GEOLOGICAL MAPPING, LITHOGEOCHEMICAL SAMPLING, TRANSIENT ELECTROMAGNETICS, AND DIAMOND DRILLING REPORT

CHU CHUA PROJECT

Chu Chua Group A
Chu Chua Group B
Chu Chua Group C
Chu Chua Group D

Kamloops Mining Division
NTS 92P/8E
Lat 51°22'N Long 120°04'W

Owner/Operator
Minnova Inc.
4th Floor, 311 Water Street
Vancouver, B.C.

Chris Wild
December, 1989

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1. INTRODUCTION

1.1 General

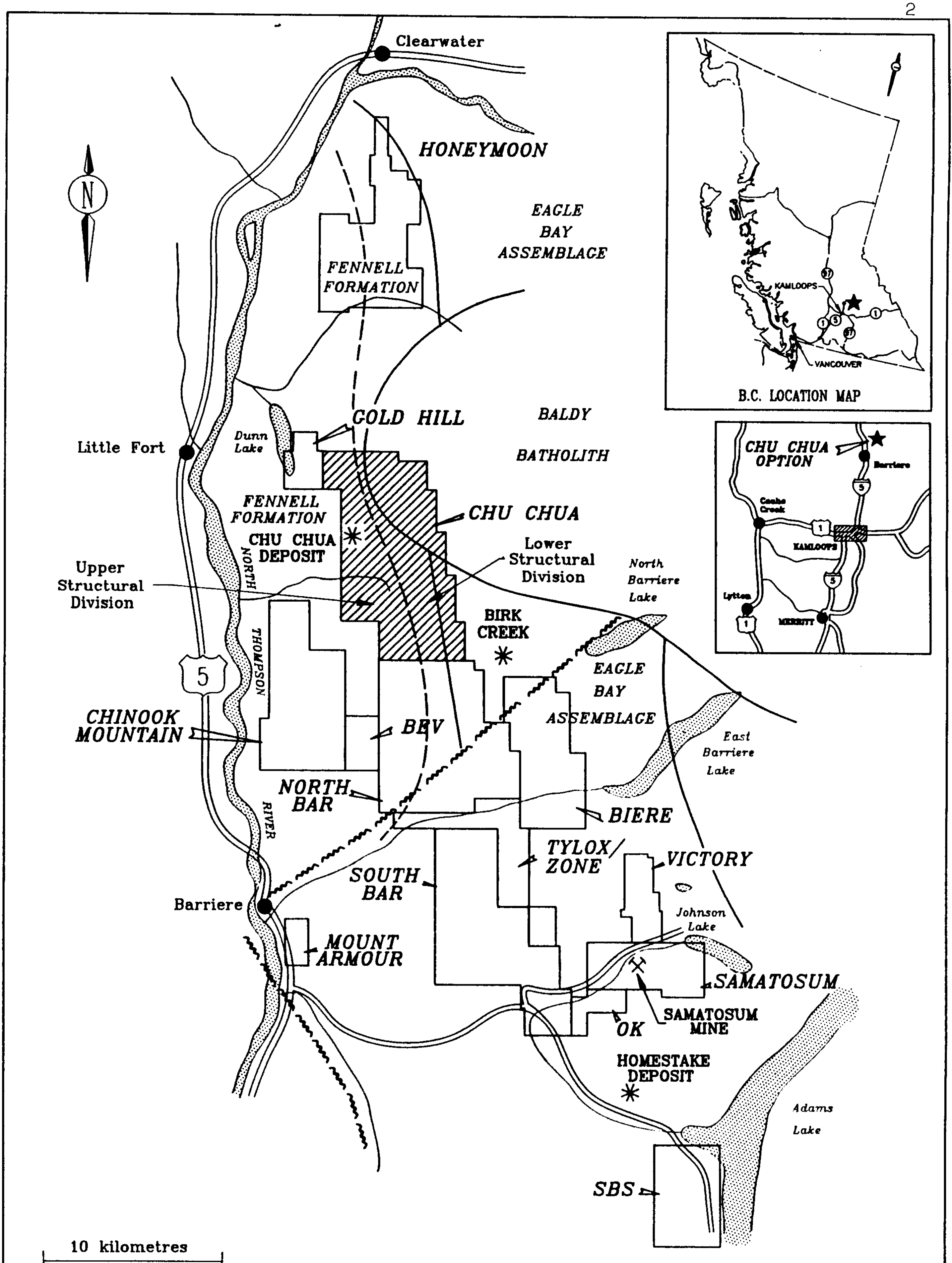
The main focus of exploration on the Chu Chua property is a cuperiferous pyritic massive sulphide with minor amounts of Au, Ag, Zn, Pb, and Co. Ore reserves are currently 1 million tonnes grading 3.1% copper. The property was optioned by Minnova Inc. in August, 1985 from Pacific Cassiar Ltd., Quinterra Resources Inc., and Vestor Explorations Ltd. This report covers the Chu chua Group A, B, C, and D mining claims totalling 96, 88, 92, and 88 units respectively. The 1989 work program on this group included geological mapping, lithogeochemical sampling, a transient electromagnetic survey, and diamond drilling.

1.2 Location and Access

The Chu Chua property lies approximately 24 kilometres northeast of Barriere, B.C. on the western flank of Green Mountain (Figure 1). From Barriere, access is easiest along the paved Barriere Lakes Road to the North Barriere Lake and Birk Creek logging roads. A 4x4 dirt road from the end of the Birk Creek road provides access to the Chu Chua deposit and to the Chu Chua North grid, immediately to the north.

1.3 Topography and Climate

The claims stretch from the relatively gentle Chu Chua and Birk Creek valleys in the south to the rugged steep terrain around Cowell and Dunn Creeks and around Green Mountain. Elevations range from 900m to 2200m. Vegetation varies from clear cut, thick second growth, and dense spruce, pine, and cedar stands at lower elevations, to subalpine and alpine above 1800m. The climate is moderate to extreme with temperatures ranging from -30°C to +35°C. Precipitation is moderate; snow can be expected from October to June. Snow is present at higher elevations well into July.



ADAMS/BARRIERE CHU CHUA OPTION

LOCATION MAP

MINNOVA Inc. DRH/sg FIGURE 1 SEPTEMBER 1989

1.4 Property and Ownership

All pertinent claim information for Chu Chua Groups A-D is summarized below. Figure 2 shows claim locations and configurations.

Group	Claim	Units	Record No.	Expiry Date
A	CC1	16	1154	Dec 29, 1998
	CC2	4	1373	Dec 29, 1998
	CC4	9	1423	Oct 10, 1992
	CC5	20	1455	Oct 24, 1990
	CC6	9	1456	Oct 24, 1989
	CC7	20	1457	Oct 24, 1990
	CC8	6	1424	Oct 10, 1991
	CC9	12	1458	Oct 24, 1989
		96		
B	CH2	20	1462	Oct 24, 1989
	CC10	20	1459	Oct 24, 1991
	CC11	20	1460	Oct 24, 1989
	CC1	16	1154	Dec 29, 1989
	CC9	12	1458	Oct 24, 1989
		88		
C	CH1	20	1461	Oct 24, 1991
	CH4	20	1464	Oct 24, 1991
	CC11	16	1471	Oct 24, 1991
	CC1	16	1154	Dec 29, 1998
	CC10	20	1459	Oct 24, 1991
		92		
D	CC1	16	1154	Dec 29, 1998
	CC10	20	1459	Oct 24, 1991
	CC11	20	1460	Oct 24, 1989
	CH2	20	1462	Oct 24, 1989
	CH9	12	1469	Oct 24, 1989
		88		

1.5 History

A massive sulphide was discovered on the CC1 claim in 1978 by Craigmont Mines Ltd. Between 1978 and 1984, they conducted linecutting, soil geochemistry, geological mapping, VLF-EM, magnetometer, and HLEM surveys over various parts of the property. Over 6000 meters of diamond drilling was completed and a Dighem AEM survey was flown over the area in 1979. Minnova Inc. (Corporation

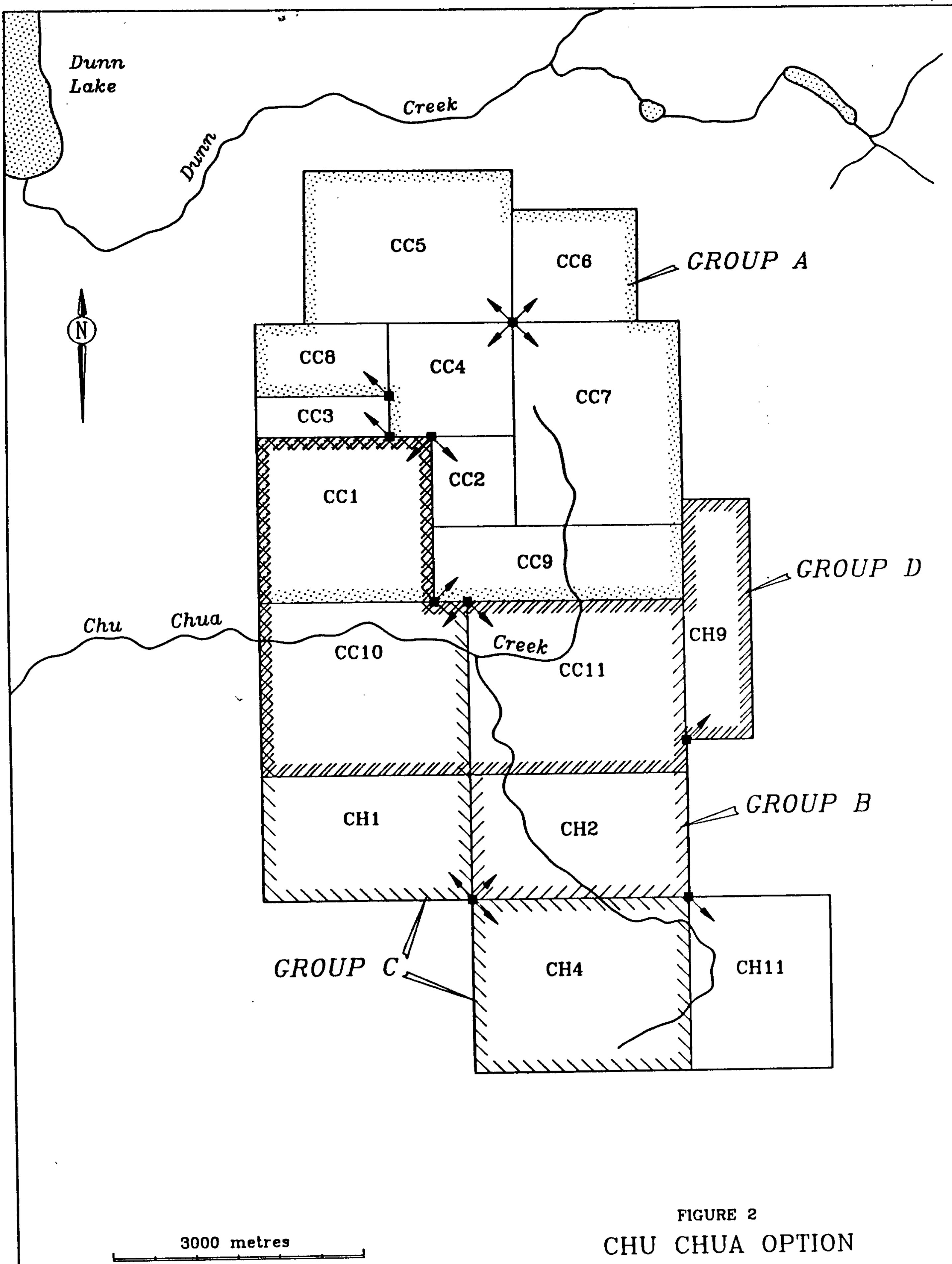


FIGURE 2

CHU CHUA OPTION

CLAIM CONFIGURATION

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DECEMBER 1989

Falconbridge Copper) acquired the property in August, 1985 and has continued with diamond drilling, soil sampling, rock geochemistry and various geophysical surveys to the present. In fall, 1988, 13 NQ diamond drillholes totalling 1151.6 meters were completed to better define near surface ore reserves (Blackadar, 1989).

1.6 Work Done

During the 1989 field season, an additional 21 diamond drillholes totalling 1662.5m were completed in the deposit area. Also, approximately 42.1 kilometres of grid cut and covered by HLEM survey in 1988 (Lear, 1989), was mapped and 300 rock samples collected for geochemical analysis. Subsequently, a grid over the deposit area was re-established and a transient electromagnetic survey was conducted by Quantech Consulting Inc. of Toronto.

2. GEOLOGY

2.1 Regional Geology

The Chu Chua property lies along the western margin of the Omineca Belt in south central B.C., in a low grade, structurally complex belt of Paleozoic volcanic and sedimentary rocks. Rocks of the Fennell Formation and the neighbouring Eagle Bay Assemblage have been divided into four structural slices separated by southwesterly directed thrust faults (Schiarizza and Preto, 1987). The lowest structural division contains Fennell rocks thrust over Eagle Bay clastic rocks (EBP). These rocks stretch north and west of Clearwater southward across and parallel to the North Thompson River to Barriere (see Figure 3).

The Fennell Formation, divided into upper and lower structural divisions, is cut by imbricated thrust faults that developed prior to metamorphism and large scale deformation. A thrust fault is thought to separate these two divisions based on conodont ages in chert beds in both the Upper and Lower Fennell (Schiarizza and Preto, 1987). Conodont ages range from Early Mississippian to Middle Permian in both divisions. Metamorphic grade is lower greenschist but many primary textures in both volcanic and sedimentary rocks are preserved. Structural deformation is not readily evident in outcrop but regional structures indicate a complex deformational history.

Schiarizza and Preto (1987) suggest that Fennell rocks are extensively imbricated, developing east verging, pre-metamorphic mesoscopic folds during tectonic emplacement. They further suggest that the variation in stratigraphic facies across these imbricate thrusts determines movement in the order of tens or hundreds of kilometres. Synmetamorphic deformation includes southwesterly directed folds and thrust faults that developed as the Chu Chua Fennell rocks became part of the west limb of the Slate Creek Anticline. The intrusion of the Raft and Baldy Batholiths in the late Cretaceous constituted a major late tectonic event. West trending folds, kinks and crenulation lineations developed near these intrusions but the contact metamorphic aureole

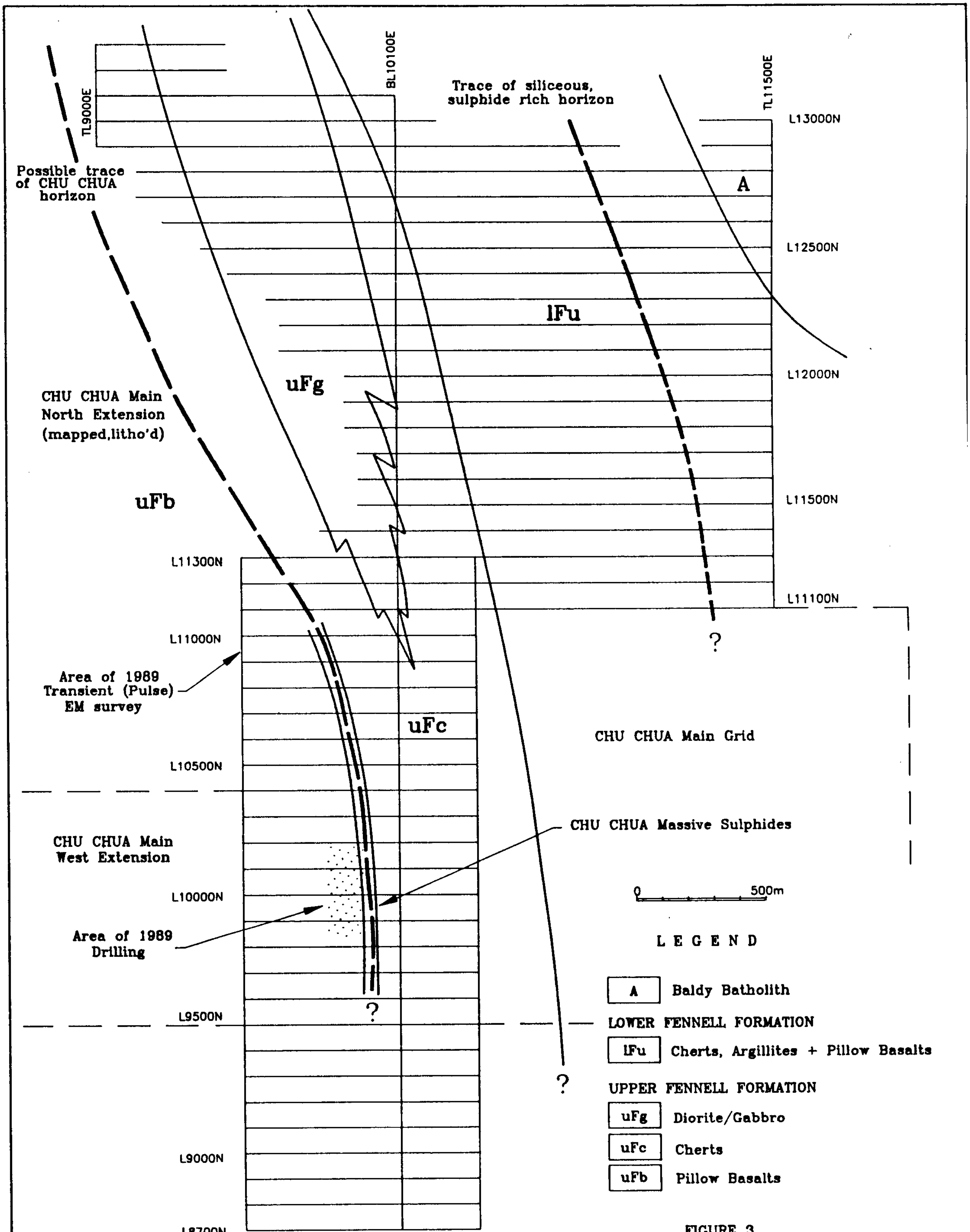

FIGURE 3

CHU CHUA OPTION
COMPILATION MAP

MINNOVA Inc.

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SEPTEMBER 1989

of the Baldy Batholith is limited to a few hundred meters. Finally, northeast and north trending faults developed in Tertiary times. One, the Barriere River Fault, appears to truncate the Fennell Formation at Barriere.

The Upper Fennell consists of massive and pillowed basaltic flows intruded by numerous dykes, sills, and discordant stocks of gabbro. Thin, fairly continuous chert and chert/argillite horizons are scattered throughout the sequence. Pillows and hyaloclastic breccias together with chert and minor argillite show this sequence to be submarine. Major element classification suggests these basalts are tholeiitic and AFM plots show a tholeiitic to calc-alkaline composition (Schiarizza and Preto, 1987). Similarly, discriminant diagrams using immobile elements Zr, Y, and Ti suggest these rocks are subalkaline and tholeiitic, most likely related to an ocean floor spreading centre. Aggarwal (1982) argued that immobile elements may have been mobile and that microphenocrysts of augite, amphibole (kaersutite) and Fe-Ti oxides suggest a more alkalic chemistry. He also suggests that Pb isotopes are more radiogenic than mid ocean ridge basalts and more indicative of an ocean island or seamount environment. It seems likely, however, that the Upper Fennell basalts with tholeiitic to transitional compositions formed in a marginal basin.

The Lower Fennell consists of basalts and gabbros very similar to those of the Upper Fennell, as well as chert, argillite, siltstone, sandstone, intermediate to felsic tuffs, quartz-feldspar porphyry domes, and intraformational conglomerate. These rocks are interpreted to be basinal with an ocean floor spreading centre and many off ridge volcanic vents present nearby. Sedimentary rocks dominate farther east, away from these volcanically active centres. Intraformational conglomerate indicate the presence of a high energy environment partially produced by an active tectonic regime.

2.2 Chu Chua North Geology

The north part of the Chu Chua property is underlain by Upper Fennell basalt and gabbro to the west, and mixed basalt, gabbro, and sediments to the east. These rocks strike approximately 340° and generally dip steeply to the west. Deformation features are rare in outcrop. The northeast corner of the property is underlain by Baldy granodiorite to quartz monzonite.

The contact between the upper and lower divisions of the Fennell is uncertain. Schiarizza and Preto (1987) place this contact along an assumed thrust fault on the west side of a large gabbro sill. However, mapping failed to locate any sign of faulting. Furthermore, based on lithology, a more practical division can be made at the top of a predominantly sedimentary sequence 500 meters east of the sills eastern contact.

The principal rock types are as follows (see Maps 1&2):

Basalt (1.1/1.2): Basalt forms massive and pillowed flows, occasionally brecciated, that are typically aphyric to weakly porphyritic with augite, hornblende (kaersutite?), and plagioclase phenocrysts. Pyrite and pyrrhotite content is typically 1-2%. There is a gradation in grain size between aphyric basalt and intrusive gabbroic sills, particularly in the southwest portion of the grid.

Diorite/Gabbro (4.1/4.2): The west side of the grid is dominated by a coarse grained gabbroic sill over 600 meters thick. This sill is apparently the same one that hosts the Windpass and Sweethome gold quartz veins, 4-5 kilometres to the north. This sill has a fairly uniform composition very similar to that of the host basalts. Two large sills are mapped in the Lower Fennell also with basaltic compositions. A hornblende porphyry is mapped immediately hangingwall to an anomolous rusty siliceous unit.

Granodiorite/Quartz Monzonite (5.3/5.4): Coarse grained and equigranular Baldy intrusive rocks form prominent knobs and numerous boulder trains in the northeast part of the grid. A contact metamorphic aureole extends through most of the east half of the grid. Sedimentary rocks show a fine grained brownish recrystallized texture while greenstones are dark grey and fine grained.

Chert/Chert Breccia (6.1/6.2): Chert varies from pale grey to green to black, is occasionally well bedded, and is usually fractured, brecciated, and mixed with other sediments. Pale, bedded chert forms lenses within basalt while dirty, disrupted cherts are more common in sedimentary sequences.

Argillite (6.3): Argillite is black, sometimes fissile, usually cherty and finely interlayered with chert beds and coarse clastic horizons.

Siltstone/Greywacke (6.4,6.6): Medium grained clastic beds are thin and gradational within chert/argillite. Bedding features and grain size are often obscured by thermal metamorphic effects. However, these units are often poorly sorted, usually dark greenish grey to black, and often contain cherty clasts which make them very similar to conglomerate.

Conglomerate/Polylithic Breccia (6.7/6.9): Most of the clasts within this poorly sorted unit are chert with minor argillite and greenstone. These rocks occur close to the intrusive contact obscuring many details; hence, there may be overlap with chert breccia/argillite units.

2.3 Lithogeochemistry

2.3.1 Analytical Methods

Rock samples were collected from most mapped outcrops generally at a 25 meter spacing along grid lines. A total of 300 lithogeochemical samples were collected and sent to Min-En Laboratories of North Vancouver, B.C. for analysis. All samples were analyzed for all major elements plus eight trace elements (Ag, As, Ba, Cu, Pb, Sb, Zn, Au). A standard fusion process with ICP finish was applied for all major elements. Au was determined by wet geochemistry while aqua regia digestion with an ICP finish was used for other trace elements. All results are listed in Appendix III.

2.3.2 Discussion

Major element analysis is useful in determining variations within certain rock types in order to pick out locations of significant alteration. Among the most useful for Chu Chua north geology are SiO_2, TiO_2, Na_2O, and K_2O. Trace elements give a count of anomalous metal contents in these rocks. The most useful of these are Ba and Cu. Plots of the above elements with grid lines and geologic contacts are included. Results for all elements are appended.

Al_2O_3: Generally, Al_2O_3 is low in sediments reflecting their cherty nature (2-6%). However, some more detrital argillites and siltstones have higher Al_2O_3. Mafics have mean content of 14.8% with a standard deviation of 2.78%.

BaT: Mafics contain little total Ba, less than 0.1%. Sediments contain values up to 1% particularly near a mineralized chert horizon in the northeast part of the grid.

CaO: Sediments contain low CaO with occasional highs in more detrital rocks. Values are very low within the contact metamorphic aureole. Mafics show some variation; the mean is 8.7%, the standard deviation is 2.58%.

Fe_2O_3: Iron content is variable in sediments but usually between 2-4%. In mafics, the mean is 10.29% and the standard deviation is 2.11%. Values are noticeably lower in the centre of the large gabbroic sill.

K_2O: Potassium is very low throughout most of the mafics. Anomalously high values are present in mafics immediately hangingwall to the siliceous horizon. Some footwall mafics and sediments are also anomalous.

MgO: The mean in mafic rocks is 6.25%, the standard deviation 2.09%. MgO shows a fairly random pattern, although values are low in cherty sediments (0.36-4%).

MnO_2: Manganese content is generally low; 0.20% in mafics, 0.05% in most sediments. There is very small range of values in mafic rocks but values in chert range up to 1.91% within the siliceous horizon.

Na_2O: Mafics show a good normal distribution with a mean of 3.35% and standard deviation 1.14%. Sodium depletion can be seen in mafics footwall to the siliceous horizon. Sediments within the siliceous horizon are also depleted. Sodium enrichment is possible in some hangingwall rocks.

P_2O_5: Values show little variation, particularly in mafics. More variation is seen in sediments; depleted values are seen in within the siliceous horizon.

SiO_2: In mafics, SiO_2 shows a tight normal distribution with a mean of 51.42% and a standard deviation of 7.83%. These values include a number of samples now believed to be hornfelsed sediments. Sediments show a wide variation; undiluted cherts are easily distinguished. Silica values are slightly higher hangingwall to the siliceous horizon.

TiO_2: In mafics, TiO_2 shows a slightly skewed normal distribution with a mean of 1.59% and a standard deviation of 0.47%. Values are more variable in gabbro sills.

S: Sulphur content is generally low. Elevated values reflect higher sulphide contents in the siliceous horizon.

Ag: Silver values are elevated in the 2.2 - 3.8 ppm range west of the main gabbro sill. Values are much lower within the gabbro sill. East of the sill, silver values are even lower. Values range from 0.3 - 2.3 ppm in the vicinity of the siliceous horizon. Overall, the mean is 1.39 and the standard deviation is 0.76.

As: Arsenic anomalies are scattered in the siliceous horizon and in a package of mafic flows hangingwall to the siliceous horizon. Values range up to 663 ppm in a good log normal distribution.

Ba: Barium values range up to 9433 ppm in the siliceous horizon and in the immediate footwall, generally within cherty sediments. Values are also elevated in mafics adjacent to chert horizons. Barium has a log normal distribution with a mean of 2.28 and a standard deviation of 0.63.

Cu: Copper anomalies are generally restricted to the siliceous horizon and immediate footwall and hangingwall rocks. Mafic rocks show several scattered anomalies. Copper shows a bimodal log normal distribution in mafic rocks with a mean of 1.50 and a standard deviation of 0.42.

Pb: Lead values show a normal distribution with a mean of 25.15 ppm and a standard deviation of 10.67 ppm. Anomalous values are scattered in the hangingwall of the siliceous zone. Two anomalies are 362 ppm and 228 ppm.

Sb: Antimony anomalies are rare. Three lie in and above the siliceous horizon. One 46 ppm anomaly lies along a chert-basalt contact.

Zn: Zinc anomalies are scattered throughout sediments in the Lower Fennell. The mean is 53.88 ppm and the standard deviation is 22.86 ppm.

3. DIAMOND DRILLING

3.1 Program Summary

Twenty-one diamond drillholes totalling 1662.5 metres were drilled into the Chu Chua massive sulphide deposit during May and June, 1989. The program further delineated ore reserves, particularly near surface reserves in copper and gold. the core was logged, sulphide intervals were split and assayed, and much of the hangingwall and footwall sections were sampled for lithogeochemical analysis. All analyses were done by Min-En Labs of North Vancouver. All drillcore is currently being stored at Minnova's Barriere warehouse.

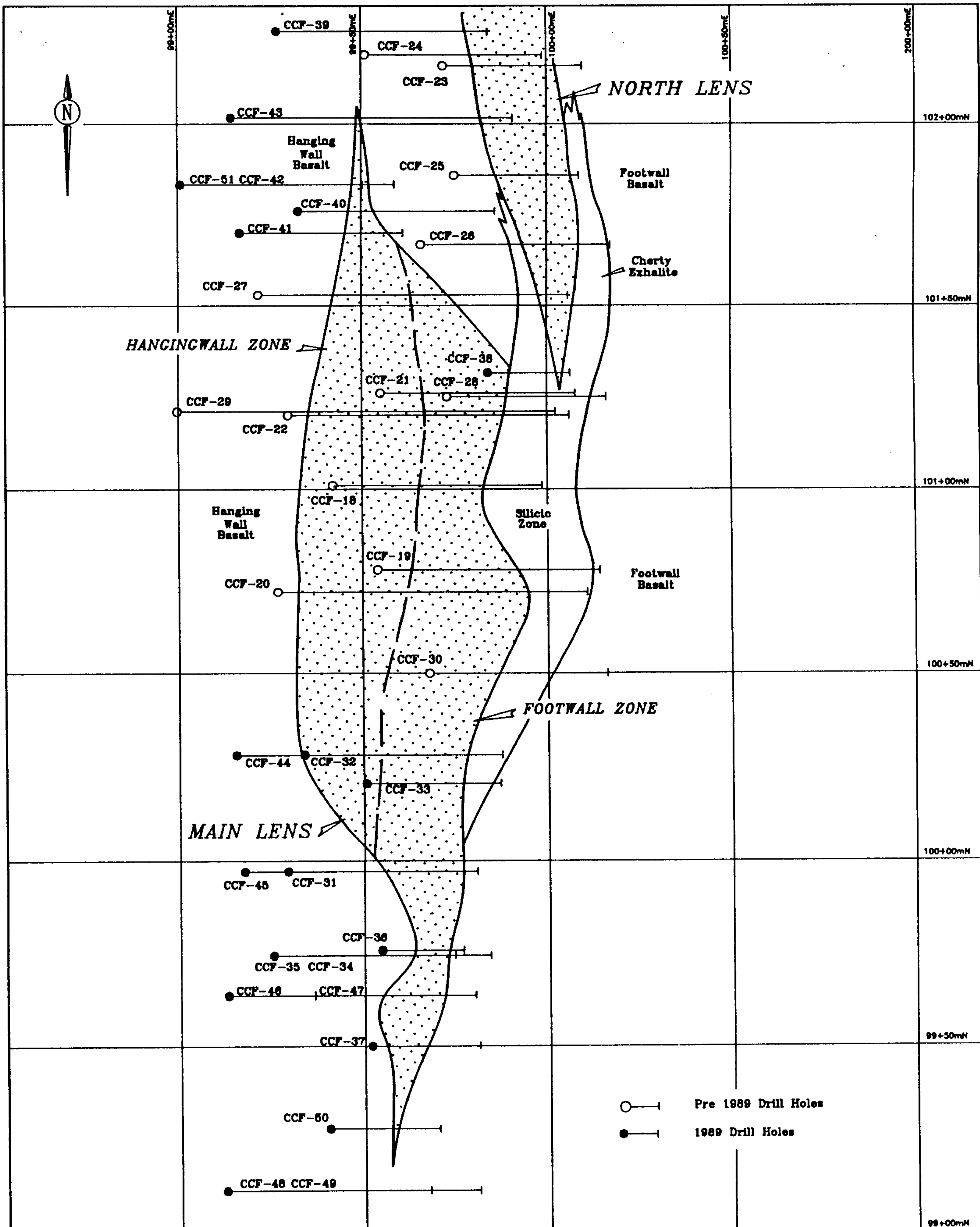
3.2 Geology of Chu Chua Deposit

3.2.1 General

The Chu Chua deposit consists of two major and several minor sulphide lenses hosted by massive and pillowed green basalt of the Upper Fennell Formation. Near surface ore reserves are pegged at approximately one million tonnes grading 3.1% copper. The lenses are oriented along a north-south trend dipping from vertical to very steeply west. The principal axes of the lenses appear to plunge gently to the south. The strike extension of near surface mineralization is approximately 300m and total thicknesses for the mineralized zones range up to 80m. Massive sulphide has been intersected as far as 350m below the surface. All 1989 drillholes were drilled east from hangingwall basalts through massive sulphides into a silicic or stockwork zone and finally into unaltered footwall basalts (Figures 4 and 5).

3.2.2 Hangingwall Basalt

The hangingwall to massive sulphide consists of unaltered massive and pillowed basalts. Pillow selvages and triple junctions and interpillow hyaloclastic breccias are easily identified. Most of the basalt is aphyric although faint green phenocrysts of augite and/or amphibole and pale grey phenocrysts of albitized plagioclase are discernible in some sections. Thin section and microprobe work



20 metres

FIGURE 4

CHU CHUA OPTION

DRILL HOLE PLAN WITH SURFACE GEOLOGY

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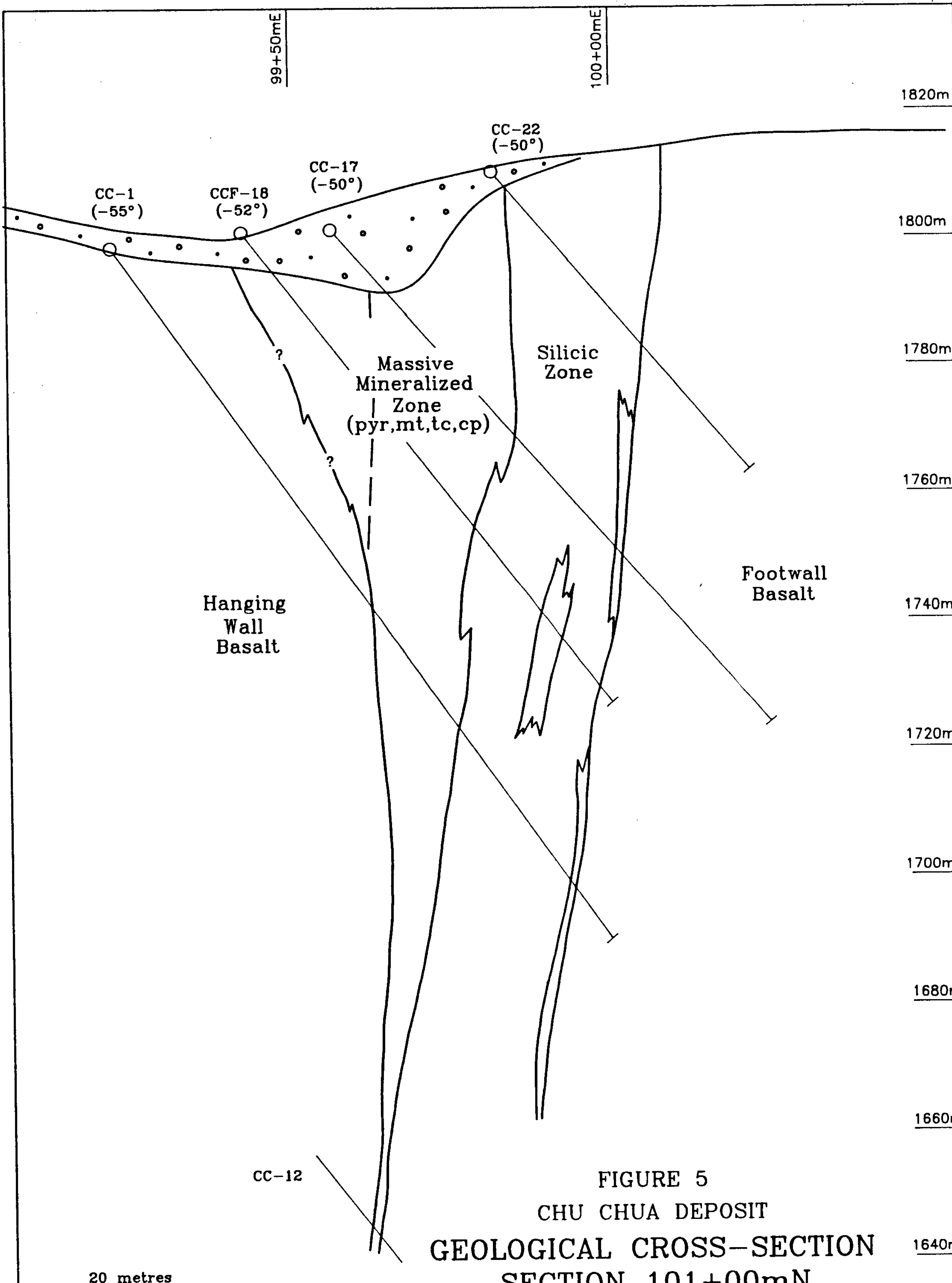

FIGURE 5
CHU CHUA DEPOSIT
GEOLOGICAL CROSS-SECTION
SECTION 101+00mN
(CC-1,CCF-18,CC-17,CC-22)

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DWB/sg (Blackadar 1988) APRIL 1989

by Aggarwal (1982), has shown the amphibole to be kaersutite which occurs with and sometimes replaces augite. Both kaersutite and augite are often altered to actinolite and sphene, characteristic of lower greenschist metamorphic facies. These basalts are often bleached to a very pale grey and cut by abundant quartz and calcite stringers. Sulphide content increased toward the deposit but the lower contact is very abrupt with only occasional massive sulphide clasts caught up in the base of the overlying flows.

3.2.3 Massive Sulphides

Massive sulphides lie immediately below a very sharp contact with the hangingwall basalts. Pyrite makes up approximately 90% of the massive sulphide, often occurring as coarse anhedral grains displaying annealed textures. Chalcopyrite is the main ore mineral occurring as massive streaks up to 25cm thick, as small inclusions in both pyrite and magnetite, and as fracture fillings and interstices in coarse granular pyrite. These textures suggest a large degree of remobilization. Thin section work (Manley, 1988 -unpublished paper), has shown good triple junctions in granular pyrite with chalcopyrite often occurring in the interstices, as tiny anhedral blebs (50-200 micrometres), and as inclusion trails inside pyrite grains. Megascopically, sections of massive sulphide show good rolled textures and brecciation, indicating either primary collapse structures or, more likely, tectonic activity.

Other economic minerals identified in drillcore include covellite, chalcocite, sphalerite and magnetite. Cubanite ($CuFe_2S_3$) and stannite are also present (Aggarwal, 1982). Covellite occurs in chalcopyrite-rich sections as fracture fillings. Chalcocite occurs as discrete grains within either pyrite or chalcopyrite (Manley, 1988). Sphalerite and possibly trace amounts of galena occur as fine grained and massive blebs usually but not exclusively with copper mineralization. Magnetite content increases toward the footwall occurring as subhedral grains possibly mixed with or replacing pyrite. The matrix is likely quartz and barite. Other metals present in the ore zone include gold (commonly 1 gpt), silver (commonly 15-30 gpt), cobalt (310-475 ppm), and trace amounts of tin (stannite), platinum, and palladium (Aggarwal, 1982).

3.2.4 Talc-Magnetite

Within the massive sulphide lenses lie several lenticular bodies of talc-magnetite. These "sublenses" have the same general shape and orientation as the main sulphide lenses but often appear to cut across the sulphides from hangingwall to footwall. Many sections show two and even three distinct parallel zones of talc and/or magnetite mineralization. Thicknesses range up to 25m but 5-10m is more the norm and the southernmost lens has a down plunge extension of at least 200m.

The talc-magnetite zones can be further broken down into sulphide-magnetite, massive magnetite, talc-magnetite, and massive talc sections, usually in that sequence from hangingwall to footwall. There is much mixing of talc and magnetite but sulphide seldom occurs with talc. Aggarwal (1982) suggested that these rocks are chemical precipitates showing a sequence of deposition at 300°C and increasing fO_2 to be:

talc --> talc + magnetite --> magnetite + pyrite --> pyrite + cpy.

This sequence agrees well with observed mineral assemblages. Furthermore, most of these rocks are fine grained and massive, with few obvious replacement textures.

Alteration of footwall and sulphide horizons also explains the presence of talc-magnetite sequences. Polished section work (Manley, 1988) clearly shows magnetite replacing pyrite in the sulphide-magnetite zone gradually overwhelming the sulphide component to form the massive magnetite zone. Talc is intimately associated with magnetite forming a fine grained matrix. The embayed and pitted nature of the magnetite in the talc-magnetite zone may indicate a further alteration eventually to a massive talc horizon. This alteration crosscuts portions of the massive sulphide lenses and helps to explain the position and variability in the zonation of the talc-magnetite horizon.

3.2.5 Silicic Rocks

A unit of very silicic rocks lies footwall to much of the Main and North Lenses and is best developed between them. They are typically 80% SiO_2, 0.3% TiO_2, depleted in Na_2O and CaO, and enriched in Ba. Al_2O_3, Fe_2O_3, and MgO are consistently lower than unaltered basalt. Thin sections show the mineralogy to be mainly quartz with fine grained phengitic mica, minor chlorite, pyrite, and chalcopyrite (Aggarwal, 1982).

In drillcore, these silicic rocks appear to be intensely silicified basalts. They have a mottled, altered appearance often with sharp colour and textural contrasts reminiscent of block boundaries, pillow selvages, and basalt breccias. Fracturing and local brecciation is common, chlorite occurs as fracture stringers. Immediate footwall zones often host pyritic stockworks associated with increased quartz-carbonate veining. Similar silicification occurs in later quartz vein selvages that cut an unaltered basaltic dyke within the silicic pile. Minor banding showing warping and truncation of bands is noted occasionally and may indicate the presence of chert horizons within the basalt package.

Aggarwal (1982) suggested that these silicic rocks are primary chemical precipitates, based on lower immobile element compositions and their fine grained nature. However, some original textures have been retained while others have been obliterated by intense quartz flooding. The presence of these rocks only between the two main massive sulphide lenses indicates that a very restricted depression existed to pool a silicic sinter or that this zone constituted an area of intense hydrothermal alteration of footwall basalt.

3.2.6 Footwall Basalt

Footwall alteration in the south part of the Main Lens and all of the North Lens is less than 2 meters and in places appears to be absent. The contact with generally unaltered footwall basalt is sharp to transitional over a few meters. Minor brecciation and quartz-pyrite stockworks die out rapidly with pyrite content down to 1-2%. The basalt becomes less bleached, increasingly competent, and primary structures such as pillow selvages become more apparent. Lower footwall basalt is virtually identical to hangingwall basalt.

3.2.7 Basalt Dykes

The deposit area is intruded by several basaltic dykes and sills. These are most easily seen cutting massive sulphide and silicic zone rock between the North and Main lenses. One dyke cuts the thick silicic package on section 102+25N in CCF-39 with a drill thickness of 12.5 meters. The orientation and continuity of this dyke is uncertain although a possible plane of failure is seen in basalt breccias in the silicic zone 25 meters to the south. Two narrow dykes were intersected in the same sequence 50 meters to the south suggesting a north-south trend. A flat lying dyke appears on section 101+25N at the top of holes CCF-28 and CCF-38. Its extent and orientation in unknown. Another possible dyke lying in the silicic zone between the North and Main lenses appears to dip vertically with an untested strike to the south. South of 100+50N, several conformable basalt flows and sills lie between fingers of massive sulphide.

3.3 Assays

3.3.1 Procedure

All massive and semi-massive sulphide and much talc-magnetite material was collected and assayed for copper, lead, zinc, silver, and gold. Specific gravities were also measured for every assay sample. Sampling intervals were chosen between 0.3 and 1.6m as dictated by visual estimates of grade. Drillcore was split or sawn in half, bagged and tagged and sent to Min-En Labs of North Vancouver for assay. A total of 329 samples were collected and assayed. All data is listed in Appendix V and with drillogs in Appendix IV.

3.3.2 Discussion

Assay results for the deposit reflect the streaky nature of chalcopyrite mineralization within massive pyrite. Highest copper grades are generally found in footwall and hangingwall zones within the massive sulphide. However, high grade streaks appear at any stratigraphic level of the massive lenses. High grade zones appear to be somewhat continuous but individual chalcopyrite streaks probably are not. Grades within high grade zones are also extremely variable depending on sample lengths, attention to mineralization by the sampler, and the amount of copper present from one hole to the next. Higher values of other metals, zinc, silver, and gold, often coincide with high grade copper values.

3.4 Lithogeochemistry

3.4.1 Analytical Methods

Continuous rock samples were taken at 1-10 meter intervals (usually 3 - 5 meters), according to geology, throughout the hangingwall, silicic, and footwall zones. Portions of talc-magnetite were also sampled. A total of 200 lithogeochemical samples were collected and sent to Min-En Laboratories of North Vancouver, B.C. for analysis. All samples were analyzed for all major elements plus eight trace elements (Ag, As, Ba, Cu, Pb, Sb, Zn, Au).

A standard fusion process with ICP finish was applied for all major elements. Au was determined by wet geochemistry while aqua regia digestion with an ICP finish was used for other trace elements. All sample data is provided in Appendix V.

3.4.2 Discussion

In hangingwall basalts several major element trends are significant. Total barium increases dramatically over tens of meters toward the deposit and is the strongest indicator of the sulphide body. CaO shows a subtle and sometimes substantial decrease in the immediate hangingwall. Na_2O becomes rapidly depleted while K_2O becomes modestly enriched within a few meters of the sulphide contact. Sulphur increases sharply and Fe_2O_3 increases marginally as pyrite and magnetite contents increase in the hangingwall. Trace elements, particularly copper, lead, zinc, and silver, show relatively high background levels with occasional spiked anomalies. Arsenic and antimony show broad though modest increases. Gold anomalies are rare.

Silicic rocks show wide ranges in both major and trace element contents, reflecting varying degrees of silicification. Al_2O_3, MgO, SiO_2, and TiO_2 numbers show this variability. Total barium exhibits sharply elevated values at or near the mineralized horizon but wide ranges of values elsewhere. CaO, Na_2O, and MnO_2 are all strongly to moderately depleted with only CaO showing any increases away from the horizon. K_2O shows dramatic increases near the ore horizon while Fe_2O_3 and S show much more subtle increases. P_2O_5 shows more variability in silicic rocks than in unaltered basalt but no real trends. Trace elements such as copper, zinc, lead and arsenic show elevated values throughout the silicic zone particularly near the sulphide horizons. Silver and antimony are very low with only occasional spot anomalies near sulphide zones. Gold anomalies are rare.

Geochemical trends seen in the hangingwall are generally reversed in the footwall. Al_2O_3, MgO, MnO_2, P_2O_5, SiO_2, and TiO_2 are all relatively constant. Total barium, K_2O, and S all decrease rapidly as visible footwall stockwork alteration diminishes Fe_2O_3 shows much variability in this transition zone. CaO and particularly Na_2O increase dramatically away from sulphide mineralization. Barium, copper, lead, and zinc concentrations decrease sharply while silver and arsenic concentrations increase as silicification weakens. Gold and antimony show only low background levels.

4. TRANSIENT ELECTROMAGNETICS

4.1 Survey Logistics

A transient electromagnetic survey was conducted over the Chu Chua deposit area by Quantech Consulting Inc. of Toronto between September 18 - 28, 1989. The survey was run on 24.3 line kilometres of grid re-established along the trend of the Chu Chua mineralized horizon (Figure 3). The baseline was recut from L87N to L113N and winglines were cut or recut from 9500E to 10400E at 100m intervals. A crew of three directed by geophysicist Sherwood Coulson conducted the survey.

The instruments used in this survey include the Geonics EM-37 transient EM system and the Polycorder data recorder. Two loops approximately 400m x 900m and one loop 400m x 800m were placed to the east of the target area from 104E to 108E. Lines were read east to west and the coil orientation was up and west. A complete description of the theory, instrumentation, computer software and hardware is included in a logistics report written by S.T. Coulson for Minnova Inc. (Appendix VI).

4.2 Results and Discussion

Anomalies interpreted on each line for both the in line horizontal and vertical components were compiled on a 1:2500 grid plan of the survey area. Anomalous trends were then plotted in an attempt to locate and identify continuations of the mineralized horizon and any potential parallel horizons.

The Chu Chua massive sulphide shows very strong anomalies in both horizontal and vertical components. The anomalies become very subtle south of L99N as the deposit quickly plunges in that direction. Massive sulphides have been intersected as far south as L97N at a depth of 400m. No promising targets are indicated south of L97N. Conductivities also diminish rapidly north of known massive sulphides at L103N. However, the horizon remains discernible, though very subtle on lines 104, 105, and 106N. The anomalies become somewhat more evident again of lines 107 - 113N trending off the grid at 340°. This trend appears to be shadowed by an even more subtle anomaly 150m to the west. The more easterly trend appears to present the best potential target for deeper Chu Chua style massive sulphides.

5. Conclusions

Work on the Chu Chua property is divided into three distinct areas, each at various stages of development.

The Chu Chua North grid is still at a reconnaissance level. Most of the area has been geologically mapped but follow up prospecting and mapping is necessary both on and off the grid. Soil sampling will be useful in better defining potentially mineralized targets. Diamond drilling will be required to fully test these targets.

The Chu Chua deposit, on the other hand, has been tested with approximately 8800 meters of diamond drilling since 1977. Open pittable reserves are pegged at 1 million tonnes grading 3.1% copper. Further shallow target diamond drilling especially south and north of recent drilling could result in a modest expansion of ore reserves. Meanwhile, production feasibility has still to be determined.

A transient electromagnetic survey (T.E.M.) run over the deposit and across possible north and south extensions has shown that any further mineralization is likely to be at depth. The best anomaly, describing a north extension of the Chu Chua horizon, should be followed up with soil sampling and geological mapping. Once the trend is accurately mapped, diamond drilling will be required to test the horizon at depth.

6. References

Aggarwal, P.K., 1982, Geochemistry of the Chu Chua Massive Sulfide Deposit, British Columbia: Unpublished M.Sc. Thesis, University of Alberta.

Aggarwal, P.K., and Nesbitt, B.C., 1984, Geology and Geochemistry of the Chu Chua Massive Sulfide Deposit, British Columbia: Econ. Geol., V. 79, pp. 815 - 825.

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Schiarizza, P., and Preto, V.A., 1987, Geology of the Adams Plateau-Clearwater-Vavenby Area: B.C. Ministry of Energy, Mines, and Petroleum Resources, Paper 1979-2, 88 pages.

APPENDIX I

Itemized Cost Statements

Itemized Cost Statement - Group A

Diamond Drilling

Drilling Costs

Leclerc Drilling Ltd., Beaverdell, B.C. Longyear S38 Drill: 502.6m @ $69.50/m	$34,930.70

Analytical

Min-En Labs, North Vancouver, B.C.	
99 assays for Cu, Pb, Zn, Ag, Au, and SG $37.50	$3,712.50
60 lithos for major and trace elements @ $23.50	$1,410.00

Personnel May 22 - June 30, 1989

D. Heberlein - Project Geologist 2 days @ $350/day	$700.00
C. Wild - Field Geologist 9 days @ $300/day	$2700.00
T. Clarke - Field Geologist 2 days @ $300/day	$600.00
A. Lowe - Core Splitter 7 days @ $150/day	$1050.00

Truck

9 days	@ $50/day	$450.00

Food and Accomodation

20 mandays	@ $25/day	$500.00

Drafting and Computer

3 days	@ $200/day	$600.00

Shipping

159 samples	@ 1.00 each	$159.00

Miscellaneous

Office Supplies, etc.	$25.80
	$46,838.00

Geological Mapping and Lithogeochemical Sampling

Personnel — July 21 - 27, 1989; August 1 - 18, 20 - 31, 1989; September 1 - 4, 1989

D. Heberlein - Project Geologist, 2 days @ $350/day	$700.00
C. Wild - Field Geologist, 40 days @ $300/day	$12,000.00
J. Watkins - Field Assistant, 20 days @ $150/day	$3,000.00
S. Noble - Field Assistant, 3 days @ $150/day	$450.00

Analytical

Min-En Labs, North Vancouver, B.C. 300 lithos for major and trace elements @ $23.50	$7050.00

Truck

40 days	@ $50/day	$2,000.00

Food and Accommodation

62 mandays	@ $25/day	$1,550.00

Drafting and Computer

8 days	@ $200/day	$1,600.00
		$28,350.00
		$75,188.00

Itemized Cost Statement - Group B

Diamond Drilling

Leclerc Drilling Ltd., Beaverdell, B.C. Longyear S38 Drill: 670.2m @ $69.50/m	$46,578.90

Analytical

Min-En Labs, North Vancouver, B.C.	
133 assays for Cu, Pb, Zn, Ag, Au, and S.G. @ $37.50	$4,987.50
81 lithos for major and trace elements @ 23.50	$1,903.50

Personnel May 22 - June 30, 1989

I.D. Pirie - Senior Exploration Geologist 1 day @ $500/day	$500.00
D. Heberlein - Project Geologist 1 day @ $350/day	$350.00
C. Wild - Field Geologist 16 days @ $300/day	$4,800.00
J. Holland - Core Splitter 8 days @ $150/day	$1,200.00

Truck

12 days @ $50/day	$600.00

Food and Accommodation

19 mandays @ $25/day	$475.00

Drafting and Computer

4 days @ $200/day	$800.00

Shipping

214 samples @ $1.00 each	$214.00

Miscellaneous

Office Supplies, etc.	$42.10
	$62,451.00

Itemized Cost Statement - Group C

Diamond Drilling

Drilling Costs

Leclerc Drilling Ltd., Beaverdell, B.C. Longyear S-38 Drill: 335.1m @ $69.50/m	$23,289.45

Analytical

Min-En Labs, North Vancouver, B.C. 66 assays for Cu, Pb, Zn, Ag, Au, and SG @ $37.50	$2,475.00
40 lithos for major and trace elements @ $23.50	$940.00

Personnel May 22 - June 30, 1989

D. Heberlein - Project Geologist 1 day @ $350/day	$350.00
T. Clarke - Field Geologist 7 days @ $300/day	$2,100.00
C. Wild - Field Geologist 1 day @ $300/day	$300.00
A. Lowe - Core Splitter 1 day @ $150/day	$150.00
J. Foffonoff - Core Splitter 3 days @ $150/day	$450.00

Truck

6 days @ $50/day	$300.00

Food and Accommodation

13 mandays @ $25/day	$325.00

Drafting and Computer

2 days @ $200/day	$400.00

Shipping

106 samples @ $1.00 each	$106.00

Miscellaneous

Office Supplies, etc.	$39.55
	$31,225.00

Transient Electromagnetics

Quantech Consulting Inc., Toronto, Ont. 24.3 line kilometres	$15,000.00
	$15,000.00
	$46,225.00

Itemized Cost Statement - Group D

Diamond Drilling

Leclerc Drilling Ltd., Beaverdell, B.C.	
Longyear S-38 Drill: 154.6m @ $69.50/m	$10,744.70

Analytical

Min-En Labs, North Vancouver, B.C.	
31 assays for Cu, Pb, Zn, Ag, Au, and SG @ $37.50	$1,162.50
19 lithos for major and trace elements @ $23.50	$446.50

Personnel May 22 - June 30, 1989

T. Clarke - Field Geologist 3 days @ $300/day	$900.00
C. Wild - Field Geologist 1 day @ $300/day	$300.00
D. Feller - Core Splitter 2 days @ $150/day	$300.00

Truck

3 days @ $50/day	$150.00

Food and Accommodation

4 mandays @ $25/day	$100.00

Drafting and Computer

1 day @ $200/day	$200.00

Shipping

51 samples @ $1.00 each	$51.00

Miscellaneous

Office supplies, etc	$43.50
	$14,400.00

APPENDIX II

Statement of Qualifications

<u>Statement of Qualifications</u>

I, Christopher J. Wild, of the City of Burnaby, British Columbia, do hereby certify that:

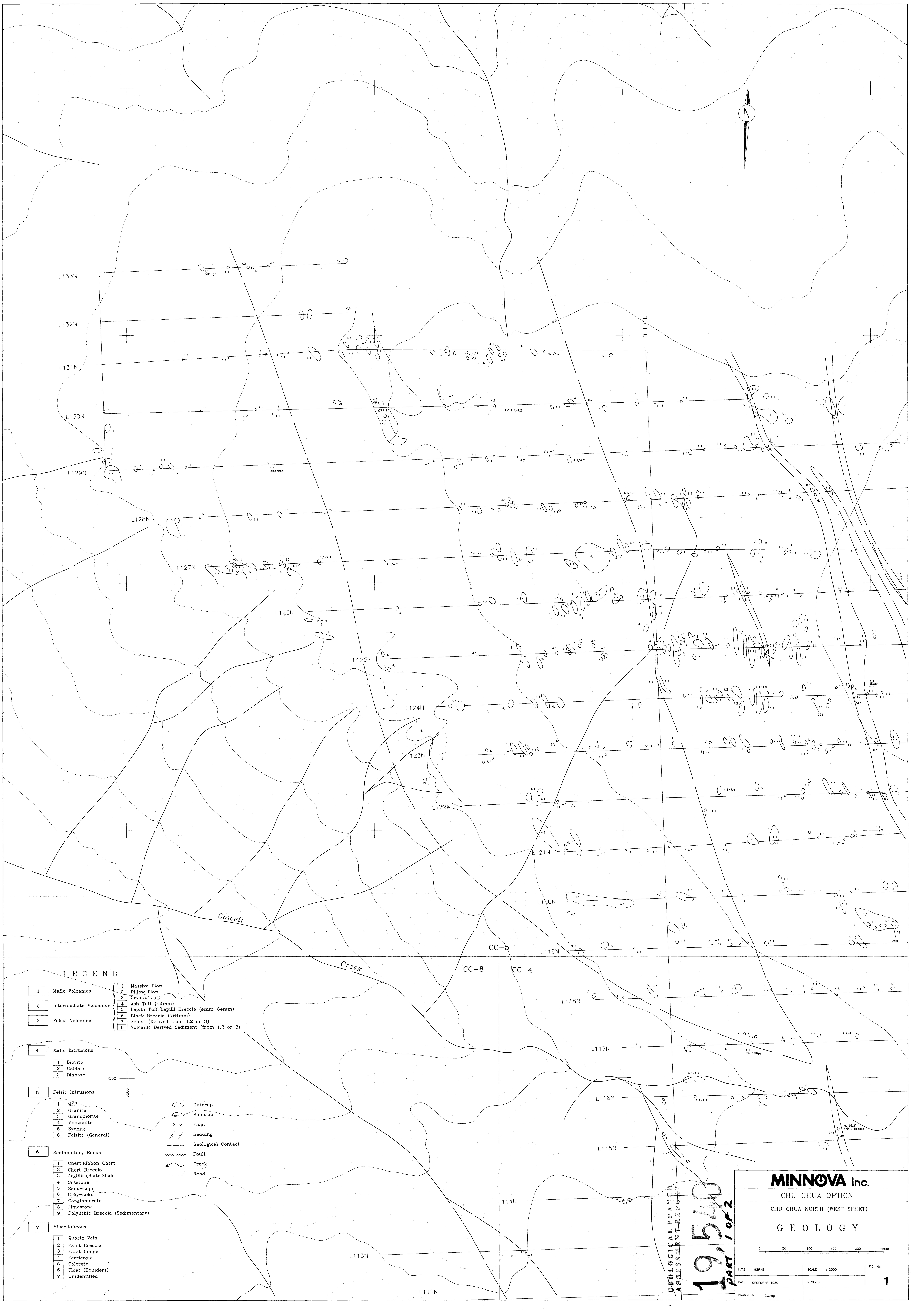
1. I am a geologist residing at 803 - 5932 Patterson Avenue, Burnaby, British Columbia.

2. I graduated from the University of British Columbia with a B.A.Sc. in Geological Engineering in 1984.

3. I have worked in mining exploration since 1982.

4. I have been employed with Minnova Inc. on a contract basis since March 1, 1989.

Christopher J. Wild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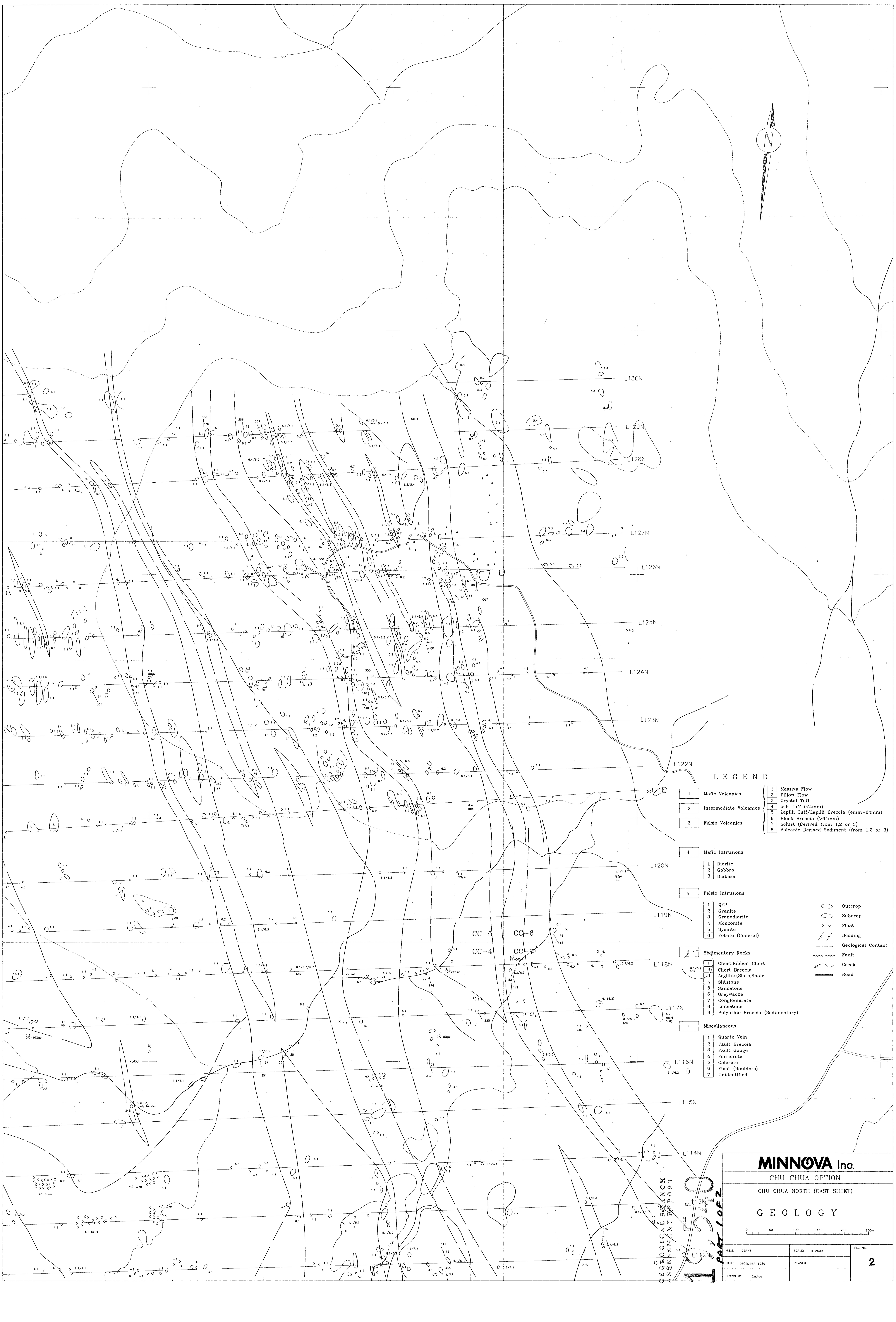
L113N
L112N
BL101E
N
Cowell
Creek
CC-5
CC-8
CC-4
7500
3500
6.1(6.3)
thinly bedded
L E G E N D
1 Mafic Volcanics
2 Intermediate Volcanics
3 Felsic Volcanics
1 Massive Flow
2 Pillow Flow
3 Crystal Tuff
4 Ash Tuff (<4mm)
5 Lapilli Tuff/Lapilli Breccia (4mm-64mm)
6 Block Breccia (>64mm)
7 Schist (Derived from 1,2 or 3)
8 Volcanic Derived Sediment (from 1,2 or 3)
4 Mafic Intrusions
1 Diorite
2 Gabbro
3 Diabase
5 Felsic Intrusions
1 QFP
2 Granite
3 Granodiorite
4 Monzonite
5 Syenite
6 Felsite (General)
6 Sedimentary Rocks
1 Chert,Ribbon Chert
2 Chert Breccia
3 Argillite,Slate,Shale
4 Siltstone
5 Sandstone
6 Greywacke
7 Conglomerate
8 Limestone
9 Polylithic Breccia (Sedimentary)
7 Miscellaneous
1 Quartz Vein
2 Fault Breccia
3 Fault Gouge
4 Ferricrete
5 Calcrete
6 Float (Boulders)
7 Unidentified
Outcrop
Subcrop
Float
Bedding
Geological Contact
Fault
Creek
Road
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 OF 2
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (WEST SHEET)
G E O L O G Y
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
FIG. No. 1
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/sg



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L114N
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L112N
CC-5
CC-6
CC-4
CC-7
7500
5000
N
LEGEND
1 Mafic Volcanics
2 Intermediate Volcanics
3 Felsic Volcanics
1 Massive Flow
2 Pillow Flow
3 Crystal Tuff
4 Ash Tuff (<4mm)
5 Lapilli Tuff/Lapilli Breccia (4mm-64mm)
6 Block Breccia (>64mm)
7 Schist (Derived from 1,2 or 3)
8 Volcanic Derived Sediment (from 1,2 or 3)
4 Mafic Intrusions
1 Diorite
2 Gabbro
3 Diabase
5 Felsic Intrusions
1 QFP
2 Granite
3 Granodiorite
4 Monzonite
5 Syenite
6 Felsite (General)
6 Sedimentary Rocks
1 Chert,Ribbon Chert
2 Chert Breccia
3 Argillite,Slate,Shale
4 Siltstone
5 Sandstone
6 Greywacke
7 Conglomerate
8 Limestone
9 Polylithic Breccia (Sedimentary)
7 Miscellaneous
1 Quartz Vein
2 Fault Breccia
3 Fault Gouge
4 Ferricrete
5 Calcrete
6 Float (Boulders)
7 Unidentified
Outcrop
Subcrop
Float
Bedding
Geological Contact
Fault
Creek
Road
GEOLOGICAL BRANCH
ASSESSMENT REPORT
PART 1 OF 2
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (EAST SHEET)
GEOLOGY
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N.T.S. 92P/8
SCALE: 1: 2500
FIG. No.
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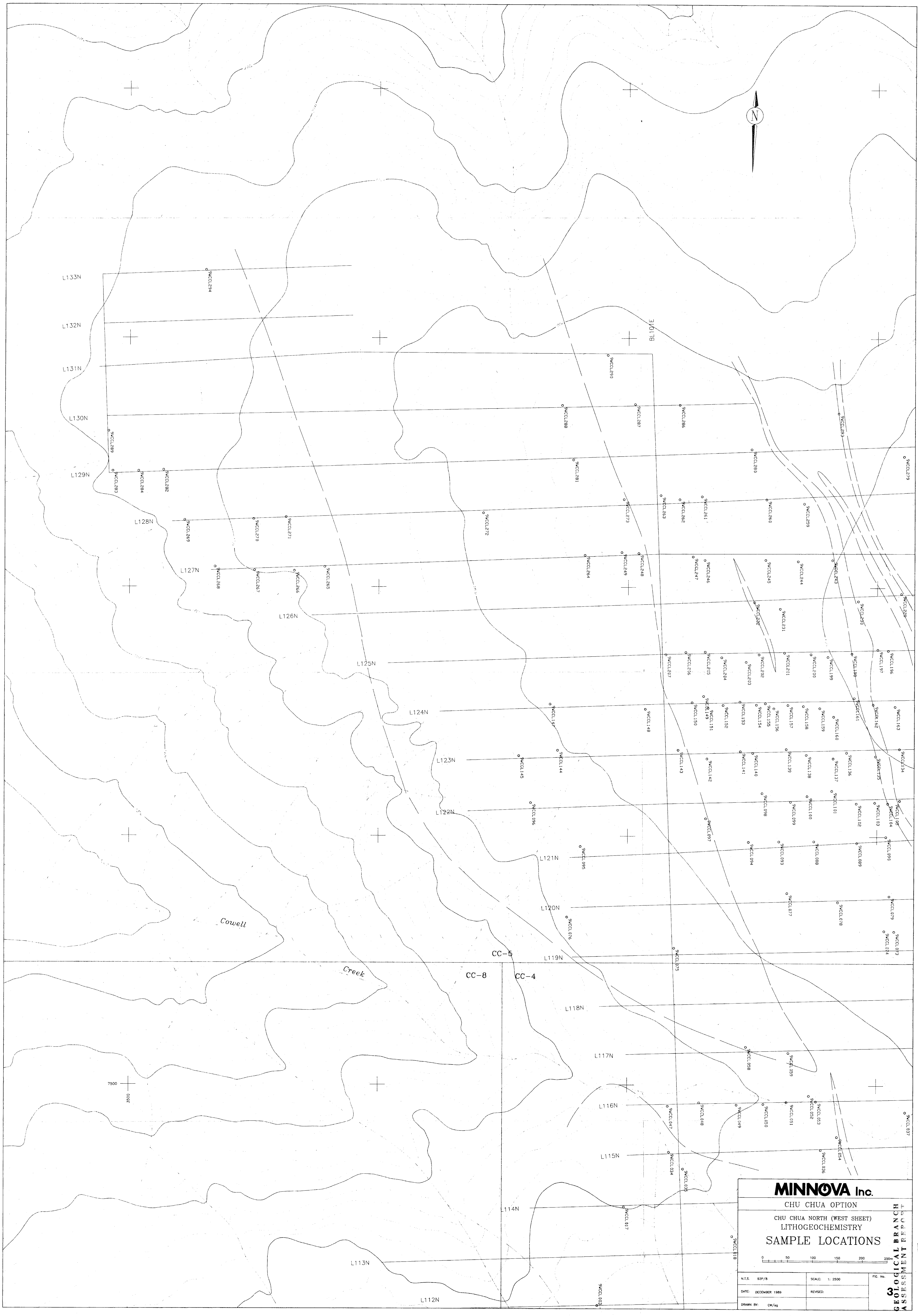
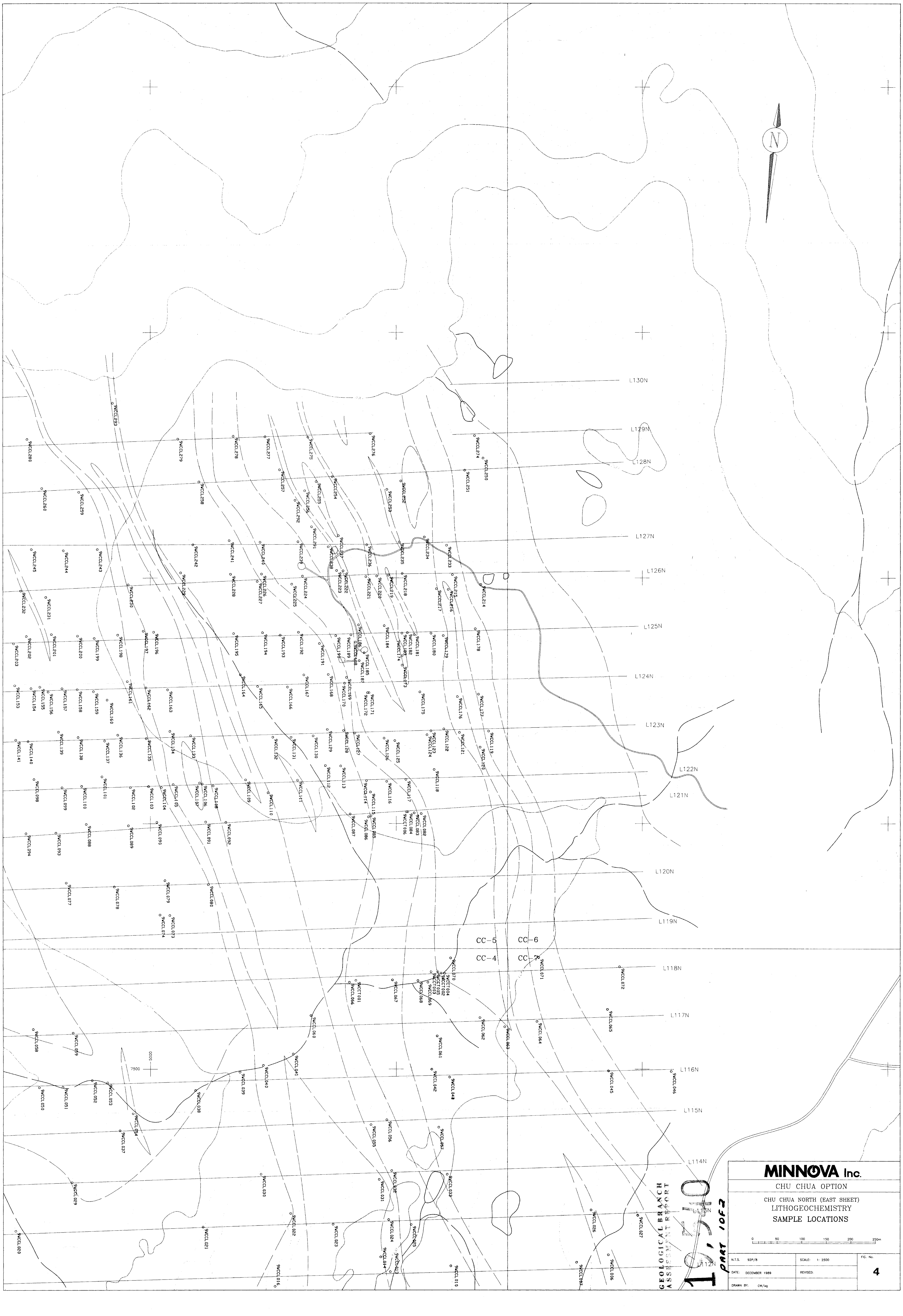
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/sg



GEOLOGICAL BRANCH
ASSESSMENT REPORT

19,540

PART 1 OF 2

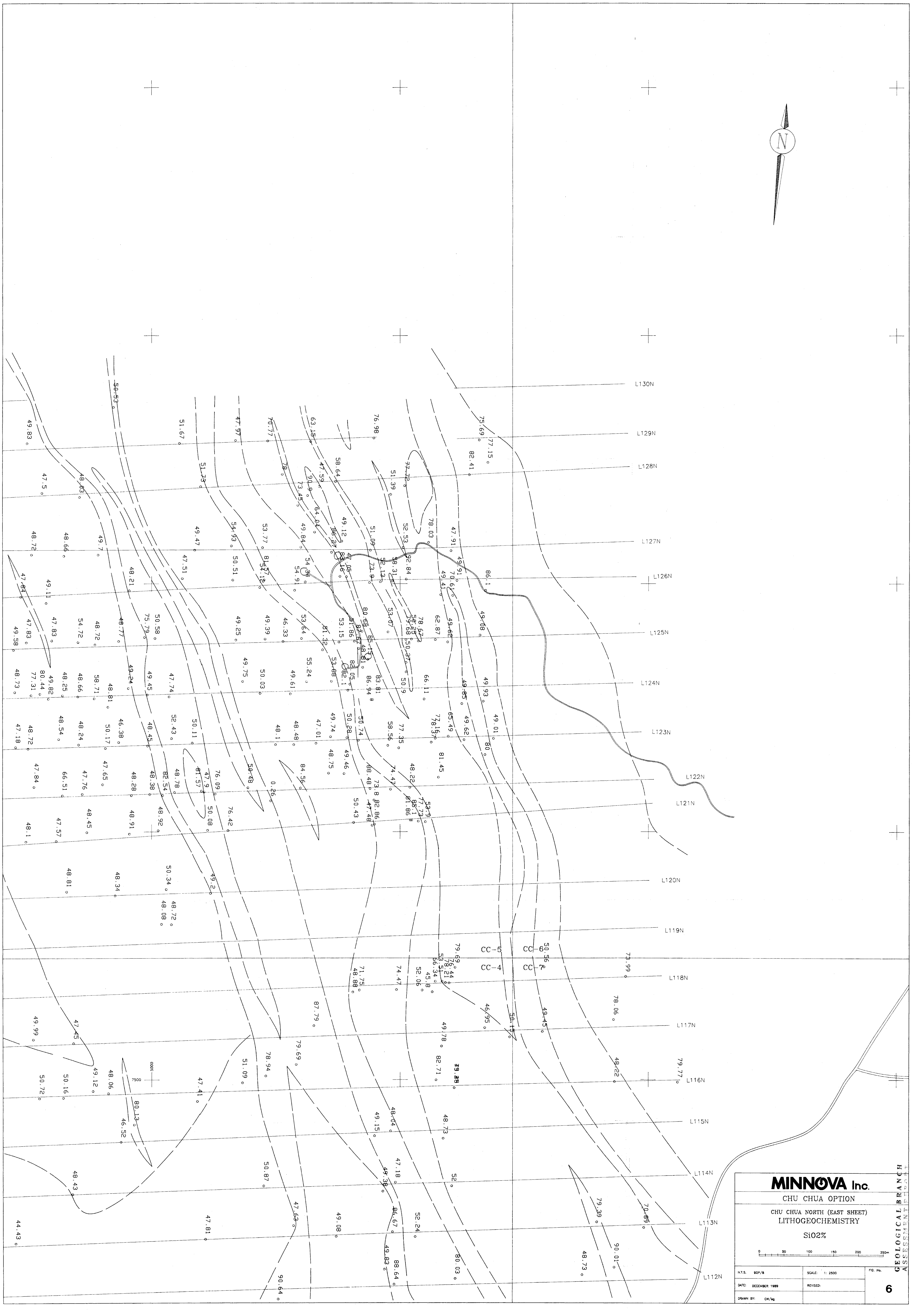


MINNOVA Inc.

CHU CHUA OPTION

CHU CHUA NORTH (EAST SHEET)
LITHOGEOCHEMISTRY
SAMPLE LOCATIONS

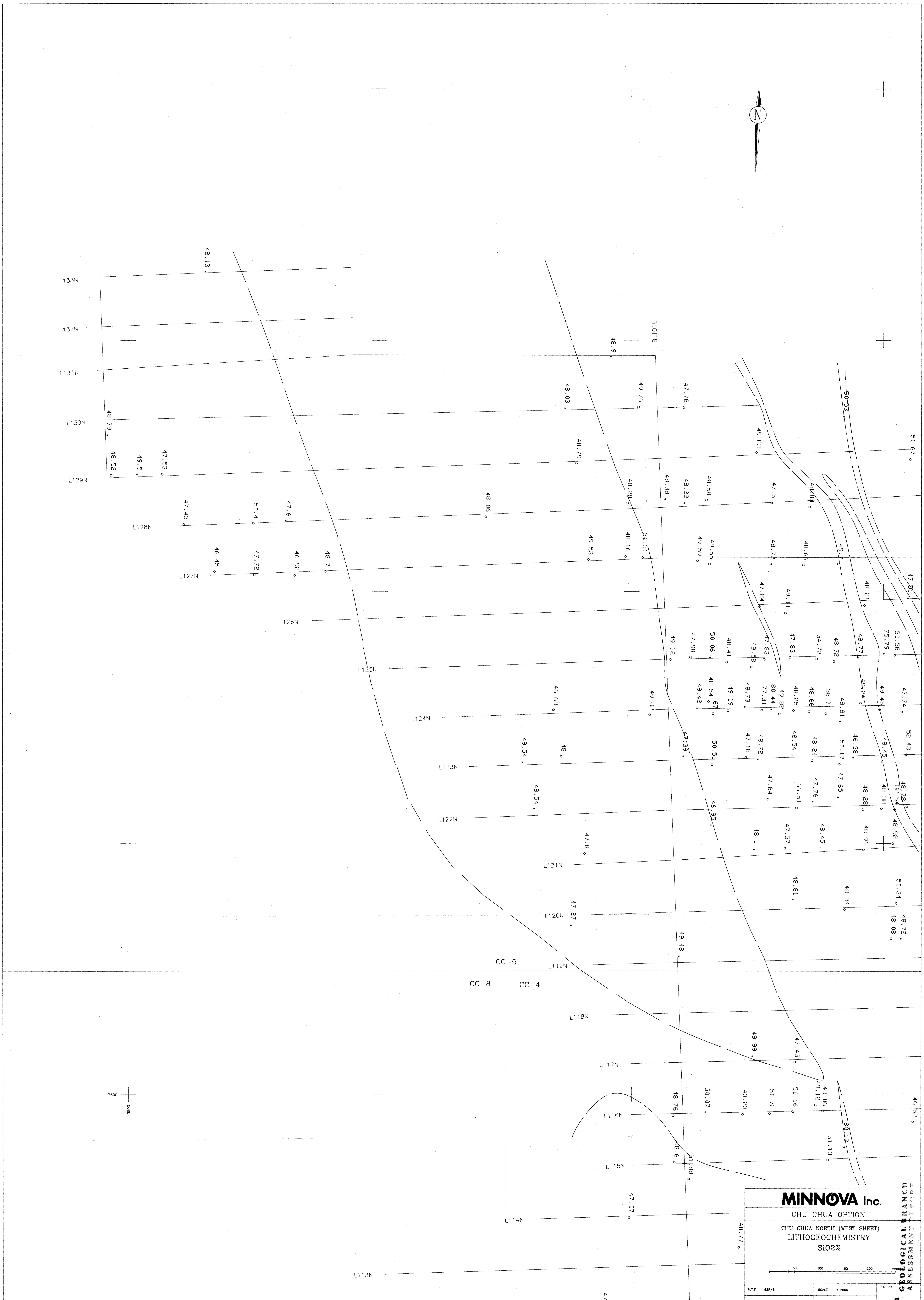
N.T.S. 92P/8	SCALE: 1: 2500	FIG. No. 4
DATE: DECEMBER 1989	REVISED:	
DRAWN BY: CW/sg		



GEOLOGICAL BRANCH
ASSESSMENT REPORT

19,540

PART 1 OF 2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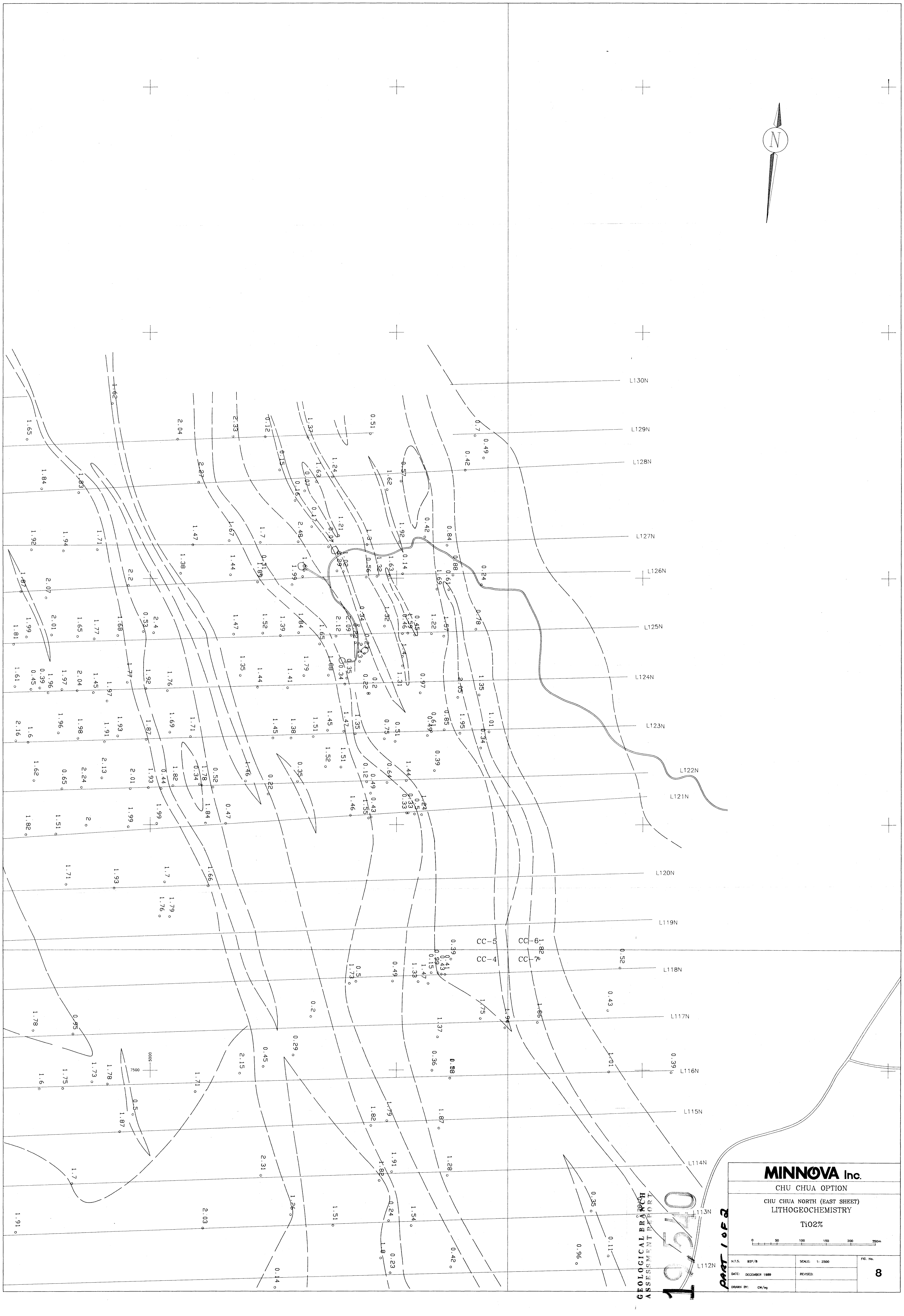
L117N
L116N
L115N
L114N
L113N
L112N
CC-5
CC-8
CC-4
7500
3500
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (WEST SHEET)
LITHOGEOCHEMISTRY
SiO2%
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
FIG. No. 5
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/sg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L114N
L113N
L112N
CC-5
CC-6
CC-4
CC-7
7500
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (EAST SHEET)
LITHOGEOCHEMISTRY
TiO2%
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
FIG. No. 8
DATE: DECEMBER 1989
REVISED:
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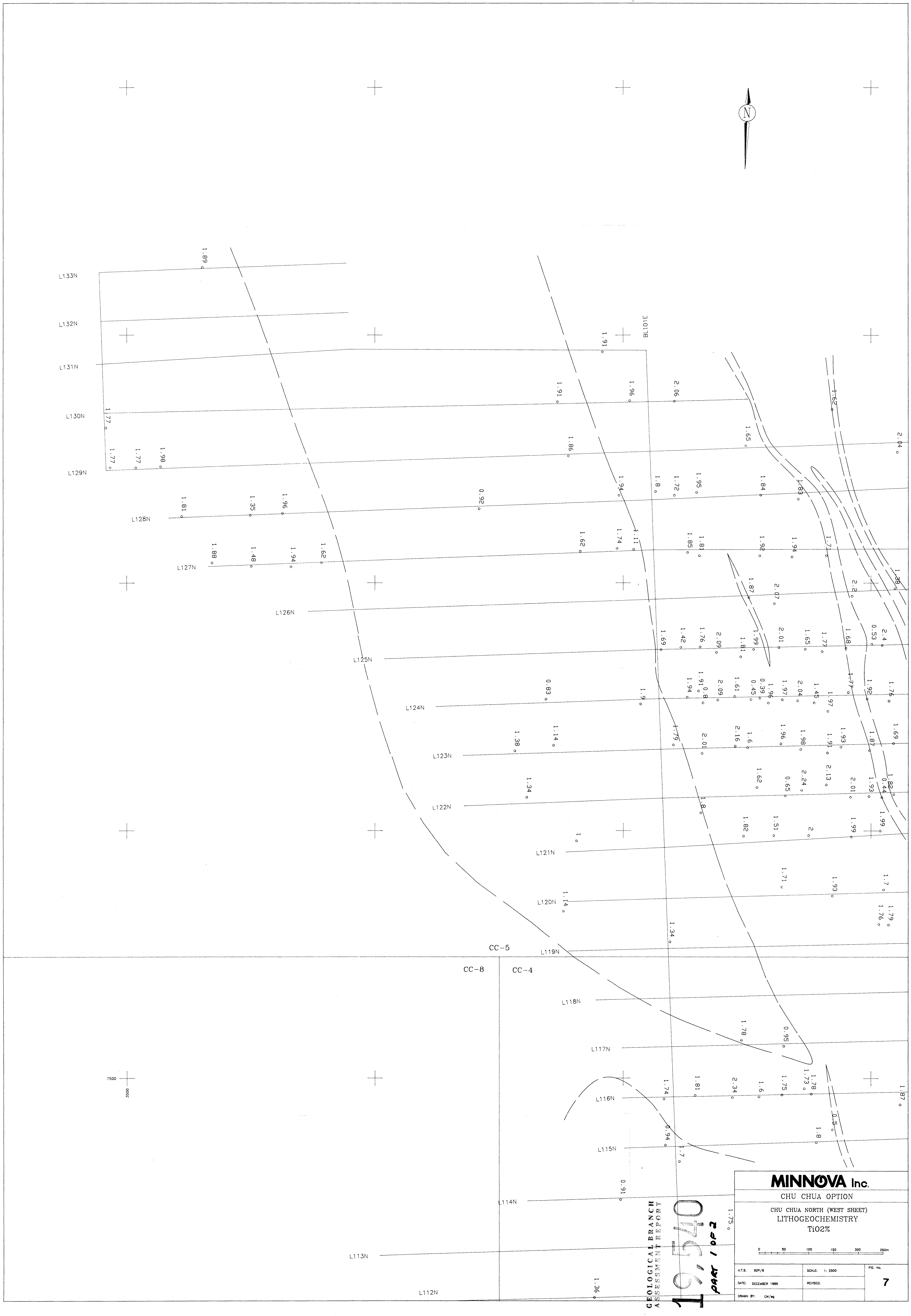
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 OF 2



MINNOVA Inc.

CHU CHUA OPTION

CHU CHUA NORTH (WEST SHEET)

LITHOGEOCHEMISTRY

TiO2%

0 50 100 150 200 250m

N.T.S. 92P/8	SCALE: 1: 2500	FIG. No. 7
DATE: DECEMBER 1989	REVISED:	
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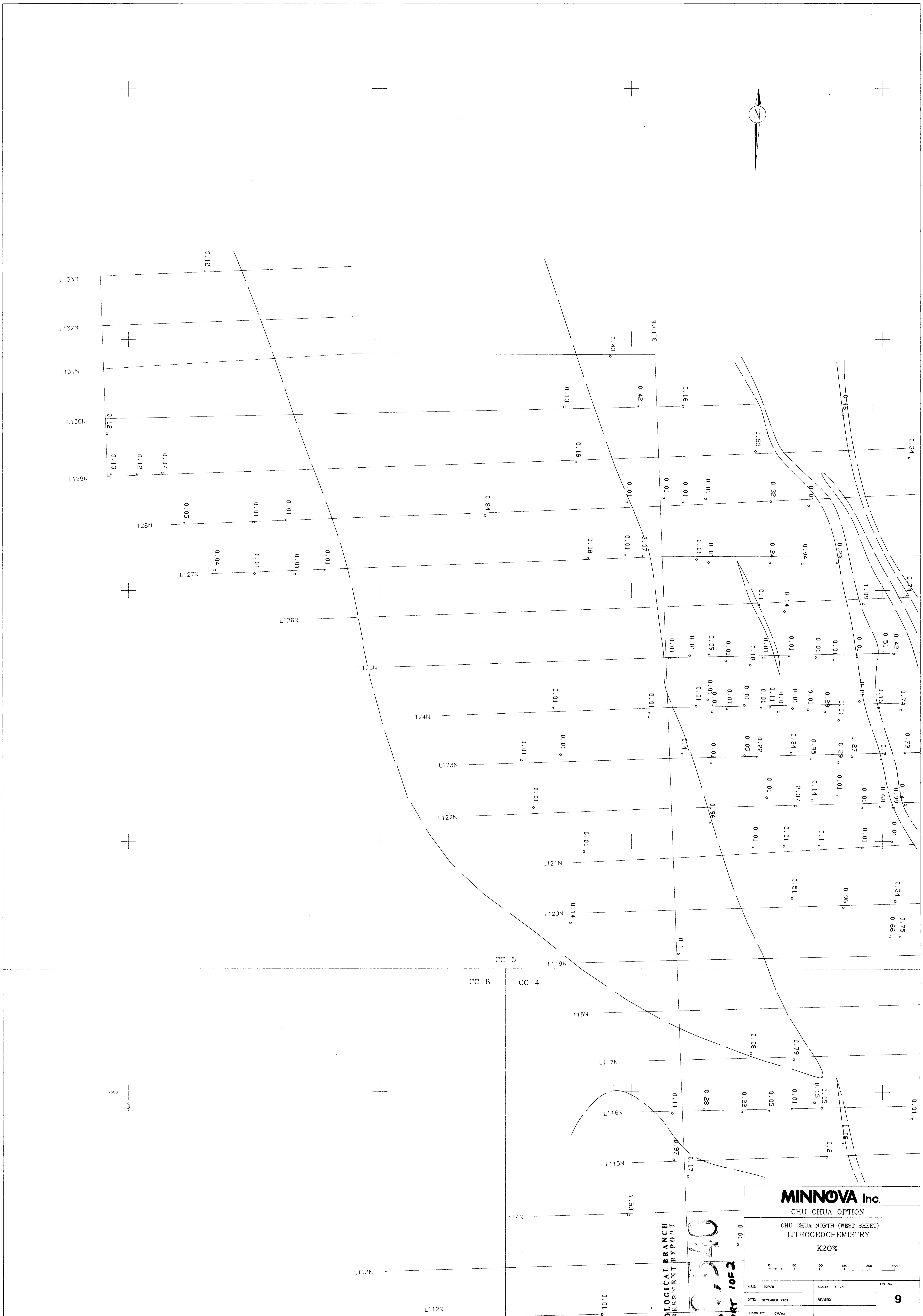
GEOLOGICAL BRANCH
ASSESSMENT REPORT

19,540

PART 1 OF 2



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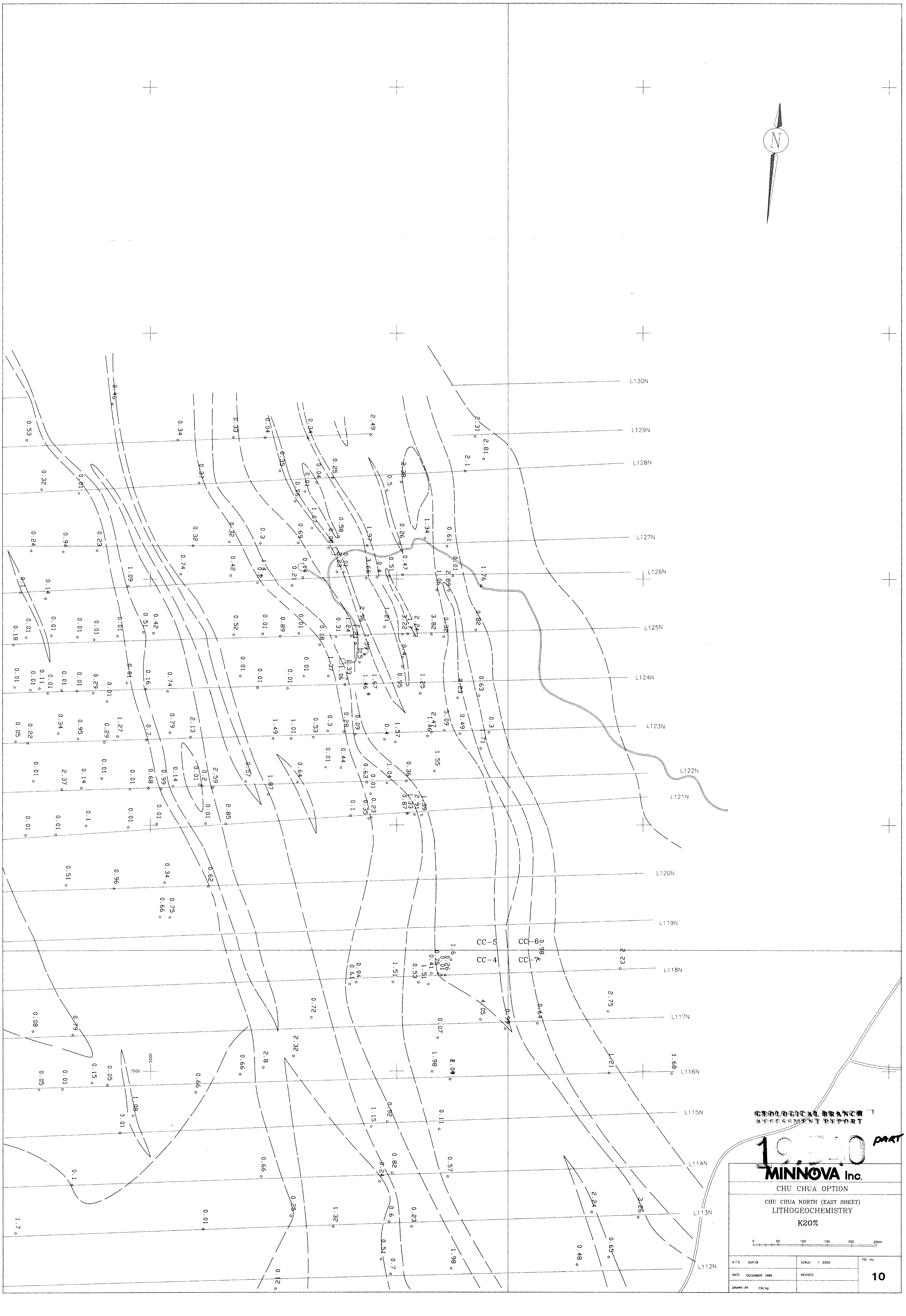
L116N
L115N
L114N
L113N
L112N
BL101E
CC-5
CC-8
CC-4
N
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (WEST SHEET)
LITHOGEOCHEMISTRY
K2O%
SCALE: 1: 2500
DATE: DECEMBER 1989
FIG. No. 9
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 OF 2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L116N
L115N
L114N
L113N
L112N
CC-5
CC-4
CC-6
CC-7
GEOLOGICAL BRANCH
ASSESSMENT REPORT
PART 1 OF 2
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (EAST SHEET)
LITHOGEOCHEMISTRY
K20%
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
FIG. No. 10
DATE: DECEMBER 1989
REVISED:
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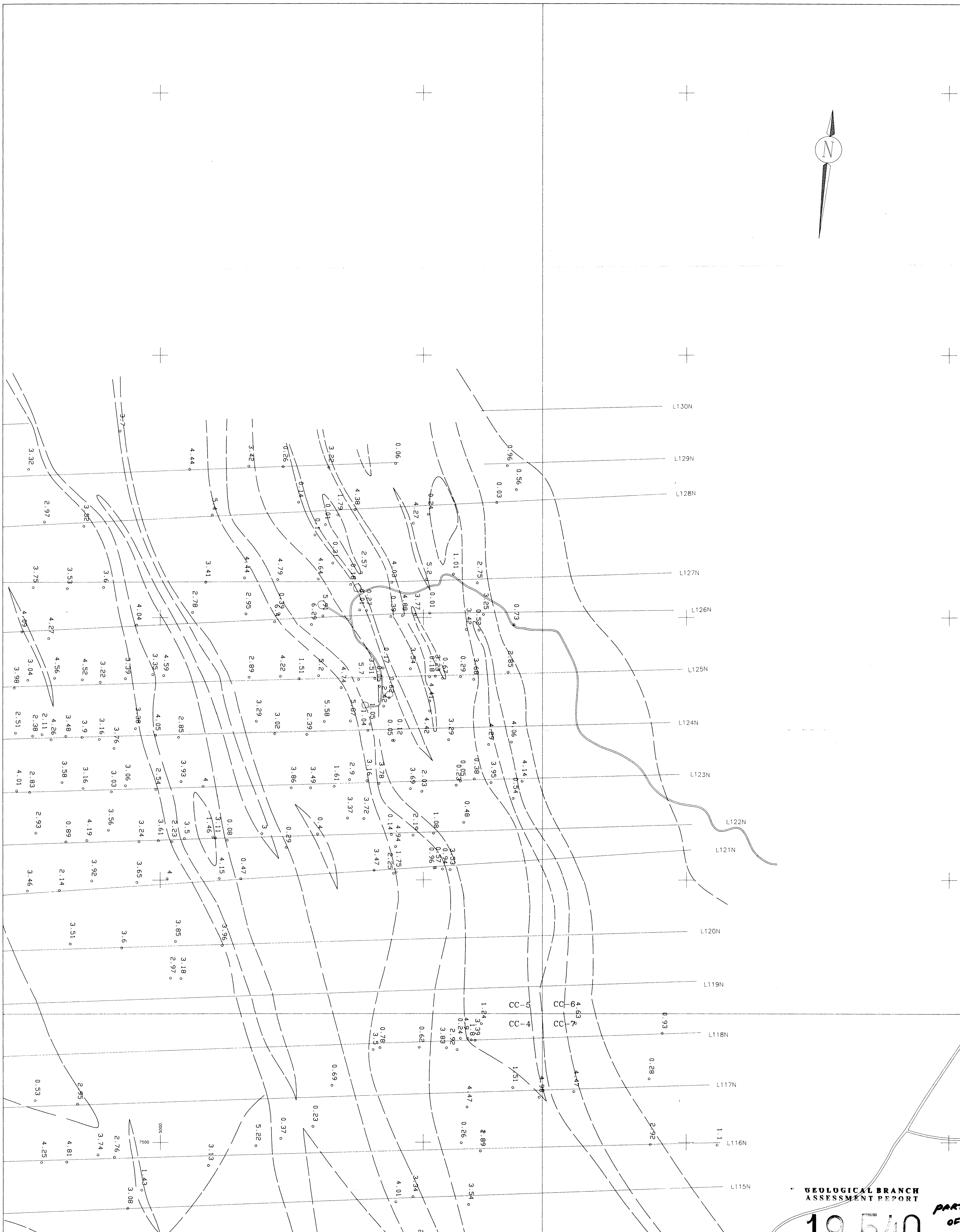

GEOLOGICAL BRANCH
ASSESSMENT REPORT

19,540

PART 1 OF 2

MINNOVA Inc.

CHU CHUA OPTION

CHU CHUA NORTH (EAST SHEET)

LITHOGEOCHEMISTRY

Na2O%

0 50 100 150 200 250m

N.T.S. 92P/8	SCALE: 1: 2500	FIG. No. 12
DATE: DECEMBER 1989	REVISED:	
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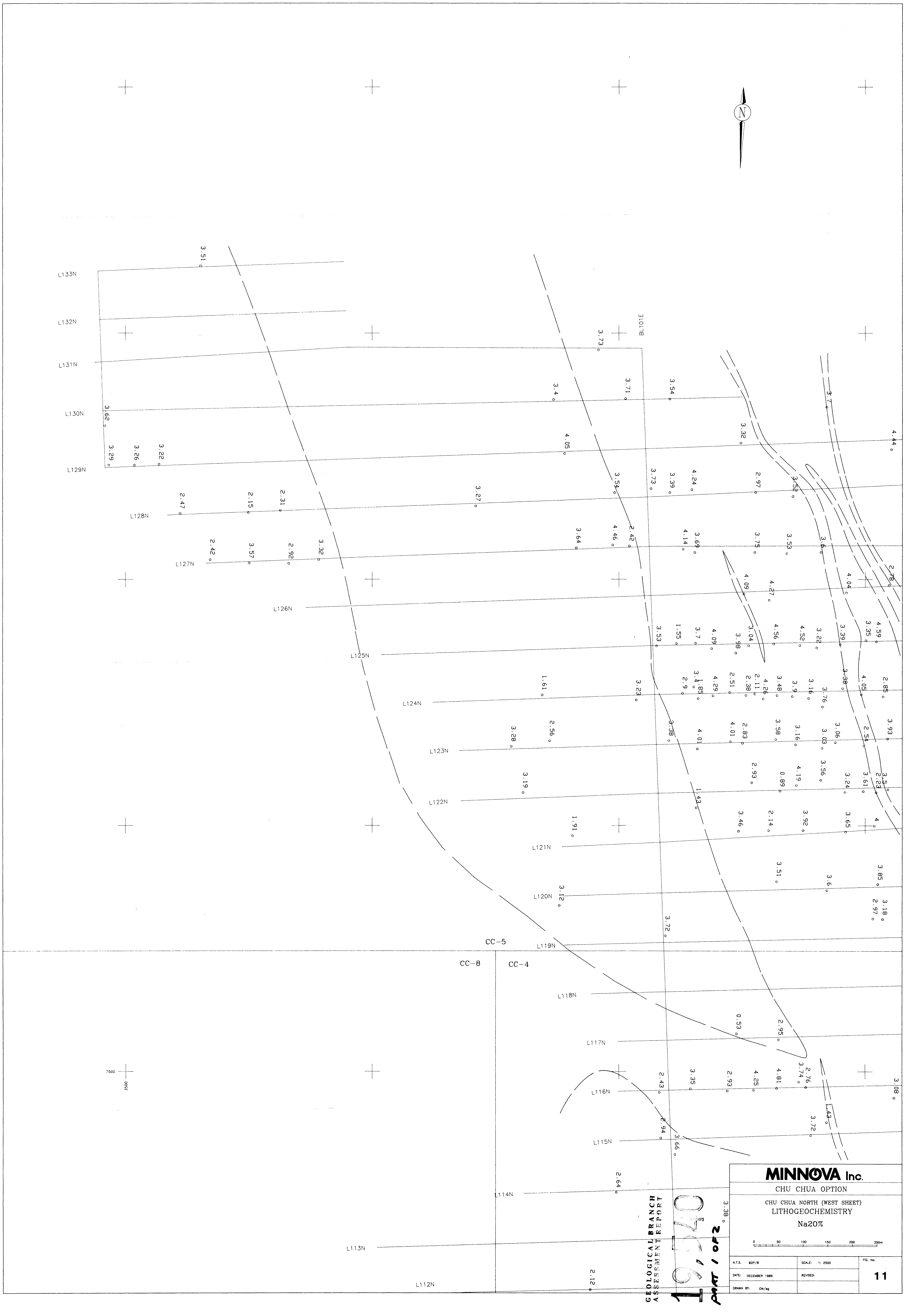
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (WEST SHEET)
LITHOGEOCHEMISTRY
Na2O%
N.T.S. 92P/8
SCALE: 1: 2500
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/eg
FIG. No.
11
GEOLOGICAL BRANCH
ASSESSMENT REPORT
PART 1 OF 2
BL101E
CC-5
CC-8
CC-4
L133N
L132N
L131N
L130N
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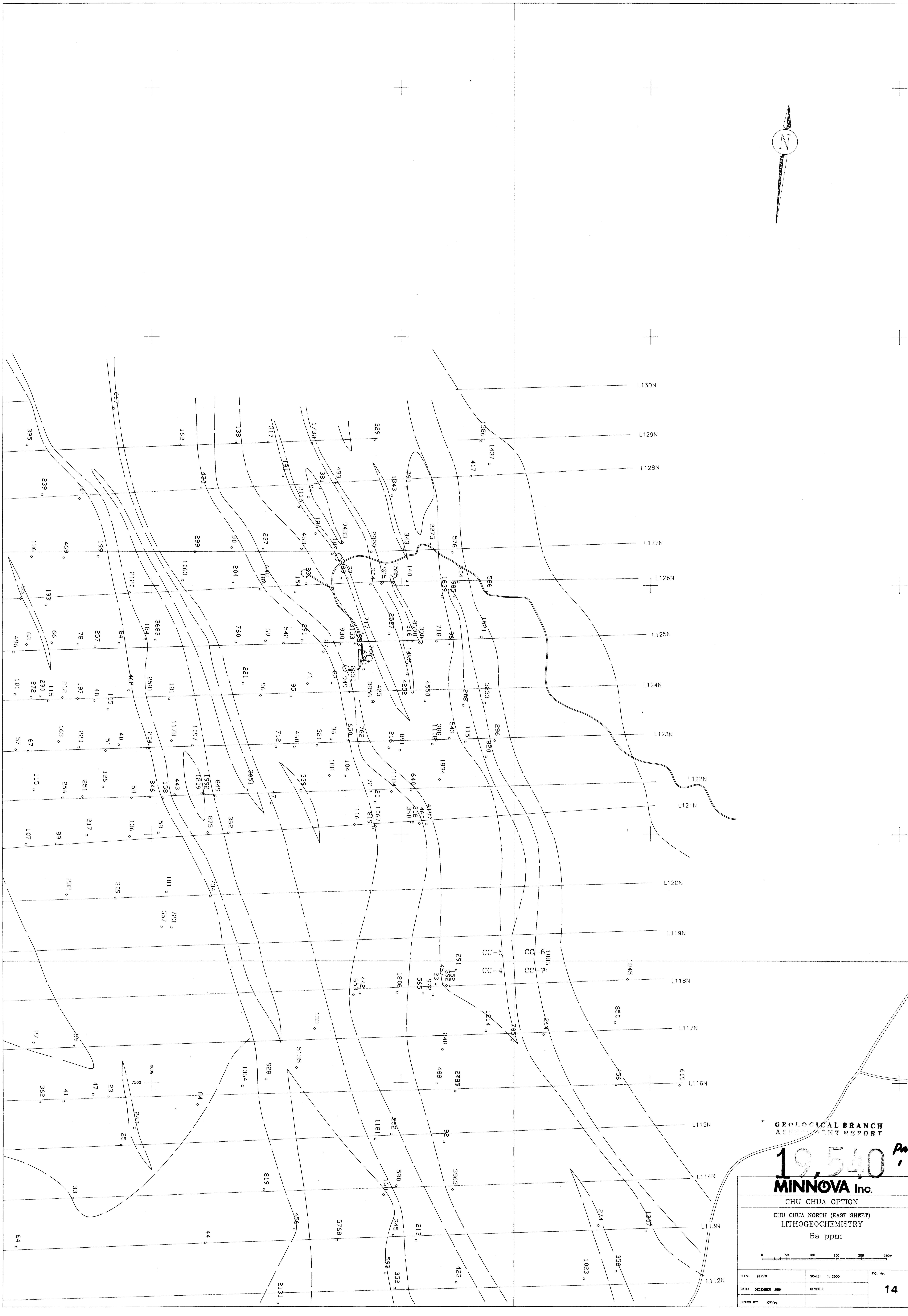
7500
3000



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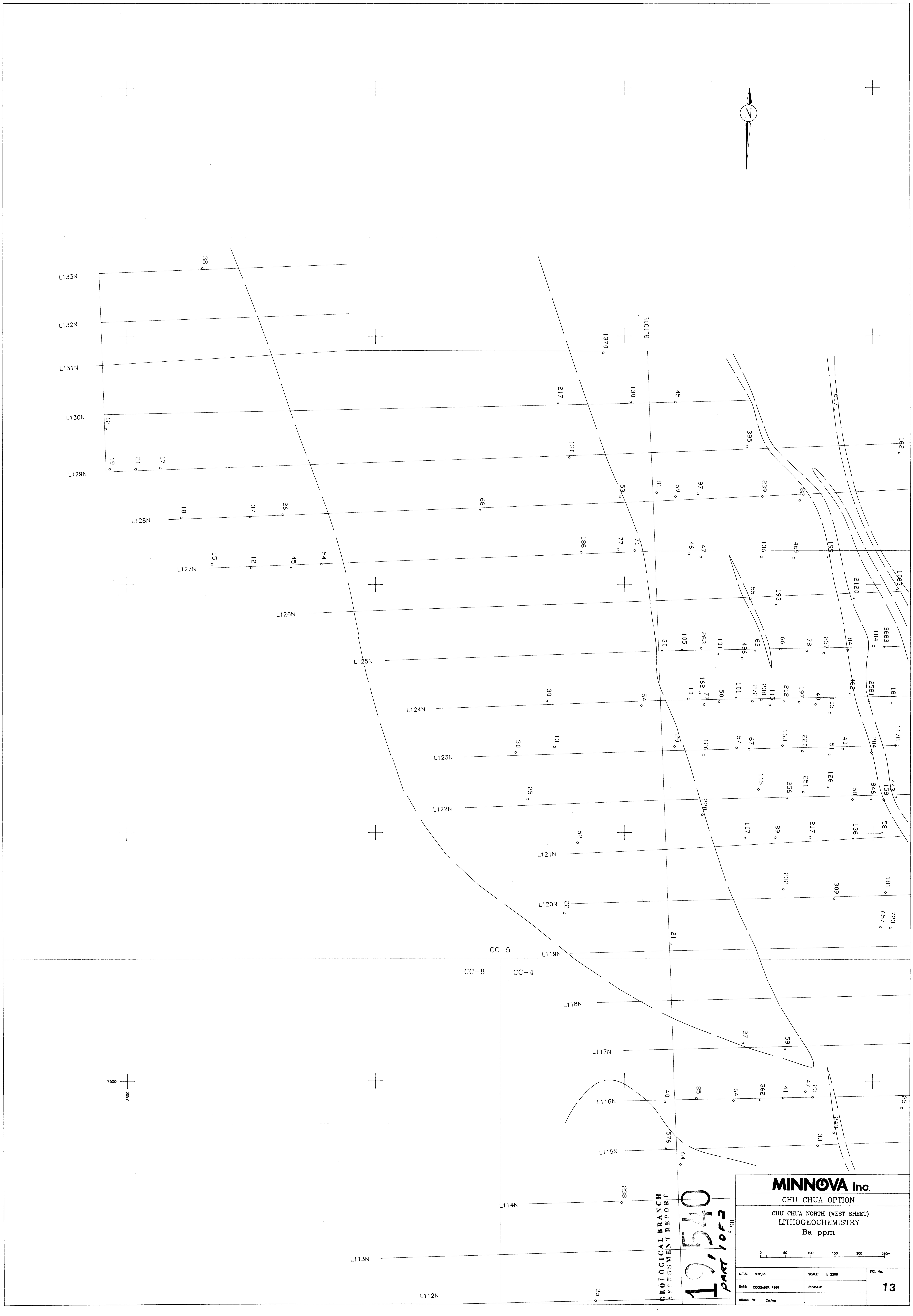
L116N
L115N
L114N
L113N
L112N
CC-5
CC-6
CC-4
CC-7
7500
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 OF 2
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (EAST SHEET)
LITHOGEOCHEMISTRY
Ba ppm
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
FIG. No.
14
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/sg



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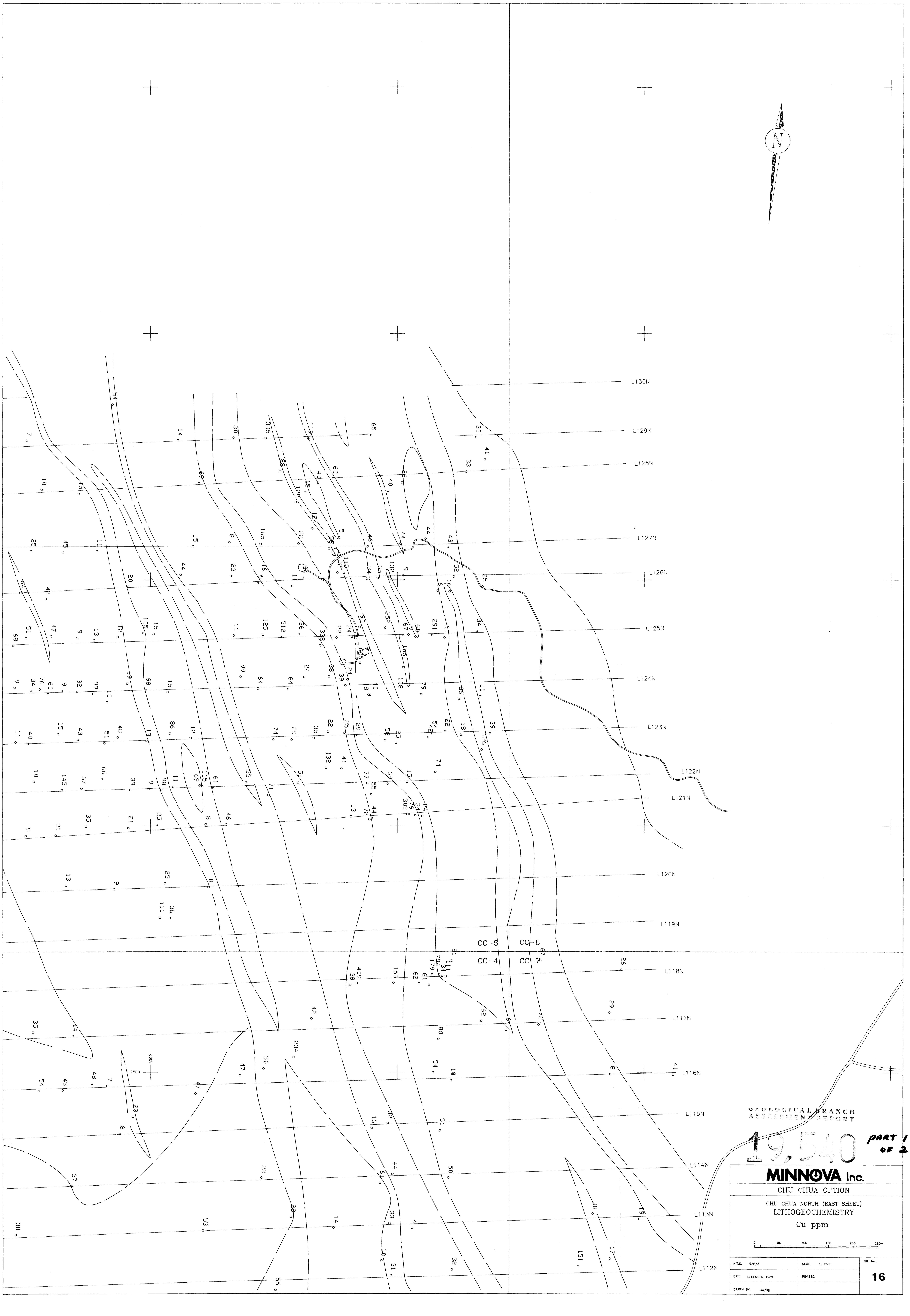
L119N
L118N
L117N
L116N
L115N
L114N
L113N
L112N
CC-5
CC-8
CC-4
7500
3500
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 OF 2
MINNOVA Inc.
CHU CHUA OPTION
CHU CHUA NORTH (WEST SHEET)
LITHOGEOCHEMISTRY
Ba ppm
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1: 2500
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CW/eg
FIG. No.
13



GEOLOGICAL BRANCH
ASSESSMENT REPORT

19,540 PART 1 OF 2

MINNOVA Inc.

CHU CHUA OPTION

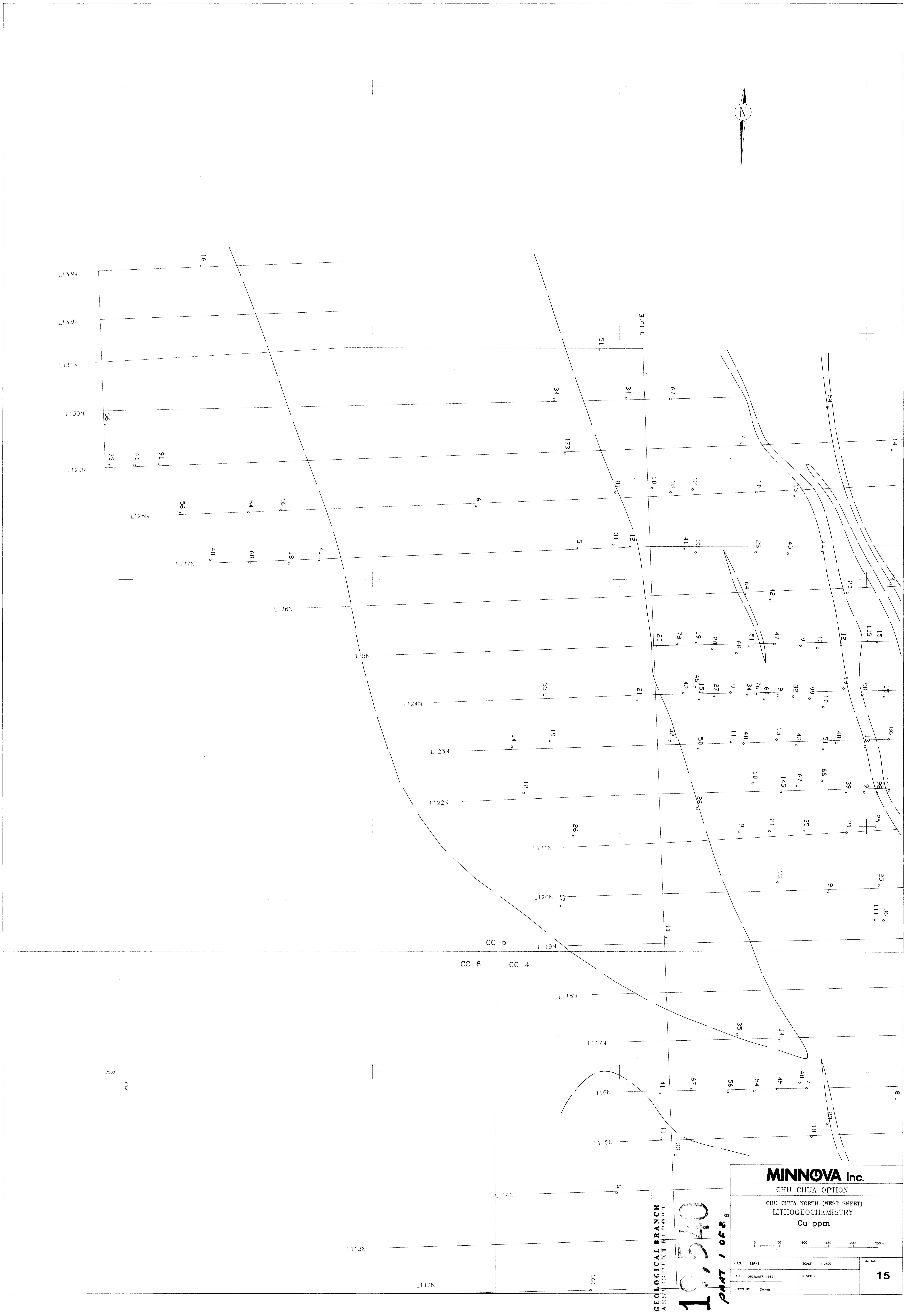
CHU CHUA NORTH (EAST SHEET)

LITHOGEOCHEMISTRY

Cu ppm

0 50 100 150 200 250m

N.T.S. 92P/8	SCALE: 1: 2500	FIG. No.	16
DATE: DECEMBER 1989	REVISED:		
DRAWN BY: CW/sg			



MINNOVA Inc.

CHU CHUA OPTION

CHU CHUA NORTH (WEST SHEET)
LITHOGEOCHEMISTRY
Cu ppm

0 50 100 150 200 250m

N.T.S. 92P/8	SCALE: 1: 2500	FIG. No.
DATE: DECEMBER 1989	REVISED:	15
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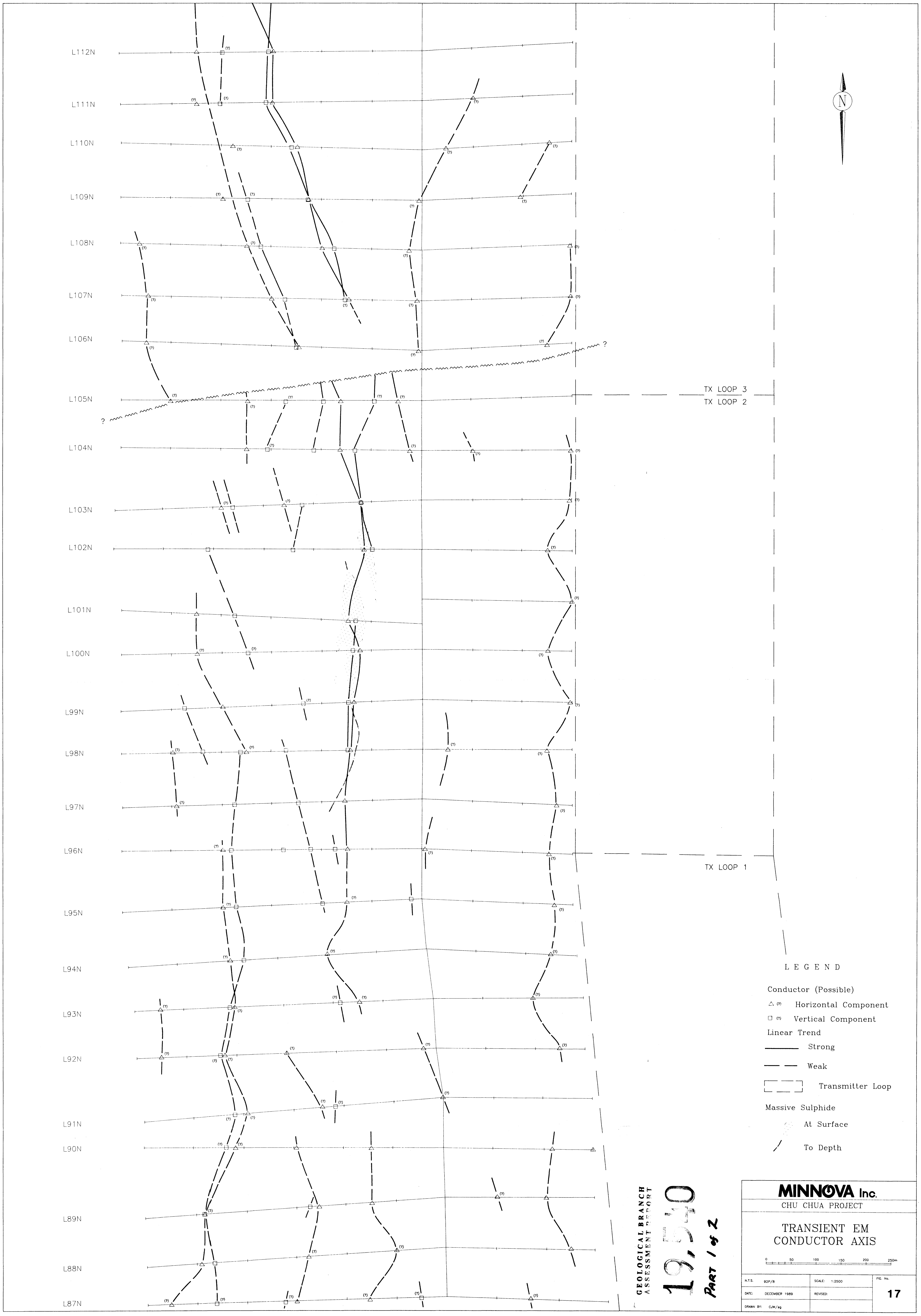

L112N
L111N
L110N
L109N
L108N
L107N
L106N
L105N
L104N
L103N
L102N
L101N
L100N
L99N
L98N
L97N
L96N
L95N
L94N
L93N
L92N
L91N
L90N
L89N
L88N
L87N
TX LOOP 3
TX LOOP 2
TX LOOP 1
N
LEGEND
Conductor (Possible)
Horizontal Component
Vertical Component
Linear Trend
Strong
Weak
Transmitter Loop
Massive Sulphide
At Surface
To Depth
GEOLOGICAL BRANCH
ASSESSMENT REPORT
19,540
PART 1 of 2
MINNOVA Inc.
CHU CHUA PROJECT
TRANSIENT EM
CONDUCTOR AXIS
0 50 100 150 200 250m
N.T.S. 92P/8
SCALE: 1:2500
FIG. No. 17
DATE: DECEMBER 1989
REVISED:
DRAWN BY: CJW/sg