AGMTalk, Doc

Rainbow-Tam O'Shanter

825626

AGM Talk 1991

ANNUAL GENERAL MEETING SLIDES

1. LOCATION MAP

2. REGIONAL GEOLOGY 1:250000 - show major deposits and quick stats; property outline

3. GEOLOGY 1:5000 - focus on porphyry - size aspects - relation to Motherlode and Greyhound deposits

4. Alteration 1:5000 - focus on concentric aspects about central chlorite magnetite core

5. Mag map 1:5000 - focus on mag highs - concentric aspects

6. Resistivity map 1:5000

7. Chargeability map 1:5000 - concentric aspects

8. Cu, Au rock geochemistry or possibly soils

9. Interpretive cross section

10. Scenery shot to close - smelter stack?

RAINBOW TAM O'SHANTER PORPHYRY

The Rainbow-Tam O'Shanter property is located in the Greenwood Mining camp of southern B. C. near the Canada U.S. border. The area is well known as a past producer of Cu and Au primarily from skarn mineralization. Most production was from the Phoenix mine which operated from the turn of the century until 1978 producing over 1 million ounces of Au, 6.5 million ounces of Ag, and 253,630 tons of Cu from over 25 million tons mined. Total production from the Greenwood Camp from 1900-1978 from 32 million tons mines was 1.2 million oz Au, 7.2 million oz Ag, and 270,945 tons of Cu. Mesothermal veins in the area have produced smaller amounts of Au and associated metals.

Regional geology of the area consists of Late Paleozoic and Mesozoic volcanic and sedimentary rocks metamorphosed to greenschist facies. These are intruded by Mesozoic plutons and unconformably overlain by Tertiary volcaniclastic and flow rocks.

Pre tertiary rocks are contained within north dipping thrust

.0375.02

slices. These slices lie above high-grade metamorphic complexes which are exposed in northern Washington. Late Paleozoic rocks consist of chert greenstone, diorite and serpentinite of the Knob Hill Group, and dark grey argillite, limestone and minor volcanic rocks (andesite) belonging to the Attwood Group. These rocks are unconformably overlain by the Brooklyn Fm - a sequence of clastic sedimentary rocks, limestones and submarine pyroclastic breccias and dioritic intrusions which hosts most of the skarn mineralization in the area.

Early Tertiary tectonism included resurgent magmatic activity, horst and graben development, and thrusting. Tertiary rock distributions are controlled by extensional faulting and three sets are recognized in the area. From oldest to youngest these comprise gently east dipping faults at the base of the Tertiary, later west dipping listric normal faults causing rotation of Tertiary strata, and finally north to northeast trending steeply dipping faults.

The Tam O'Shanter porphyry is located along the eastern margins of the Toroda Creek graben, which flanks the Tenas Mary horst to the west. To the east of the horst is the Republic graben which extends south into the United STates. To the north and east of the porphyry, across the area known as Deadman Flats, area located the Motherlode and Greyhound skarn deposits. These are less than 2 km away and can be seen from the porphyry forming a roughly arcuate trend, occurring as proximal deposits to the Tam system. Bounding the porphyry system to the west are Tertiary sediments made up of Kettle River Formation arkosic and volcaniclastic sediments and Marron Formation trachytic flows. The Tertiary units are in fault contact with the porphyry, the fault dipping moderately to the west. These units are geochemically and geophysically inactive.

Permian cherty sediments, crystal and ash tuffs and minor andesitic volcanics occur to the south of the porphyry. This contact is thought to be a fault dipping to the south.

The porphyry itself is dioritic in composition texturally ranging from fine grained microdiorite to coarser grained (2mm) phases, and local feldspar crowded phases. The system is exposed for roughly ---km northward by ---km eastward. Cross faulting has dissected the system into a number of individual ~~faults~~. segments

Alteration of the system consists of three principal types - a central zone of chlorite-magnetite alteration, and outer annular pyritic haloes and zones of pervasive silicification. The central chlorite-magnetite alteration zone is interpreted as a potassic core to the system, but rather than K-feldspar alteration, biotite is thought to be the original alteration assemblage, and has subsequently been retrograde altered to chlorite and magnetite. Within this area disseminated Cp is seen to 5% finely disseminated throughout. Cp also occurs with epidote as vein selvages about central silica vein cores. Moving outward from this central core the porphyry occurs a dioritic phase near to the Chl-mt alteration, and a leucodioritic phase further out.

Moving outward from the core zone, intermediate argillic alteration is recognized over a broad area and varies in intensity and mineralogy. Chlorite and calcite veins and stringers are seen, as is hematized magnetite, pyrite and specular hematite in veins and disseminations. In localised areas feldspars are seen to be altered to clays within the porphyry.

Further from the core a zone of advanced argillic alteration is encountered with quartz seen locally chalcedonic form (this is not the dominant form of silicification , however), pyrite rich high sulphidation assemblages (including abundant magnetite), and possibly pyrophyllite as veins and fracture fillings. Sericite is also encountered to a small degree occurring as fracture fillings.

The Finally, an outer annular zone of silica flooding is encountered consisting of coarse to fine sugary crystalline quartz in some areas and vuggy silica elsewhere. These areas display stockwork fracturing (to 90% locally) on close inspection, and subsequent silica healing. malachite and Fe staining is seen on many exposures of this alteration type occurring along fractures. SiO^2% from many samples taken from these zones is, interestingly, lower than might be expected and may suggest the presence of the alumina silicate zunyite which is common in advanced argillic alteration zones of porphyry deposits, but because of its resemblance to fine grained quartz may not have been recognized. The lack of clay minerals may suggest fluids producing advanced argillic alteration may have been higher temperatures (+300°) than previously thought in this system. Within the outer zones of silicification hydrothermal breccias are also seen.

P.7 from alteration book: The assemblages characteristic of the high-temperature advanced argillic alteration are named "high alumina alteration". Alteration tends to be localized and occupies pods and lenses up to tens of metres in length, in silicified zones which, in turn, may be surrounded by sericitic zones.

ROCK GEOCHEMISTRY

Rock geochemistry from surface samples outlines a number of distinct areas showing Cu isopleths of >500 ppm and >1000 ppm and Au isopleths of >100ppb and >500 ppb. Within these areas however are samples up to 7103 ppm Cu and 3780 ppb Au, and 7256 ppm Cu and 1450 ppb Au. The zones outlined, too, are constrained by the availability of outcrop to be sampled. It is noteworthy that anomalous Cu and Au values occur together.

Overlaying available results with geophysics shows the following:

GEOPHYSICS

The system is defined well by mag, resistivity, and chargeability induced polarization surveys.

The magnetometer survey defines several areas of high magnetic gradient flanked by areas of mag lows. The extents of the central chl-Mt zone are clearly defined by the survey. Several other zones to the north and south however are not explained in this way. The broad anomaly from line 20N to 24N may be a buried Chl-Mt alteration zone which may be fault truncated.

CHARGEABILITY

Chargeability is shown in plan for N=1 over the property area and shows several strong zones of chargeability. These coincide well with areas of pyritization and may define pyritic haloes about the core area. Chargeabilities near the chl-Mt alteration zone overlap this area to a certain extent.

Broad zones of high chargeabilities in the southern portion of the grid result from the sedimentary package which includes some argillite horizons. This limits the use of I.P. in this area.

An obvious north-east southwest chargeability break is shown trending from L4N to L18N and show up as well as a resistivity feature. Interestingly, this break shows no expression on the magnetometer plan map.

RESISTIVITY

Resistivity plan shows a number of resistivity features (lows) coincident with chargeability highs and areas of low to moderate magnetic relief. Of interest in the northern portions of the grid are in areas of silicification. This suggests that possibly other alteration assemblage minerals are present, possibly albite or zunyite, an aluminosilicate similar in appearance to fine grained quartz.

The lower resistivities also suggest that the zones of silicification are not as laterally pervasive as seen in mapping. The silicification might be more localised and selective and the reason virtually all outcrop seen in these areas is simply due to weathering of less resistant areas between the silicification zones.

SCHEMATIC SECTION

From surface mapping at property scale to regional observations the following schematic section is proposed as a model for the system. The section represents a north-south transect through the property facing west and incorporates property and regional scale observations. The section clearly shows the geometric relations between known skarn mineralization, high grade

Cu-Au mssx vein mineralization, and high grade base metal veins and the porphyry system. From the central porphyry system a metal zonation is evident on a regional scale from Cu-Au disseminated porphyry mineralization to peripheral skarn deposits indicated by the Motherlode, Greyhound and the more distal phoenix deposits, to the high grade Cu-Au mssx veins seen on the Wildrose property, through to base metal bearing quartz veins seen more distally from the porphyry system.

Overlaying an alteration model over this section, again, a strong zonation is evident extending from the central potassic zone indicated by chl-Mt alteration through the intermediate argillic zone indicated by chlorite veining, calcite veining and disseminations, localised clay alteration of feldspars, hematized Mt, pyrite and specular hematite. Intermediate argillic alteration grades into advanced argillic alteration within the porphyry and into the volcanic and volcaniclastic portions of the system and indicated by the increasing presence of silica, occasionally seen in chalcedonic form (but not common), possible pyrophyllite and/or anhydrite, pyritic haloes, and magnetite. Propyllitic alteration is of a regional scale and is not shown. Finally, advanced argillic alteration is associated with, or grades into silicification zones characterized by hydrothermal breccias, stockwork (up to 90%) fracturing and silica healing, and pervasive silica flooding throughout.

The concentric configuration of the system therefore promotes a number of areas that could host potential ore zones. As much of the gold in these gold rich copper deposits was introduced with copper during K-silicate alteration, the potassic core presents a possible ore zone. However, as advance argillic zones were the last to be active in these systems, and may have overprinted some potassic alteration, these areas too present potential ore zones.

In closing, the Tam O'Shanter porphyry system is a large system showing concentric alteration and mineralization zonation, excellent soil geochemistry, broad zones of high chargeabilities, excellent Cu-Au surface sample grades, and alternating mag highs an lows.

The mining history of the Greenwood area, and deposit types mined in the past (primarily skarn) almost dictate the presence of a large tonnage disseminated porphyry system. The Tam O'Shanter porphyry may be that system, and if so Minnova may well become the major contributor in restoring the city of Greenwood to the flourishing community it once was at the turn of the century. Well, on second thought we could just build a new town.

AGMTALK4.DOC.

RAINBOW TAM O'SHANTER PORPHYRY

TITLE AND LOCATION SLIDE

Good morning. In the next 10 minutes I will ~~give~~ present a brief overview of Minnnova's Cu-Au porphyry prospect in the Greenwood area of B.C.

The Rainbow-Tam O'Shanter property is located in the Greenwood Mining camp of southern B. C. near the Canada U.S. border.

SMELTER SLIDE

The city and surrounding area has a rich history of mining dating back to 1900. The area is well known as a past producer of Cu and Au primarily from skarn mineralization.

REGIONAL GEOLOGY SLIDE

Most production came from the Phoenix mine which operated from the turn of the century until 1978.

Mesothermal veins in the area account for smaller amounts of Au and associated metals.

Regional geology of the area consists of Late Paleozoic and Mesozoic volcanic and sedimentary rocks metamorphosed to greenschist facies and intruded by Mesozoic plutons. These are unconformably overlain by Tertiary volcaniclastic and flow rocks.

Late Paleozoic rocks consist of chert greenstone, diorite and serpentinite of the Knob Hill Group, and dark grey argillite, limestone and minor volcanic rocks of the Attwood Group. These are unconformably overlain by Triassic Brooklyn Fm - a sequence of clastic sedimentary rocks, limestones and submarine pyroclastic breccias and dioritic intrusions.

Early Tertiary tectonism included resurgent magmatic activity, horst and graben development, and thrusting.

The Tam O'Shanter porphyry is located along the eastern margin of the Toroda Creek graben flanking the Tenas Mary horst to the west. To the east of the horst is the Republic graben which extends south into the United States. To the north and east of the porphyry are the Motherlode and Greyhound skarn deposits. These are less than 2 km away and visible from the property forming a roughly arcuate trend, occurring as proximal deposits to the Tam system.

PROPERTY GEOLOGY

Bounding the porphyry system to the west are Tertiary sediments made up of arkosic and volcaniclastic sediments and trachytic flows. The Tertiary units are in fault contact with the porphyry. The fault dips moderately to the west.

Late Paleozoic cherty sediments, crystal and ash tuffs and andesitic volcanics overlie the porphyry to the north and south and are host to small Cu-Au bearing sulphide vein deposits.

The porphyry itself is dioritic in composition, texturally ranging from fine grained microdiorite to coarser grained (2mm) phases, and local feldspar crowded phases. The system is exposed for roughly 1.4km northward by 1.6km eastward. Extensive block faulting has strongly dissected the system.

OVERLAY PROPERTY ALTERATION

Alteration consists of three principal zones - a central zone of chlorite-magnetite alteration, outer ~~annul~~ar pyritic haloes and outer zones of pervasive silicification. The central chlorite-magnetite alteration zone is interpreted as a potassic core to the system, but rather than K-feldspar alteration, biotite is thought to be the original alteration assemblage which has subsequently undergone retrograde alteration to chlorite and magnetite.

Moving outward from the core zone, intermediate argillic alteration is recognized over a broad area and varies in intensity and mineralogy. Chlorite and calcite veins and stringers are seen, as is hematized magnetite, pyrite and specular hematite in veins and disseminations. In localised areas feldspars are seen to be altered to clays within the porphyry.

Further from the core a zone of advanced argillic alteration is encountered indicated by increasing silica content. Pyrite rich high sulphidation assemblages which include abundant magnetite are observed, and pyrophyllite may be present occuring as veins and fracture fillings. Sericite is also encountered to a small degree occurring as fracture fillings.

Finally, advanced argillic alteration is assoc c̄ or grades into an outer zone of silica flooding ~~is encountered~~ consisting of coarse to fine sugary crystalline quartz in some areas, and vuggy silica elsewhere. These areas display stockwork fracturing up to 90% locally, and subsequent silica healing. Malachite and Fe staining are common ~~is seen on many exposures of this alteration type occurring along fractures~~. Hydrothermal breccias are ~~commonly~~ seen in the outer zones of silicification.

CU-AU ROCK GEOCHEMISTRY SLIDE

Rock geochemistry from surface samples outlines a number of areas of high Cu-Au values. Cu is outlined in blue showing areas of >500 ppm and >1000 ppm Cu: Au is outlined in red showing areas of >100ppb and >500 ppb Au. Within these areas however are samples of greater than 7000 ppm Cu and greater than 3500 ppb Au. Furthermore, the zones outlined are constrained by the availability of outcrop to be sampled which in this area is ~~as little as 15% and~~ primarily exposed in road cuts. Note that anomalous Cu and Au values occur together.

OVERLAY GEOLOGY/ALTERATION SLIDES ON CU/AU GEOCHEM

Relating rock geochemistry to geology and alteration shows a correlation between higher Cu-Au results and peripheral advanced argillic alteration zones, as well as with the central Chl-Mt alteration zone. Higher grades generally occur along the inner margins of the pyritic haloes.

OVERLAY CU/AU ON CHARGEABILITY

The chargeability plan shown here has contours at +10 mV/V, +20 mV/V, and +30mV/V. A distinct circular trend in chargeability is shown around the porphyry. Relating surface grades to induced polarization geophysics shows a strong correlation between the margins of high chargeabilities ~~and~~ to higher grades.

OVERLAY CU/AU ON MAG

The magnetometer plan map clearly shows the central chl-mt zone as well as a number of mag features not readily explained. Relating magnetometer results to both chargeability and surface sample grades shows higher grades occuring with coincident chargeability and ~~magnetometery~~ magnetic anomalies. ~~As you can see there are several areas of coincident mag and chargeability anomalies with only marginal geochem response that present themselves as excellent exploration targets.~~

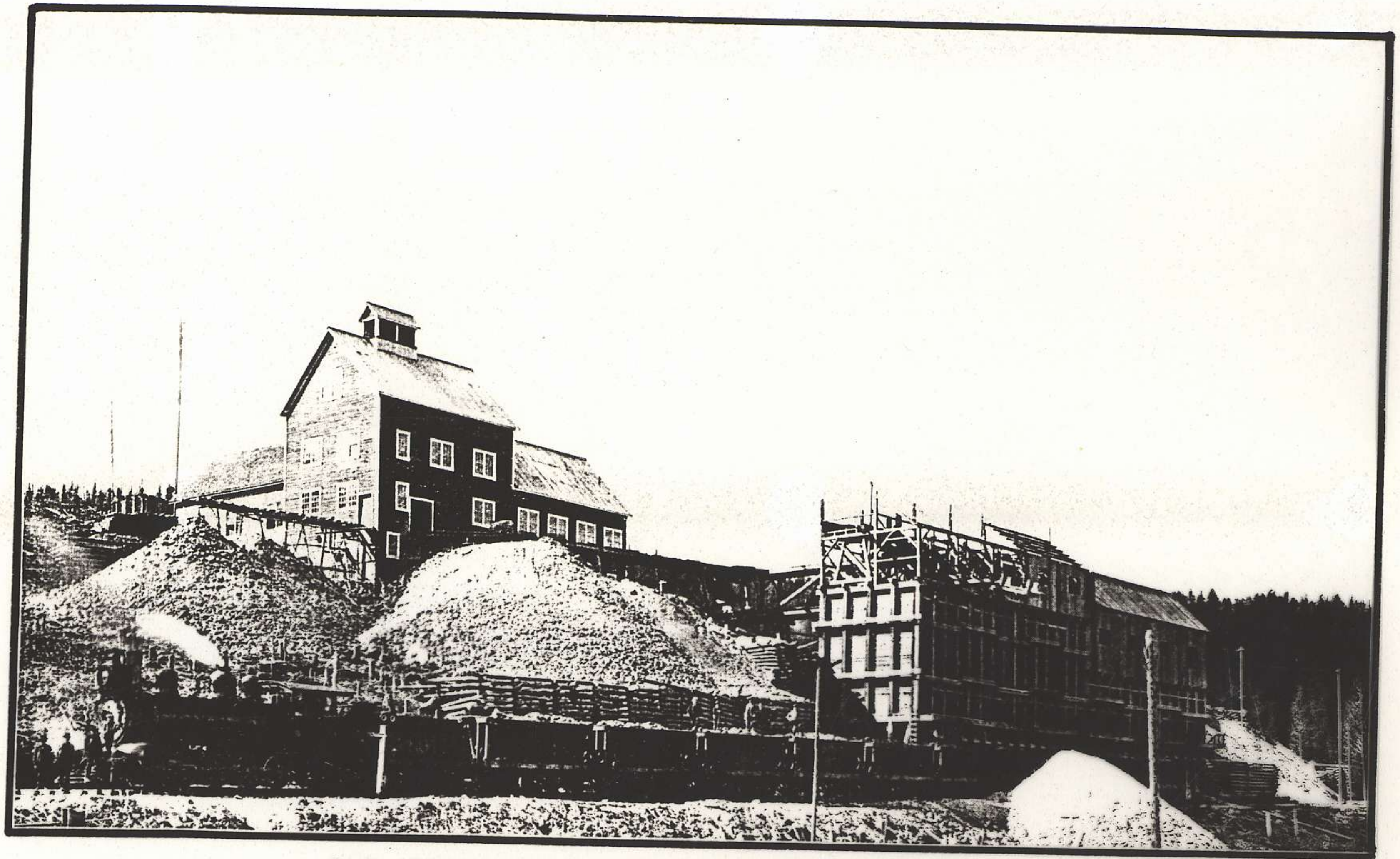
So the integrated approach of property scale mapping of rock types and alteration, property scale geophysics, and regional observations may be summarised in the following metallogenic model.

METALLOGENIC MODEL + Alteration

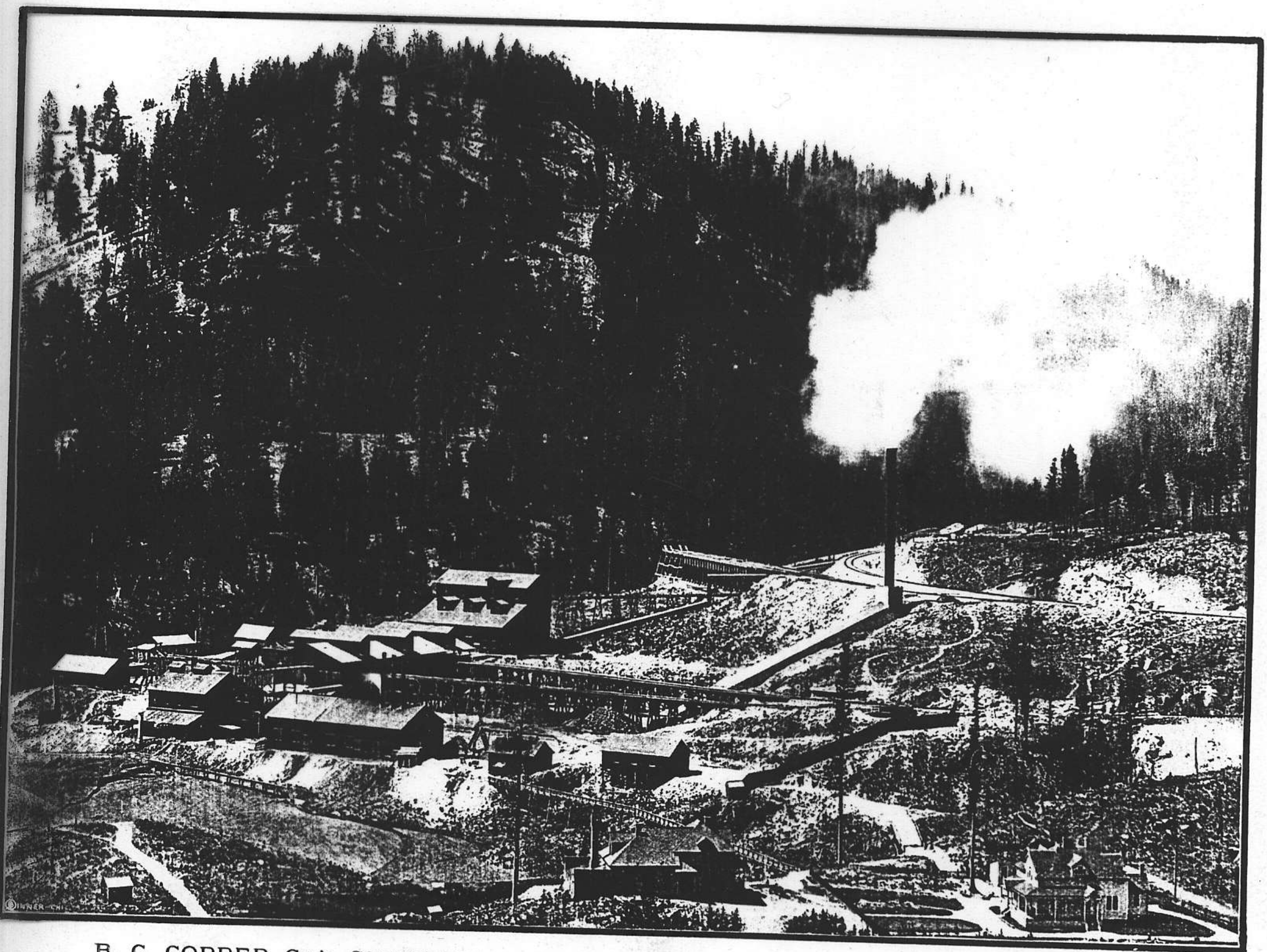
The section represents a north-south transect through the property facing west and incorporates all property and regional observations. The model clearly accounts for the geometric relations between the porphyry system and known skarn and vein mineralization. In the central portion of the model disseminated Cu-Au porphyry mineralization is seen with an outward zonation through proximal Cu-Au bearing mssx veins to base metal bearing quartz veins more distally, and finally to peripheral skarn deposits such as the Motherlode, Greyhound, and Phoenix deposits.

~~OVERLAY ALTERATION ON MODEL~~

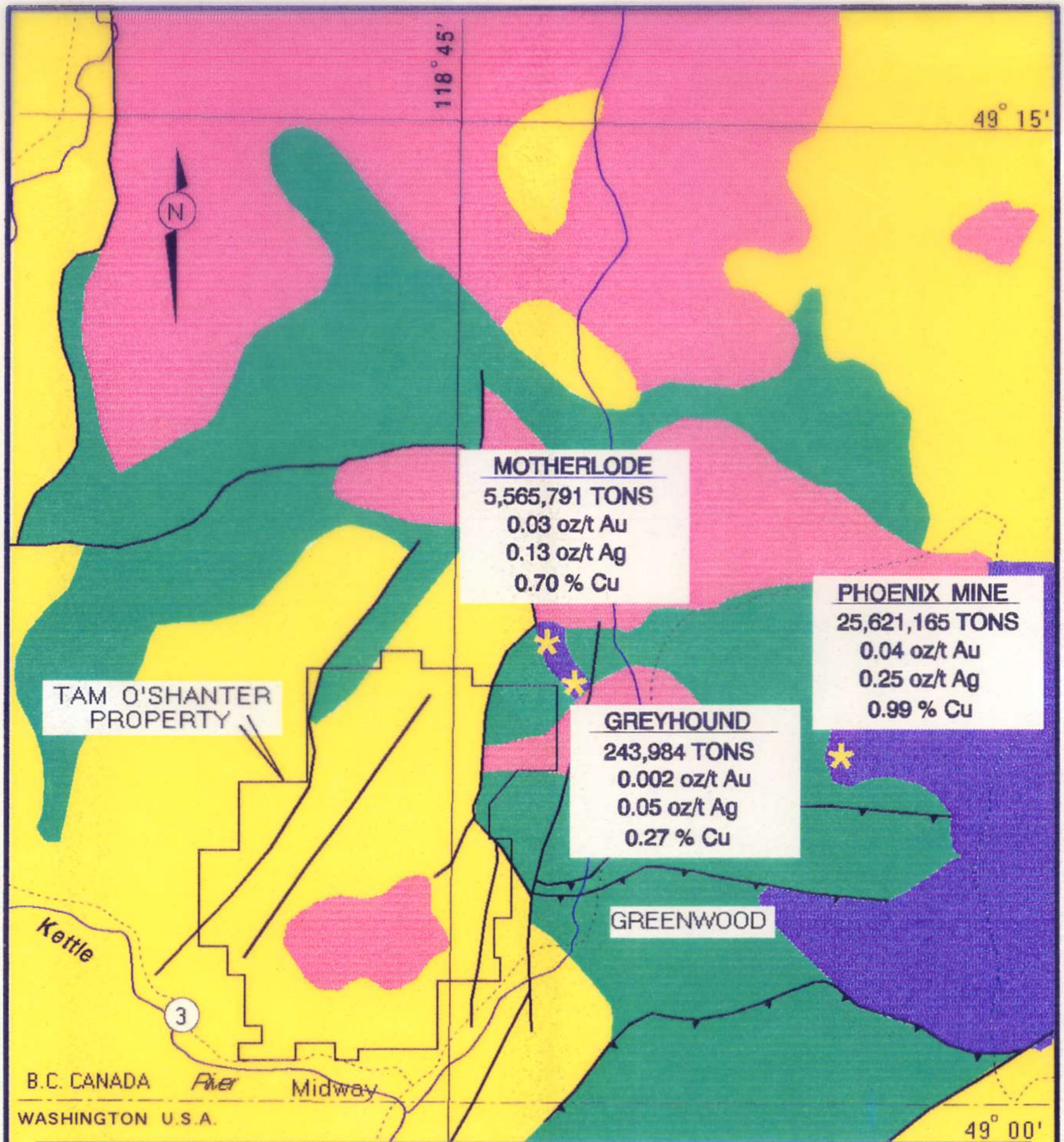

TAM O'SHANTER
PROPERTY
GREENWOOD B. C.



OLD IRONSIDES SHAFT-HOUSE AND BINS, PHŒNIX.



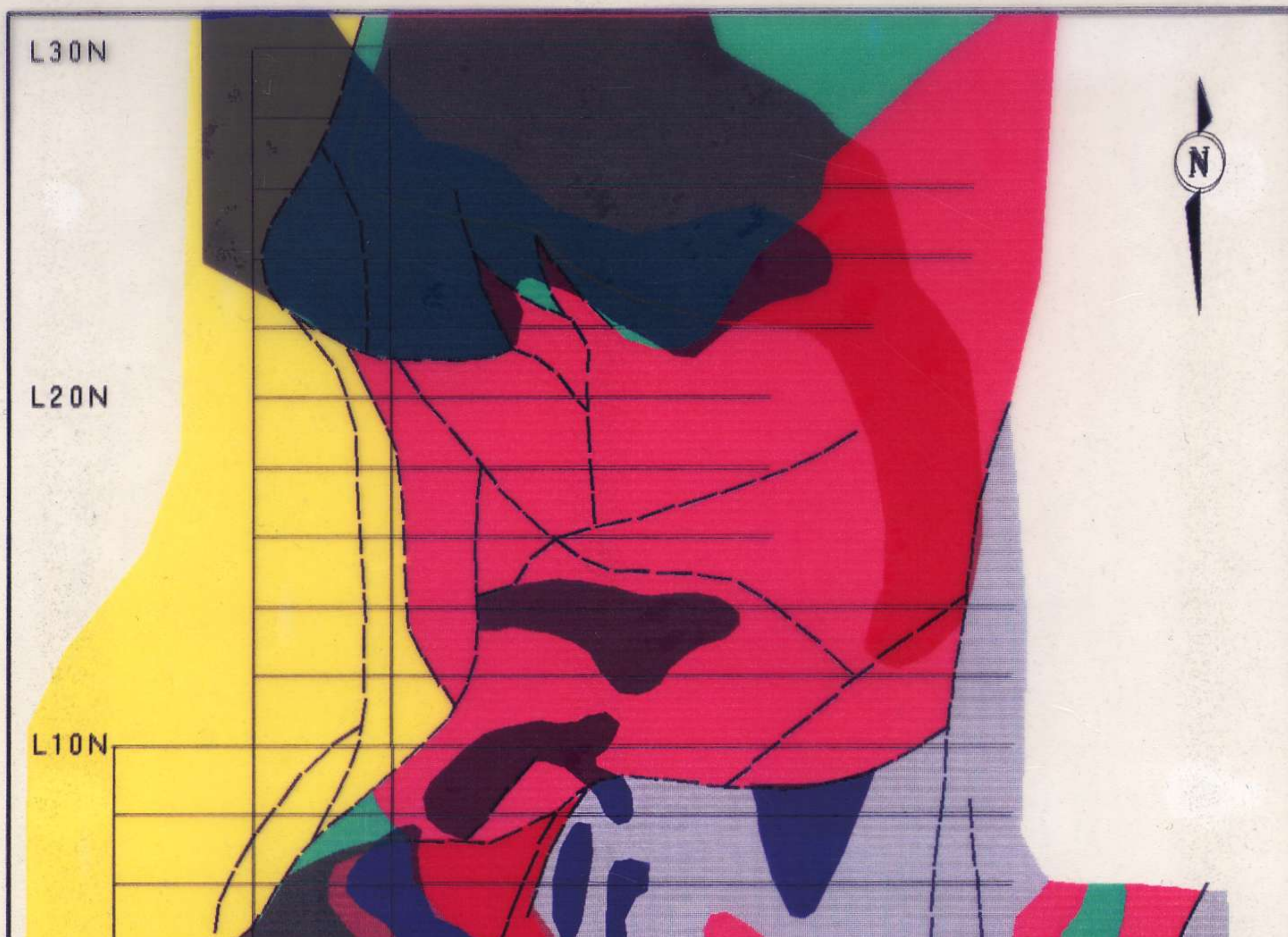
B. C. COPPER Co.'s SMELTER—GREENWOOD-KETTLE RIVER MINING DIVISION.



TAM O'SHANTER - REGIONAL GEOLOGY

LEGEND

- TERTIARY SEDIMENTS, VOLCANICS, VOLCANICLASTICS
- CRETACEOUS / JURASSIC INTRUSIONS
- TRIASSIC SEDIMENTS
- CARBONIFEROUS / PERMIAN SEDIMENTS, VOLCANICS, VOLCANICLASTICS



TAM O'SHANTER - ALTERATION

TAM O'SHANTER - GEOLOGY

CHLORITE - MAGNETITE ALTERATION (RETROGRADE ALTERATION OF BIOTITE)

TERTIARY SEDIMENTS

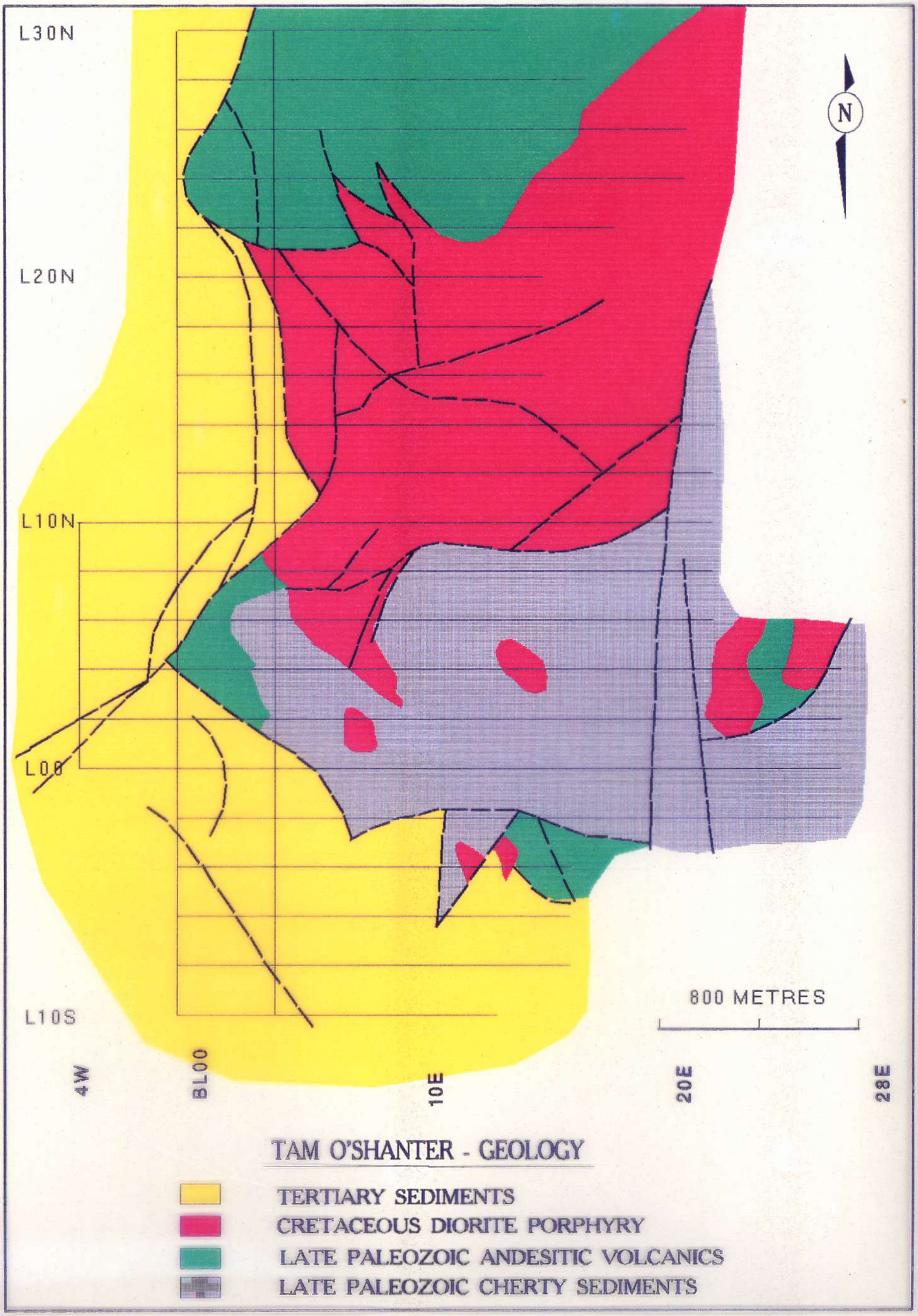
CRETACEOUS DIORITE PORPHYRY

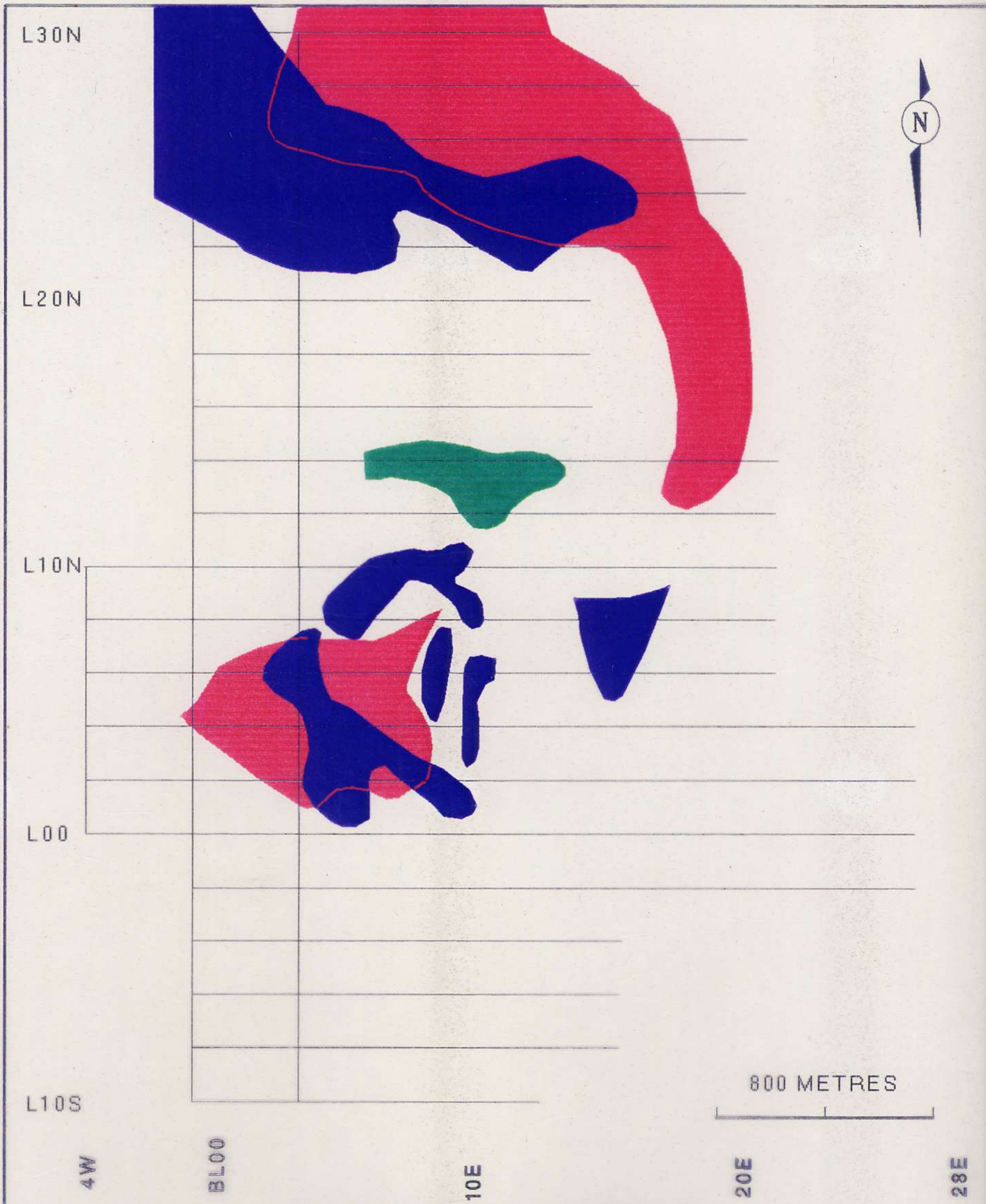
SILICIFICATION

LATE PALEOZOIC ANDESITIC VOLCANICS

PYRITIZATION

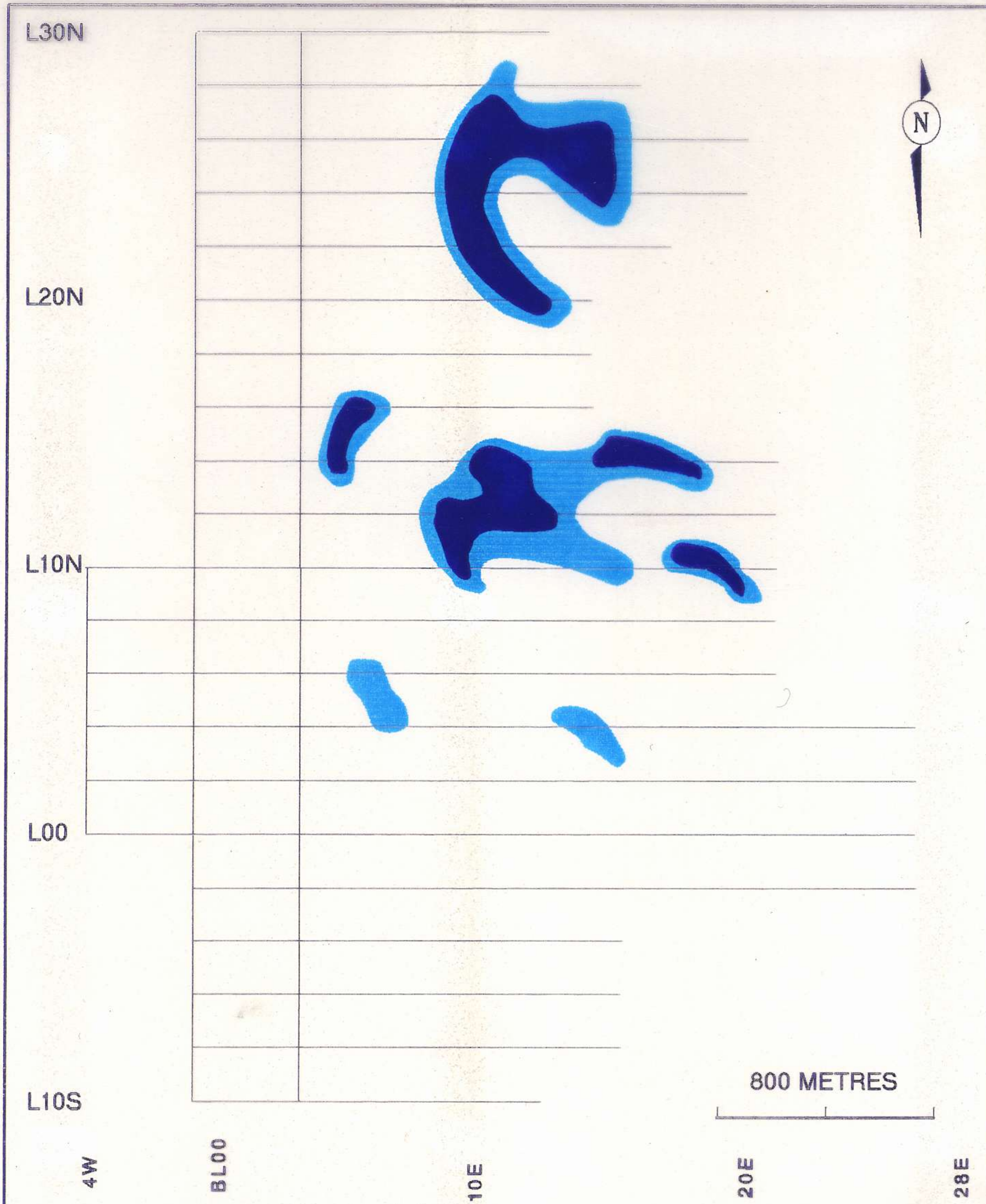
LATE PALEOZOIC CHERTY SEDIMENTS


L30N
L20N
L10N
L00
L10S
N
800 METRES
4W
BL00
10E
20E
28E
TAM O'SHANTER - GEOLOGY
TERTIARY SEDIMENTS
CRETACEOUS DIORITE PORPHYRY
LATE PALEOZOIC ANDESITIC VOLCANICS
LATE PALEOZOIC CHERTY SEDIMENTS

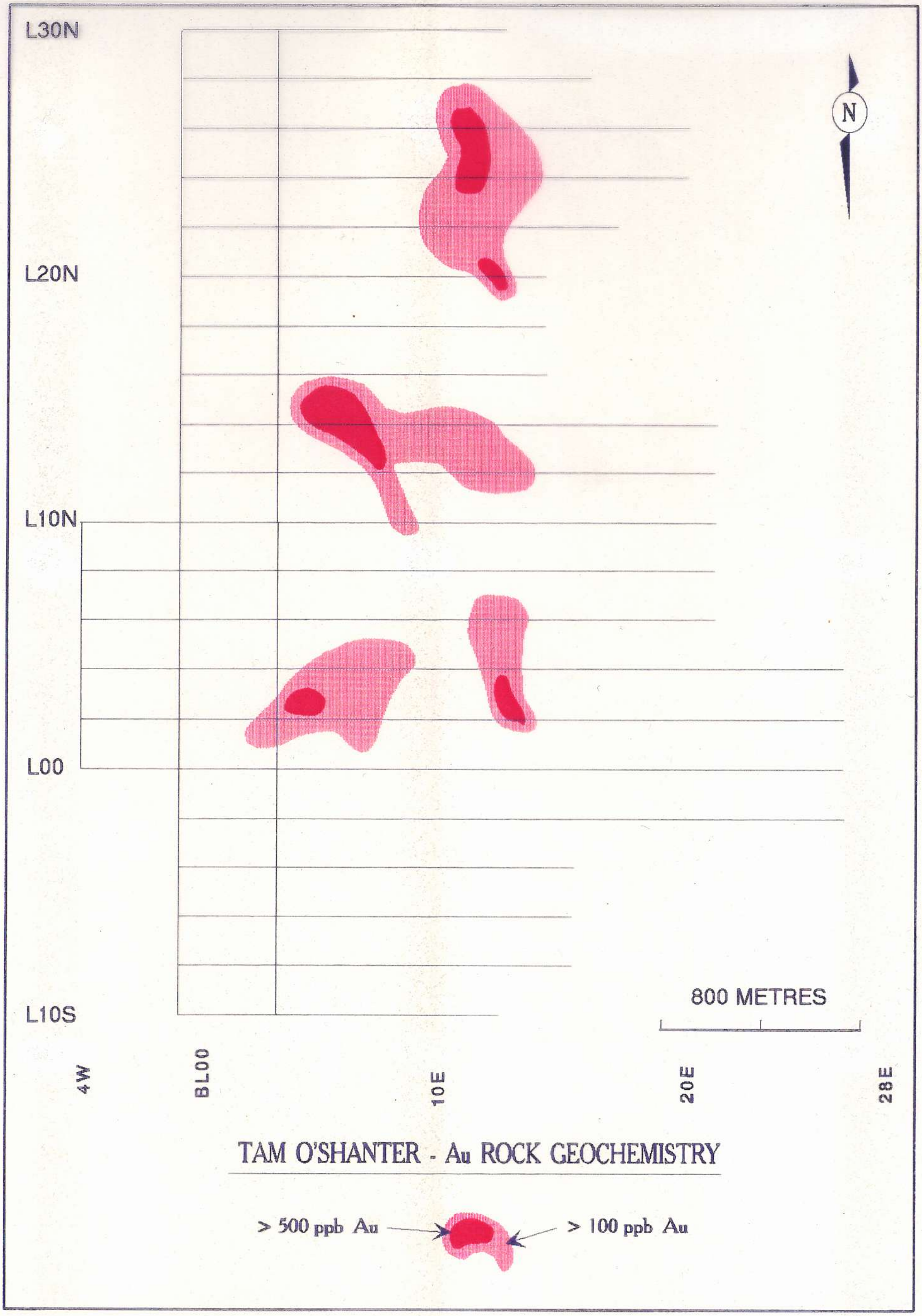


TAM O'SHANTER - ALTERATION

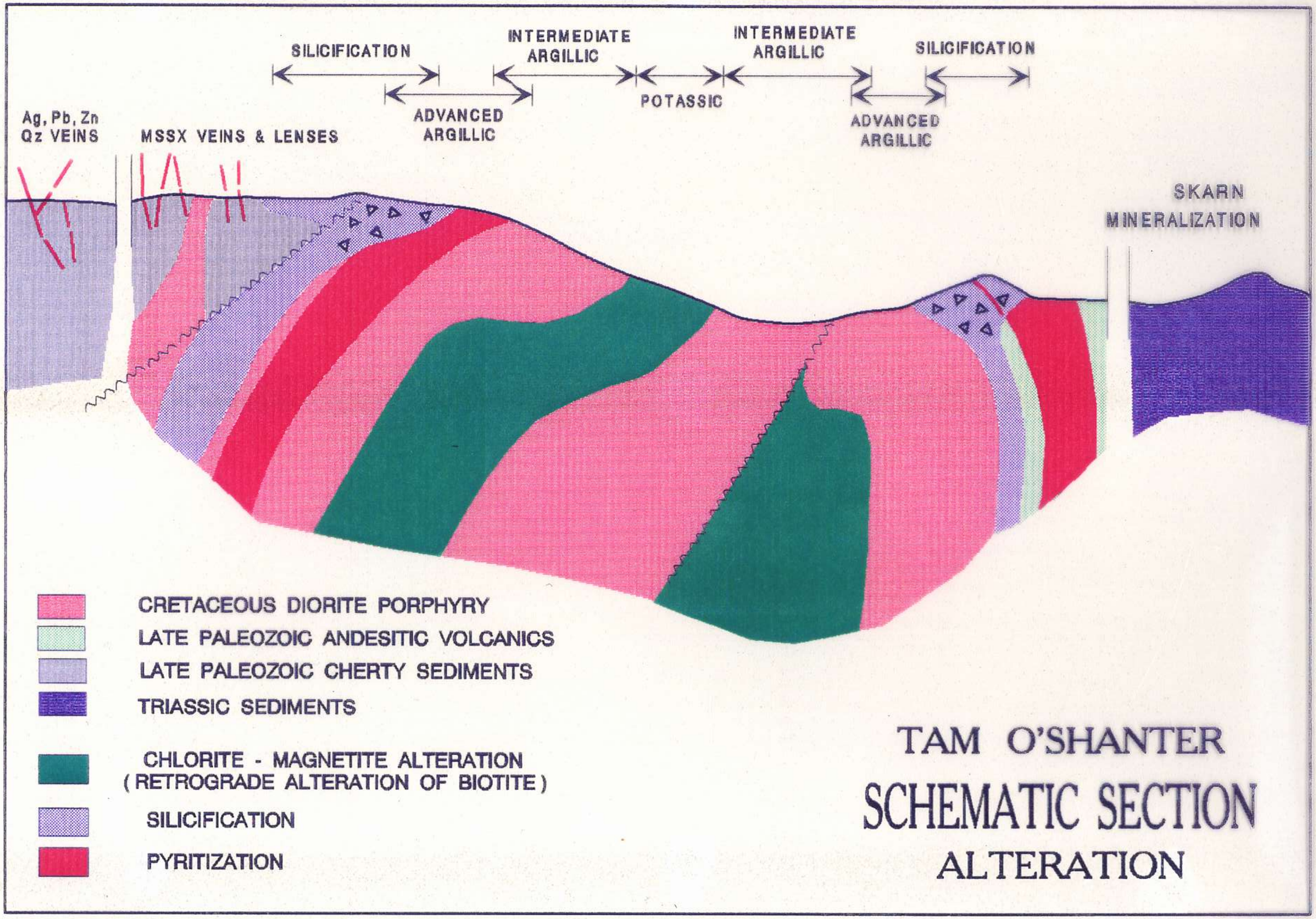
- CHLORITE - MAGNETITE ALTERATION (RETROGRADE ALTERATION OF BIOTITE)
- SILICIFICATION
- PYRITIZATION

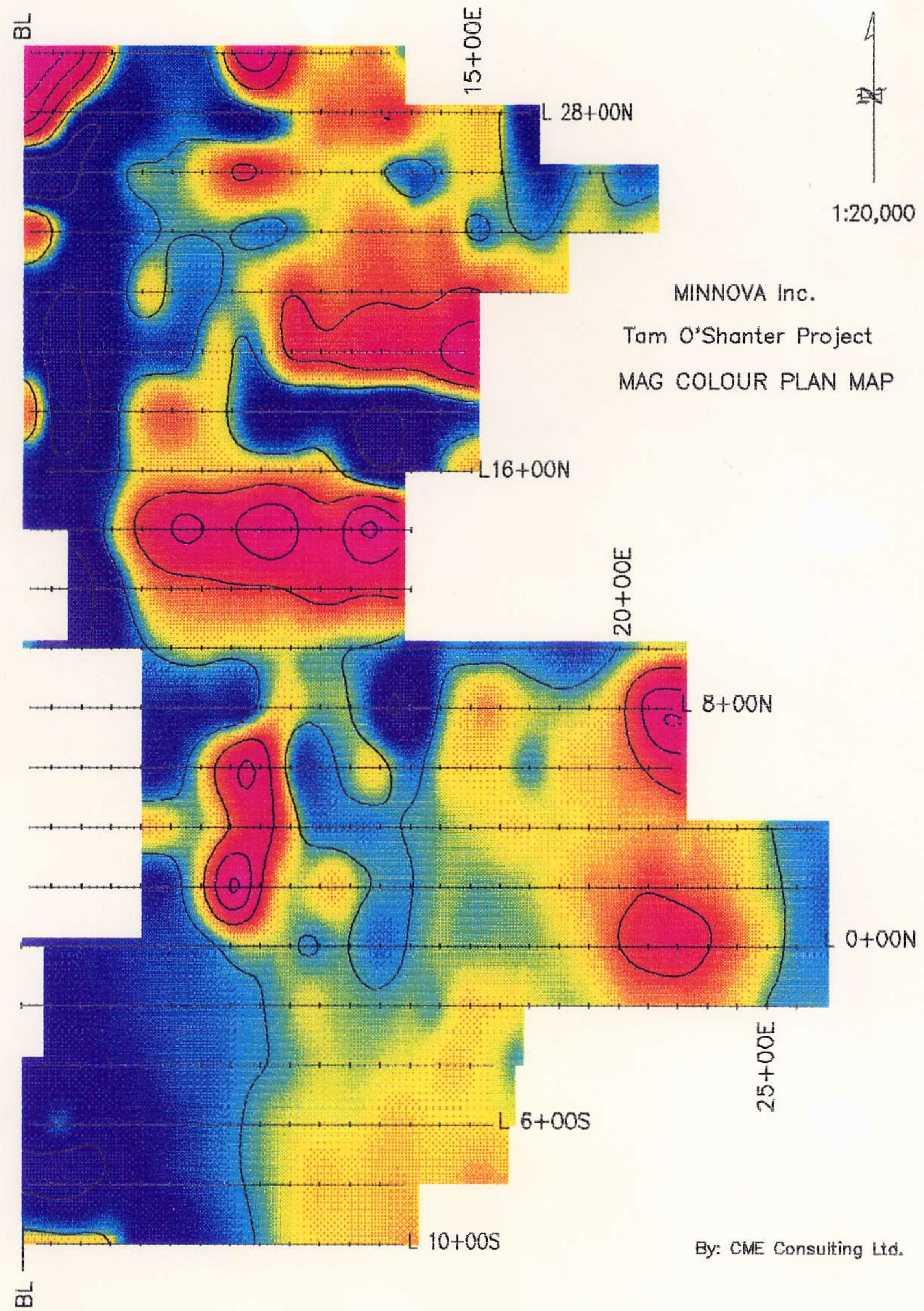


TAM O'SHANTER - Cu ROCK GEOCHEMISTRY



TAM O'SHANTER - Au ROCK GEOCHEMISTRY


SILICIFICATION
INTERMEDIATE ARGILLIC
INTERMEDIATE ARGILLIC
SILICIFICATION
ADVANCED ARGILLIC
POTASSIC
ADVANCED ARGILLIC
Ag, Pb, Zn Qz VEINS
MSSX VEINS & LENSES
SKARN MINERALIZATION
CRETACEOUS DIORITE PORPHYRY
LATE PALEOZOIC ANDESITIC VOLCANICS
LATE PALEOZOIC CHERTY SEDIMENTS
TRIASSIC SEDIMENTS
CHLORITE - MAGNETITE ALTERATION (RETROGRADE ALTERATION OF BIOTITE)
SILICIFICATION
PYRITIZATION
TAM O'SHANTER
SCHEMATIC SECTION
ALTERATION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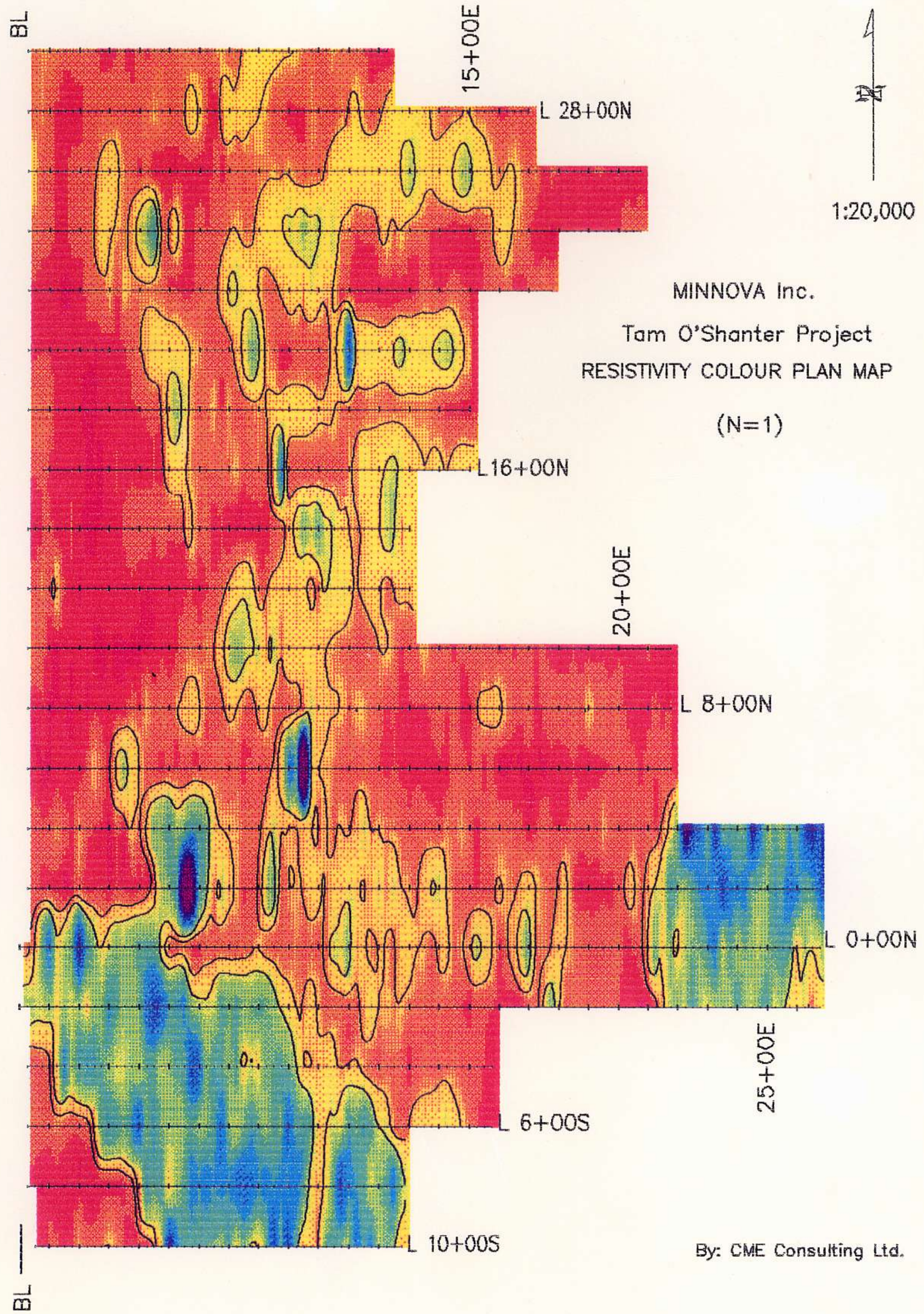
15+00E
L 28+00N
1:20,000
MINNOVA Inc.
Tam O'Shanter Project
MAG COLOUR PLAN MAP
L16+00N
20+00E
L 8+00N
L 0+00N
25+00E
L 6+00S
L 10+00S
By: CME Consulting Ltd.
BL



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L 6+00S
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MINNOVA Inc.
Tam O'Shanter Project
RESISTIVITY COLOUR PLAN MAP
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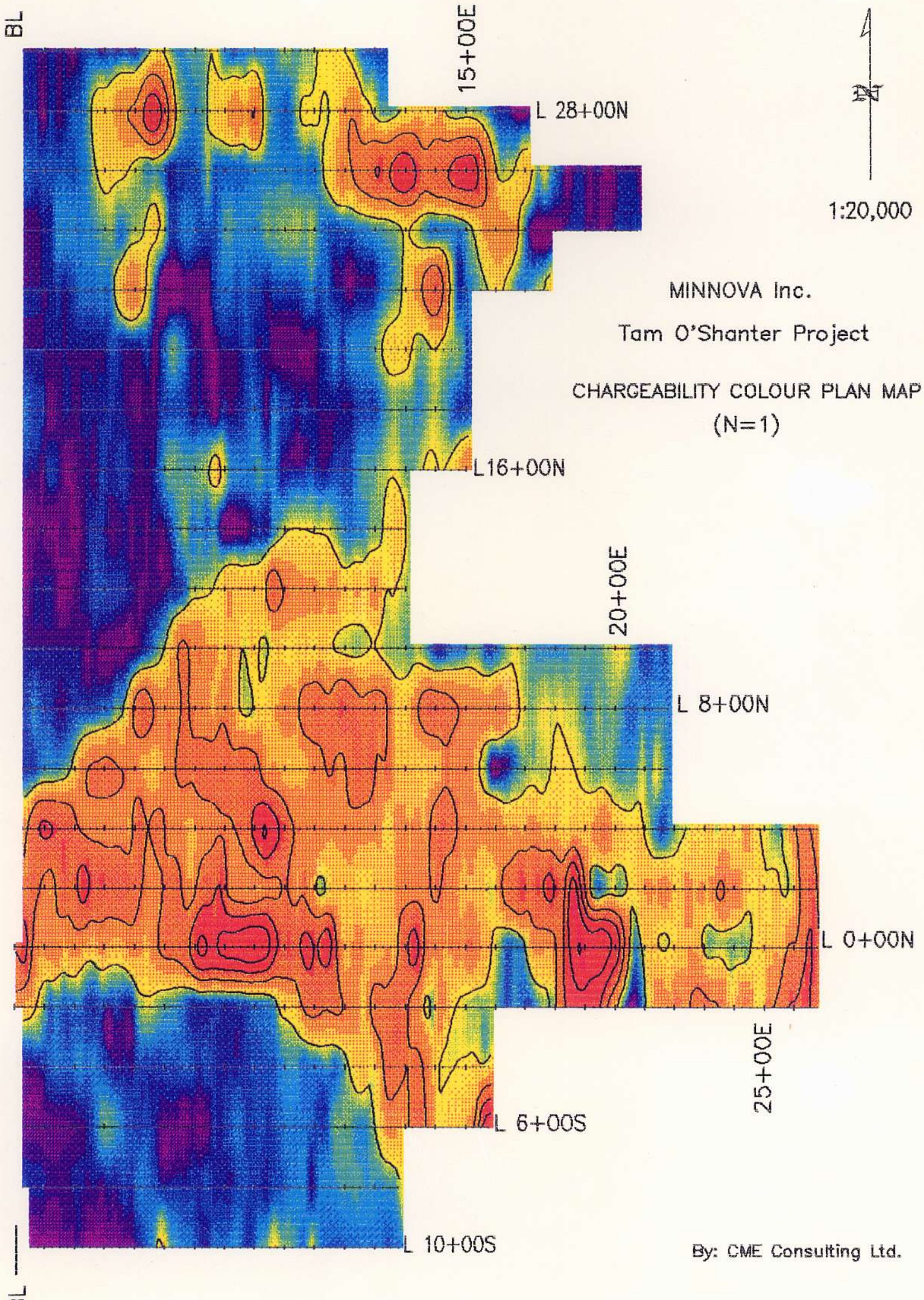
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MINNOVA Inc.
Tam O'Shanter Project
CHARGEABILITY COLOUR PLAN MAP
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L16+00N
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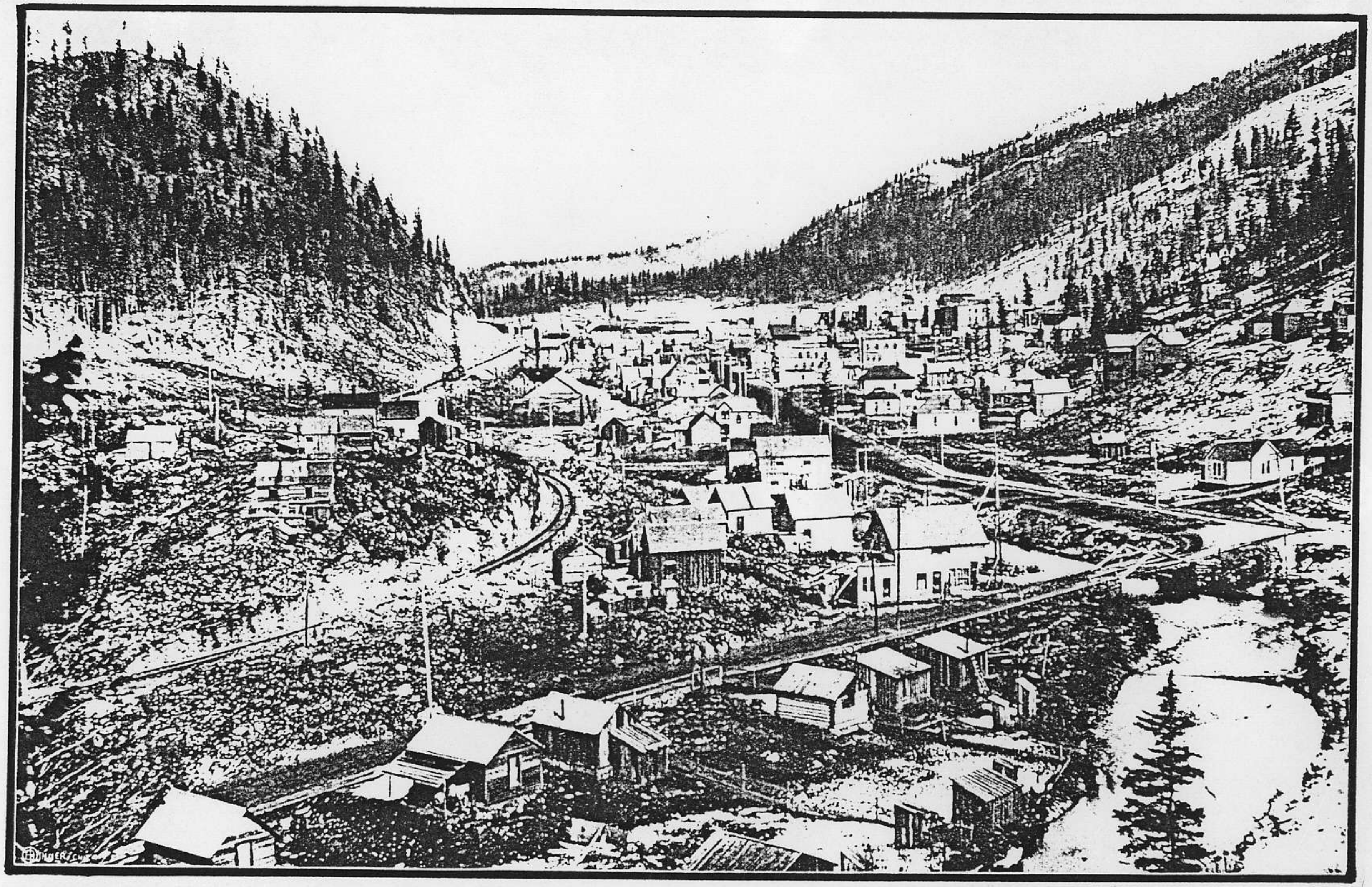
By: CME Consulting Ltd.



TOWN OF GREENWOOD, KETTLE RIVER M. D.—LOOKING NORTH.

RAINBOW TAM O'SHANTER PROPERTY

SUMMARY

1. LARGE CU-AU PORPHYRY SYSTEM
   1.4 km x 1.6 km

2. CONCENTRIC MINERALOGIC ZONATION

3. CONCENTRIC ALTERATION ZONATION

4. STRONG CU-AU SOIL GEOCHEMICAL RESPONSE

5. BROAD, ROUGHLY CONCENTRIC ZONES OF HIGH CHARGEABILITIES (to > +35 mV/V) WITH COINCIDENT RESISTIVITY LOWS (to <100 ohm-m)

6. HIGH CU-AU SURFACE SAMPLE GRADES (to >7000 ppm CU and >3500 ppb AU)

7. HIGHER SURFACE SAMPLE GRADES ASSOCIATED WITH COINCIDENT CHARGEABILITY AND MAGNETIC HIGHS

8. STRONG CU-AU CORRELATION

9. GEOMETRIC RELATION TO KNOWN DEPOSIT TYPES MINED IN AREA