine grained "Schlieren" 0.5 m carb. vein, trend 040/55SE	67a (SM) Diorite-Gabbro, foliated, partly carb. altered. Non-magnetic. Feldspar, 30-40% amphibole, 5% carb., <1% limonite. Texture: medium grained, foliated, scattered large feldspar. 1/2 of sample cut by // thin brown carb. veinlets. Sharp boundary to un-veined diorite. Alt: 1/2 Fresh, 1/2 carb. veined. 67b (SM) Carb - quartz vein, coarse grained, 10% quartz, ~90% brown carb. (ankerite?) Thin fractures & limonite, + blac' opaque.
OG-68-90	Diorite, cut by centimetre thick random felsic veins (stockwork). Strongly fractured, rubbly.	68 (SM) Diorite-Gabbro, medium grained, fractured, altered. Feldspar, 30-40% amphibole, trace limonite. Texture: medium grained (1-2 millimetre), massive to weakly foliated. Feldspar in part sugary, (recrystalized). Strongly fractured (millimetre scale) Alt: Weak-moderate. Feldspar mostly fresh but fractured, and sugary, with Fe-oxide microfractured at <1 millimetre scale.
OG-69-90	Quartz-diorite, weakly foliated, (Fol. 050°/705E) cut by 8 m thick quartz-carb. vein and limonite, trace cu-stain. Quartz vein in part brecciated, foliated, trace tourmaline.	69a (SM) Quartz-diorite/granodiorite, foliated, partly altered. Feldspar, 20%, quartz 10-15% amphibole, 15-20% carb, 1% opaque, <1% limonite, <1% leucox/sphene. Texture: medium grained (1-2 mm) strongly foliated. Strong carb. impregnation of microfractures. Alt: Moderate. Feldspar in part fresh, abundant brown carb. in microfracture. 69b (SM) Granodiorite, fresh, foliated/Granite, Magnetic. Feldspar, 25-30% quartz, 10-15% amphibole/chlorite. 1-2% magnetite. Texture: Medium grained (1-2 millimetre, foliated) Metamorphic granitic. Alt: Weak saussuritization of feldspar. 69c (SM) Quartz vein. White quartz, fractured. Thin fracture fillings of limonite and minor Cu. stain. (malachite, chrysocolla) 69d (SM) Quartz vein? or quartzose gneiss. Quartz, 5-7% limonite, 1% tourmaline. Texture: Quartz sugary. Distinct foliation or shearing, oriented limonite stringers. Strongly tectonized.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-70-90	Foliated amphibole gneiss, banded, fractured. Fol. 055/75SE Felsite dyke 0.5m trend 090/705.	70a (SM) Mafic amphibole gneiss/amphibolite. Feldspar, amphibole 40-50%. Texture fine grained (0.3-1 millimetre), strong foliation, strong parallel alignment of amphibole, feldspar. Alt: centimetre size gray carb rich patches and red limonite staining. 70b (SM) Fine grained aplitic dyke. Feldspar ~50% quartz, 1% biotite and amphibole, opaque. Texture fine grained., weak foliated, stretched quartz grains. Scattered small Femag crystal.
OG-71-90	Foliated, banded intermediate/mafic amphibole gneiss. Cut by >5m thick felsite sill.	71 (SM) Amphibole gneiss. Composition intermediate/mafic. Feldspar, 30% amphibole, 3-5% quartz? Texture fine grained, foliated. Alt: Fresh.
OG-72-90	Foliated amphibole gneiss. Fol. 050/60SE. Boudined felsic bands 1 m brown Fe-carb alteration zone.	72a (SM) Strongly carb altered gneiss, brown, weakly magnetic. Carb 25%, feldspar, 25% chlorite, 1-2% opaque. Texture medium grained, foliated, relict texture somewhat preserved. //carb stringers,//foliate. Disseminated opaque. 72b (SM) Felsic gneiss, fine grained, weakly magnetic. Feldspar, 30% quartz, 5% biotite, 10-15% sericite? (white), 1% opaque, 1% sphene. Texture fine grained, strongly foliated: Cut by a few 1 millimetre veinlets. Quartz, chlorite, carb and limonite.
OG-73-90	Banded, intermediate, amphibole, gneiss/diorite. Fol. 070/60SE Cut by minor aplitic veinlets.	73 (SM) Fine grained diorite as amphibole gneiss. Massiv magnetite. Feldspar, 40% amphibole, trace limonite, magnetite. Texture fine grained, massive variable grain size (diorite inclusions) Texture blotchy, not gneissic. Interpret: Probably an intrusive diorite, not gneiss. Diorite with fine grained inclusions? Alt: Fresh, unaltered.
OG-74-90	Contact between amphibole-gneiss and massive diorite. Fol 050/80SE	74a Mafic amphibole gneiss. Feldspar, 50% amphibole. Texture fine-grained-medium grained, strongly foliated, centimetre-scale feldspar-quartz boudined bands. 74b Foliated diorite, medium-coarse grained, Feldspar, 25-30% amphibole, 3-5% epidote, trace opaque. Texture medium grained, 1-4 mm. metamorphic, blotchy. Thin epidote fractures. Alt: weak <5% epidote.

SAMPLE #	OUTCROP	PETROGRAPHY
		74b (PM, Transmitted Light) Classific: Partly altered metadiorite. Min: Major: Plagioclase 70%, amphibole 15-20%. Minor: Epidote, 10%, sericitie. Accessory: Apatite, sphene, opaque. Texture: Medium grained, weakly foliated, metamorphic. Large blotchy hornblende in a matrix of fine grained, recrystallized, mosaic feldspar partly sericitized. Epidote patches, stringers Scattered apatite, sphene, opaque. Comment: Feldspar mosaic seems younger than large, oriented hornblende.
OG-75-90	Diorite with enclosed 4m raft of gneiss. Diorite hosts a decimetre size ultramafic inclusion. Fol. (gneiss) 060/70SE	75a (SM) Diorite, medium grained, foliated, magnetic. Feldspar (plagioclase), amphibole 20%, K-feldspar? (pink) 20%, quartz 5-10%, 1-2% magnetite, 1% epidote. Texture: medium grained (1-2 millimetre), fol. Scattered 2-3 millimetre grains of K-feldspar(?) and quartz. 75a (PM, Transmitted Light) Classific: Diorite Min: Major: Plagioclase 80%, hornblende 15-20% Minor: -- Accessory: Apatite 1%, opaque, epidote, sphene, sericite, chlorite. Texture: Medium grained, weakly foliated, metamorphic texture. Mosaic plagioclase matrix, slightly oriented large (<1-3millimetre) poikilitic hornblende. Epidote as scattered patches, grains. Opaque as scattered subhedral, equant grains. 75b (SM) Ultramafic hornblendite, coarse grained, fresh, weak magnetic ~98% hornblende, accessory carb, limonite, feldspar. Texture: coarse grained, 3-8 millimetre, massive, equant hornblende. Carb. in fine fractures.

SAMPLE #	OUTCROP	PETROGRAPHY
		75b (PM, Transmitted Light) Classific: Coarse ultramafic hornblendite Min: Major: Hornblende Minor: Epidote 3-5% Accessory: Apatite 1-2%, opaque, sphene Texture: Very coarse grained, 2-5 millimetres hornblende crystals, randomly oriented. Texture metamorphic. Mosaic c large, anhedral hornblende grains. Apatite interstitial to hornblende. Finely disseminated opaque, epidote.
OG-76-90	Diorite (unaltered), cut by m wide breccia dykes with quartz-carb-pyrite (limonite) matrix. Fragment in breccia decimetre size, heterolithologic, shape angular and round. Fragment composition felsic, diorite, mafic. Some fragments Schistose, fine grained. Matrix 10-30% of outcrop.	76a (SM) Heterolithologic, limonitic breccia. Feldspar, amphibole/chlorite, 5%, quartz 0-20%, limonite (after pyrite). Texture: Medium grained diorite and granite, not foliated, strongly fractured. Disseminated limonite (pyrite). Alt: Limonite, minor carb. (in veins). 76b (SM) Host rock: Diorite, weak foliation, weak magnetic. Feldspar, 30% amphibole, 5% epidote, trace magnetite. Texture medium grained, weak foliated, blotchy, metamorphic. 1% thin epidote fractures. Alt: Weak, epidote.
OG-77-90	Diorite, cut by green breccia zone and red breccia zone with quartz-carb-limonite stockwork/matrix. Young felsic intermediate porphyritic dyke (at adit)	77a (SM) Three fragment types: a) Quartz diorite, medium grained, moderately, 15% amphibol 5% quartz. Disseminated 5% limonite (after altered pyrite?) Centimetre quartz and limonite - matrix patches. Quartz fine grained and coarse grained, euhedral. b) Fine grained foliated felsite (dyke rock?) Aplitic, feldspar and 25% quartz, 5% sericite? 1-2% limonite, disseminated (pyrite)? and in thin fractures. c) medium grained, altered diorite. Feldspar, 25% amphibole/chlorite. Massive to weakly foliated. Impregnated with 1-5% limonite after pyrite.

SAMPLE #	OUTCROP	PETROGRAPHY
		77b (SM) Red breccia. Coarse grained carb - quartz - limonite matrix. Several fragment lithologies: a) fine grained rock, feldspar-quartz, fresh feldspar, limonite stained b) Altered diorite, medium grained, feldspar→sericite (soft), 15% chlorite, carb-rich, limonite stained. 77b (PM, Transmitted Light) Classific: Partly altered felsic rock (dyke?) Min: Major: Quartz 50%, feldspar (→sericite) 50% Minor: Accessory: Opaque <1%. Texture: Massive, medium grained (0.5-1.5 millimetre). Anhedral, interlocking grains of quartz and partially sericitized feldspar. Some 5-10 millimetre size sericitized patches without quartz. Scattered 0.2-1 millimetre opaque. 77c (SM) Quartz-Diorite,porphyry?, fine grained - massive, fresh. Feldspar - 15% amphibole - chlorite, 10-15% quartz, 5% limonite. Texture: fine grained, massive feldspar quartz matrix, acicular Femags, scattered 1-3 millimetre red limonite stains.
OG-78-90	Diorite, fractured, foliated, 060/70 NW. Feldspar "Augen" shaped.	78 (SM) Diorite, foliated, weakly altered, platy. Feldspar, 20% amphibole, 3% epidote, trace limonite. Texture medium grained, foliated, sub //fractures, strongly aligned amphibole, stretched feldspar. Alt: Weak to fresh.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-79-90	Diorite Breccia, Limonitic. Minor quartz-carb-limonite matrix. Disseminated 5% millimetre size limonite (after pyrite?)	79 (SM) Various fragment types. a) Diorite, medium grained, 20% amphibole, weak-moderately altered, metamorphic. b) Quartz-diorite, porphyry (feldspar phenoxts), acicular femags. Very fine grained quartz - feldspar matrix). 79 (PM, Transmitted Light) Classific: Partly altered feldspar - porphyry. Min: Major: Feldspar 70-80% Minor: Chlorite 5-7%, carb 5-10%, quartz 2-5%. Accessory: Opaque 1-2%. Texture: Fine grained, massive, igneous, porphyritic. Fine grained matrix (50-100 microns) of lathy and anhedral, interlocking feldspar crystallites. Scattered 1-2 mm boxy, altered phenocrysts of feldspar (to sericite) and femags (to chlorite, sericite). Carb. as scattered 0.5 millimetre patches, Opaque 0.5-1 millimetre.
OG-80-90	Diorite, in sharp contact with faulted, brecciated diorite (1 m), and limonitic breccia. (1 m)	80a (SM) Diorite, massive, weak altered, weak magnetic. Feldspar, 25% amphibole, 5% epidote, trace carb, limonite. Texture medium grained - coarse grained (1-3 millimetre), 0.5% opaque (magnetite), massive, blotchy feldspar. Alt: Weak, feldspar mostly fresh, disseminated epidote. 80b (SM) Highly altered diorite, brown (from Fault?) Clay or sericite (after feldspar), chlorite, minor carb, limonite. Quartz? Texture: Relict texture preserved, medium grained (1-2 millimetre), slightly vuggy. Alt: Strong. Unidentified, soft, ochre coloured, altered minerals (after feldspar), sericite? (Not carbonate) 80c (SM) Highly altered diorite or felsic rock, white & ochre sericite (feldspar), limonite(10-15%), chlorite? quartz? Texture: medium grained, vague relict texture, massive. Slightly vuggy. Disseminated limonite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-80-90 Con't...		80c (PM, Transmitted Light) Classific: Altered quartz - porphyry? Min: Major: Sericite (after feldspar) Minor: Limonite 2% Accessory: Quartz 1-2% opaque. Texture: Very fine grained, massive. Texture strongly obscured by alteration. Minor igneous relict texture of feldspar. Rare corroded 0.3 millimetre quartz phenoxts(?) Disseminated limonite. Some 4 millimetre size patches of 0.3 millimetre flakey sericite and opaque.
OG-81-90	Foliated diorite, green, knotty weathering. Aligned mafic streaks in coarser feldspar-rich matrix. Fol 015/60E Cut by 10-30% centimetre thick quartz-carb-limonite (pyrite) stockwork.	81a (SM) Diorite, massive, fresh, non-magnetic. Feldspar, 25% amphibole, 1% quartz, trace carb. Texture: medium grained (1 millimetre), blotchy, massive. Scattered 3-5 millimetre blotches of feldspar and quartz. Alt: Weak to none. 81b (SM) Quartz-limonite veins. 2 types of intergrowth: a) 3 centimetre vein, coarse grained euhedral-quartz margin, centre of coarse grained limonite with pyrite relicts. b) Black 'webbing' of hematite/limonite, vuggy intergrown (margin?/with anhedral, clear quartz).
OG-82-90	Diorite-Gabbro weak inclusion textures. Weak lineation 25°plunge, az. 230°. Rare 2-10 centimetre quartz veins, weak fracturing.	82 (SM) Diorite-Gabbro, fresh, medium grained, non-magnetic. Feldspar, 40-50% amphibole, accessory epidote, sphene/leucoxene. Texture: medium grained (1 millimetre), weak foliation/massive, blotchy metamorphic. Alt: Weak, fresh, to epidote.
OG-83-90	Diorite, massive, strongly fractured, crumbly. Common 2-5 m felsite dykes.	83. (SM) Diorite, weak altered, crumbly. Feldspar, 15% amphibole, 5% biotite, 30 quartz, 5% pink feldspar (K-feldspar?) Texture: fine grained medium grained (0.5 millimetre), weak foliation. Strongly fractured. Alt: Weak, feldspar white, hard, fresh.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-84-90	Amphibole-gneiss, banded. Fol. 045/90 Cut by ~2 m thick vein: quartz - tourmaline - carb - limonite, and epidote vein. Trend of qv 050/90. Massive tourmaline vein 0.5 m.(= luxullianite)	84a (SM) Vein: Quartz (95%), minor black hematite (1-3%). Red limonite as the fracture filling. Tourmaline (1%) as scattered small grains. 84b (SM) Vein: Fine grained, massive epidote (90%) with minor, disseminated tourmaline (5-8%) and 1-2% limonite. 84c (SM) Vein: Massive tourmaline rock, ~100% medium grained - coarse grained, porous. Crystal orientation random.
OG-85-90	Diorite with fine grained inclusions. Colour green. Fractured, crumbly.	85a (SM) Diorite, fine grained. Feldspar, 25% amphibole, trace limonite, accessory epidote. Texture: fine grained-medium grained, variable grain size, schlieren of slightly coarser (1 millimetre) diorite within fine grained diorite (0.2-0.5) Alt: Weak, altered, feldspar ~1/2 → epidote. 85b Quartz vein, massive, white.
OG-86-90	Road Cut. Altered foliated diorite. Strongly fractured, crumbly. Abundant 1 centimetre white carb veins, concentrated near surface.	86a (SM) Feldspathic, ultramafic hornblendite, medium grained 10% ~feldspar. Strongly altered, soft, crumbly. Inclusions? 86a Diorite, medium grained, feldspar, 15% amphibole. Crumbly. Limonitic fractures at millimetre-scale. (Crumbly!) 86b (PM, Transmitted Light) Classific: Strongly epidotized diorite(?) Min: Major: Epidote Minor: Chlorite, 10-20%, quartz 5-10%. Accessory: Opaque. Texture: Massive. Fine grained. (50-200 microns), hornfelsic. Metasomatized rock consisting of epidote matrix with scattered chlorite flakes and minor intersitital quartz. Chlorite forms clusters and might reflect a former diorite texture. Comment: Previous rock strongly obscured.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-87-90	Local talus. 87A ultramafic hornblendite (dyke?) ~5 m thick. Unconformably overlain by Tertiary bedded, coarse grained sandstone. (87B)	87a (SM) Ultramafic hornblendite, foliated, non-magnetic ~100% dark green amphibole/hornblende. Texture: medium grained-coarse grained, acicular crystals, oriented, 1 centimetre equant hornblende. Radiating amphibole. 87b Tertiary sandstone, coarse grained, reddish, bedded.
OG-88-90	Tertiary tuff, cream coloured, fine grained, cruddy bedded. Sample intervals 10-30 m, Sample sequence from base upwards.	88a (SM) Tertiary crystal tuff. Cream colour, fine grained, soft ash matrix, 10-20% 0.1 - 1 millimetre quartz, feldspar clasts (phenocrysts?), 1% oxides (magnetite?) Weakly magnetic. 88b (SM) Tertiary crystal tuff. As 88a. 88c (SM) Tertiary lithic crystal tuff. Felsic composition. Fine grained, cream coloured ash matrix, 2-5% millimetre-1 centimetre size lithic volcanic clasts, 5% feldspar, quartz phenocrysts (0.1 - 1 millimetre), 1-2% femag phenocrysts (Pyrite?, magnetite) Weakly magnetic. 88d (SM) Tertiary, bedded crystal tuff. Similar to 88a. Crude centimetre scale bedding. 20% 0.5 - 1.5 millimetre phenocrysts of quartz, feldspar and pink, round lithic(?) fine grained clasts. 1-2% 0.1 - 0.5 millimetre black oxide grains (magnetite) Weakly magnetic. 88e Tertiary tuff. (no sample left) 88f (SM) Tertiary crystal ash tuff. Similar to 88a. >90% soft whit ash matrix. 1-2% oriented welded (?) shards, 1-2% feldspar, quartz phenocrysts, 1-2% femag (biotite) phenocrysts, trace black oxide. Non magnetic. 88g (SM) Tertiary lithic crystal tuff. Colour medium green grey. Granular texture. Closely packed 0.3-2 millimetre feldspar, quartz phenocrysts, felsic, lithic volcanic clasts (pink and green). Trace black oxide (magnetite). Weakly magnetic. 88h (SM) Tertiary lithic crystal tuff. Colour pink-grey, similar to 88g. Weakly magnetic. Tertiary vesicular lava. Composition - intermediate, colour medium grey-brown. Very fine grained feldspathic matrix, 10% - 1-2 millimetre calcite (?) filled vesicles. Distinctly magnetic.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-89-90	Stock-pile of breccia ore near house.	Red breccia ore. Sieved through fly-screen (-2 millimetre) Panned from 28 lbs. to ~1 lb.
OG-90-90	Creek bed outcrop. Ultramafic hornblendite, cut by 5-10% leuco-diorite and white, feldspathic veins - stockwork. Ultramafic seems to enclose ~4 m wide gneiss raft? Contacts of ultramafic to diorite not exposed. It is unclear if ultramafic is dyke, layer or inclusion, or plug	90a (SM) Feldspathic hornblendite. Coarse grained, ~9% hornblende grains (2-20 millimetre) with ~10% interstitial, epidotized feldspar. Non-magnetic. 90b Fine grained mafic hornblende - gneiss or diorite. 90c Aplitic vein, coarse grained, white, Feldspar, 10% quartz. Cut b sub-parallel >1 millimetre quartz - carb veinlets. 90d Ultramafic hornblendite, coarse grained, massive, crumbly. 90e Ultramafic-mafic hornblendite. Cut by 20% white, aplitic veins. 90f (SM) Mafic hornblende-gabbro, cut by 4 centimetre leuco-diorite vein. Hornblende-gabbro medium grained, 60% hornblende, 40% feldspar. 90g (SM) Feldspathic hornblendite, massive 1-5 millimetre hornblende with 10-20%, interstitial, fine grained, feldspar. Scattered 5-10 millimetre thick pink K-feldspar(?) lenses/veins. 90h (SM) Quartz vein, 0.5 m thick. Quartz with 5-10% red limonite patches, fractures.
	90i - 10 m dyke	90i (SM) Aplitic dyke, medium grained, massive, 60% quartz, ~40% feldspar, trace chlorite, 0.5% 0.5 millimetre limonite (after pyrite?)
OG-91-90	0.5 m Quartz vein in diorite/amphibole gneiss	91 (SM) Quartz vein with fracture filling of web-structured hematite - limonite.
OG-92-90	Banded amphibole gneiss. Composition intermediate and mafic. Samples from 50 m area. Fol. 060/70NW	92a Intermediate amphibole - gneiss. 92b Felsic(?) biotite - amphibole gneiss. 92c Felsic gneiss. Epidote in veinlets. 92d Mafic - Ultramafic-chlorite-gneiss. ~ 2 m band.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-93-90	Diorite-Gabbro, foliated, cut by felsic dyke	93a (SM) Meta quartz diorite/hornblende-gabbro, medium grained. Metamorphic texture, weak foliation. 40-50% blotchy hornblende, feldspar, 5% quartz. 93b (SM) Aplitic dyke, medium grained, massive. Feldspar, 30% quartz, trace chlorite.
OG-94-90	Foliated gneiss, Fol. 040/75 NW	94a (SM) Felsic gneiss, fine grained, foliated, microfolded. Feldspar, 20% quartz, 5% amphibole or chlorite. 94b (SM) Mafic Amphibole-gneiss. Fine grained, fol. 60-70% amphibole, 30-40% feldspar. Vague, stretched fragmental textures.
OG-95-90	Road Surface	95 Magnetic fraction of local debris on road.
OG-96-90	Shaft, near house. Surface. Magnetic particles picked up by magnet.	96 (PM, Reflected Light) Various round and angular particles, ~1-4 millimetre diameter. Interpreted as man-made, debris from a small smelting operation. Two major types of material: a) Sulphide matte. Shape consistently round, globular. High reflectivity, colours whitish to cream to pink-grey. Isotropic and anisotropic. Probably a variety of compositions. Rimmed by oxides or alloys. b) Oxide or alloy. Colour grey, low and moderate reflectivity. Isotropic and anisotropic, probably several types. Commonly showing concentric zoning and/or flow lines. Strongly magnetic.
OG-97-90	Creek bed, ~300-400m SW of house. Old tailings (from 1870-1940) adhering to sides of creek bed.	97 Pink-grey very fine tailings.
OG-98-90	Location as 97. Creek bed.	Recent creek sands down stream from old mine, shaft, and mill. Mineralogy: Feldspar, quartz, amphibole, little magnetite.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-99-90	Outcrop. ~100m SW of house, at old mill site, below old shaft. Lithology: Soft, altered, chloritic mafic-ultramafic schist, fine grained. Vague dark inclusions. ~10% centimetre-thick feldspathic, light green grey stockwork.	99 (SM) Ultramafic chlorite - amphibole - biotite, schist, foliated, fine grained-medium grained. Soft, crumbly. Some pieces show ~10% feldspar interstitial to amphibole, chlorite. Cut by thin carb veinlets.
OG-100-90	Stock-pile of breccia ore ~100 NW of house. Various pieces.	100 (SM) Quartz-breccia, red, limonitic, non-magnetic. ~50% centimetre size, red, limonite-impregnated altered mafic rock fragments in quartz matrix. ~10% black, 0.5 - 1 centimetre size fragments of webby, porous hematite - limonite. ~40-50% quartz matrix, white. Fractured, in part brecciated. Fractures filled with black and red Fe-oxide. 100 (PM, Transmitted Light) b Classific: Coarse grained quartz with partly altered rock fragments and limonite impregnated phyllosilicates. Min: Major: Quartz - 70% Minor: Plagioclase 20%, chlorite (?) 3-5 sericite 3-5%. Accessory: Limonite 5% Texture: Rock fragments millimetre-centimetre size. Plagioclase partly sericitized, medium grained, mosaic texture limonite impregnated. Quartz mostly coarse grained, in part euhedral, vuggy. Chlorite, partly silicified and limonite-impregnated, fills space between euhedral quartz crystals. Thin chlorite veinlets cut euhedral quartz.

SAMPLE #	OUTCROP	PETROGRAPHY
OG-100-90 Con't...		100 (PM, Reflected Light) a Classific: Brecciated Fe-oxide ore. Min: Major; Several phases of Fe-oxide, Fe-hydroxide? White-grey, anisotropic (?) Bluish-grey, anisotropic (hematite?) Greenish-grey, anisotropic, abundant red internal (goethite?) Texture: Breccia texture. Fragments of massive and fibrous, acicular hematite (<0.1-2 millimetre) in matrix of goethite and gangue. Goethite (?) is commonly cryptocrystalline and colloform, concentrically structured.