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THE CINOLA DEPOSIT

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September 3, 1980

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CINOLA GOLD DEPOSIT

ILLUSTRATIONS

ABSTRACT

The Cinola Deposit is a gold property located on Graham Island, of the Queen Charlotte Islands, British Columbia. Exploration by several different companies has been carried out since the discovery in 1970. Recent drilling has delineated a large tonnage, low grade gold deposit in a unique geologic setting. The deposit is found in intrusive subvolcanic felsic rocks and Tertiary volcaniclastic sediments that have been intensely brecciated and silicified. The mineralization is bounded at its base and on the west side by younger normal fault that may have substantial lateral movement.

Gold mineralization is closely associated with the degree of silicification and spatially with the felsic intrusive rocks. Two types of gold mineralization are present: thick, moderate grade disseminations and thin, high grade veins. Most of the gold is less than 0.5 microns in size but free gold is visually observed in quartz veins. The sedimentary stratigraphy has no control on the gold mineralization. Similarly, the gold content is not directly related to the pyrite or carbon content of the host rocks. The only sulfides of significance in the deposit are pyrite and marcasite. Other sulfides have been reported but occur in only trace amounts. Alteration consists of strong argillic alteration of the sediments. Reserves at the Queen Charlotte gold property are in excess of 30 million tons containing 0.06 oz per ton gold. Significant gold has been encountered in drilling outside the area containing the reported reserves. Additional surface exploration targets are present.

INTRODUCTION

Purpose and Scope

The purpose of this report is to describe the geology of the Cinola Gold Deposit and formulate a genetic model. The Cinola gold property, also known as the "Babe" or Specogna deposit, is located at Longitude 132° 13' W and Latitude 53° 32'N. It is 18 km south of the town of Port Clements, on Grahan Island in the Queen Charlotte Islands of British Columbia. The deposit occurs at the border between the Skidegate Plateau and the Queen Charlotte lowlands on a small hill with an elevation of 90-220 m. The area is generally heavily timbered and the climate is mild, but wet.

History of Discovery

Champigny, Sinclair and Sanders (1980) have prepared an excellent report on the discovery and history of exploration of the deposit. In summary, the property was located by two local prospectors in 1970 and was optioned to a succession of companies through 1977. These early companies did extensive geochemical soil sampling, trench sampling and moderate amounts of drilling. Consolidated Cinola Mines bought the deposit in 1978 and together with Energy Reserves of Canada formed a joint venture to explore and develop the property. The joint venture, which became active in August of 1979, enlarged the higher grade ore reserves that had been discovered by Consolidated Cinola Mines in late 1978 and early 1979. The dramatic increase in the price of gold during late 1979 and early 1980 strongly influenced the development decisions of this large tonnage, low grade deposit. Consolidated Cinola Mines is the operator for the joint venture.

The geology of the Queen Charlotte Islands is described by Sutherland-Brown (1968). Early reports on the Cinola gold property include Sutherland-Brown and Schroeter (1975 and 1977) and Richards, Christie, and Wolfhard (1976). Champigny and Sinclair (1979) have summarized the geology prior to the formation of the joint venture.

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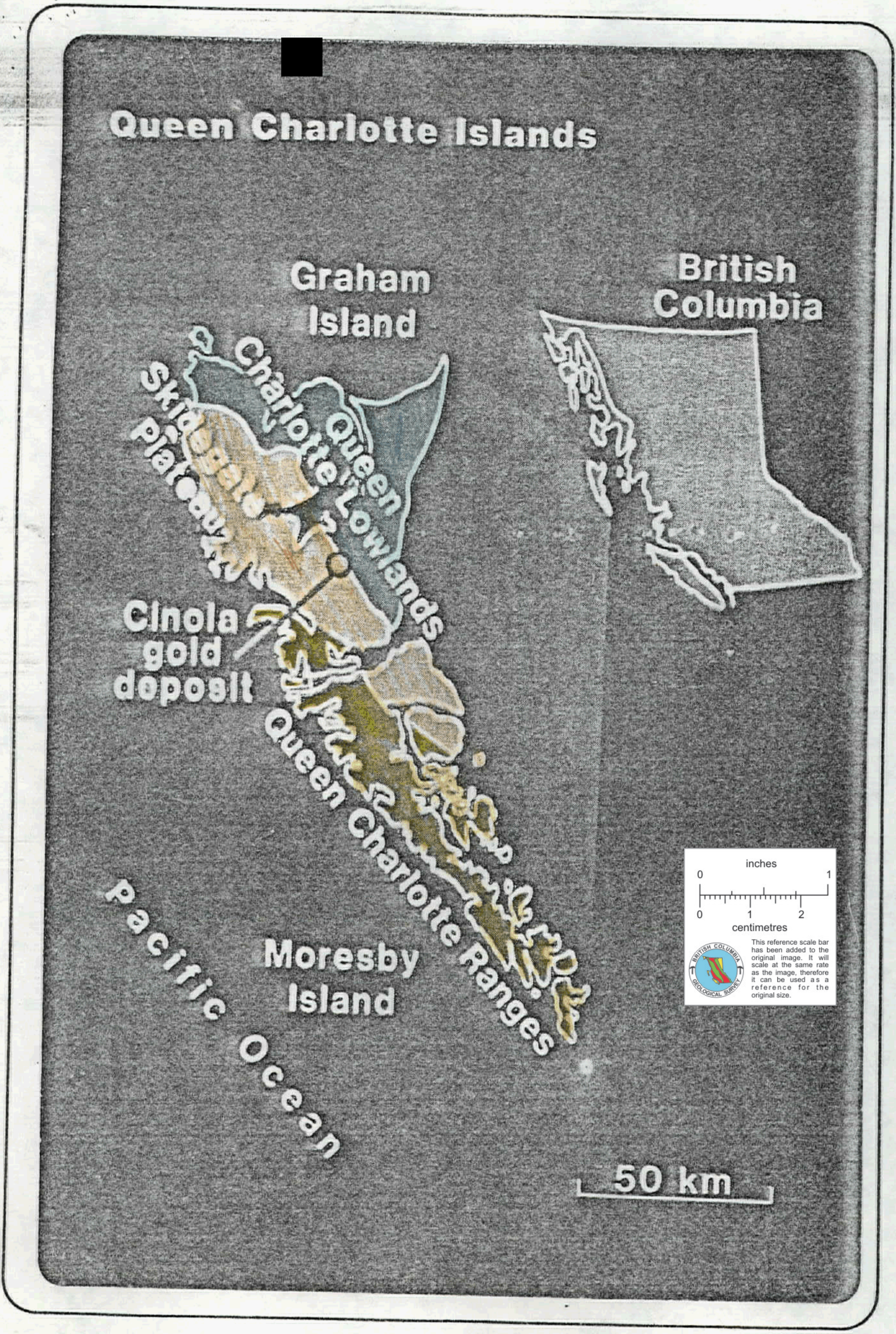
Queen Charlotte Islands
Graham Island
British Columbia
Queen Charlotte Lowlands
Skidegate Plateau
Cinola gold deposit
Queen Charlotte Ranges
Moresby Island
Pacific Ocean
50 km
inches
0
1
0
1
2
centimetres
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These authors represent the principle geologic and administrative staff for the joint venture from August 1979 to the present. This included supervision of diamond core drilling and sample preparation of over 13,700 meters of core. This core was logged, split, and analyzed for gold. Supplemental work included relogging of old core and surface geologic reconnaissance.

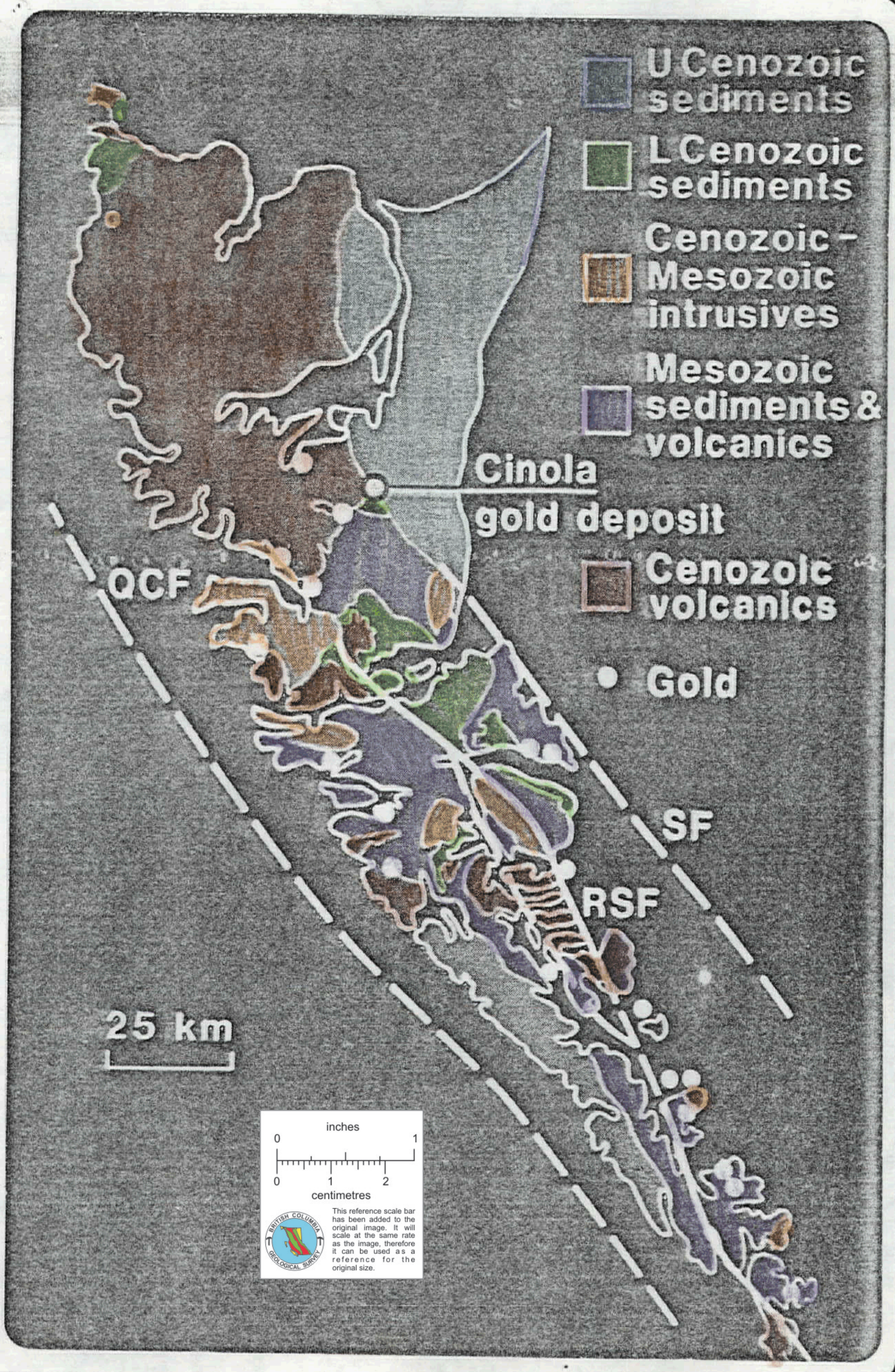
Contract and in house laboratory work was carried out in support of the field operations. Principle laboratory methods included thin section analysis, microprobe scanning and quantitative analysis.

Regional Geology

The Queen Charlotte Islands lie in the western system of the Canadian Cordillera within the Insular Fold Belt which contains late Paleozoic, Mesozoic and Tertiary rocks. The pacific continental shelf is narrow in this area and terminates a few miles west of the islands. The Cinola property is located at the boundary between the Skidegate Plateau and the Queen Charlotte Lowlands. This physiographic break coincides with the Sandspit fault system. The Sandspit fault can be traced across Graham Island for over 60 km and has displacement of thousands of meters with the down dropped block to the east (Sutherland-Brown, 1968). Part of this fault system displaces the Cinola orebody.

West of the Sandspit fault in the Skidegate Plateau, west-dipping rhyolite tuffs of the Masset Formation of Early Tertiary age unconformably overlie folded sediments of the Queen Charlotte Group of Cretaceous age. East of the fault is the Queen Charlotte Lowland with limited exposures of unconsolidated clastics of the Mio-Pliocene Skonum Formation, the host for the Cinola gold orebody. Pleistocene glaciation has caused extensive modification of the plateau and thin till deposits mantle much of the lowlands and plateau.

There are numerous gold occurrences on Queen Charlotte Island. A belt of gold mineralization at least 30 miles wide and 150 miles long containing over 70 gold properties is the site of active exploration and staking. Some of these active gold prospects are shown by blue dots on the following illustration. Major international companies, junior companies and individuals are currently active in the area.


U Cenozoic sediments
L Cenozoic sediments
Cenozoic - Mesozoic intrusives
Mesozoic sediments & volcanics
Cinola gold deposit
Cenozoic volcanics
Gold
QCF
SF
RSF
25 km
inches
0
1
0
1
2
centimetres
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STRATIGRAPHY

Footwall Section

The oldest rock unit found in the immediate vicinity of the deposit is a dark mudstone which is correlated with the upper member of the Haida formation of the Queen Charlotte Group. The mudstone, which is not mineralized, forms the footwall fault block with the mineralized section. Only the upper 41 m of the mudstone has been penetrated by drilling and much of this section is sheared and fractured by the faulting.

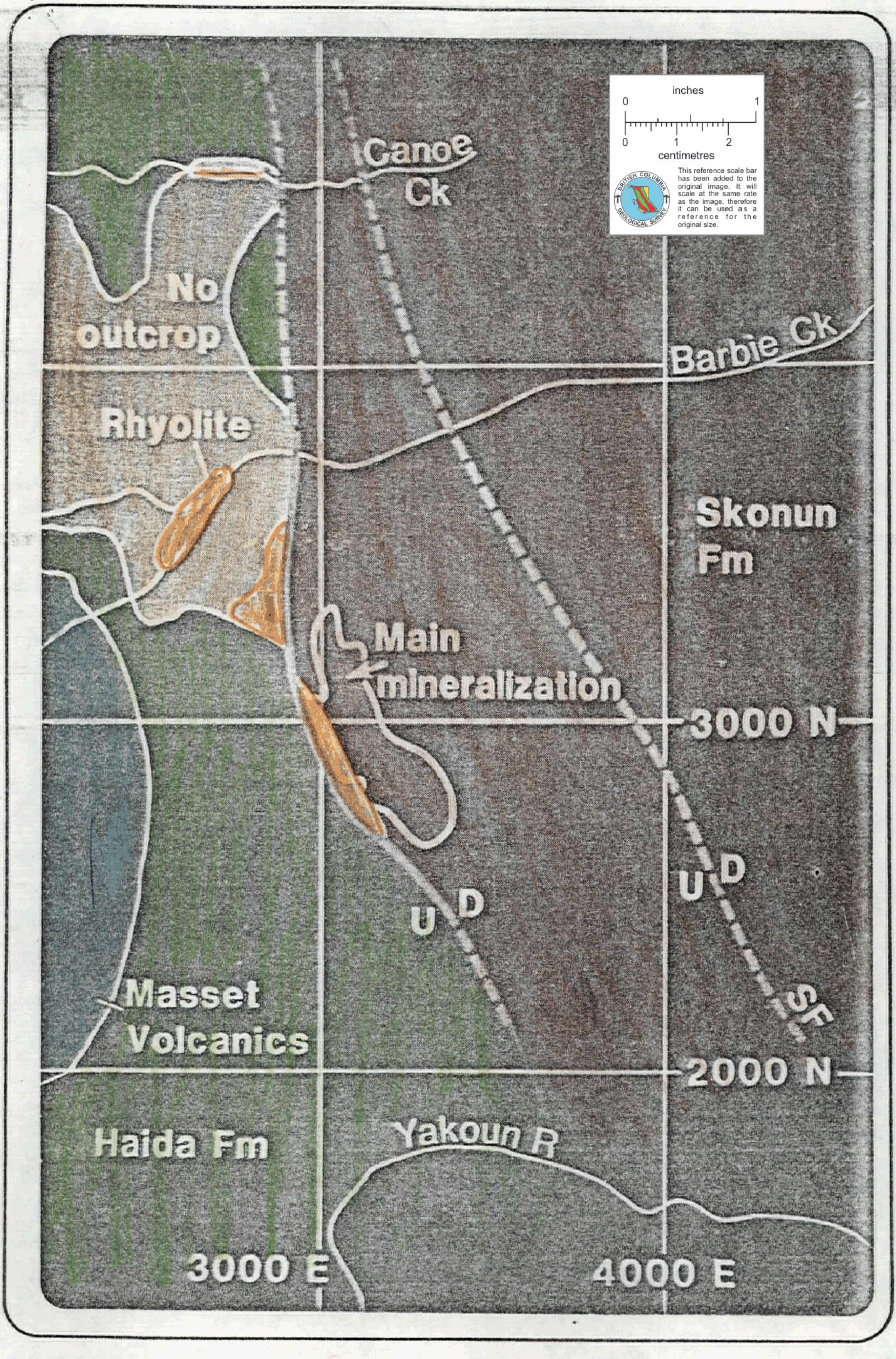
The unit is a soft, dark grey to dark brown mudstone that is carbonaceous and commonly calcareous. Irregular veinlets of white calcite less than 1.0 mm wide are common. Pyrite, that is likely syngenetic, occurs as disseminations and nodules in amounts up to 5%. For several meters below the fault zone the mudstone is silicified and brecciated with clear quartz veins. Within this zone the rock has the appearance of an argillite. The unit is massive with no visible indications of bedding.

According to Sutherland-Brown (1968) the Haida Formation was deposited in a Lower to Upper Cretaceous marine basin. The mudstone member of the Haida Formation is at least 300 m thick.

Hanging Wall Sedimentary Section

The mineralized section on the hanging wall of the fault is a complex interfingering of coarse conglomerates and minor fine-grained clastics intruded by rhyolitic subvolcanic units. An extensive zone of brecciation, quartz veining, silica flooding, and argillic alteration obscures precise stratigraphic correlation of some of the units on the hanging wall.

The sedimentary section above the fault has been correlated with the Mio-Pliocene Skonum Formation based on lithology. Sutherland-Brown (1968) describes the Skonum as marine to non-marine, poorly consolidated siltstones, sandstones and conglomerates that total over 1800 m in thickness. The section penetrated by drilling is over 400 m vertical thickness and consists of approximately 20% mature fine clastics and 80% immature coarse clastics that generally dip gently to the northeast.



inches
0
1
0
1
2
centimetres
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BRITISH COLUMBIA GEOLOGICAL SURVEY
Canoe Ck
No outcrop
Barbie Ck
Rhyolite
Skonun Fm
Main mineralization
3000 N
U
D
U
D
SF
Masset Volcanics
2000 N
Haida Fm
Yakoun R
3000 E
4000 E

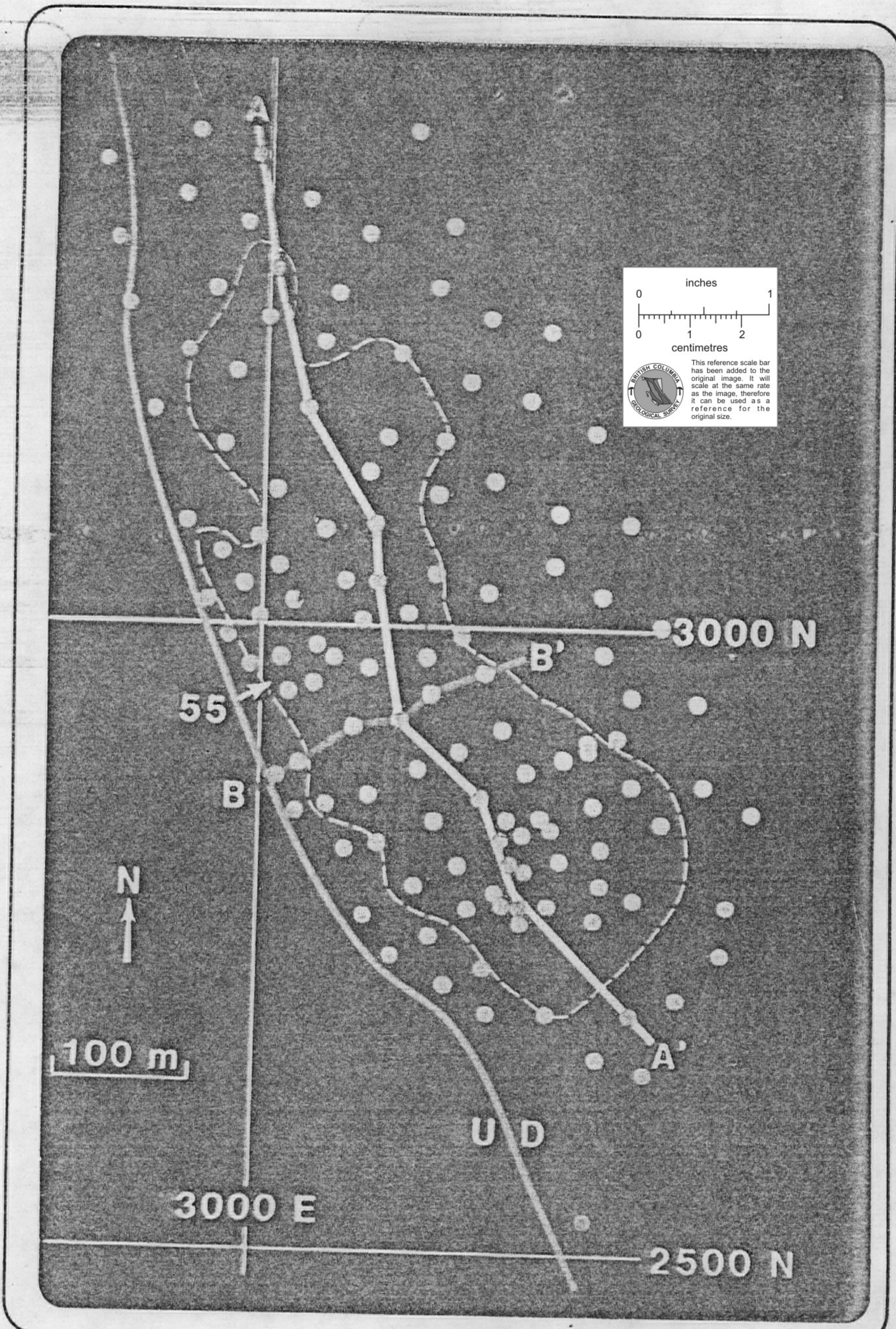
Twofold subdivision is appropriate as coarse clastic sediments are present in the lower parts of the deeper drill holes on the east side of the property. These sediments consist dominantly of tan, pebble to cobble size, rounded to subrounded fragments of aphanitic felsic volcanic rocks, but boulder size clasts are not uncommon. Minor clasts of basic volcanic rock, phaneritic plutonic rocks, and sedimentary rocks are present. The fragments are generally clast supported. Carbonized wood fragments and pyrite each make up less than 3 percent of the rock. No well developed bedding is present, but crude graded bedding is discernible in massive boulder conglomerate units greater than 100 m thick.

The upper portion of the sedimentary section consists of fine clastics interbedded with the coarse clastics. The dominant rock type is a tan to grey volcanic conglomerate composed of a sandy matrix with mostly aphanitic felsic volcanic fragments that are either clast or matrix supported. The clasts, which vary in size from 1-10 cm, make up 30-70% of the rock. The clasts are generally subrounded and often show a weathered or altered rind. Carbon fragments and pyrite are common constituents of this conglomerate. The conglomerates within the upper sedimentary section are up to 30 m thick but generally consist of fining upward sequences from conglomerates through sandstone to siltstone in thicknesses of 1-3 m.

Units that are interfingered with the volcanic conglomerate and that are used for stratigraphic correlation between holes include a green pebble or mafic rich conglomerate, siltstones and sandstones, a crowded-pebble conglomerate and a distinctive lithology termed the X-unit.

The green mafic conglomerate consists of a predominance of mafic volcanic pebbles. Most of the clasts have a distinct chlorite-epidote alteration. The subrounded clasts are 2-5 cm in size and generally show clast support. Carbon fragments and disseminated pyrite occur as common accessories. This mafic rich conglomerate is generally less than 5 meters thick and has a lenticular shape suggestive of a channel deposit.

Mature siltstones and sandstones that are used for correlations are grey to dark grey. (Tan siltstones and sandstones commonly cap the upward fining conglomerate sequences but these tan, fine clastics are


A
3000 N
B'
55
B
N
100 m
A'
U D
3000 E
2500 N
inches
0
1
centimetres
0
1
2
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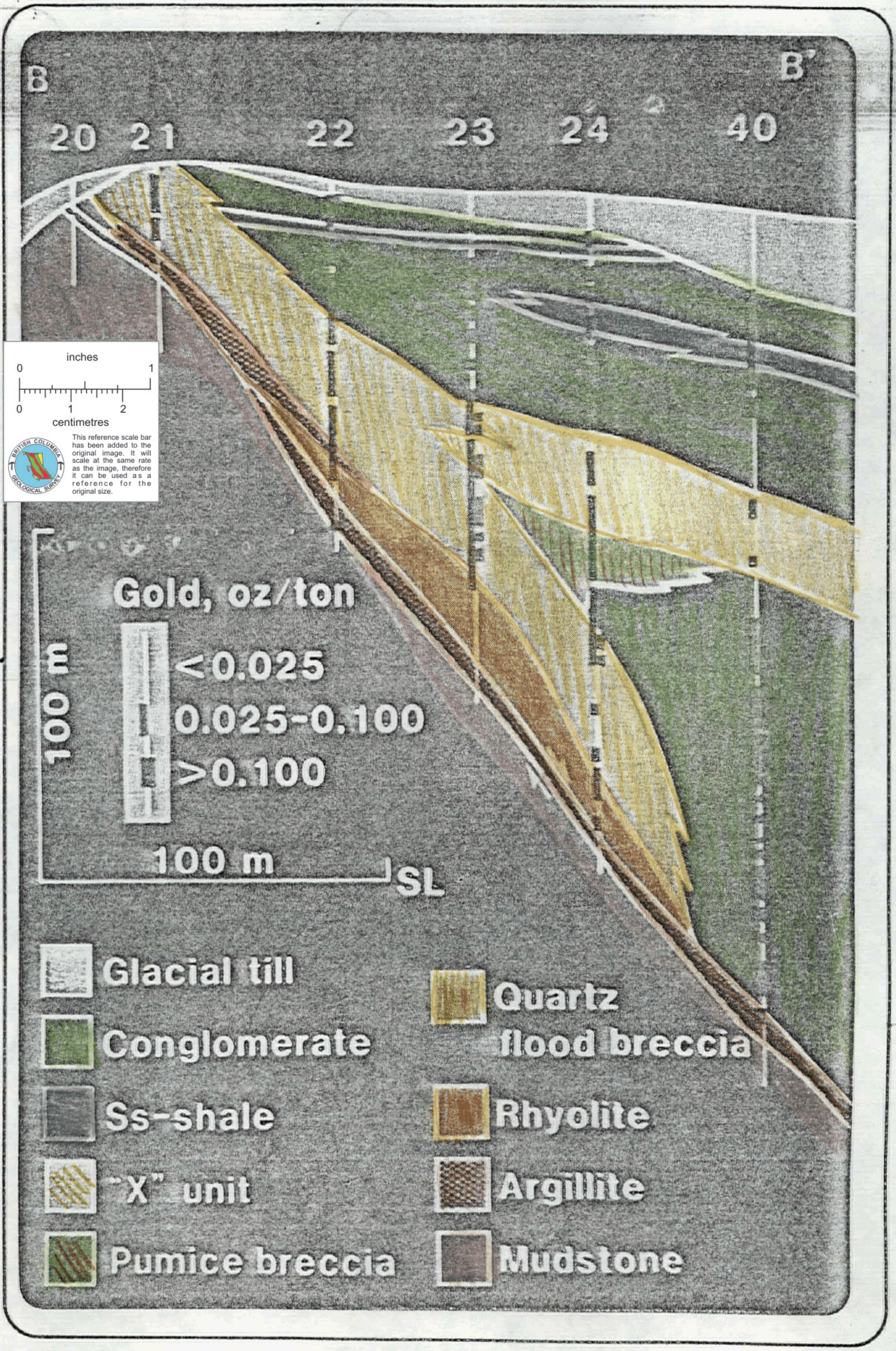
BRITISH COLUMBIA GEOLOGICAL SURVEY


B
B'
20
21
22
23
24
40
inches
0
1
0
1
2
centimetres
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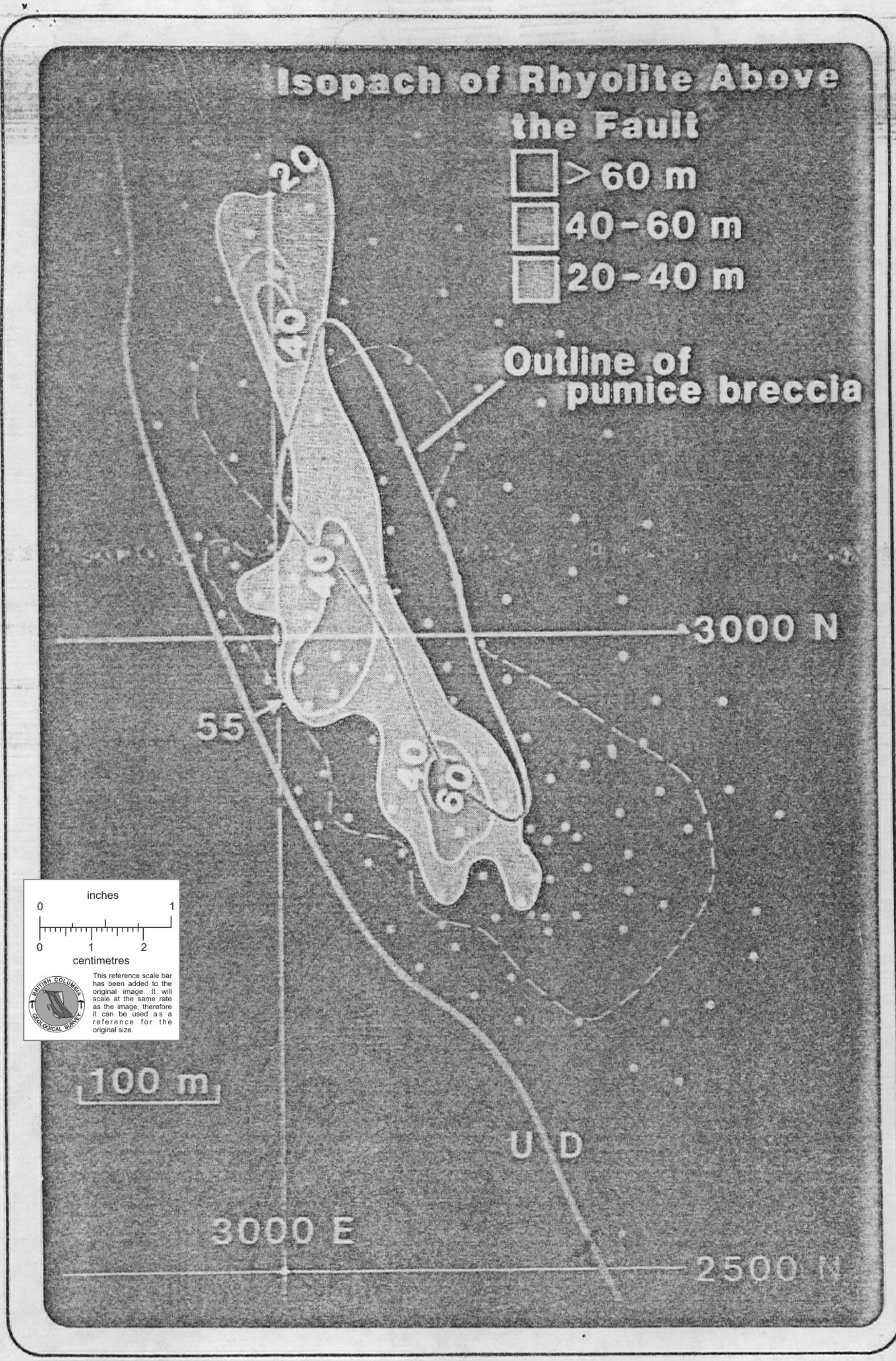
Gold, oz/ton
<0.025
0.025-0.100
>0.100
100 m
100 m
SL
Glacial till
Conglomerate
Ss-shale
"X" unit
Pumice breccia
Quartz flood breccia
Rhyolite
Argillite
Mudstone

generally not laterally continuous.) The grey siltstone and sandstone units are generally less than 10 m thick. These units are thinly bedded, well sorted and organic rich sediments. Ripple laminations are common in the sandstones. The sandstones are very fine to fine-grained and are well rounded. There is up to 3 percent pyrite which is usually present in the sandy lenses. Pelecypod shell fragments are found in a grey sandstone interbedded with a pebble conglomerate at the surface on the north end of the deposit. Minor glauconite is present in sandstone in a drill hole 200 m east of the mineralized zone. Both of these constituents are suggestive of a marine enviornment for most of the sedimentary section.

The crowded-pebble conglomerate and the X-unit are two closely related lithologies and have been combined on the figure. Both are local units found above the rhyolite intrusive. The crowded-pebble conglomerate consists of 80-90 percent 0.5-1.0 cm clasts with very little matrix. The clasts are subrounded and are mostly aphanitic volcanic fragments. Carbon framents and pyrite are common constituents. The crowded-pebble unit commonly overlies the X-unit. The X-unit has the lithology of a conglomeratic siltstone with a distinctive bimodal assemblage of constituents. It is a poorly sorted grey to greyish brown siltstone with pebbles of subrounded lithic clasts and angular carbon fragments evenly distributed in the siltstone matrix. The clasts, which are mostly volcanic, make up 10-20% of the rock and are completely matrix supported. Clay balls with a diameter of less than 1.0 cm make up a minor percentage of the clasts. Pyrite content is variable and can be up to 5 percent.

The rhyolite is porphyritic with 5-15 percent phenocrysts set in a light grey aphanitic groundmass. The phenocrysts are typically 1-2 mm in diameter and consist of equal amounts of anhedral quartz and altered, subhedral potassium feldspar. Disseminated pyrite makes up less than one percent of the rock. Similar rhyolite porphyries, in addition to several other distinctive phases, are present in the mineralized zone above the fault. One of these phases is a rhyolite porphyry that has been brecciated and veined with medium grey quartz veinlets. Several stages of quartz veining are evident. The quartz veinlets are commonly 2 cm in width and often have vugs which are partially filled with clear terminated quartz. Also present is a rhyolite phase that has a crackle breccia appearance. This unit, called a rhyolite stockwork, is a rhyolite porphyry that has been


Isopach of Rhyolite Above the Fault
>60 m
40-60 m
20-40 m
Outline of pumice breccia
20
40
40
40
60
3000 N
55
100 m
U D
3000 E
2500 N
inches
0
1
0
1
2
centimetres
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GEOLOGICAL SURVEY

shattered and cross-cut by numerous veinlets of quartz with pyrite and hematite. There is also minor finely disseminated pyrite and hematite. The aphanitic groundmass is generally tan to light grey but also has a greenish cast from the presence of finely distributed chlorite.

Closely related to the rhyolite phases and occurring immediately above them are two other breccia units. The pumice breccia is a cream to pinkish tan rock which consists of finely, vesicular siliceous fragments. Quartz veinlets are common and up to 5 percent disseminated pyrite is present. The pumice breccia may represent a frothy, volatile rich rhyolite phase or a siliceous sinter deposit. Overlying the pumice breccia and generally forming the contact zone between the rhyolite phases and the sediments is a unit termed the quartz flood breccia. The quartz flood breccia consists of brecciated and silicified units that have had much of their original texture destroyed. The pyrite content of the quartz flood breccia is minor. Thin pebble or breccia dikes (less than 1.0 m thick) have been observed in this unit and also may be present in the normal sedimentary section but are more difficult to recognize.

STRUCTURE

Bedding

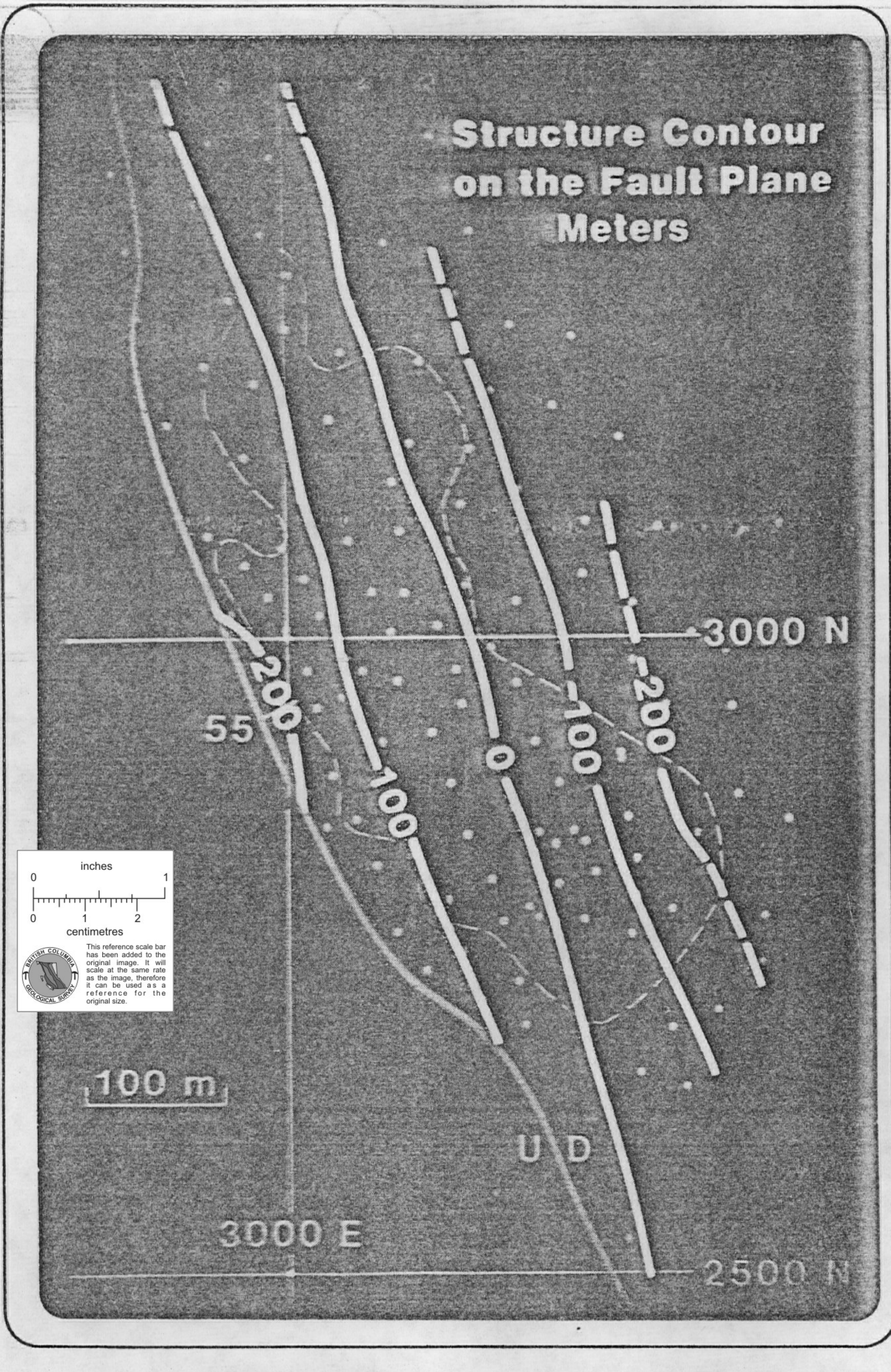
The lenticular shape of many of the stratigraphic units make structural interpretation difficult. Since no key marker beds have been recognized, the fine-grained clastic units are used to determine bedding attitude. The beds making up the mineralized section strike N5-10W and dip 20° to the northeast. No folding within the mineralized section has yet been recognized. Also not determined is the attitude of the mudstone in the footwall.

Faulting

The major structural feature of the property is the fault that separates the silicified gold bearing host rocks from the mudstone.

The fault zone strikes N15-20W and dips 55° to the northeast. The amount of displacement has not been determined from core logging. Slickenslide striations in several holes indicate a major strike slip component. This fault is part of the major Sandspit fault that is traced across much of the southeastern Graham Island. Regional studies suggest the system is a normal fault with considerable horizontal displacement (Sutherland-Brown, 1968). The faulting appears to be, in part, post mineralization. Drilling to the east side of the property indicates that the rhyolite is not present. In addition, mineralization is found below the fault to the northwest, suggesting that this area may be the root zone of the rhyolite intrusion and the mineralization.

High grade gold mineralization present at the Marino showing may be correlative with high grade zone proximal to diamond drill hole 78-6 in the southeast portion of the orebody


Structure Contour
on the Fault Plane
Meters
3000 N
200
55
100
0
100
200
100 m
U D
3000 E
2500 N
inches
0
1
0
1
2
centimetres
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ALTERATION

Silicification

The rocks in the central portion of the Cinola deposit are moderately to strongly silicified. All rock types above the rhyolite porphyry have been equally subjected to silicification and veining. The strongly silicified sections often have a boxwork type of texture where much of the original rock has been leached away. The silica veining occurs in widths of 1 mm to greater than 2 m. Silica veining is of several generations with the color ranging from dark grey, light grey, white, brown and clear. The paragenetic sequence is complex and has not been established. The veins are generally massive and only the clear or latest stage of quartz has open space filling.

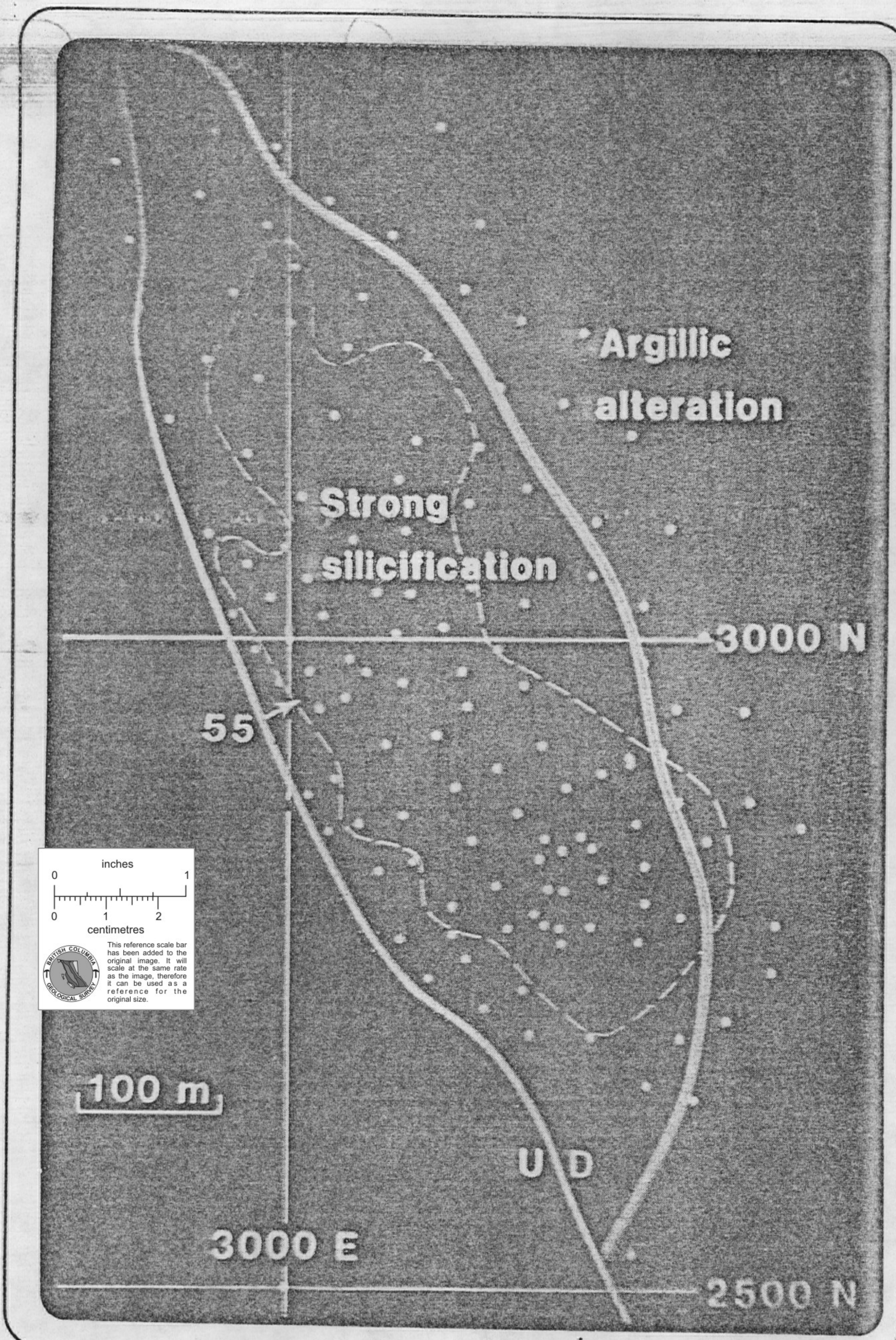
The silicification is strongest above the rhyolite units and the pumice breccia. The quartz flood breccia unit is an extreme alteration phase in which the original rock texture has been obliterated by brecciation, silicification and silica veining. The silicification grows weaker away from the rhyolite units and grades into a halo of advanced argillic alteration.

Argillic

The advanced argillic alteration is typically developed in the sediments and equally affects both the fine and the coarse clastics. Within the conglomerates both the matrix and the clasts are likewise equally altered. The advance argillic alteration causes an almost complete change to a light tan clay.

Orebody Shapes

In plain view, the main mineralized zone covers an area of 700 by 200 meters. Gold is present from the surface to depths of 300 meters. The fault zone forms a lower boundary to the main zone of gold mineralization. The gold mineralization has a close association with the degree of silicification. Where the rock is moderately silicified, regardless of lithology, gold values generally exceed 0.025 oz/ton. Individual quartz veins carry gold values in excess of 0.100 oz/ton. The gold mineralization is generally thicker and of higher grade above areas where the rhyolite units are greater than 20 m thick.



Argillic
alteration
Strong
silicification
3000 N
55
100 m
U D
3000 E
2500 N
inches
0
1
0
1
2
centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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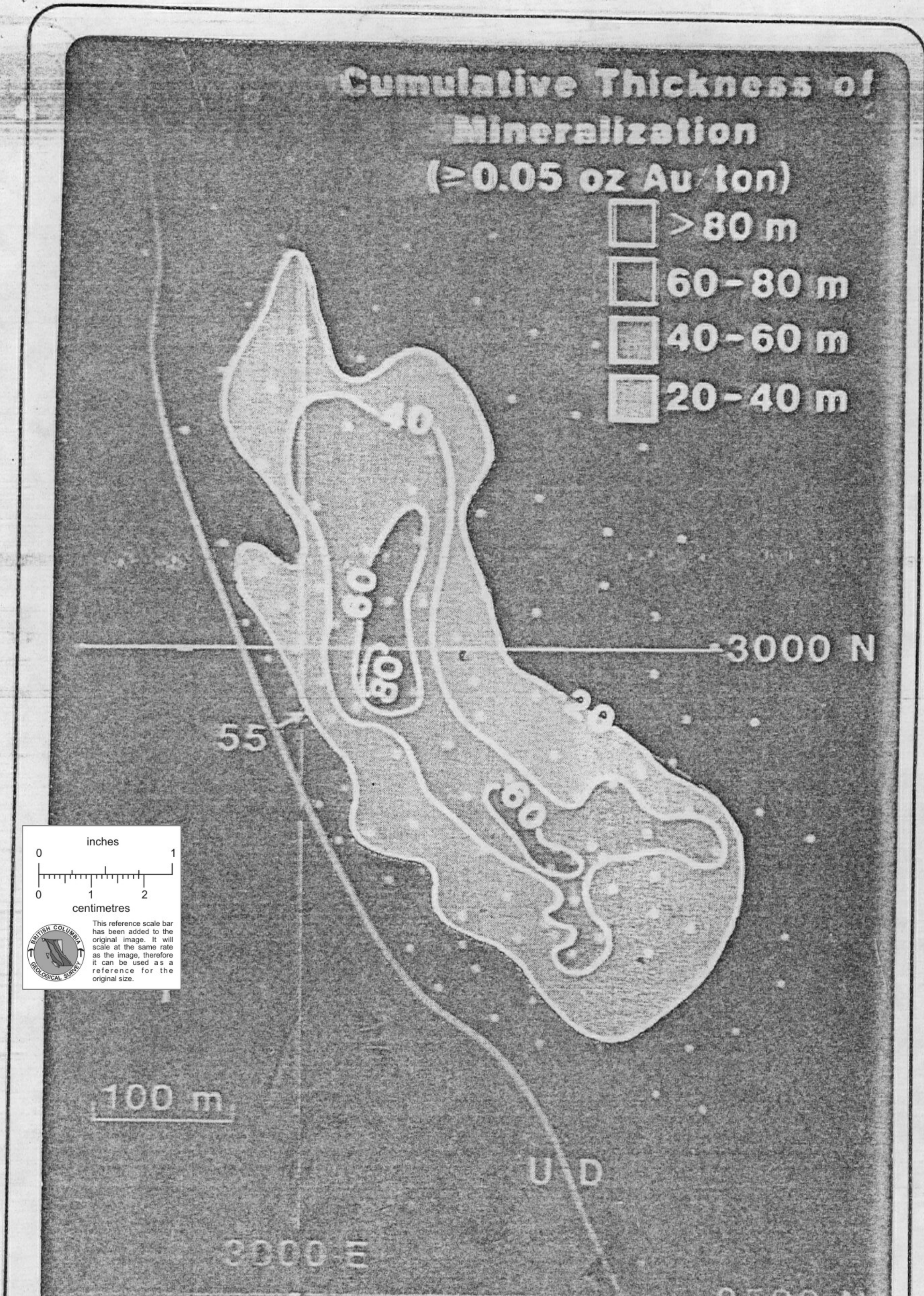

Cumulative Thickness of Mineralization
(≥0.05 oz Au/ton)
>80 m
60-80 m
40-60 m
20-40 m
40
60
80
20
60
3000 N
55
100 m
U D
3000 E
2500 N
inches
0
1
0
1
2
centimetres
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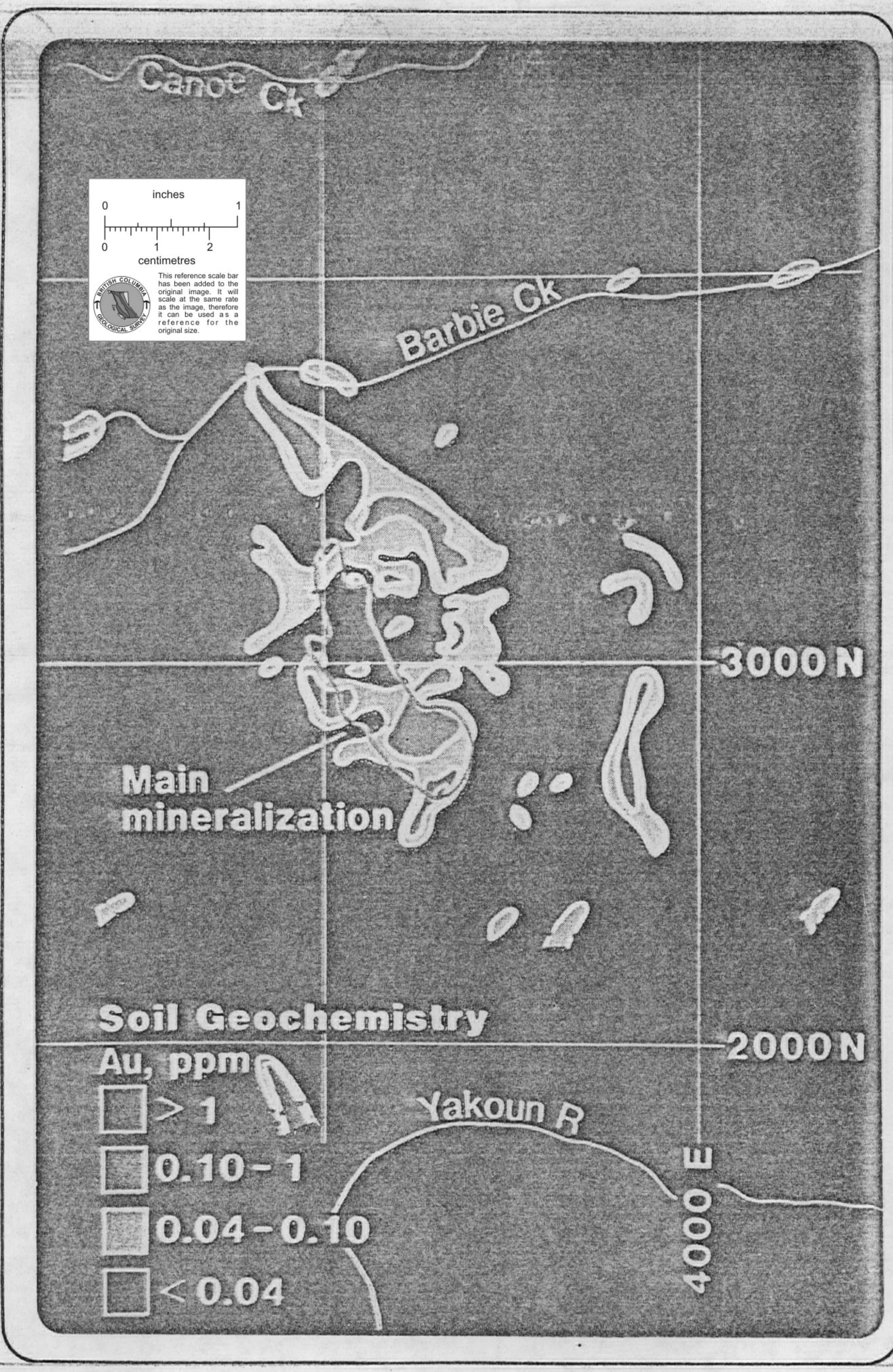
Canoe Ck
inches
0
1
0
1
2
centimetres
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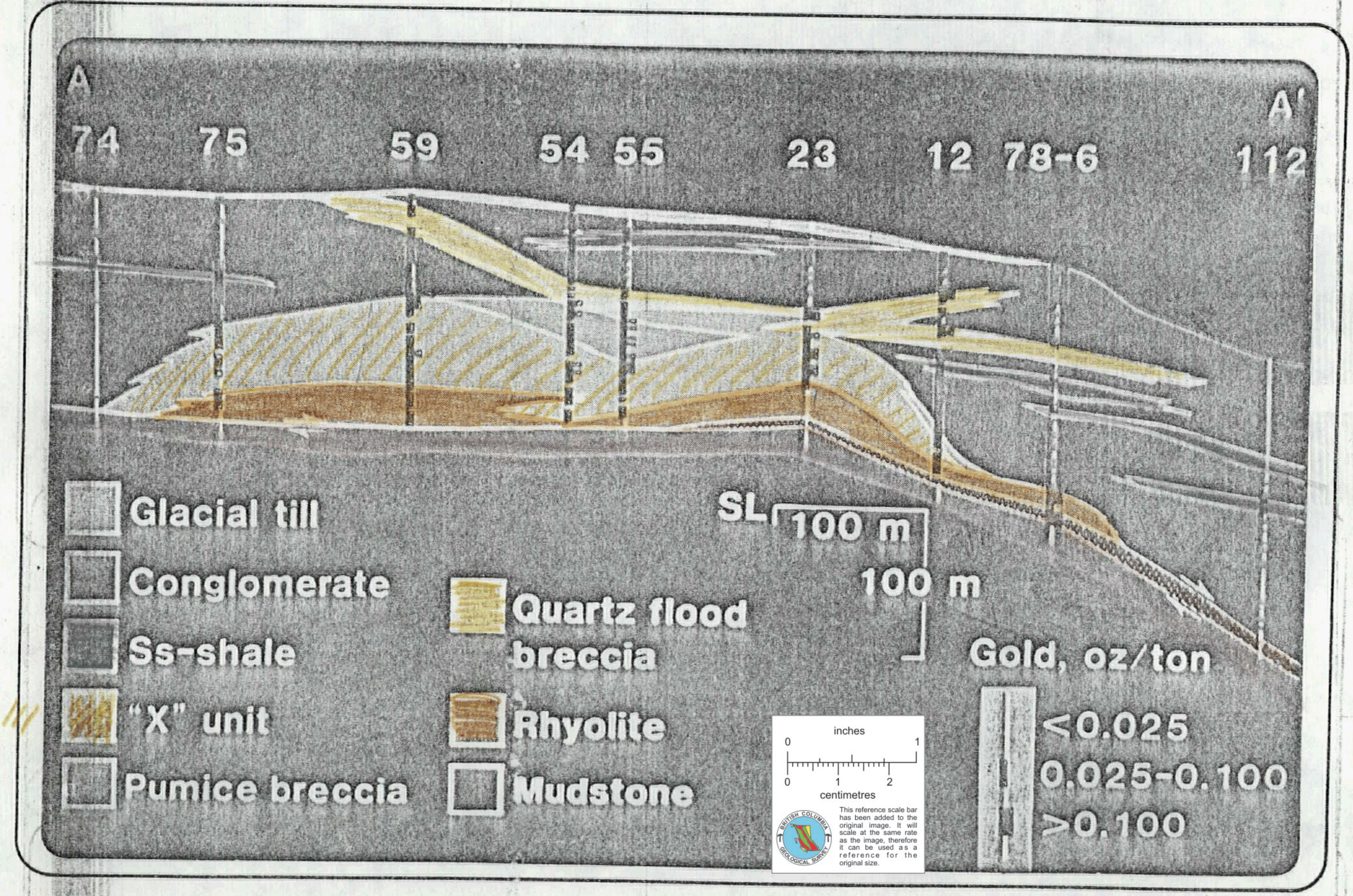
BRITISH COLUMBIA GEOLOGICAL SURVEY
Barbie Ck
3000 N
Main mineralization
Soil Geochemistry
Au, ppm
> 1
0.10 - 1
0.04 - 0.10
< 0.04
2000 N
Yakoun R
4000 E



A
A'
74
75
59
54
55
23
12
78-6
112
Glacial till
Conglomerate
Ss-shale
"X" unit
Pumice breccia
Quartz flood breccia
Rhyolite
Mudstone
SL
100 m
100 m
Gold, oz/ton
<0.025
0.025-0.100
>0.100
inches
0
1
0
1
2
centimetres
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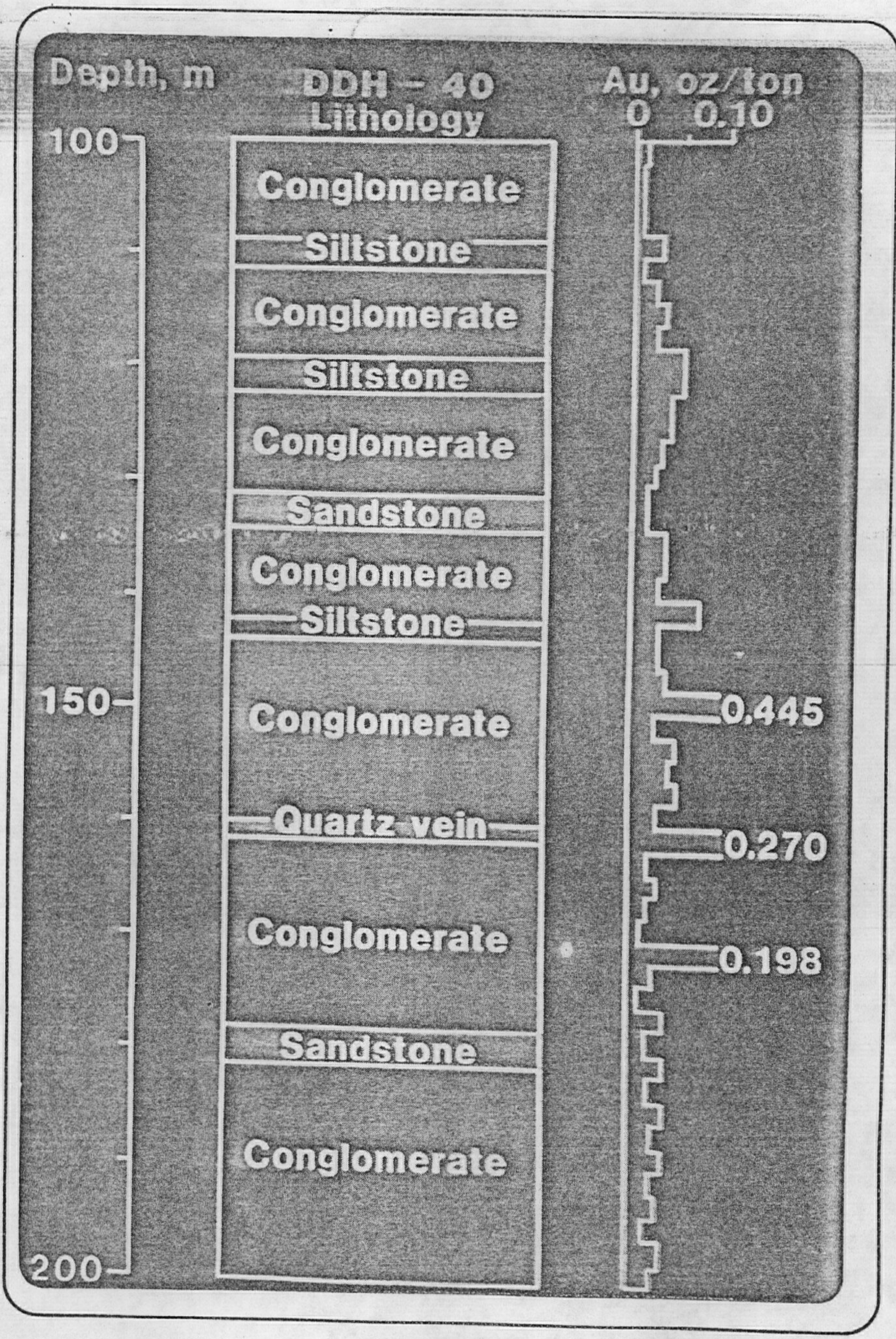
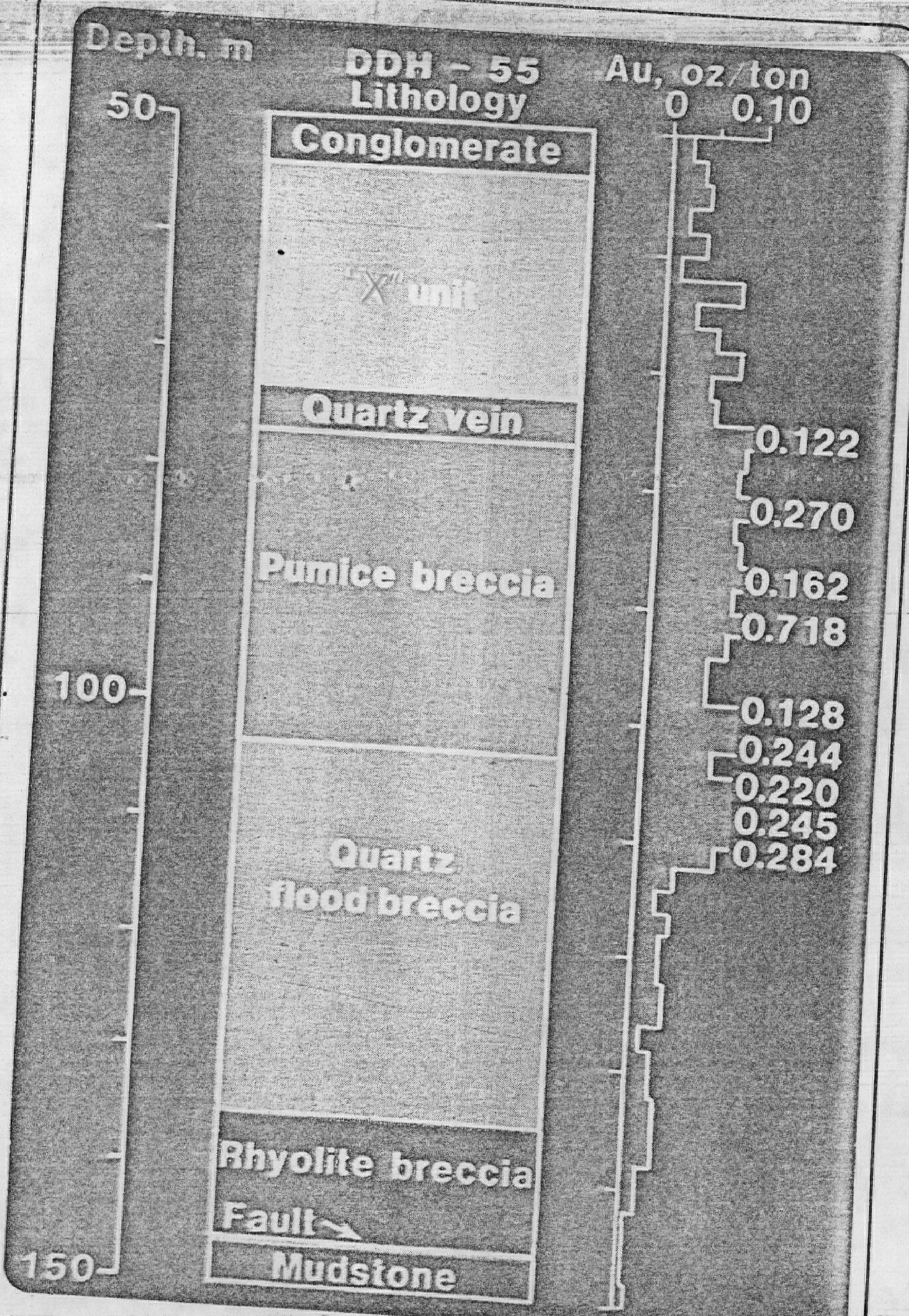
BRITISH COLUMBIA GEOLOGICAL SURVEY



Depth, m
DDH - 40
Lithology
Au, oz/ton
0
0.10
100
150
200
Conglomerate
Siltstone
Conglomerate
Siltstone
Conglomerate
Sandstone
Conglomerate
Siltstone
Conglomerate
Quartz vein
Conglomerate
Sandstone
Conglomerate
0.445
0.270
0.198



Depth, m
DDH - 55
Lithology
Au, oz/ton
0
0.10
50
100
150
Conglomerate
"X" unit
Quartz vein
Pumice breccia
Quartz flood breccia
Rhyolite breccia
Fault
Mudstone
0.122
0.270
0.162
0.718
0.128
0.244
0.220
0.245
0.284

In general, there are two types of mineralization. A low grade disseminated type is characterized by sub-microscopic gold and grades of 0.020-0.100 oz/ton. The high grade type occurs in silica veins, has visible gold and has grades in excess of 0.100 oz/ton.

Comparative Assays
DDH - 16

Depth, m	BW	S1	S2	UN
14 - 16	0.065	0.065	0.070	0.076
16 - 18	0.035	0.025	0.030	0.030
18 - 20	0.088	0.110	0.110	0.056
20 - 22	0.030	0.020	0.020	0.028
22 - 24	0.025	0.020	0.020	0.018
24 - 26	0.025	0.025	0.020	0.036
26 - 28	0.360	0.320	0.310	0.300
28 - 30	0.240	0.150	0.120	0.070

MINERALIZATION

Mineralogy

Gold

The mineralogy of the deposit is quite simple with only iron sulfides occurring in any appreciable amounts with the gold. The gold assays from the core range from trace amounts to over 4.00 oz/ton averaged over a 2 m interval. Much of the gold is evenly distributed throughout the silicified host. Because of this, the gold has no direct relationship to the pyrite-marcasite content or the carbon content. Within the conglomerates approximately equal amounts of gold are found in both the clasts and the matrix indicating the pervasive nature of the mineralizaing process.

Mineralogical studies (Gosparrini, 1979) have shown that much of the gold is too fine to be resolved by the highest microscope magnification of 1250 times (0.5 microms). Most of the free gold observed is found in transecting veinlets of quartz with the free grains generally being less than 10 microns. This free gold is present in the native form, dominantly in discreet grains not associated with pyrite or other sulfides.

The chemical content of the gold particles includes approximately 10 percent silver but no appreciable amounts of other elements (Gasparrini, 1979). The ratios of gold to silver within the host rocks vary widely, but overall is 0.5-0.3.

Sulfides

Iron sulfides are the dominant sulfide in the deposit and occur ubiquitously. Undoubtably, more than one generation of pyrite and marcasite occurs within the mineralized zone. Some of the pyrite in the sedimentary section is syngenetic. However, the marcasite and vein pyrite is related to the mineralizing process. Pyrite-marcasite forms 1-5 percent of the rock volume but locally ranges over 15 percent. The pyrite occurs as crystalline disseminations, replacement of rims and centers of pebble and breccia fragments, and replacement of carbon fragments. Pyrite is also present in thin quartz vein in the rhyolite stockwork. The pyrite form is commonly granular to massive but crystal forms such as cubes and octabedrons are also present.

Marcasite is mixed in with the pyrite and is hard to distinguish. The marcasite generally occurs as radiating blades.

Other sulfides that have been reported but occur in only trace amounts are sphalerite, chalcopyrite and pyrrhotite (Gasparrini, 1979).

Other Minerals

Native copper, cinnabar and rutile also occur in minute amounts in the deposit. Mercury concentrations as high as 19,200 ppb have been noted. Anomalous element concentrations include arsenic and antimony.

White calcite veins less than 10 cm wide are present, but rare, within the silicified section. The calcite is apparently late in the mineralization sequence.

Hematite is found in the quartz-pyrite veins in the rhyolite stockwork and also disseminated in the groundmass of this particular unit.

Genesis

The gold mineralization is directly related to the degree of silicification. The silicification appears to be controlled by proximity to the rhyolite. As suggested by Champigny and Sinclair (1979), intrusion of the porphyry created a hydrothermal system in which fluids rich in gold percolated through the clastic sequence. Cooling of these hydrothermal fluids resulted in super-saturation and precipitation of quartz and gold with traces of silver, mercury, arsenic and antimony.

Subsequent to the intrusion of the rhyolite, faulting displaced the orebody. Outcrops of rhyolite with minor amounts of gold to the northwest, the Marino showing, suggest that this area may have been the root zone of the rhyolite porphyry of the hanging wall.

Richards, Christie and Wolfhard (1976), suggested that the Cinola deposit is a Carlin type based on metallic mineral assemblage, alteration mineralogy, permeability control of mineralization, mode of occurrence of gold and proximity to a major structure. Differences between the Cinola deposit and the Carlin type are regional geologic setting, lithology of the host rocks, the extensive nature of the alteration and the close association of the rhyolite intrusion. Better analogs with the Cinola deposit are Pueblo Viejo in the Dominican Republic and Hauaki in New Zealand.

SUMMARY

1. Silicified breccia zone immediately above a subvolcanic rhyolite intrusive complex.

2. Dislocated by post-mineral normal fault.

3. No stratigraphic influences on the mineralization but it is hosted by an unusual suite of coarse volcaniclastic sediments.

4. Two types of gold mineralization
   a. Disseminated submicroscopic, low grade
   b. Visible and coarse/structure controlled unevaluated to date, intercepts 4.0 oz over 2 m without reserves or followup

5. Announce reserves of 35 m̄ tons .055 oz/ton gold.

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