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CLEVELAND TIN LIMITED

PROGRESS REPORT

ON

EXPLORATION LICENCE 1/63

FOR PERIOD FEBRUARY 1979 TO

AUGUST 1979

79-1391

OPEN FILE

BY: T. Tulp
Senior Mine Geologist

A. Eadie
Geologist

SEPTEMBER, 1979

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CT 113E/73	" " "	1.1000
CT 113F/73	" " "	1.1000
CT 113G/73	" " "	1.1000
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1. Summary

Diamond drilling 500 metres north of the mine was successful in locating limestones (Halls formation equivalents). Below the limestones a chert unit occurs which outcrops and can be used as a marker to locate Halls Formation.

Surface mapping defined detailed stratigraphy in the southern strike extensions of Halls Formation and the Eastern Sediments. Both sequences are considered to be prospective hosts for sulphide-cassiterite mineralization.

Continuation of this mapping is recommended to further define the prospective hosts.

Geophysical surveys of areas, north and south of the mine by a deep sensing technique (U.T.E.M.) did not identify known mineralization, nor did they yield major anomalies.

It resulted in the identification of zones with low order anomalies which will require further follow up, within the Eastern Sediments and Halls Formation.

A review of existing geochemical data was initiated to attempt to identify any subtle anomalies in the areas sampled.

2. Introduction

The exploration licence surrounding Cleveland Tin mine was granted to Aberfoyle Tin N.L. in August 1963.

The licence has been held in the names of Aberfoyle Tin N.L., Cleveland Tin N.L., Abminco N.L., Cleveland Tin Ltd, all of which were or are subsiduaries of the Aberfoyle Group of companies.

The Licence area is situated in north-west of Tasmania, 98km from Burnie, at latitude 41° 28'S longitude 145° 24'E.

Exploration since 1963 was by the Aberfoyle Group or by consultants to the group. Activities up to 1976 were primarily aimed at exploration of the area to locate outcropping ore bodies. Techniques used during initial exploration were geological mapping, soil, bedrock, stream sediment and water geochemistry, with limited geophysical coverage by ground and airborne magnetometer, S.P., and IP surveys. (References covering all previous exploration are included in this report).

No outcropping orebodies were located beyond the limits of the Cleveland Mine.

Commencing in 1976 Ranson applied statistical analytical techniques to the results of the soil geochemical surveys covering the licence. As a result of that study he concluded that the Cleveland mine area was unique in its geochemical character and by comparing the mine sequence geochemistry to that of other rock types he concluded that the Mine/Falls Creek Sequence was the most prospective rock unit in the licence area (Ransom 1977).

To allow escalation of exploration within the mine lease, suspension of work commitment was granted for licence 1/63 from January 1978 to February 1979. Subsequently ore reserves at the mine have been increased by approximately one million tonnes.

Exploration on E/L 1/63 recommenced late in 1978. The objectives of the program were to:

- resolve structural problems and attempt to locate extensions of the mine stratigraphy north of the current mine.
- Improve the definition of stratigraphy in the Mine/Falls Creek Sequence, aimed at assessing the economic potential of the area.
- Review existing geochemical data to assist in identifing lower priority surface anomalies, that may relate to subsurface mineralization.
- Apply new ore search techniques that are available, to locate subcropping mineralization.

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3. Results

3.1 Extensions of Mine Stratigraphy to the North

Anomalous tin-zinc soil geochemical results located north of the mine (lines G3b, to G4) were investigated by IP techniques and diamond drilling (Hole Nos. C1020, C1027). The drilling intersected grey shales, graphitic cherts and sandstones. Interpretation of the results identified the source of the IP as the graphitic cherts. No explanation was apparent for the anomalous geochemical results nor was any correlation of the stratigraphy with the mine possible.

Interpretation within the mine, completed during 1978 suggested that Halls Formation may be continuous at depth to the North. Faults were thought to have off-set Halls Formation.

Costeaning between lines G4 to Y section was completed to provide outcrop within the problem area.

Detailed mapping of costeans delineated the Deep Creek Volcanic sequence, faulted against the mica sandstone. Interpretation of Halls Formation indicated that it was off-set to the east, by the Perserverence fault (east-west faulting) and then down thrown beneath the volcanics on a north-south striking fault. To test this interpretation diamond drilling was designed to locate Hall's Formation.

Two holes No. C1285, C1290 were drilled on section Z500 and intersected 25 to 30 metres of limestones and cherts (Refer, cross section Z500 and diamond drill logs for C1285 and C1290).

The chert unit below the limestones was interpreted to be the same as that intersected in C1020 and C1027 and outcropped at surface.

Conclusions from the program were:

- Ore lenses within Halls Formation were possibly represented to the north by detrital limestones. This relationship was later verified by underground development.

- Halls Formation was continuous to the north, enhancing the exploration potential there.

- Faulting has off-set Halls Formation, and the current surface is coincident with a fault window in Halls Formation.

- The chert horizon intersected below the limestones, represents an effective marker horizon at surface. This unit can be used to define the possible stratigraphic position of Halls Formation.

- The anomalous surface geochemical results were not explained.

3.2 Surface and Mapping

During 1978 road access and development for forestry operations east and south of the mine exposed significant new rock outcrops in the prospective Host unit of Eastern Sediments and Halls Formation.

In the current programme detailed mapping covered an area of 1.8sq kilometres, from Wa section in the north to 300 metres south of Ra25. Two additional short traverses were undertaken north of Wa section. They were aimed firstly, to delineate the chert marker horizon and secondly to substantiate the locality of a sandstone unit within a sequence of brown siltstones previously mapped by R. Cox and Cominco Exploration.

3.2.1 Procedure

Detailed chain and compass traverses were carried out, using a Suunto compass and clinometer. Traverses were corrected for misclosures and slope variation, and where possibly tied in to Cleveland Mine Survey stations.

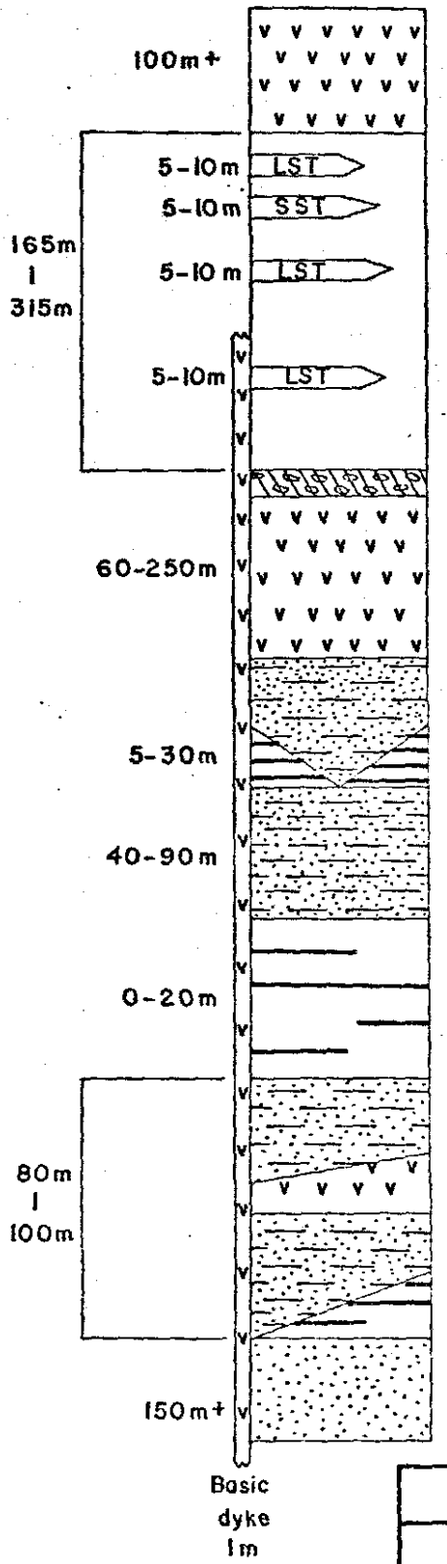
The traverses and geological data were transferred to 1:1000 Cleveland Mine surface Geology Plans (Plate Nos. CT113A/72, CT113B/72, CT113C/72, CT113D/72 CT113E/72, CT113F/73, CT113G/73, CT113H/73, CT113I/73, CT113J/73. Data was re-plotted at 1:25000 scale, and the re-interpretation of Cleveland geology is shown on plate no. SG-1-P-25000-601.)

3.2.2 Stratigraphy

The gross stratigraphy and distribution of rock types presented previously were slightly modified. The mapping of new outcrops enabled better definition of geological contacts and the recognition of several internal marker horizons. A stratigraphic column is presented for the type section (AH). Variation from the type section to the north and the south will be discussed below. It should be noted that the stratigraphic column is an extension of that postulated by T. Tulp (March 1977).

Battery mineralization is known to become uneconomic south of A section and is one of the southernmost ore lenses (the other being B South which becomes uneconomic south of Af section). A series of pyritic shales and siltstones were mapped south for 250m from Battery adit. These are in part bleached, chaotic and clayey and can be correlated to lithologies intersected in drilling, interpreted to be in the Battery position (Refer specimen 183629).

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EASTERN VOLCANICS - spilitic lavas and intercalated tuffaceous sediments.

EASTERN SEDIMENTS - intercalated sediments consisting of 3 limestone units, grey siltstones, brown siltstones and cherts, and a sandstone unit.

PURPLE TUFF - intercalated tuffaceous sediments.

DEEP CREEK VOLCANICS - spilitic basalt flows - intercalated tuffaceous sediments.

HALLS FORMATION

Grey coloured shales, brown, grey to black cherts. Battery mineralization (variable thickness).

Dominantly grey coloured shales, brown shales and cherts and greywackes.

Variable thickness cherts and silicified shales.

B South mineralization with interbedded cherts.

Grey coloured shales and greywackes.

Henry's volcanics, tuffaceous sediments tending to be basalt flows to the north.

Grey coloured shales and greywackes.

Khaki (footwall) mineralization consisting of cherts and interbedded lode units.

CRESCENT SPUR MICA SANDSTONE

Dominantly grey coloured greywackes with minor chaotic shales.

CLEVELAND TIN LTD			
STRATIGRAPHIC COLUMN FOR SOUTHERN SEQUENCE			DRAWING N° SG-1-M-000-600
DRAWN R.J.R.	DATE 28-8-79	SCALE	SHEET

Another bleached claystone outcrop coincidentally occurs a further 500 metres to the south east along strike.

Above Battery position are several grey shales, grey to black cherts and brown siltstones.

Conformably above these sediments are the Deep Creek basic volcanics. They are defined as a sequence of spilitic lavas with interlayered tuffaceous sediments and brown siltstones. They thin from 250 metres in the north to 60 metres at Falls Creek in the south. North of Wa section, the Deep Creek volcanics appear to thicken due to a facies change. Intercalated sediments within the volcanics increase in volume.

Immediately above the basic rocks is a 5-10 metre unit of purple brown shales, tuffaceous siltstones and volcaniclastic lithic tuffs outcropping over a strike length of 1500 metres. Its uniformity and association makes it a suitable marker horizon.

The Eastern Sediments are a sequence of grey silstones black cherts, brown siltstones/cherts, chaotic calcareous rocks and mica sandstones. It should be noted that the mica sandstone is indistinguishable from the other sandstones over the licence area. Its close association with brown cherts and siltstones allows it to be predicted along strike, and it was used as a marker horizon. The limestones are poorly outcropping but are clearly defined in drill core over a strike length of approximately 500 metres. Three beds have been identified in drill core, one of which outcrops on Alm section 150 metres east of the southern base line (refer specimen, 183628). A coincidental bleached, and weathered clay zone occurs 600 metres south along strike, and is interpreted to be the limestone equivalent.

North of Wa section a sandstone unit outcrops along the Deep creek from G2 to G5 in a sequence of brown siltstones, grey siltstones and brown chert. It is suggested that these rocks are the faulted strike equivalents of the Eastern Sediments.

The Easter Volcanics overly the Eastern Sediments and appear to be conformable. Contact relationships were not observed. Petrologically and in outcrop they are identical to the Deep creek volcanics.

There appears to be a regional facies change in Halls Formation south of the mine environment. The silstones and cherts decrease in outcrop expression and sandstones become more dominant.

In the south there is a discontinuous sequence of weathered basic volcanics and tuffaceous sediments. They occur adjacent to the southern base line between RA 14 and 300 metres south of RA 25. The rocks exhibit the same characteristics as the Deep creek volcanics and the Eastern Volcanics. A faulted contact was observed with basic volcanics adjacent to mica sandstones. It is suggested that they are the faulted strike equivalents of the Washington Mine Volcanics.

A 0.5 to 1 metre basic intrusive dyke, extremely weathered and altered is mappable. This unit was previously incorrectly defined by Cox as a quartz porphyry. It was observed in underground development, and occurs at surface, predominantly on Ae section, cross cutting stratigraphy.

3.2.3 Structure

No attemptwas made to alter the structural interpretation as presented by Ransom (1976).

The strike of units are still predominantly east of north, with dips being variable but predominantly steeply to the west.

Open folds were observed in the field and plunge at low angles to the north east and south west. Rarely westerly plunging folds occur. Stratigraphic buckling may be related to either parasitic folding on regional fold limbs or dragging into the fault zones.

Faulting is represented on both macroscopic and mesoscopic scales. The surface expression of the Perseverance fault system was observed and interpreted in the vicinity of W/Wa sections. Several faults were mapped and exhibit the following characteristics:

- shear zones, breccia zones up to several metres wide, predominantly cross cutting stratigraphy and dipping at steep angles (Qa style fault).
- bleached pug zones up to 20cm wide, subparallel to stratigraphy (Nadir, Ratchet, EN faults style), dominant effect seen in diamond drilling from T to AH section.
- minor thin quartz veins with slickenside minimal outcrop scale displacement and variable orientation.
- irregular, discontinuous crush zones, shear zones, probably associated with soft sediment slump structures.

The limited strike extent of fault zones and the difficulty in correlating structures on surface to diamond drill core data precludes effective interpretation at this stage of the program.

3.2.4 Discussion

The program defined the strike equivalents of Halls Formation and Eastern Sediments stratigraphy. Several problems were not resolved and are discussed.

* The contacts of several units are observed as being buckled in a number of localities. This may be due to a function of topography i.e. near parallel slopes and dips, or related to faulting. Detail from the mine area shows that major buckles in units are related to faulting. Fault interpretation is perhaps premature at this stage due to the problem of their discontinuous surface expression.

* Thinning of Halls Formation and the Deep Creek Volcanics are interpreted in the Falls Creek area, and are possibly due to the following:

  - they thin out due to a facies change along strike and their southern strike equivalents are predominantly sandstones with minor interbedded shale and cherts.

  - the units are faulted out.

* North of L section the Eastern Sediments are observed to thin, lithologies and structures from diamond drill core data does not correlate with the surface geology. This may be related to facies thinning or faulting. These known facts suggests a flat dipping easterly fault, but interpretation is tenuous at this stage.

* South of Falls creek a sequence of shales, cherts, and brown siltstones occurs between a sandstone unit and a basic volcanic unit. At this stage it is suggested that they represent the faulted extensions of either the Eastern Sediments or Halls Formation faulted extension.

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3.3 Geochemistry

Soil geochemical sampling within EL1/63 of the prospective rock types/areas were completed by 1977. A statistical review of the data by Ransom (Feb 1977, August, 1979) was aimed at assessing - particular geographic areas within EL1/63 and individual stratigraphic Formations.

The review consisted of comparing from each area or rock type - Logarithmic and arithmetic means, variances and standard deviations
- correlation matrix and standardized, log transformed partial regression coefficients.

This review concluded that the most prospective area for further exploration was the Mine/Falls Creek Sequence.

As no geochemical anomalies were located a second review aimed at locating low order anomalies was initiated.

The aim of this review is to:

- consider differing accuracy caused by various analytical techniques.
- consider and attempt enhancement techniques to highlight the chemistry associated with possible ore emplacements. Preliminary results of trace element distribution on L section suggests halos of Flourine and Rubidium exist around the Cleveland ore.

3.4 Geophysics

University of Toronto Electro-Magnetic (U.T.E.M.) Survey.

Refer to Appendix II for the detailed report by Y. Lamontagne (January, 1979).

Late in 1978 a newly developed deep sensing geophysical system (U.T.E.M.) was engaged to explore both north and south of the current Cleveland mine workings.

The survey delineated several weak electrical conductors in Halls Formation and the Eastern Sediment sequence.

The technique did not recognize the mineralization in the south end of B-South (line AH). Consequently its application in recognizing other mineralization simmilar to Cleveland is dubious.

Y. Lamontagne expressed doubts on a number of anomalies and attributed them to possible hidden cultural features associated with the mine.

* Comparison of the U.T.E.M. anomalies recorded (Lamontagne 1979) with soil and stream geochemistry and rock units suggest the following:

  - In the south an anomalous zone is located within the Eastern Sediments regionally proximal to the mica sandstone marker horizon. (lines AH, AM, AU, RA3, RA4, RA8).

  - An anomolous zone adjacent to a basic volcanic sequence (potentially strike equivalents of the Washington Mine Volcanic) and black cherts (locally pyritic).

  - An anomalous zone in the southern strike extent of Halls Formation, (lines RA12, RA18, RA21, RA25).

  - Two weakly anomalous zones in the north apparently coincidental with known outcropping graphitic cherts which in drilling were below limestone equivalents of Halls lenses, (lines G7, G9, G11).

4. Finance

Expenditure for the period August, 1977 to July 1979 is as follows:

Geology	$ 18,789
Survey	$ 14,773
Geophysics	$ 15,388
Geochemistry	$ 5,258
Drilling	$ 37,735
Misc.	$ 3,125
Tenure	$ 376
Total	$ 95,444

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5. Conclusion and Recommendation

Recognition of extensions of mine stratigraphy to the north has resulted in the definition of:

- Limestones which are stratigraphically equivalent to the ore lenses enhancing the potential.

- A chert horizon, below the limestones, which outcrops and can be used as a marker horizon.

The anomalous geochemistry north of the mine was not explained by the results of the diamond drilling.

Surface mapping of new exposures improved definition of the detailed lithologies south of the mine. Two regional marker units were recognised. They are:

- a purple tuff unit stratigraphically above the Deep Creek volcanics, outcropping over a strike length of 1.5 km.

- a single mica sandstone unit within the Eastern Sediments mappable over 1.5 km.

In the north an outcropping chert unit can be mapped several hundred metres to the north of Wa section. Its location is correlated with a chert bed occurring below limestones equivalents of Halls Formation.

Continuation of this mapping is recommended to cover new rock exposures and with the aid of costeaning to resolve structural and lighological problems.

A second review of the available geochemistry is necessary to attempt to quantify subtle anomalies and geochemical trends.

Application of a new geophysical technique (U.T.E.M.) was not successful in recognising known mineralization. Cultural features may be responsible for some of the U.T.E.M. anomalies, however several require follow up work. The anomalous zones are located in the:

- Eastern Sediments proximal to the sandstone marker unit.

- Stratigraphy adjacent to a basic volcanic and black cherts which appear to be the strike equivalents of the Volcanics around the Washington Mine.

- Southern strike extent of Halls Formation.
- North of the mine apparently coincident with the outcropping graphitic cherts.

Compilation and interpretation of geology, geochemistry and geohpysics is to continue to delineate potential ore bodies.

Total expenditure for the 22 months from August 1977 to July 1979 was $95,444.

Submitted By:

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T. Tulp for A. Eadie.

A. Eadie
Geologist

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Reid, A.M.	( )	The Mount Bischoff Tin Field Tas G.S.BULL 334, 150-166

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APPENDIX I

Report CMS 79/4/28 - Cleveland Rocks

H.W. Fander. Central Mineralogical Services.

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Mr. T. Tulp
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LUINA / TAS. 7321

9th May, 1979

REPORT CMS 79/4/28

YOUR REFERENCE:	Letter dated 17.4.1979
DATE RECEIVED:	27th April, 1979
SAMPLE NOS.:	183 606, 183 607, 183 609, 183 610, 183 620, 183 623, 183 624, 183 626, 183 628, 183 629, 183 635, 183 636, 183 637, 183 642, 183 643, 183 644, 183 646, 183 654, 183 656, 183 657, 183 661
SUBMITTED BY:	T. Tulp
WORK REQUESTED:	Petrology

H.W. Fander, M. Sc.

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REPORT CMS 79/4/28

Cleveland Rocks

The twenty-one rocks were thin-sectioned, and the offcuts were given K-feldspar stain tests in view of possible tuffaceous components. The rocks are briefly described in the accompanying tables; more detailed descriptions did not seem to be justified at this stage.

Comments

All the rocks are sediments, with little evidence of any significant metamorphism, though many show the effects of pre-consolidation movement. A late-stage post-lithification fracturing phase occurs, generally accompanied by veining. In most cases, the veins are quartz or quartz-chlorite; in one rock, quartz-phlogopite veins occur, and in two others, there are unusual veins of quartz with soft, resilient carbonaceous (?bituminous) matter.

Most of the sediments are shales or argillites, ranging into siltstones; some are carbonaceous, others hematitic, ie. formed under varying environmental conditions. A carbonaceous dolostone also occurs and is probably a member of a black shale sequence. Cherts are well represented, ranging from fairly pure, fine, layered rocks through soft-pebble cherts to argillaceous cherts and cherty shales/argillites.

The evidence for pyroclastic components is poor, except in one rock (183 654); one or two of the other rocks (e.g. 183 637, 183 643, 183 636) may represent extremely altered tuffs similar to 183 654.

Some of the lithologies are quite similar and many are broadly similar; comparisons and correlations are difficult, because many rocks lack distinctive characteristics, with a few obvious exceptions as indicated in the tables.

H.W. Fander, M. Sc.

Sample Details	Rock Type - Composition	Fabric	Minor Minerals	Comments
183 606 (T.S.27440)	Micaceous, Feldspathic Sandstone. Small angular to subangular quartz, K-feldspar, plagioclase grains, many small flakes of muscovite, biotite; argillaceous matrix.	Bedding-alignment of elongate grains. Moderate sizing/sorting. Silty, fine-grained.	Rare lithic grains - fine mica schist, felsite. Detrital heavy minerals.	Fine-grained sediment with distinctive lithology (especially biotite). Heavy minerals are zircon, rutile, opaque oxides, tourmaline.
183 607	Micaceous, Feldspathic Sandstone. Angular to subangular, subrounded quartz; K-feldspar, plagioclase cleavage fragments, muscovite + biotite flakes, silt matrix.	Generally bedded, but sorting/sizing poor - moderate.	Rare schist, meta-quartzite grains. Detrital garnet, tourmaline, ?kyanite.	Very similar to 183 606, but coarser and poorer sorting/sizing. Fine quartz-clay matrix/cement. Lithified, but unmetamorphosed.
183 609	Brecciated Shale. Mudstone pebbles, lenses; deformed and interrupted silty layers; set in a mass of ultrafine quartz and recrystallized clay. Later brecciation.	Slumping and soft-sediment deformation, superimposed brecciation.	Small fractures contain pale chlorite. Pyrite in later, tectonic fractures.	Believed to be a turbidite, with silt and soft-pebble beds; brecciated after lithification, when competent.
183 610	Ferruginous Shale. Silt-size clay flakes, quartz grains, in ferruginous clay matrix; showing extensive soft-sediment deformation, later brecciation.	Fine, complex folding, deformation, squeezing; fractures, veins.	Quartz-pyrite veins; goethite impregnations of some layers.	As for 183 609, thought to be a soft-sediment deformation with superimposed, post-lithification fracturing, veining.
183 620	Shale. Fine silt-sized clay flakes, quartz grains, in a weakly ferruginous clay matrix, with many small goethite spots (?oxidised pyrite).	Well-bedded clay flakes; faint, fine layering. No deformation, uniform.	Weak limonite-staining along some layers (?more porous).	Featureless, fine sediment, lithified and unmetamorphosed. Very probably pyritic (i.e. syngenetic pyrite) now oxidised.
183 623	Soft-Pebble Chert. Microcrystalline quartz, minor clay, as subrounded fragments 0.1 - 5.0mm, in matrix/cement of same components. Later brecciation/veining.	Faint banding in some pebbles. Typical pre-consolidation features.	Chlorite patches, infillings. Quartz-chlorite veins, with goethite (?pyrite).	Pebbles formed from semi-consolidated chert, deposited in/cemented by same material; some patches pigmented with fine hematite (oxidised in part).
183 624	Brecciated Soft-Pebble Chert. Subrounded pebbles and grains, of various sizes/shapes, in chert matrix. Cut by massive quartz veins containing chlorite.	Typical soft-sediment breccia textures; some fragments faintly banded.	Small oxidised pyrite crystals in chert. Carbonaceous films.	Very similar to 183 623 in composition and history. Quartz veins are fairly massive, weakly stressed.
183 626	Deformed Cherty Shale. Deformed, recrystallized clays, hematite-pigmented, with shale pebbles, small chert spheres, siltstone fragments, globular chert grains; limonite veins.	Many soft-sediment deformation textures; later tectonic veins.	Carbonaceous films. Quartz and goethite veinlets.	Turbidite rock with soft-sediment pebbles as well as lithified material; chert is contemporaneous. Possible syngenetic pyrite (oxidised).

130022

021

Sample Details	Rock Type - Composition	Fabric	Minor Minerals	Comments
183 628	Carbonaceous, Pyritic Dolostone. Fine, granular dolomite, minor detrital quartz, mica. Abundant framboidal and anhedral pyrite; interstitial carbon films.	Well-bedded, fine-grained, silt-grade. Dolomite granular, but not detrital.	Occasional shale-siltstone lenses or streaks.	Typical member of a "black shale" sequence. Dolomite appears primary. Other sulphides may be present.
183 629	Carbonaceous, Pyritic Siltstone. Fine silt-size quartz and clay/mica grains in carbonaceous clay matrix; abundant fine framboidal pyrite - some pyrite/carbon beds.	Good bedding; interrupted carbonaceous-pyritic layers. Fine-grained.	Occasional small nodules of impure chert.	Evidence of minor pre-consolidation movement, but no faulting/brecciation. "Black shale" sequence rock.
183 635	Banded Hematitic Chert. Micro- to cryptocrystalline quartz, variable amounts of ultrafine clay and hematite pigmentation. Small-scale faulting, brecciation.	Most faulting, brecciation pre-dated lithification. Later fractures, veins.	Quartz-chlorite veins fill late fractures.	Extensive small-scale fractures developed after deposition, before lithification; younger, distinct, tectonic fractures/veins.
183 636	Argillaceous Siltstone. Fine silt-size quartz and clay/mica flakes in pale, limonitic, argillaceous matrix; fine ?hematite throughout.	Faint bedding, but generally featureless. Verging on argillite.	Quartz-goethite veins - adjacent rock is limonite-stained.	Could be a bleached, oxidised equivalent of 183 629. Perhaps more appropriately classified as silty argillite.
183 637	Hematitic Silty Argillite. Silt-size quartz, clay grains, many small (< 50 μ) clay aggregates or pellets; abundant ultrafine interstitial hematite and clay.	Fine bedding, accentuated by more/less hematite. Brecciated.	Veins and breccia-zone fillings of chert. Limonite veins.	No petrographic evidence of pyroclastic components, and K-stain negative; however, some relict features not incompatible. See notes.
183 642	Indurated, Carbonaceous Shale. Virtually all recrystallized clay; some layers only are carbonaceous. Complex small-scale fracturing-recrystallization pattern.	Wedges, slivers and blocks with different orientation; post-depositional movement.	Rare small chert pellets. Possible ultrafine SiO_2.	Fabric suggests incompetent fracturing during recrystallization, i.e. some tectonism during lithification.
183 643	Hematitic, Argillaceous Siltstone. Dominantly small subparallel clay/mica flakes in ultrafine hematitic clay matrix; irregular bleached zones/lenses.	Clay flakes finely bedded, but otherwise uniform. Small-scale fracturing.	Occasional small cherty pellets. Haphazard limonite veinlets.	Dominantly argillic composition, but clay-flakes are silt-size; perhaps shale would be a better term, but fabric not shaly.
183 644	Veined Chert. Featureless, homogeneous, microcrystalline quartz-typical recrystallized chert-with many quartz-carbon veins.	Veins are of replacement type, not fracture-filling.	Goethite veinlets; diagenetic quartz veinlets.	Unusual carbonaceous patches common in quartz veins; appears to be amorphous carbon, possibly bituminous in part.

130023

022

Sample Details	Rock Type - Composition	Fabric	Minor Minerals	Comments
183 646	Ferruginous Shale. Almost entirely composed of recrystallized clay flakes, well-orientated, with ultrafine goethite pigment. Patches + veins of phlogopite.	Zones of wedging - fracturing. Also later fractures/veins.	Phlogopite veins contain goethite (?oxidised sulphides).	Fabric similar to 183 642, possibly correlatable, but this rock not carbonaceous (?oxidised). Phlogopite veins are metasomatic.
183 654	Basic Tuff (?Re-worked). Small fragments of devitrified ?basic glass, chloritised ferromagnesian minerals, decomposed magnetite/ilmenite; abundant fine leucoxene.	Well-sorted/sized; grain-shapes suggest some re-working. Bedded.	Occasional angular sulphide (?pyrite) grains.	If re-worked, then rock is a volcanor sandstone; components easily decompos and thus details obliterated. Possibl Crimson Creek unit.
183 656	Ferruginous Shale. Silt-sized quartz splinters, clay/mica flakes, semi-amorphous interstitial clay and hematite pigment. Hematitic layers.	Well-bedded, laminated. Fine silt- to clay-grade. Uniform.	Small tension-cracks filled withpale green fibrous chlorite.	Similar to other ferruginous shales, uniform, undisturbed. Laminations due to variable hematite distribution/ concentration.
183 657	Argillaceous Chert. Crypto - to microcrystalline quartz, with embedded clay/mica flakes, ultrafine chlorite (diagenetic); merging into cherty argillite.	Parallel orientation of micaceous minerals. Very fine-grained.	Pale chlorite pseudomorphs after syngenetic -diagenetic pyrite crystals. Quartz veins.	Late-diagenetic replacement of early-diagenetic pyrite by chlorite. Quartz veins post-date lithification. No evidence of tuffaceous material.
183 661 (T.S. 27460)	Carbonaceous, Argillaceous Chert. Dominantly cryptocrystalline quartz with small embedded clay flakes; carbonaceous in part, but mostly bleached.	Finely banded due to variations in carbon pigment. Ultra-fine-grained.	Ptygmatic sericite veinlets; quartz veins with carbon (cp. 183644) ?Halite cavities.	Bleaching (removal of carbon) probably occurred before lithification. Oxidise framboidal pyrite present. Standard ch

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APPENDIX 2

1. Covering memo to U.T.E.M. Survey - S.S. Webster-Aberfoyle Exploration

2. U.T.E.M. Survey in Tasmania - Y. Lamontague 26th January, 1979

CLEVELAND NORTH

Only weak anomalies were observed on the northern survey area for the two transmitting loops. The data was heavily disturbed by shallow cultural features (pipes, cables and overhead powerlines), but any response due to a good, deep conductor should have been evident through this cultural noise.

The anomaly at 6E on line G15 has been recommended for follow-up if no surface conductors are evident. The source is interpreted to have a depth of 50 metres.

A weak linear trend has been interpreted from G5 through G11, as evidenced at station 1.5W on lines G6 and G7. This anomaly may be due to the width of a broad conductive rock unit.

CLEVELAND SOUTH

Three anomalies were detected during the UTEM survey south of Cleveland Mine. Unfortunately, no traverses could be conducted over the Cleveland orebody due to mine workings. Traverse line AH is the closest line to the orebody, but no anomaly is evident to suggest that the mineralization is conductive.

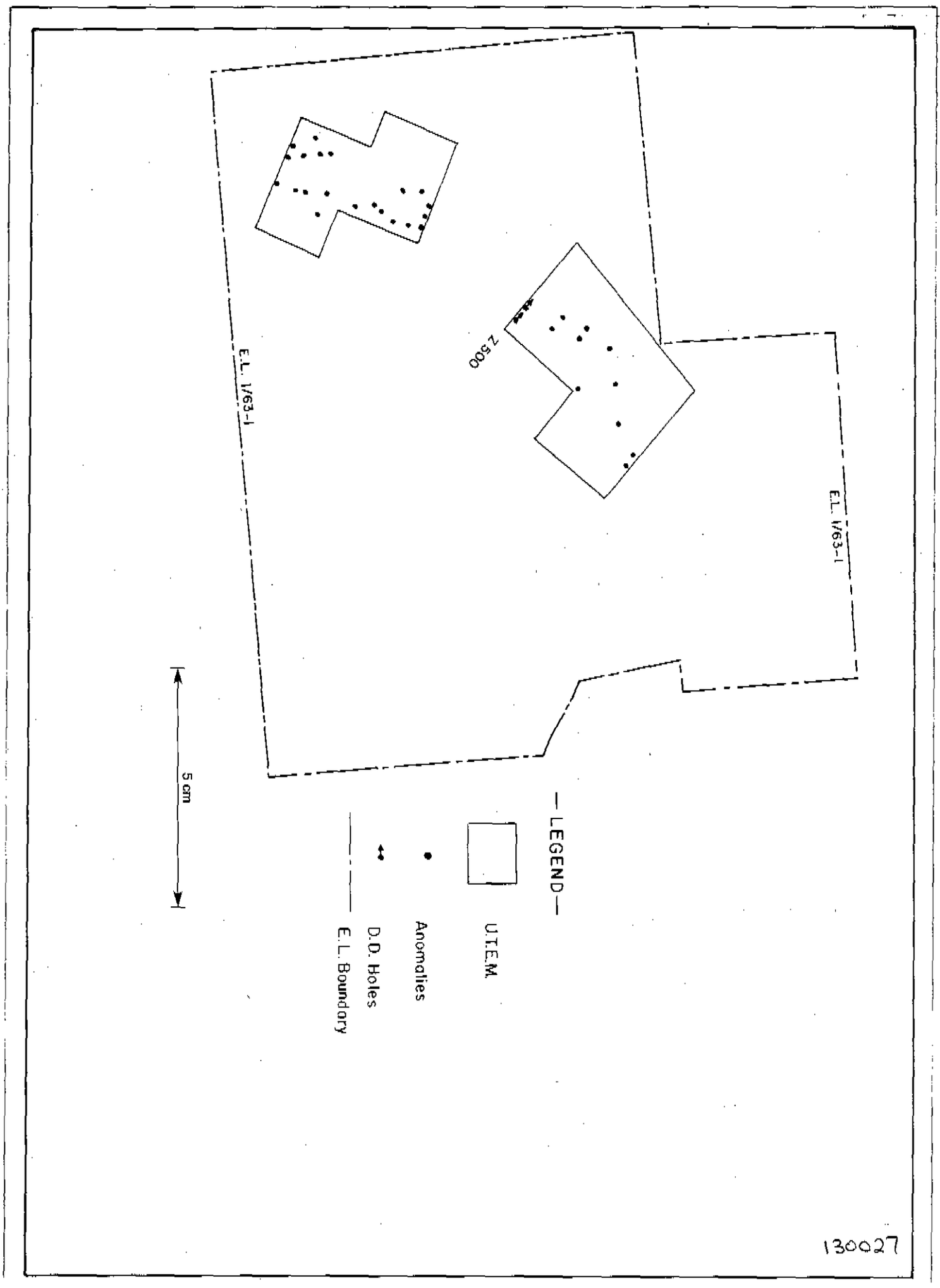
Anomaly A is interpreted on all lines as a continuous trend from line AH to line RA25. The strongest responses of the trend occur on the southernmost lines from RA18 to RA25. Positions are marked on the attached plates. The anomalous trend maps either a fault or a conductive rock unit. The enhanced response on the southern lines may indicate mineralization, which could be checked by geochemical or Induced Polarisation traverses.

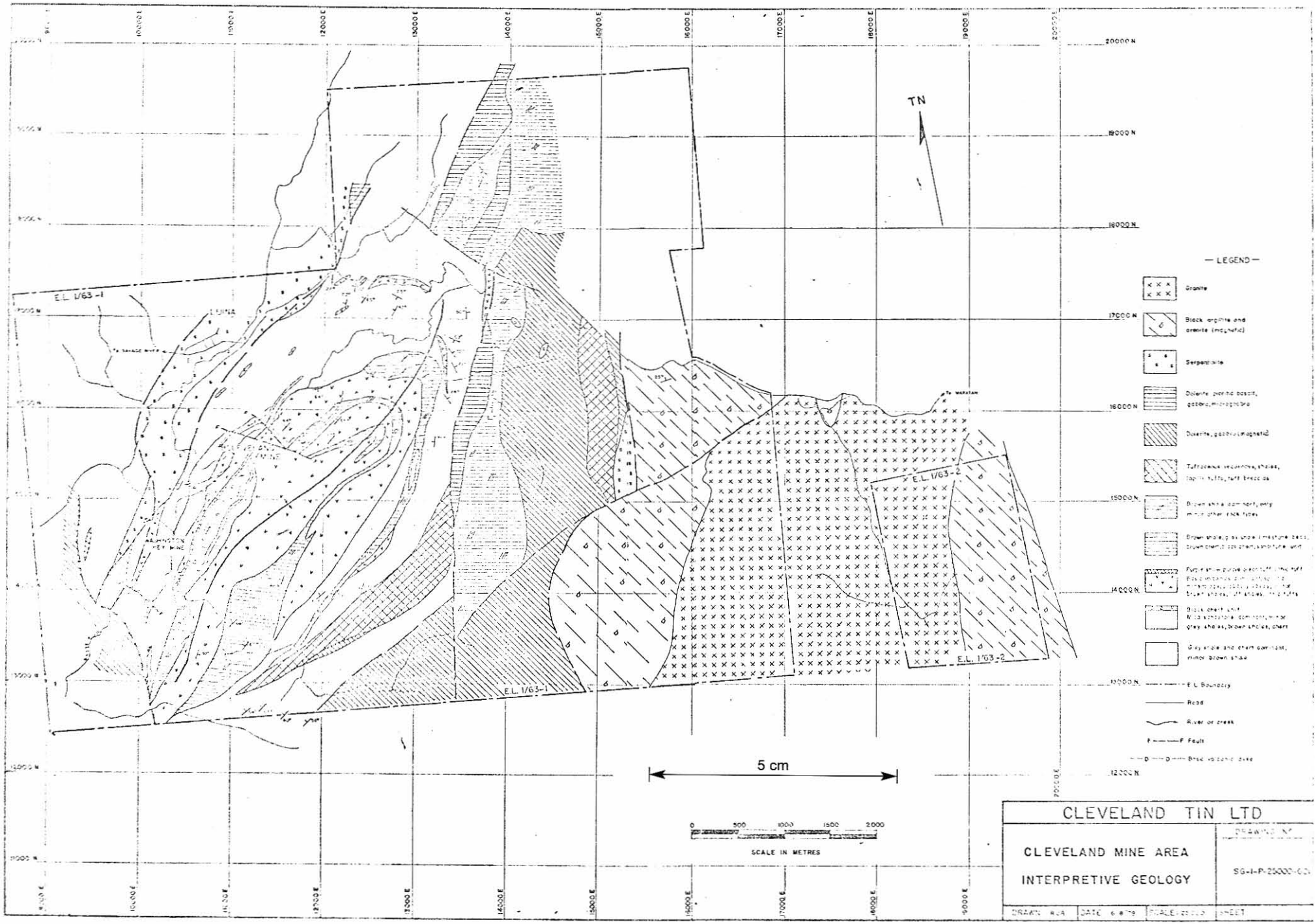
Anomaly B is evident on four lines RA14 to RA25 as shown by the steep gradients near 2W on line RA18. The position of this anomaly is coincident with an inferred fault contact of ultramafic with Hall's formation in the south west corner of the Exploration Licence.

Anomaly C is inferred from extrapolation of the western end of lines AU, AM and AV, and is therefore of dubious significance.

Follow-up of these anomalies should initially be undertaken with detailed geological mapping, and then by Induced Polarisation or geochemistry if favourable rock types are indicated.

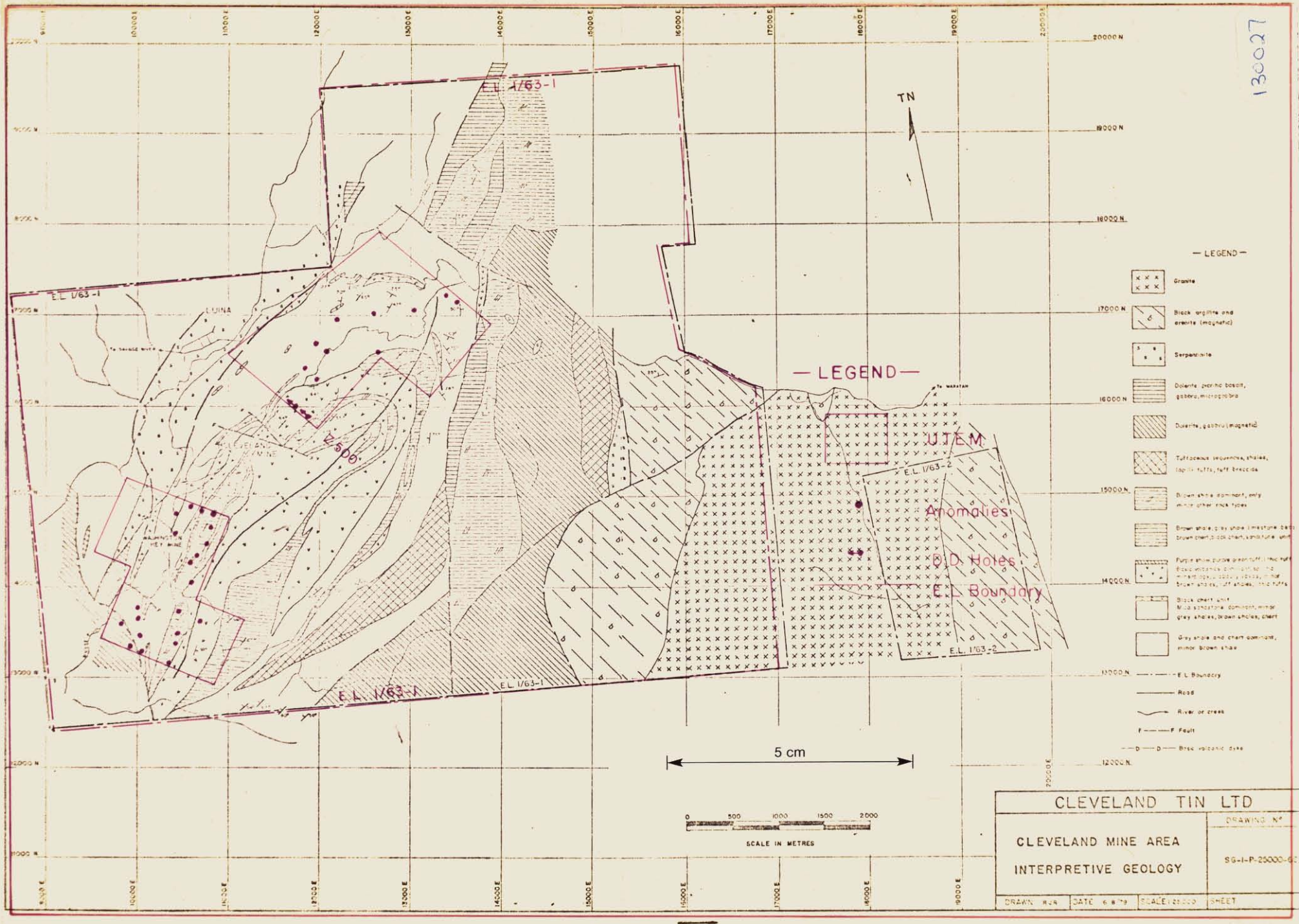
S.S. Webster


E.L. 1/63-1
Z500
E.L. 1/63-1
5 cm
— LEGEND —
U.T.E.M.
Anomalies
D.D. Holes
E.L. Boundary
130027



130028
22.
920

22.
130028
130027
020



027

130029

UTEM SURVEY IN TASMANIA

Y. Lamontagne 26th January, 1979

The surveys which are reported on here were conducted in the Cleveland area in November and December 1978. The field work was carried out from November the 23rd to December the 13th by Yves Lamontagne with the assistance of Steve Ranford.

The purpose of the survey was to search areas in the vicinity of known deposits.

FIELD WORK

The measurements were made using 4 transmitter loops.

INTERPRETATION

Only a preliminary interpretation of the UTEM data will be presented at this stage; which should be sufficient to follow up anomalies. Since there were no exceptional anomalies found and desirable targets are not expected to have very high conductivities, a more detailed physical interpretation may be of limited use and may not be justified. The main value of the UTEM data is that they located some potential targets and give geometrical information on them. The interpretation maps and the notes of this report gives this type of information. But the choice of which of the many weak conductors to follow up should be based mostly on geological considerations.

The following is an area by area enumberation of the main conductors found. For each area, a somewhat idealized map of the grid was drafted, on which the positions of the conductors are shown. Since the lines are often mislocated, the maps are probably distorted and are only useful for locating the anomalies relative to the pickets as they are labelled in the field.

CLEVELAND SOUTH AREA

(Loop numbers 860 (loop S2) and 862 (loops S1))

In the south part of the Cleveland grid, there is a main conductor labelled A on the interpretation map which runs fairly continuously from above 1.50E on line AH to about 3E at line RA25. The best anomalies are those in the south part of the grid particularly from lines R18 to RA25. The response at line AH over the south extension of the Cleveland Mine is almost non-existent except for a small narrow channel 6 response at 1.60W and possibly one at 0/25W (ch 7). These axes are located to within about half a

028

130030

station spacing (± 12m for the first and ± 25m for the second). Conductor A appears to be striking to about 0.75E on line AH. The exact position of the deposit under line AH has not been correlated with this data yet. The best anomaly of conductor A is on line RA21.

Conductor B shows on four lines (Ral4 to RA25) and follow fairly well the trace of an inferred fault. The best anomaly on line RA25 would indicate a conductance of about 5 to 15 ohms depending on the southern extent of the conductor.

Conductor C is only a speculation based on the variation of the response at the west end of lines AM and AU. If it is real, its position is poorly defined by the data.

Since there was no measurements made over the main part of the Cleveland Mine (because of the mine installations), it is difficult to judge what conductance range is significant in this area. Certainly, the south extension of the mine (which reportedly has little conductive sulphides) produces no prominent anomaly. On electrical merit alone, the south part of conductor A (particularly at line RA21) looks most promising.

CLEVELAND GRID LINE LABEL CROSS-REFERENCE

Cleveland North Grid

Lines	Plot Labels	
G4	9N	
G5	10N	
G6	11N	loop label 864 (N2)
G7	15N	
G9	17N	plot hand labelled
G11	20N	common line
G13	23N	
G15	26N	loop label 863 (N1)
G17	29N	

Cleveland South Grid

Lines	Plot Labels	
AH	10N	
AM	plot mislabelled	
AU	6N	loop labelled 860 (loop S2)
RA3	4N	
RA5	3N	
	1N	
RA8	10N	
RA12	7N	
RA14	5N	loop labelled 862 (loop S1)
RA18	4N	
RA21	2N	
RA25	0	

CLEVELAND NORTH GRID

(Loop Lable 863 (N1) and 864) N2)

The response in that part of the grid is dominated by cultural conductors: One large power line cutting across the loops and the near loop part of the lines, a multiple power line running parallel to the road waste within about 200m, telephone lines, dual cables running along the ground generally in the vicinity of the second power line and a large diameter (about AWG 6) galvanized steel cable running roughly along the Cleveland Mine tram. There is a major response on line G15 (at 850W) (almost 1000% peak to peak) which is apparently caused by some long cultural conductor (perhaps a buried pipe) which was not noted in the field. (Please note that the coordinate system in loops N1 and N2 is different for every line. The plot coordinates are the same as the picket labels and relative position in plan can be roughly inferred from the distance to the transmitter wire which is generally 20 to 60m E of the end of the lines. In loop N2, the station zero appeared to have been arbitrarily chose to coincide with the tram on most lines).

Only the conductors which appear to be of geological origin have been reported on the preliminary map. None of these are exceptional and some are poorly defined because of high power line noise prevailing in most of the area. The best anomaly is probably at 6W on line G15, which looks only to channel 8.

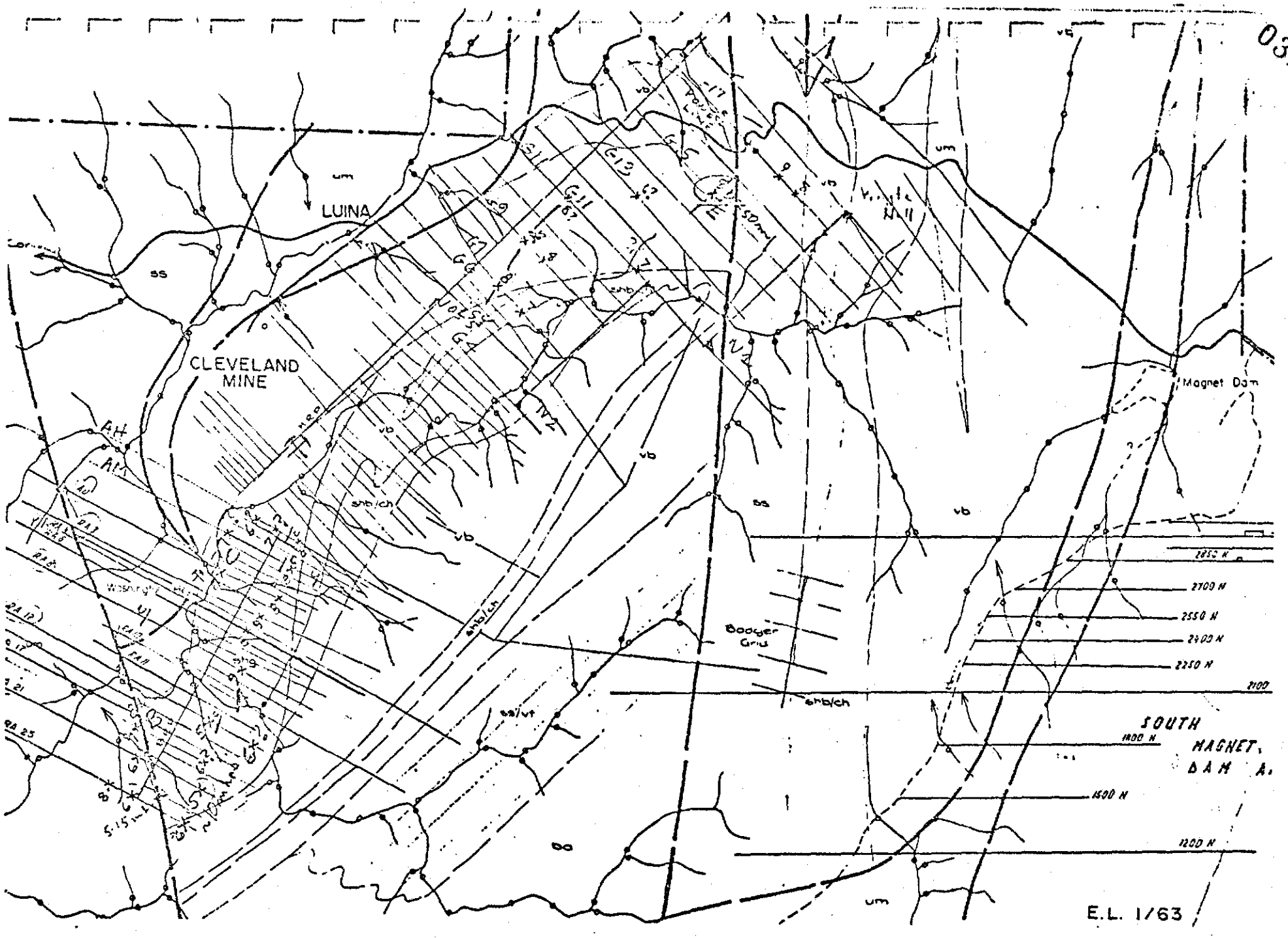
A great part of the north Cleveland grid cannot be considered properly covered because of the high cultural noise and the numerous large cultural responses, the possibility of a large highly conductive body is ruled out. Such a body would produce a response which would override the interferences, particularly on late channel.

None of the conductors found in the north grid would warrant

030

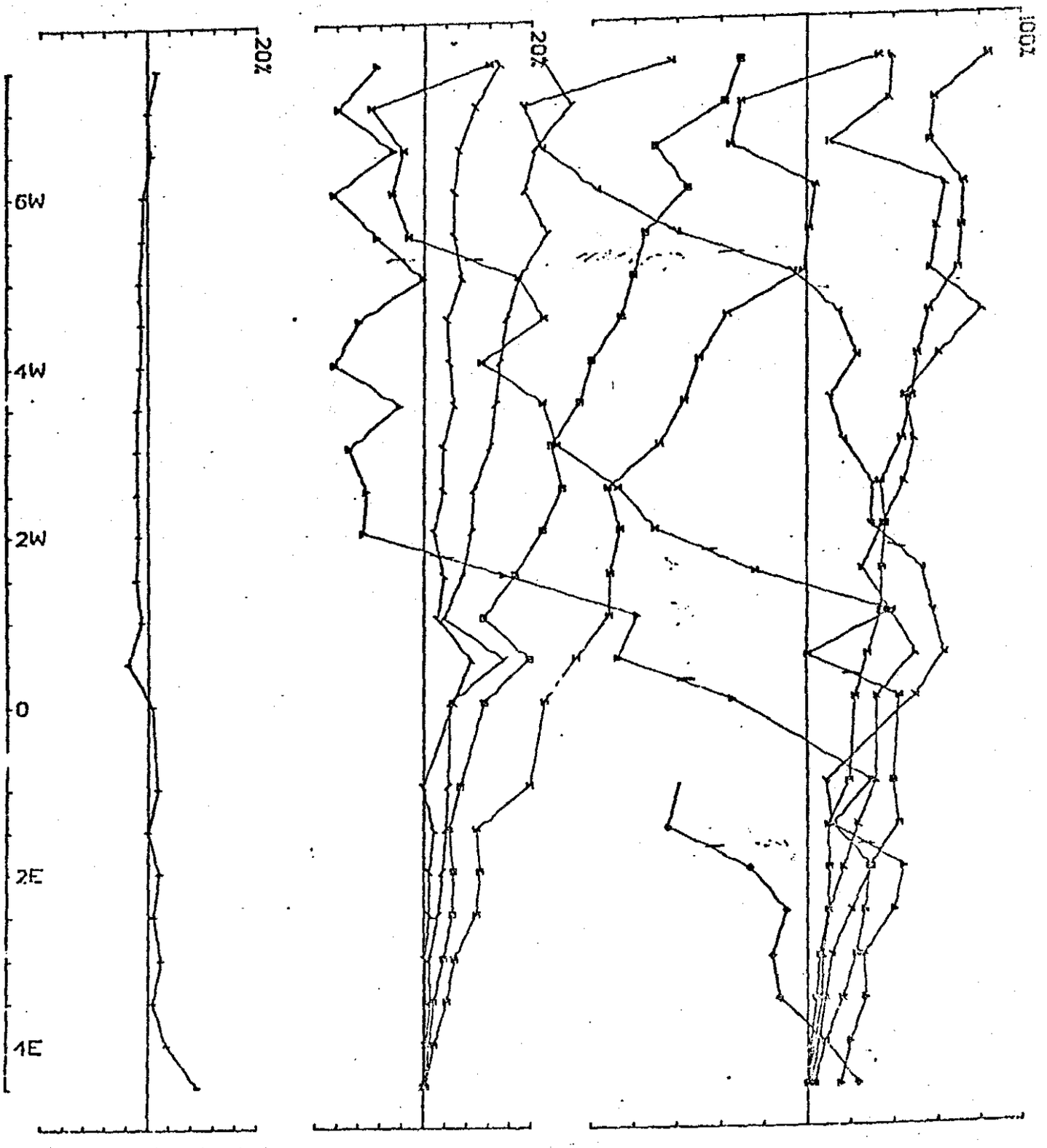
130032

any extensive follow-up judging from their electrical properties alone. The first follow-up work advisable in this area is to search on the ground near the inferred location of the conductors for possible wires or pipes, particularly where the anomaly is very abrupt. Anomaly E on line G15 would appear the most likely to have a geological origin, since the inferred depth is of about 50m.


031
LUINA
CLEVELAND MINE
Magnet Dam
Booger Grid
2850 N
2700 N
2550 N
2400 N
2250 N
2100
SOUTH MAGNET, DAM A.
1800 N
1500 N
1200 N
E.L. 1/63
130033
24.

032

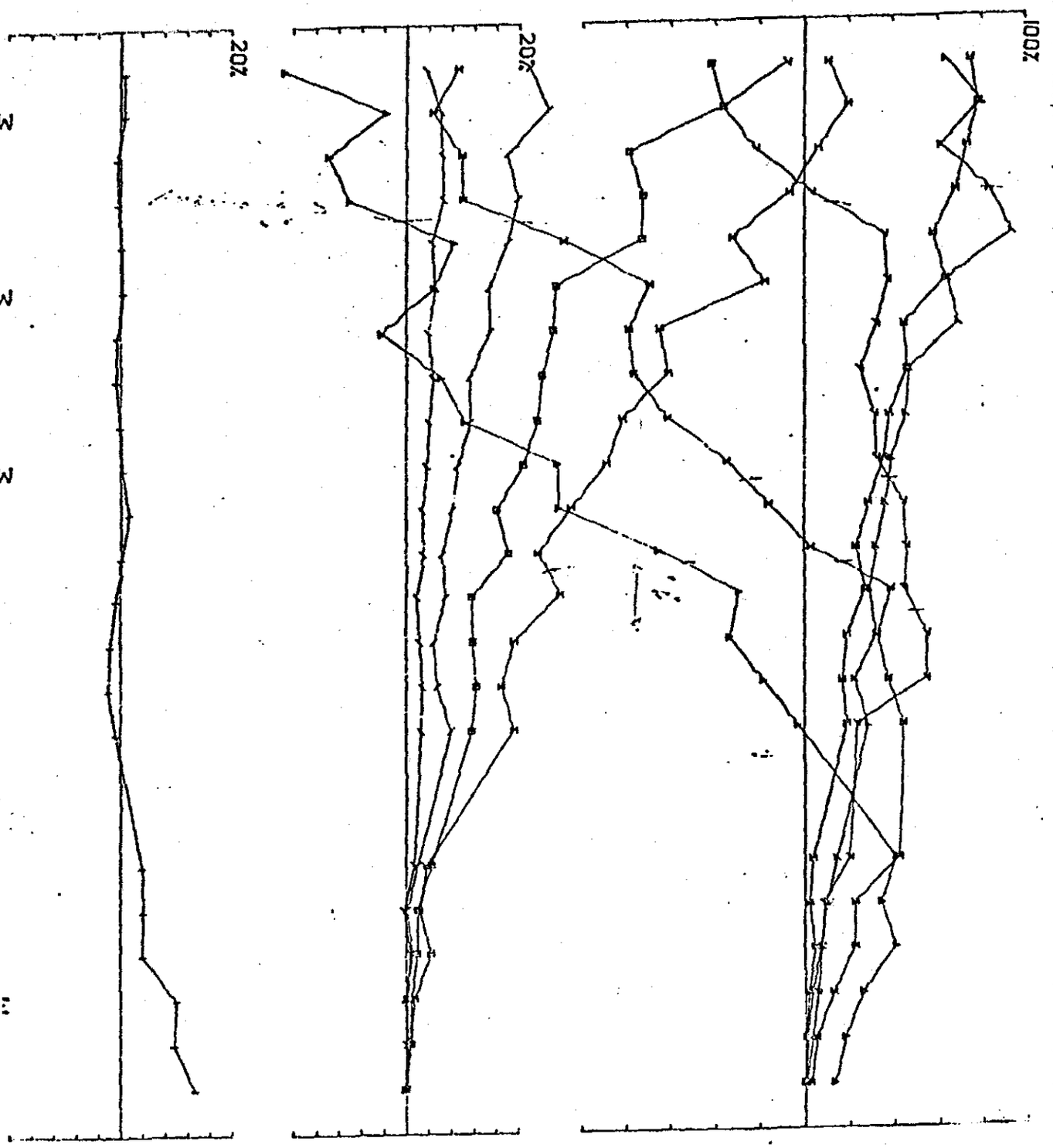
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CLEVELAND 4 25.50 HZ C-P)/P C-C)/C1 Hz G4 9N 864

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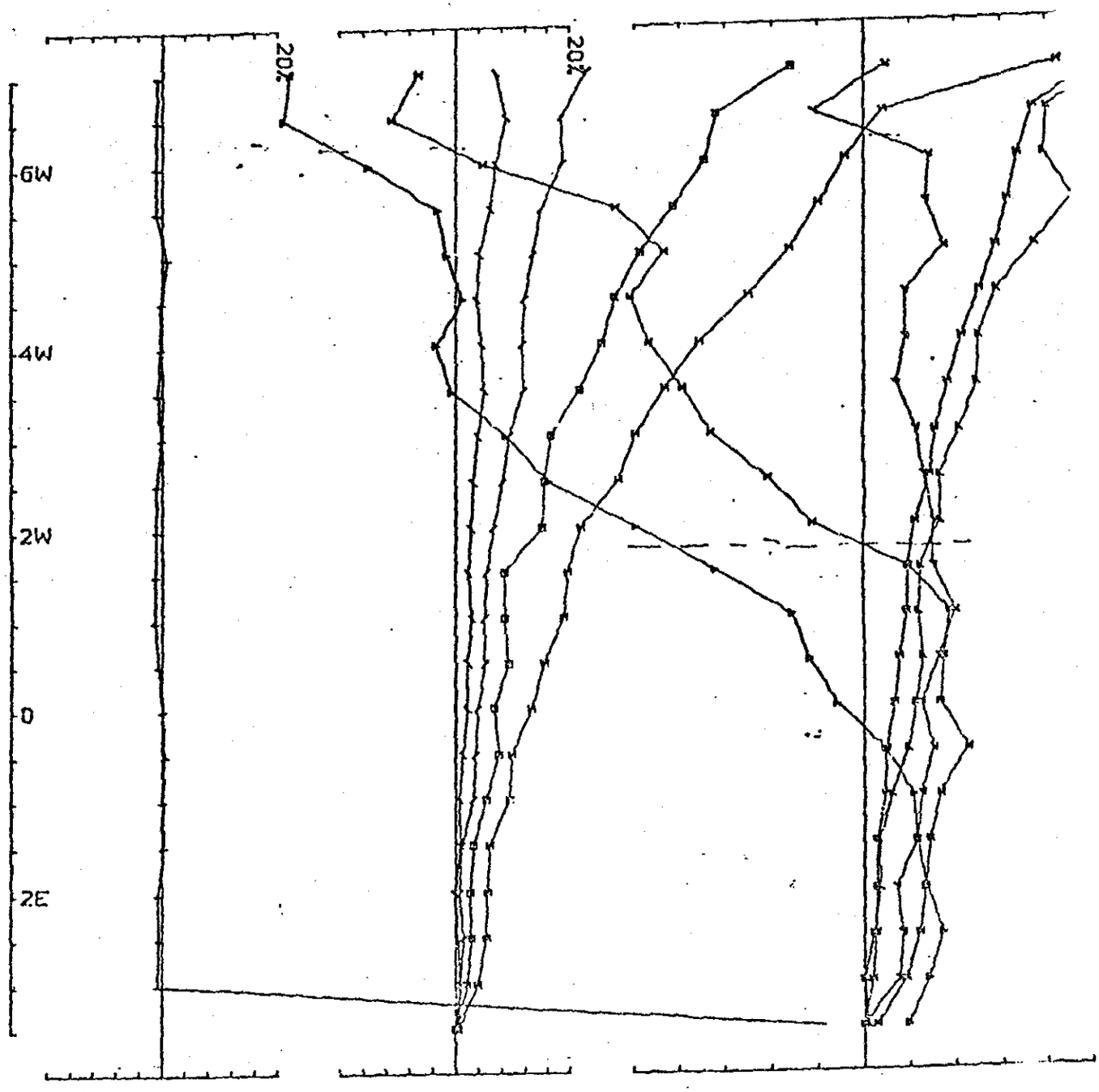
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CLEVELAND 4 25.50 HZ C-P)/P C-CI)/CI Hz GS ION

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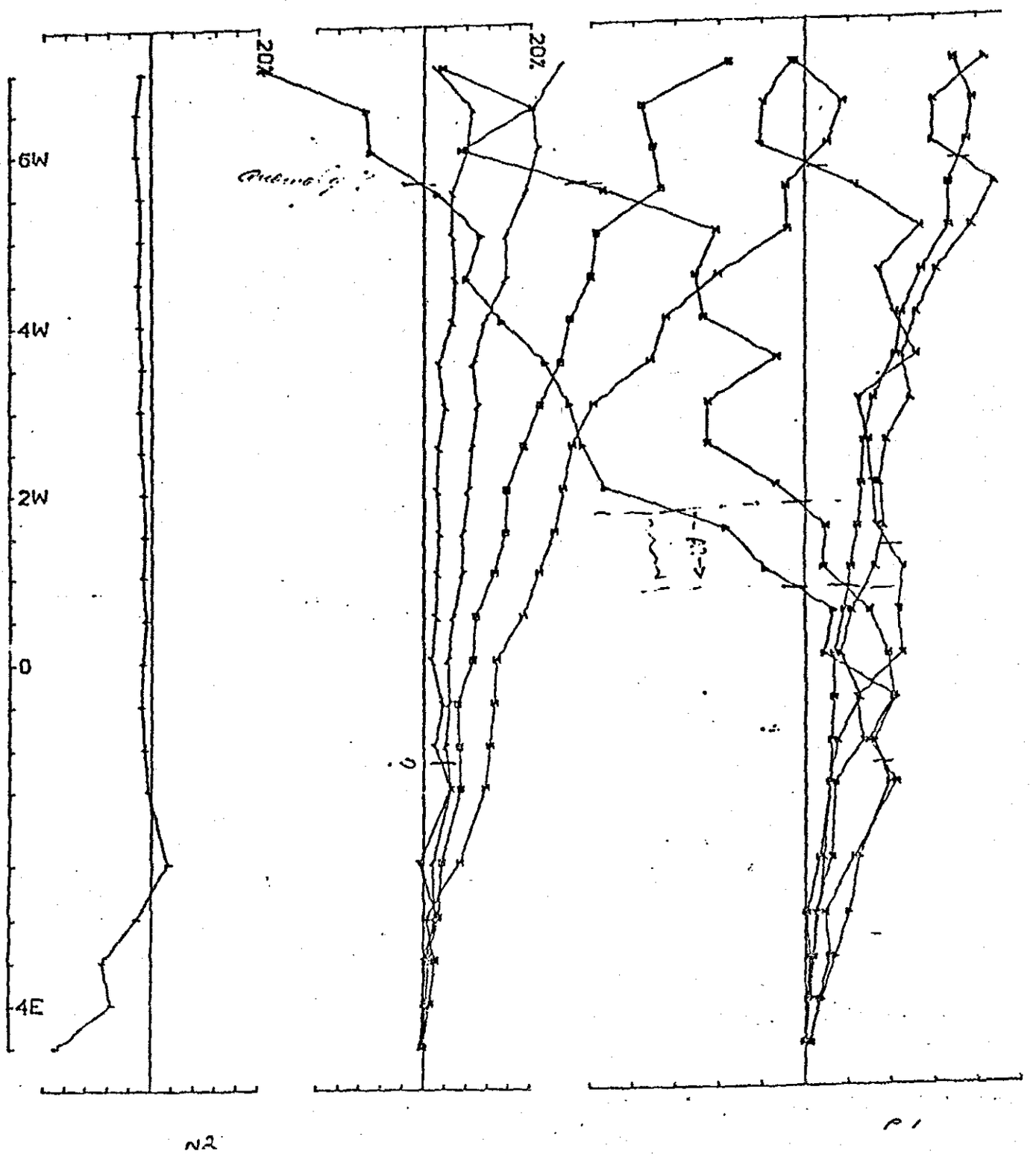
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G7.

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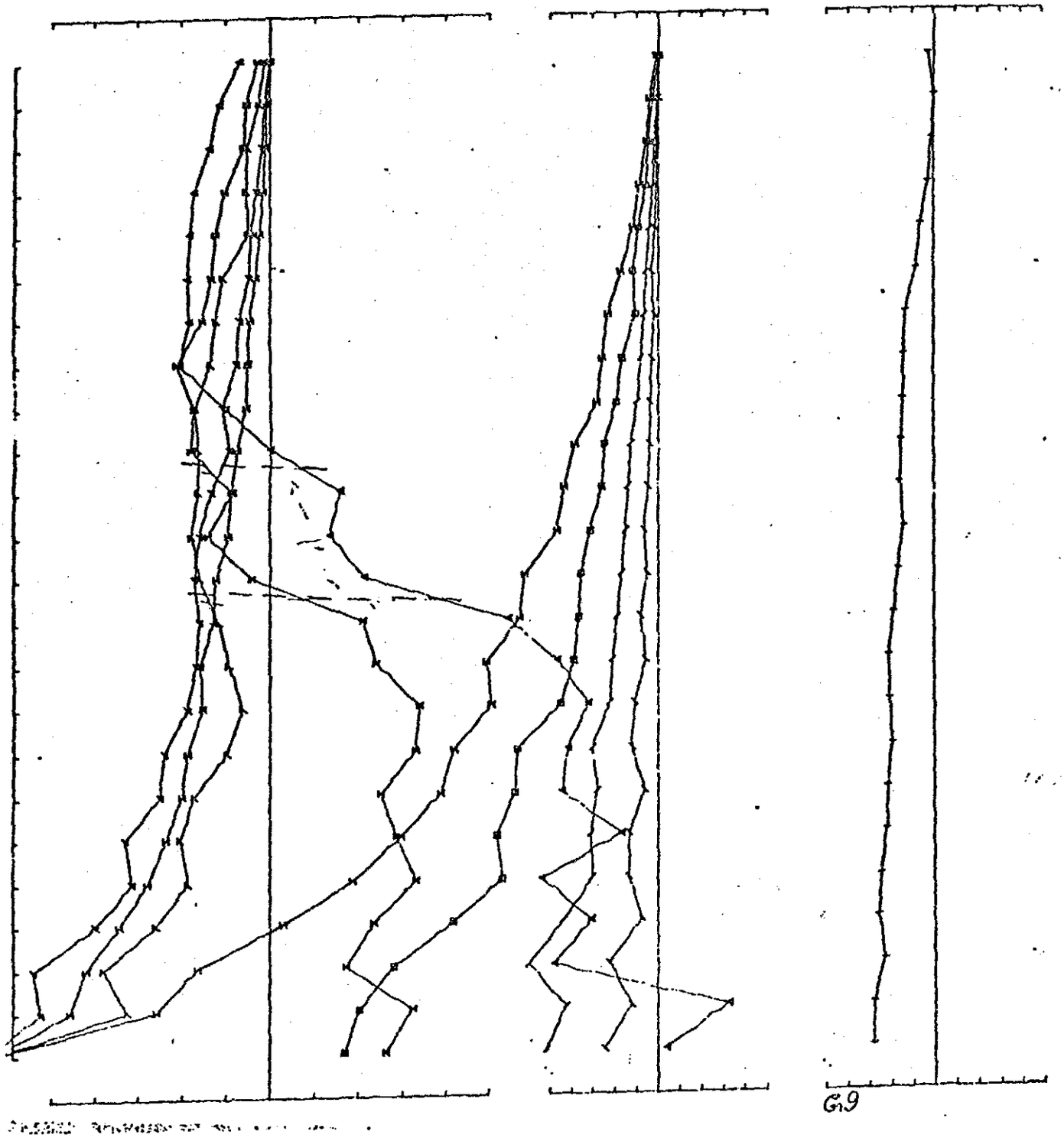


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LINE G9

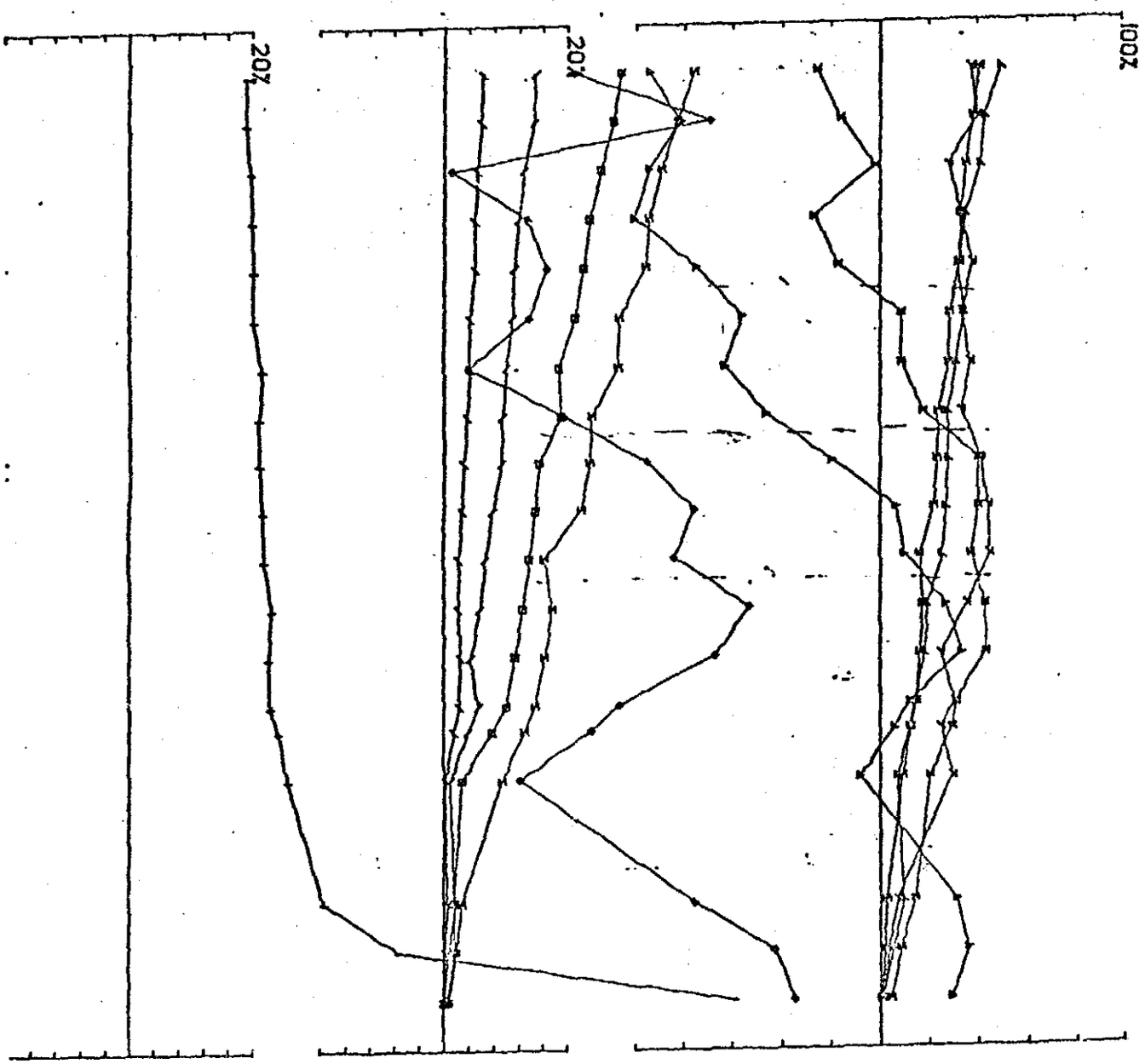
CLEVELAND N2. 17N 964



G9

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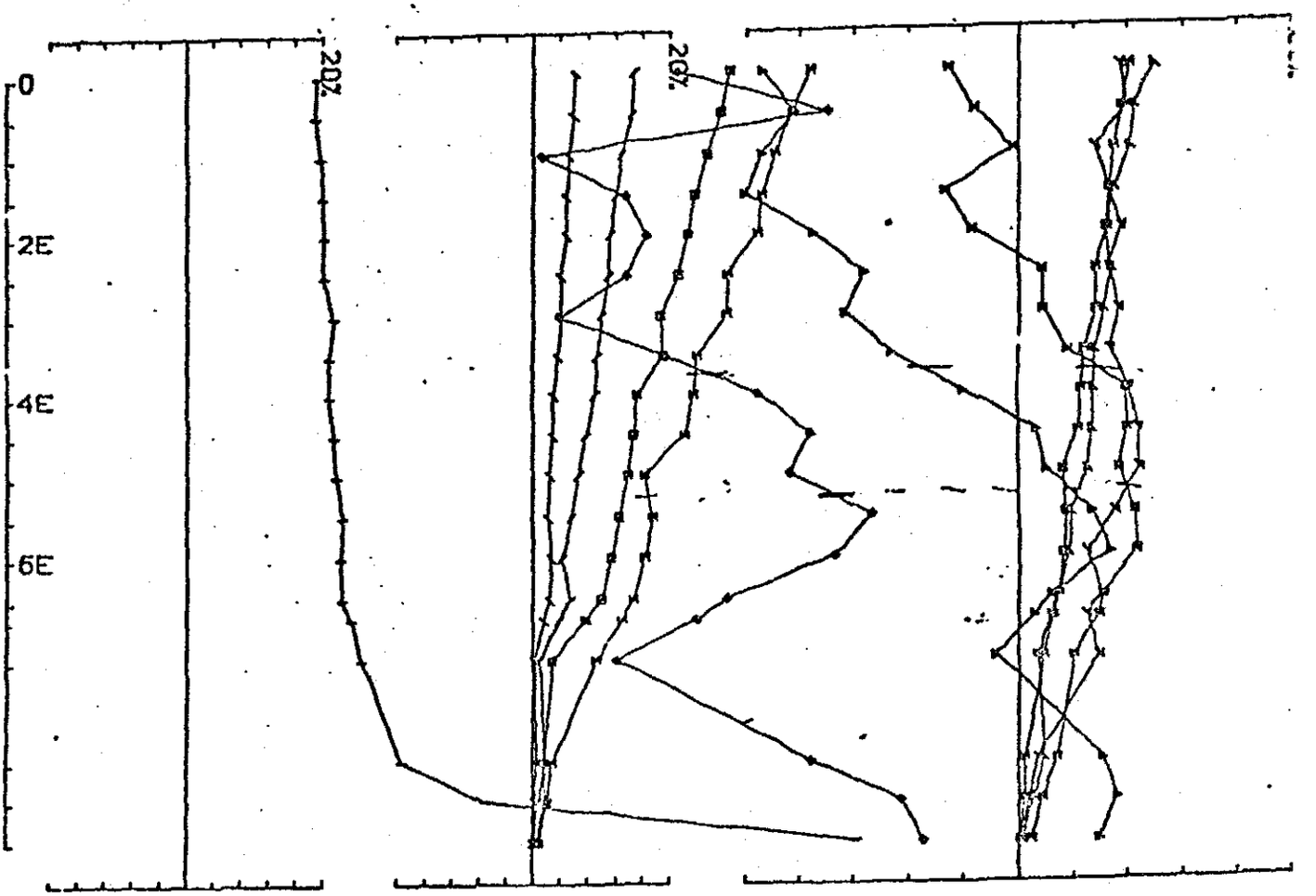


G II ( )

CLEVELAND NI 25.50 HZ C-P)/P C-C1)/C1 Hz 20N B

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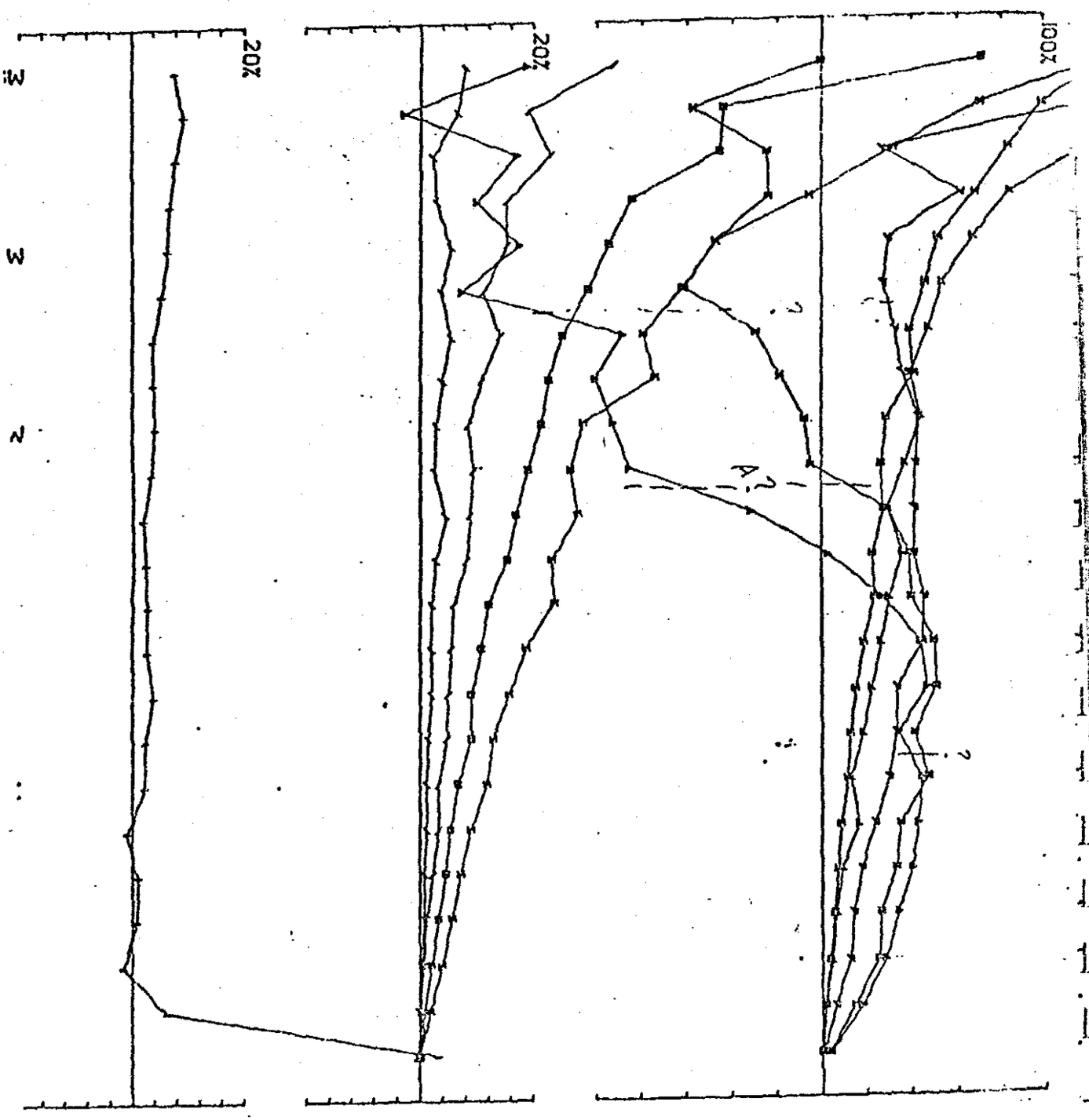
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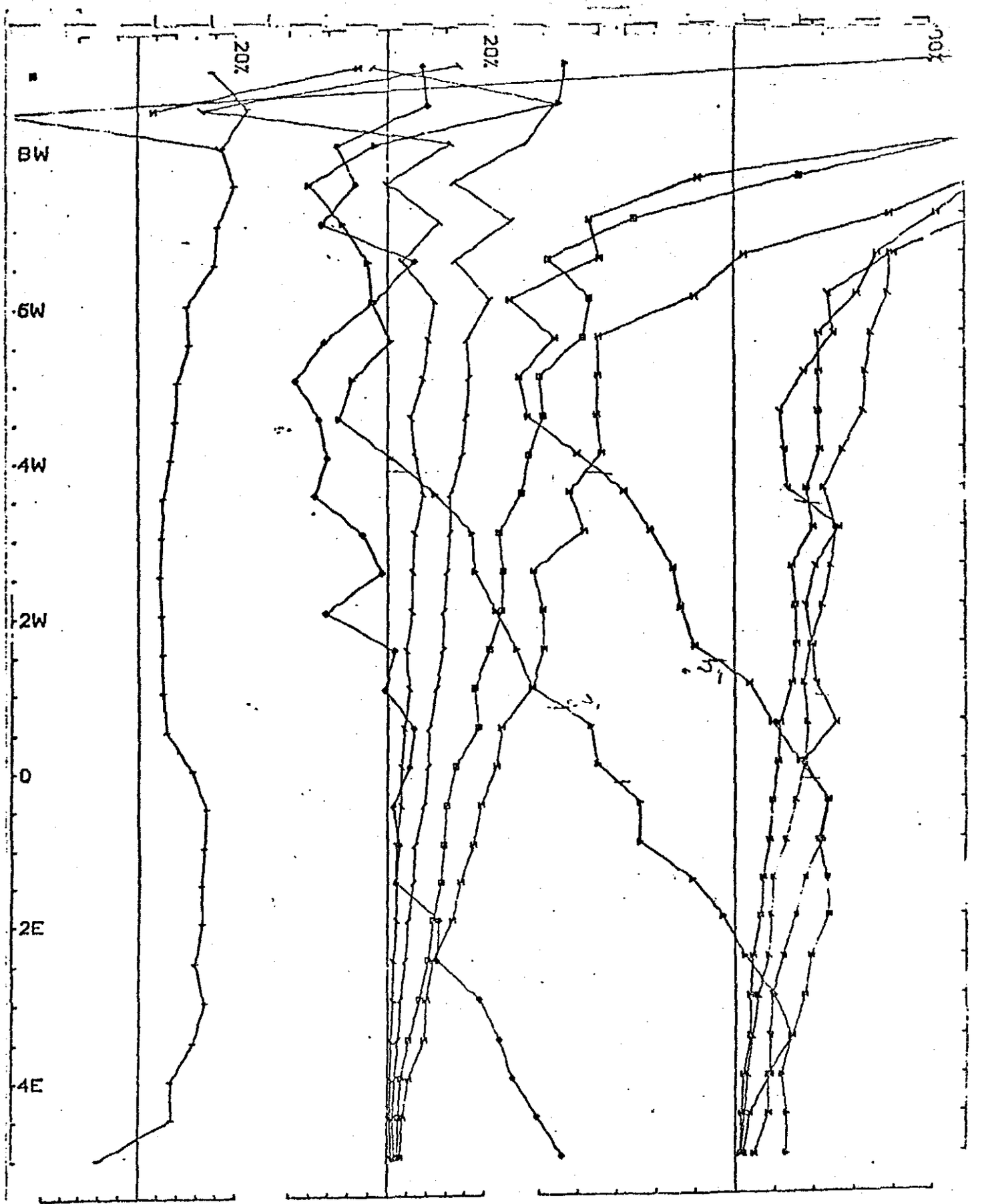
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:LEVELAND 4 N2 25.50 HZ C-P)/P C-C1)/C1 Hz G11 20N e

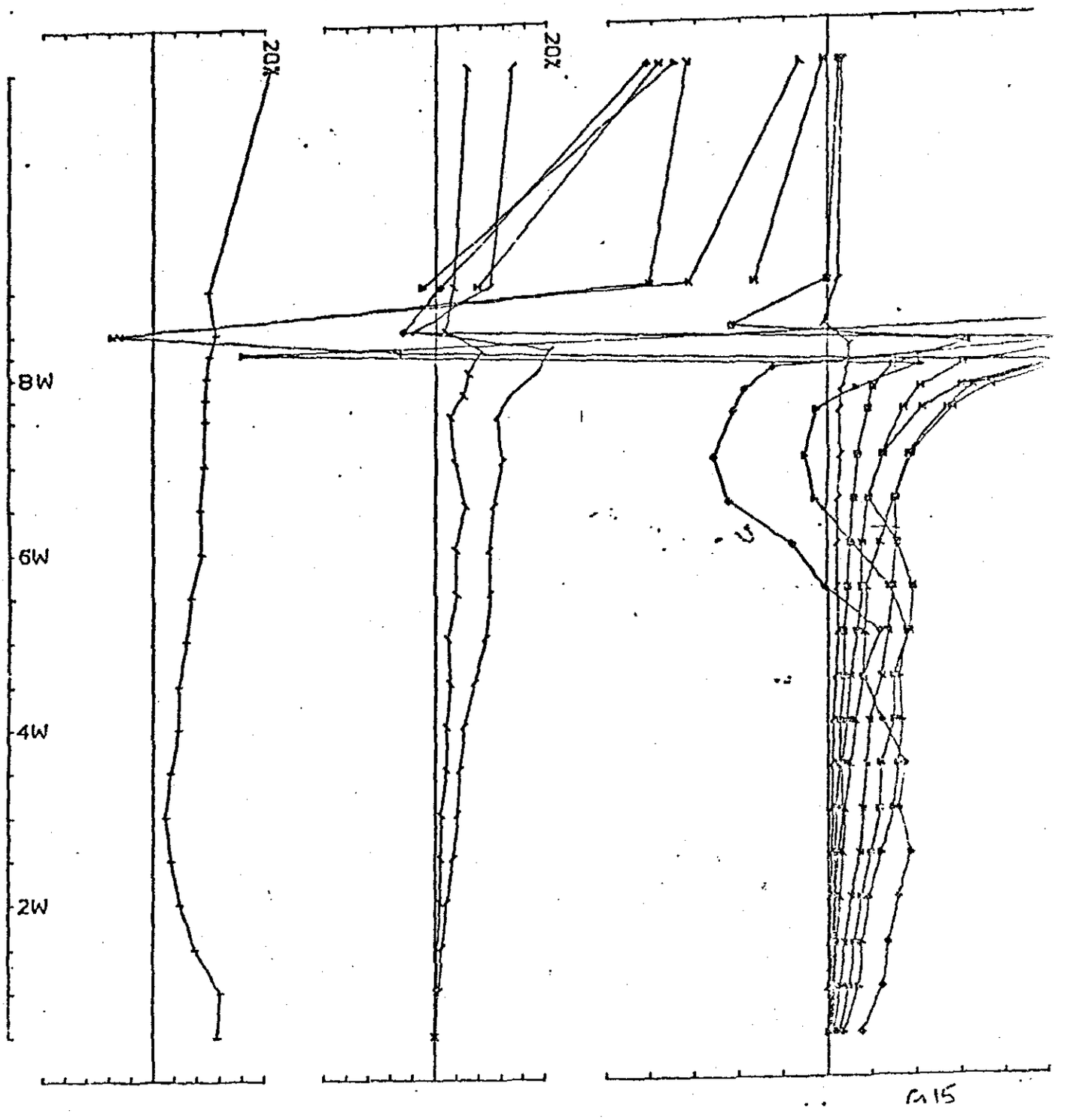
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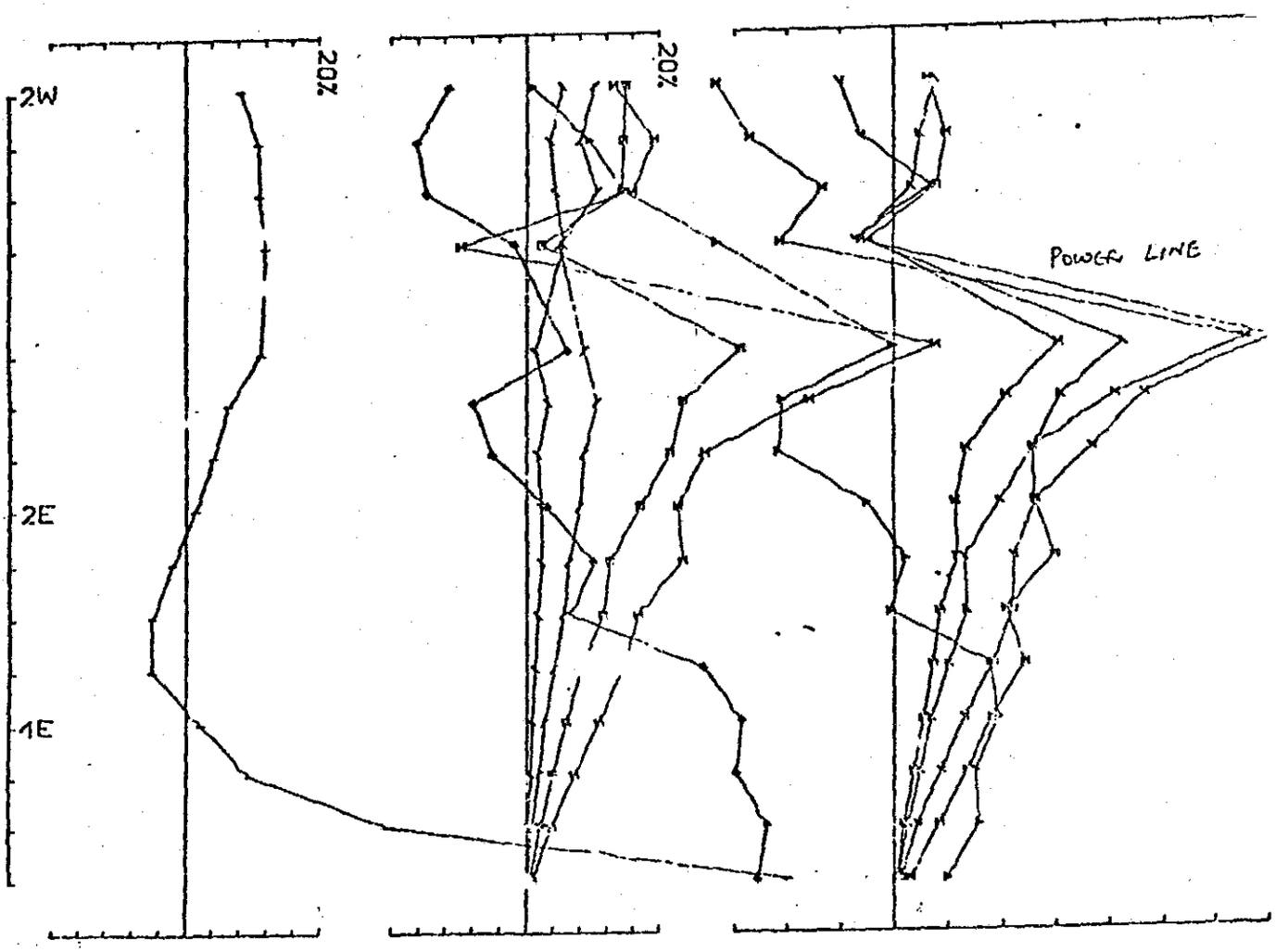
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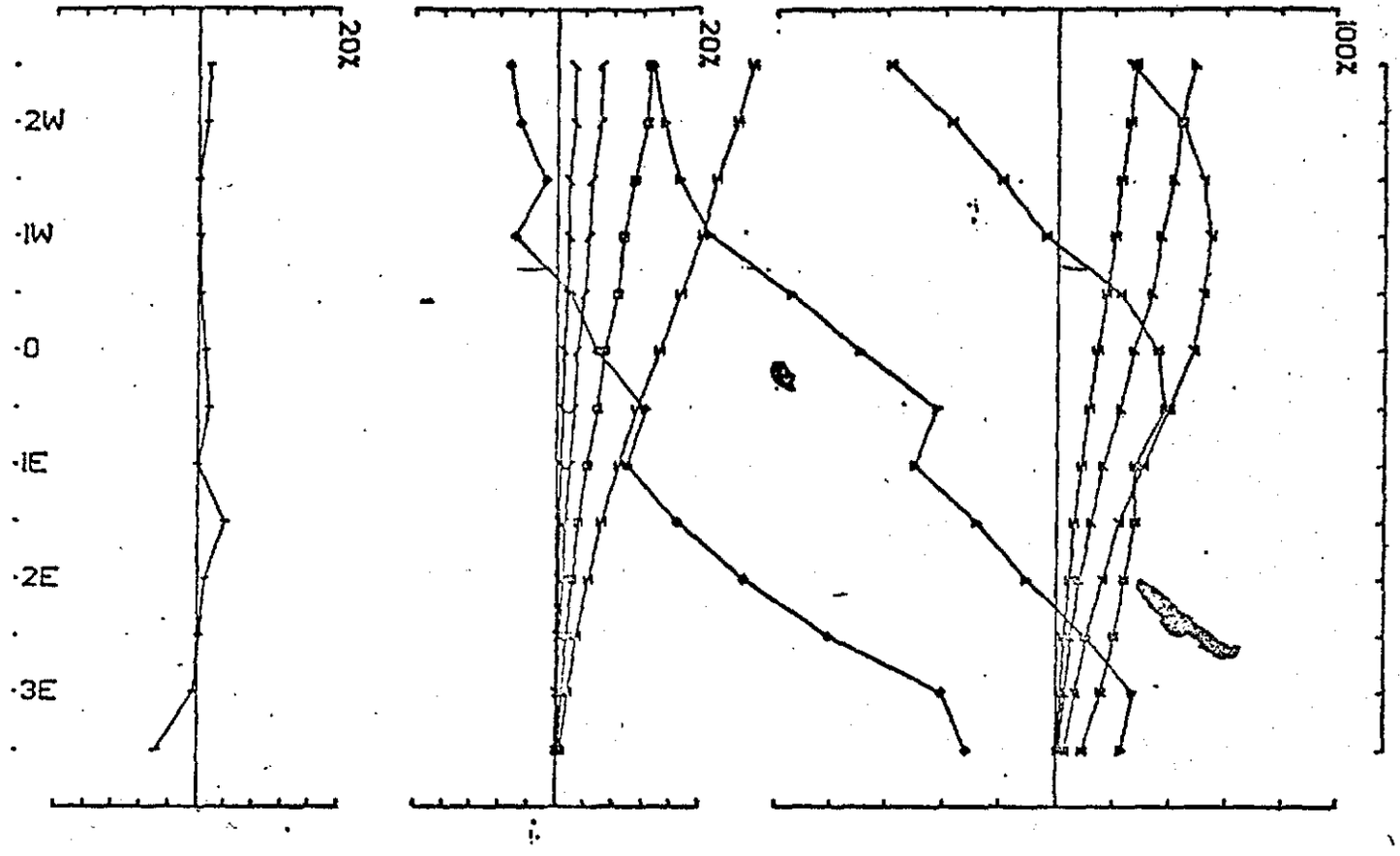


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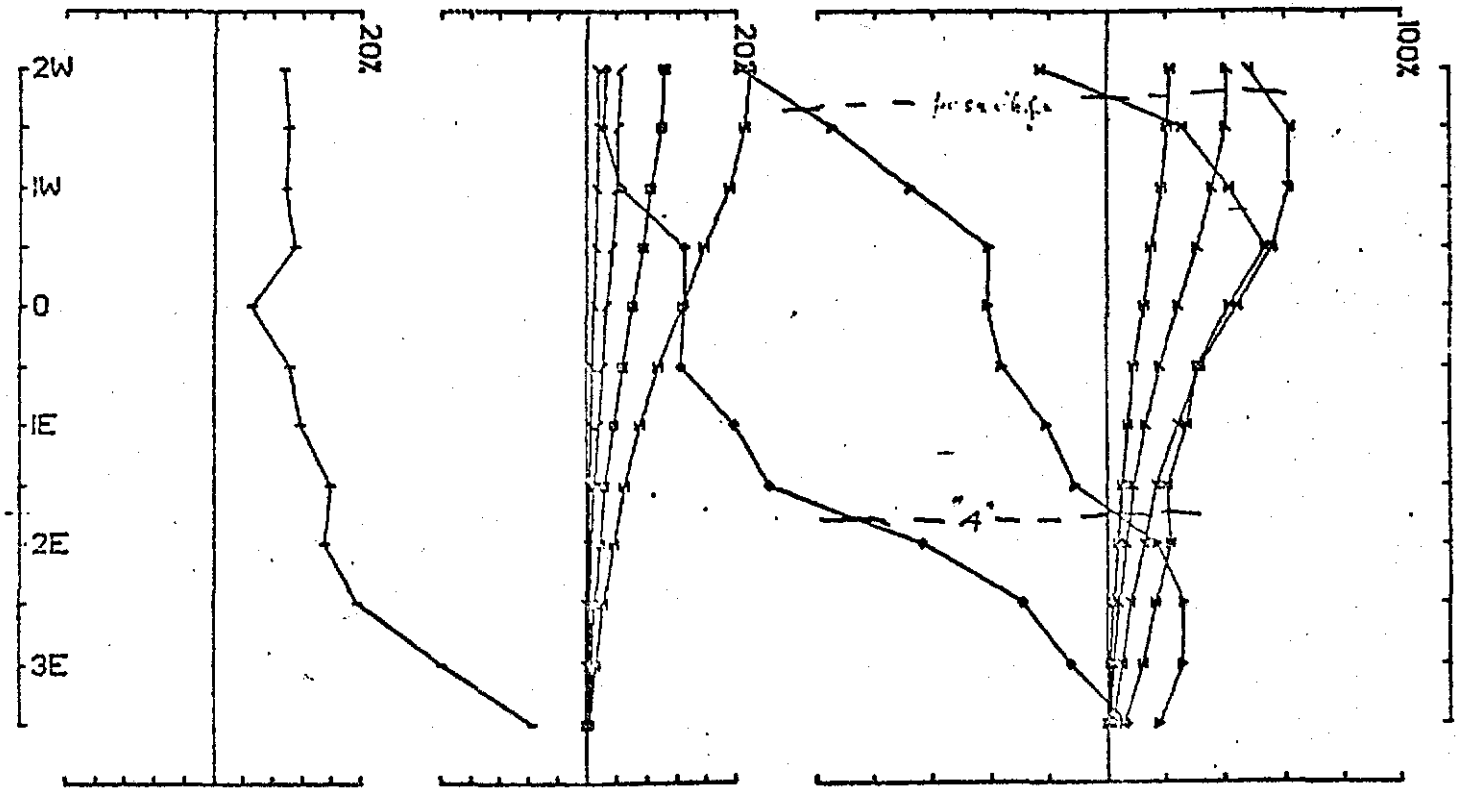
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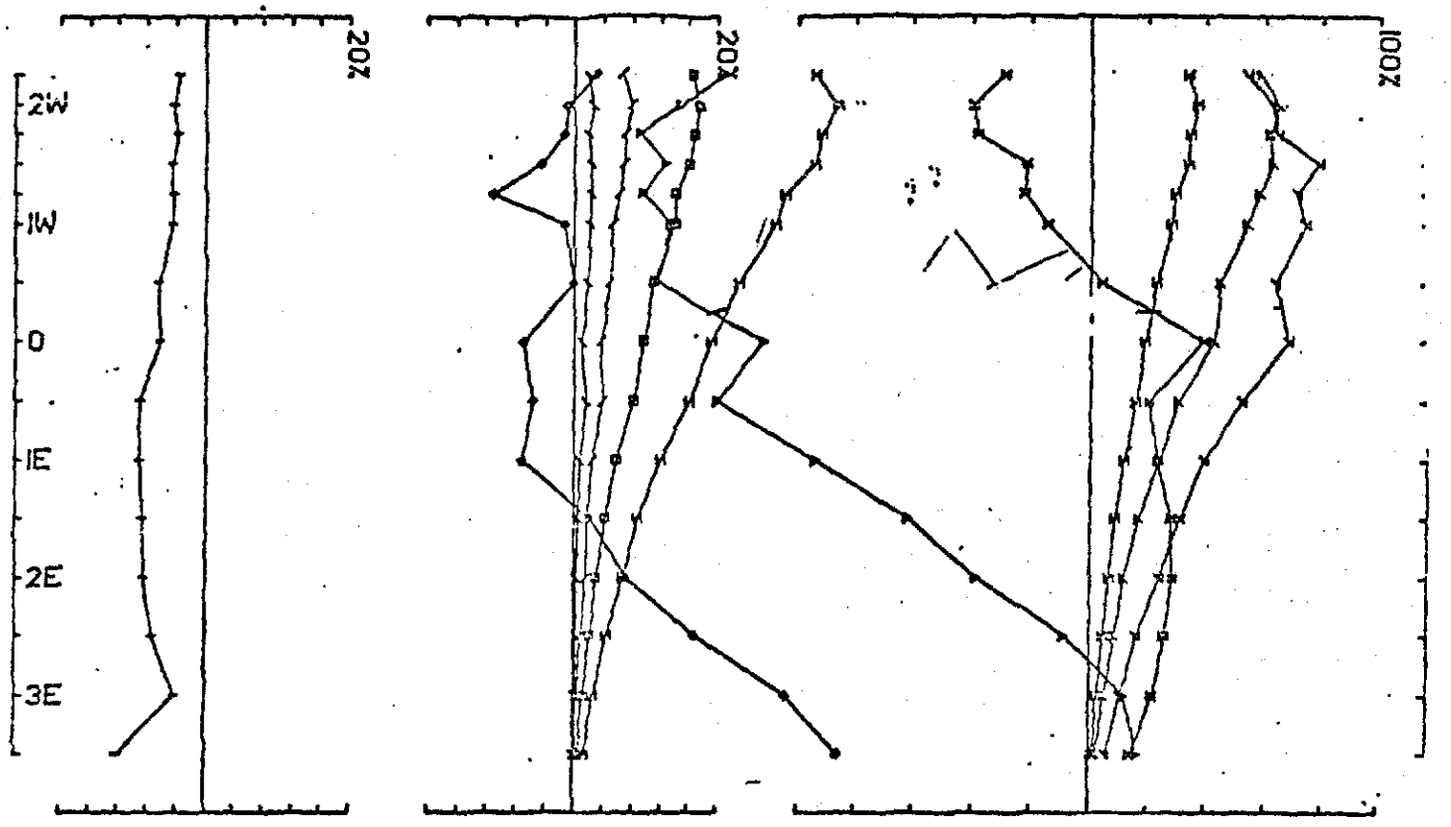
CLEVELAND 25.50 HZ C-P)/P C-C1)/C1 Hz 860

LINE AM

130045



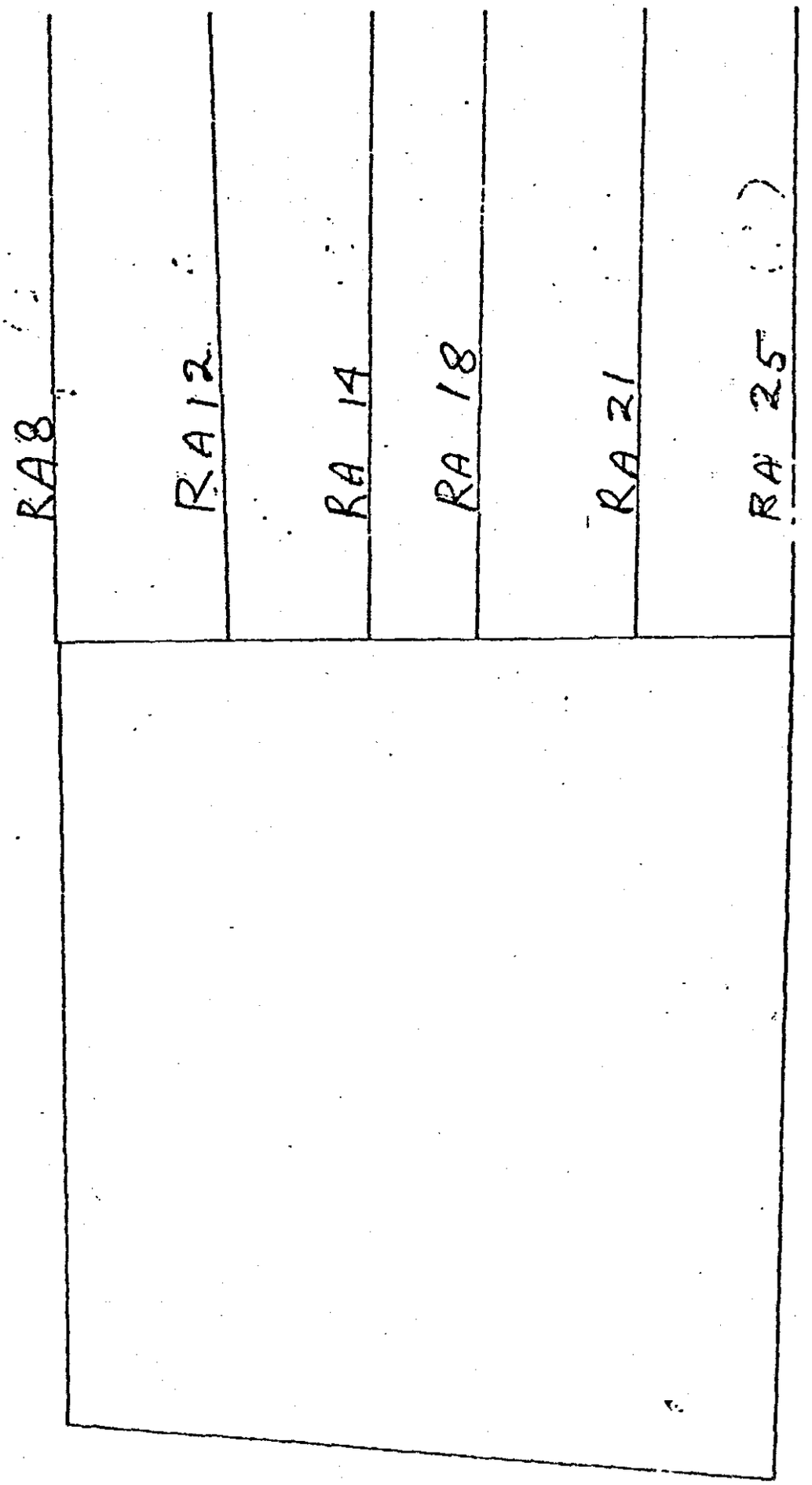
CLEVELAND 25.50 HZ C-P)/P C-C1)/C1 Hz AU 6N 860

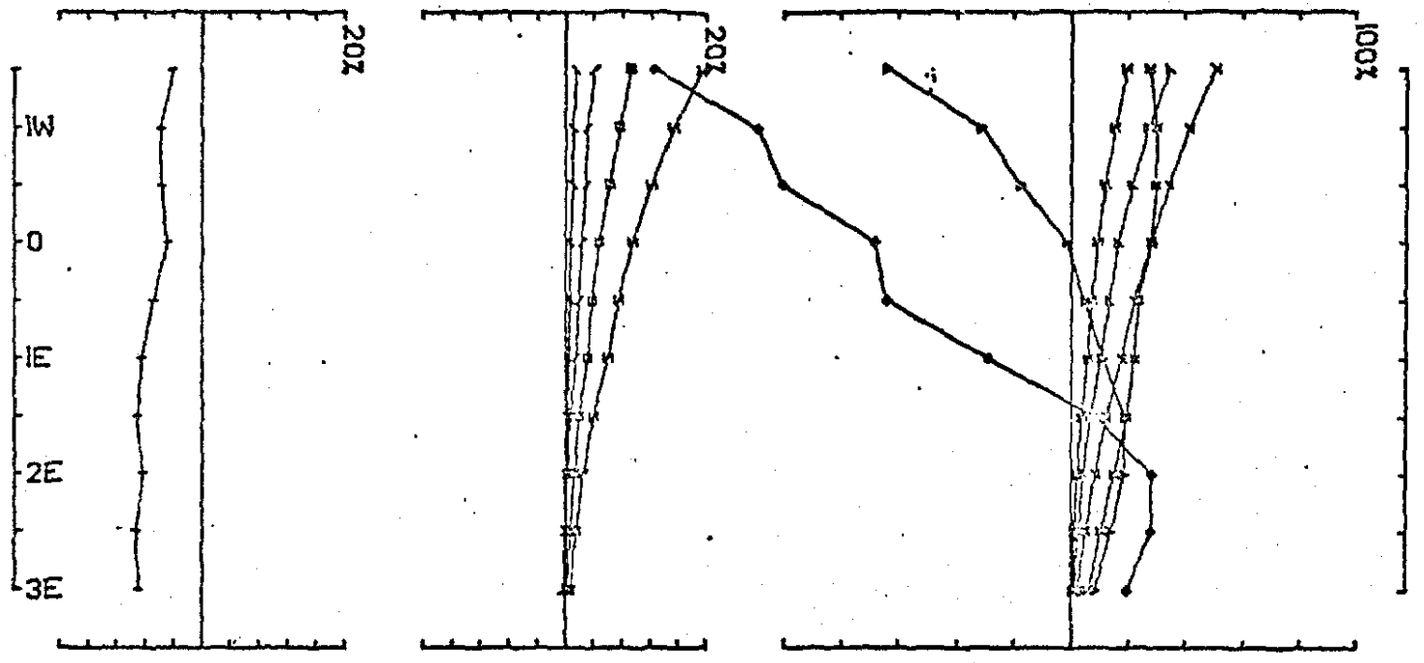


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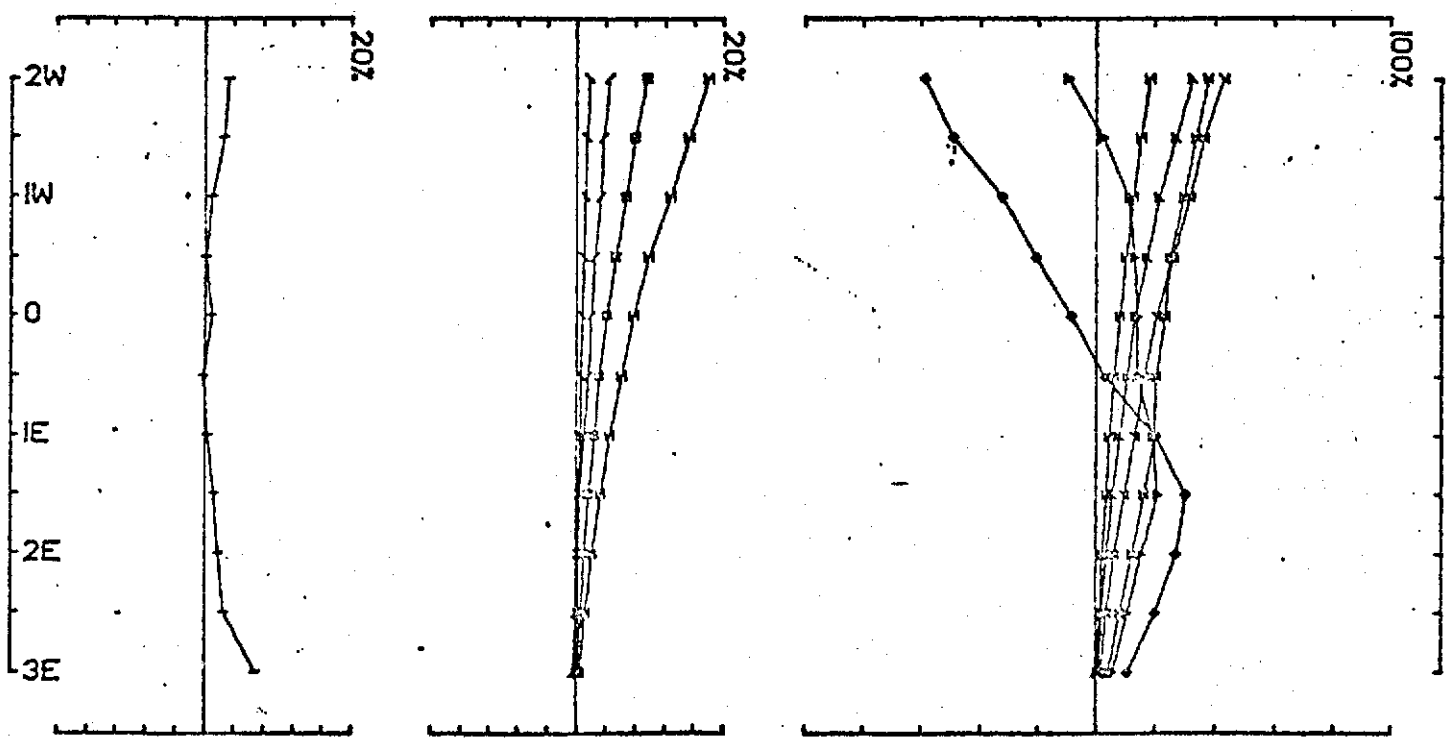




RA3

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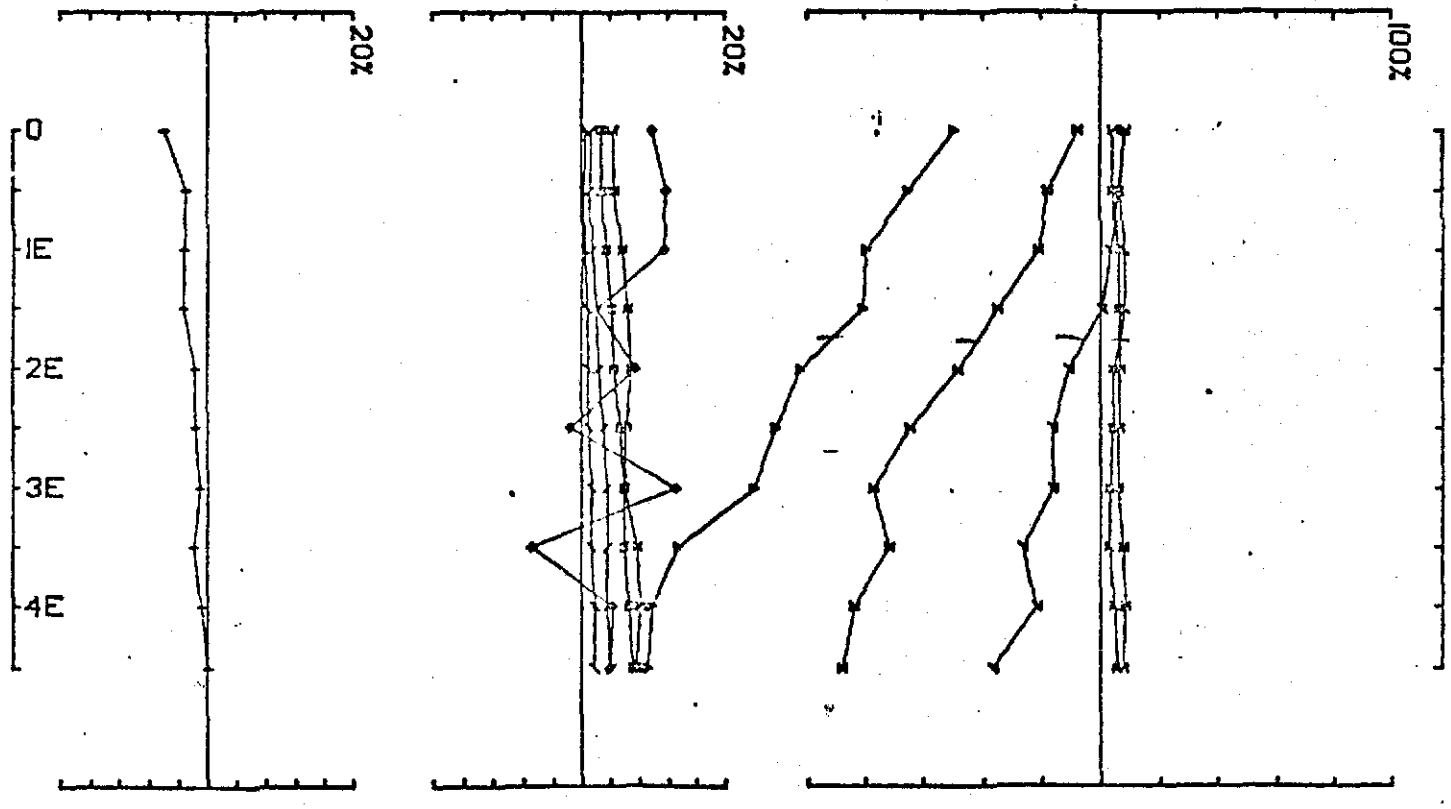
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130050

049



CLEVELAND 25.50 HZ C-P)/P C-C1)/C1 Hz ION 862

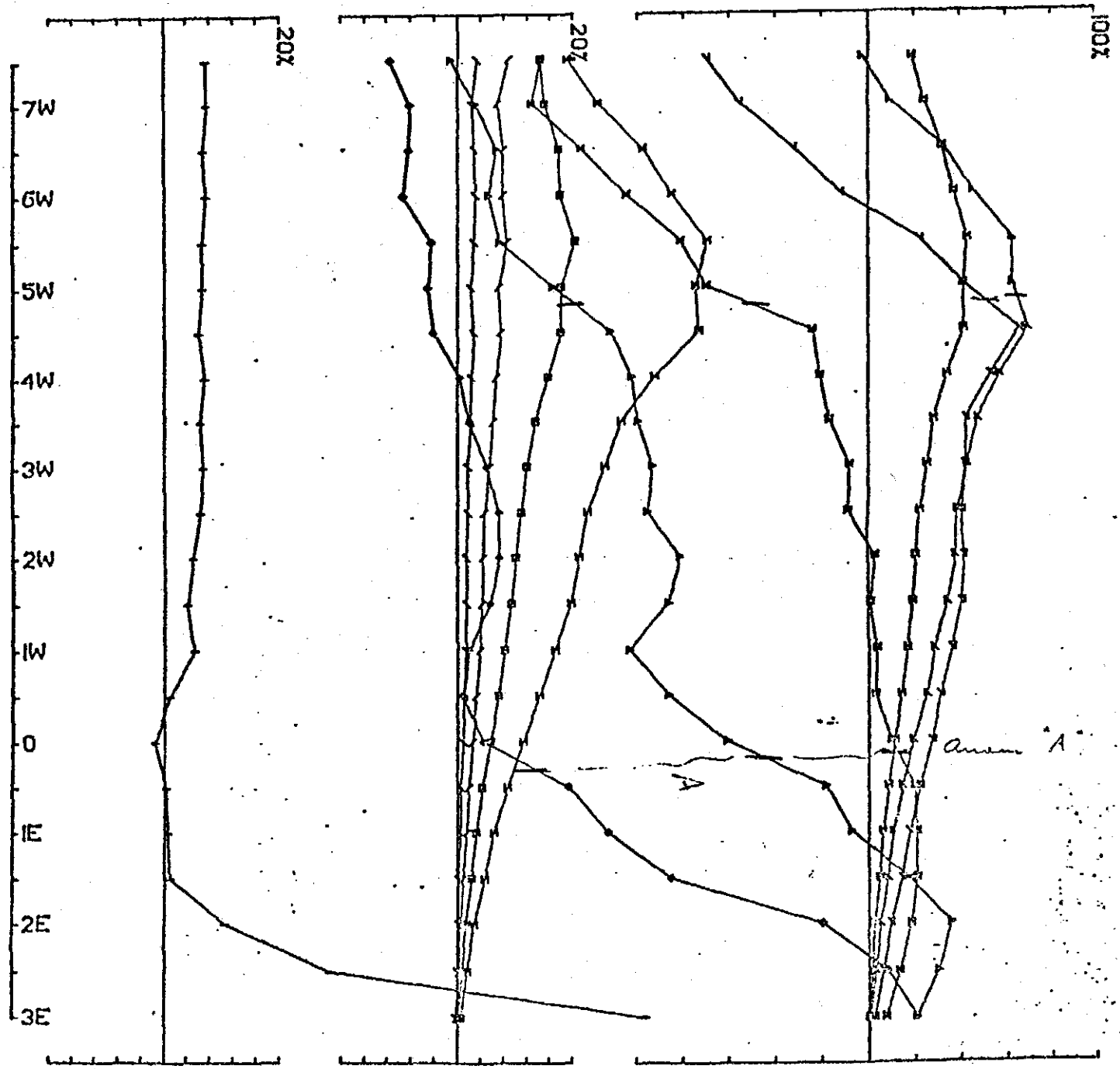
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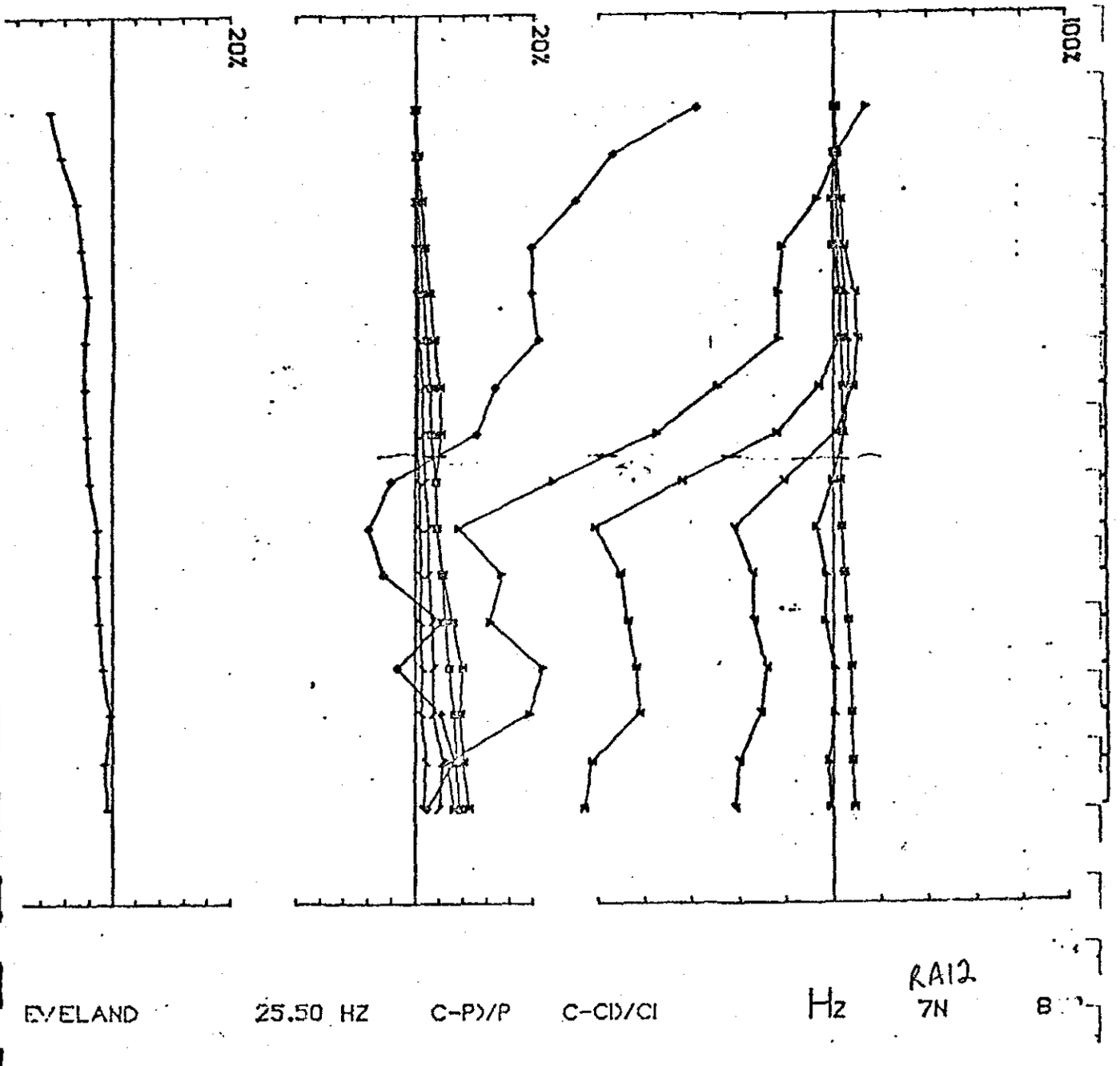
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130052



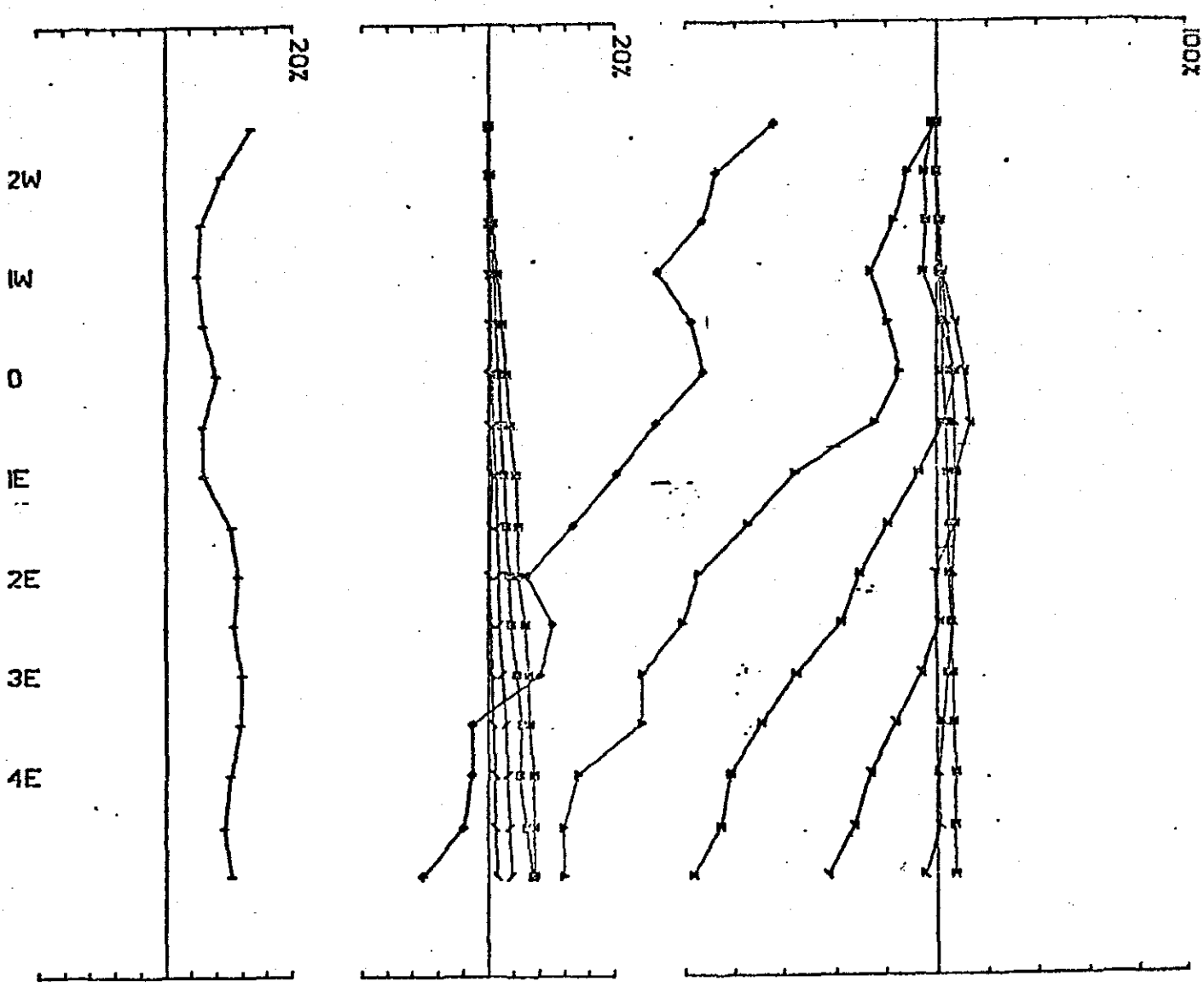
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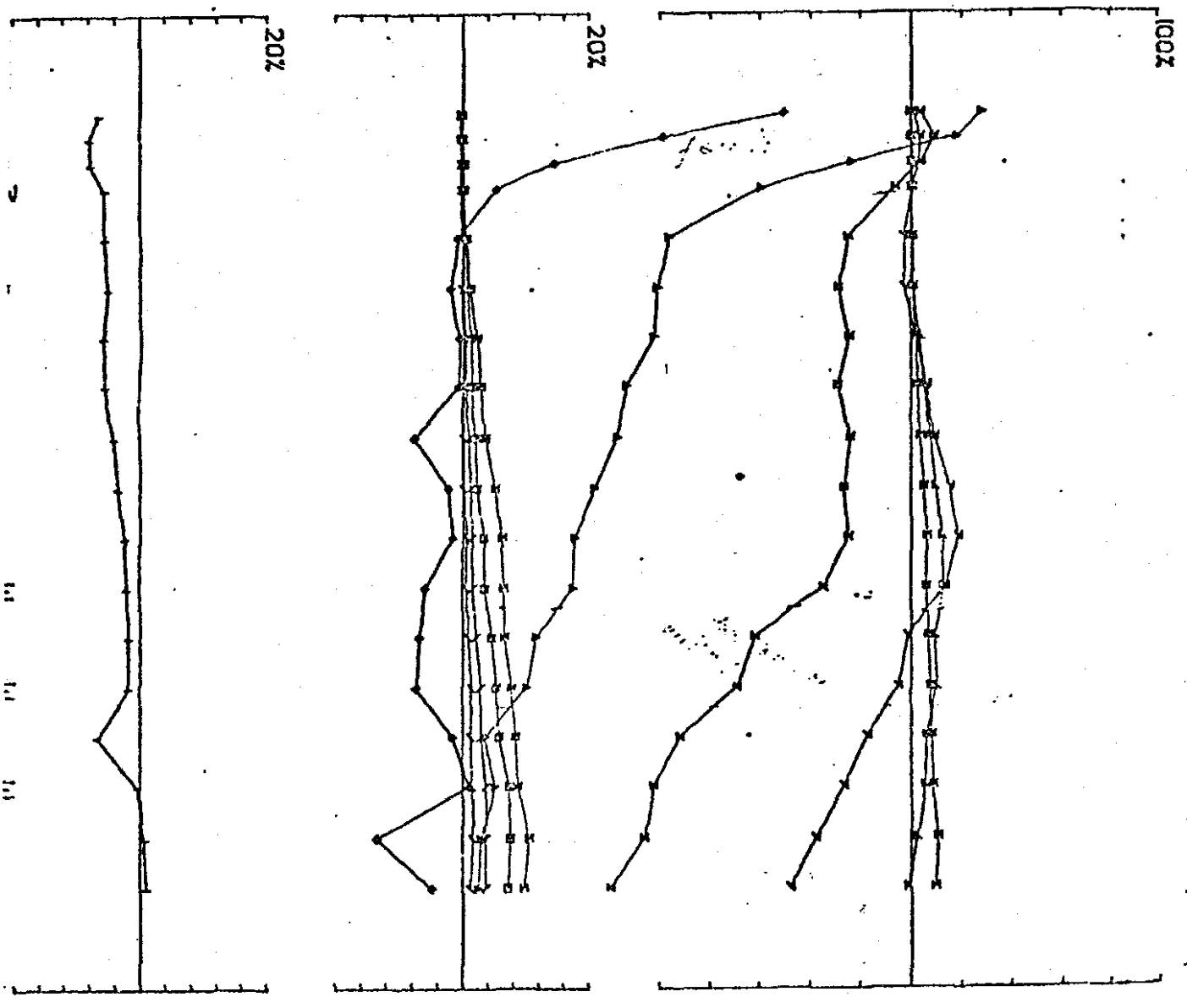
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CLEVELAND 25.50 HZ C-P)/P C-C1)/C1 Hz RAIN 5N 862

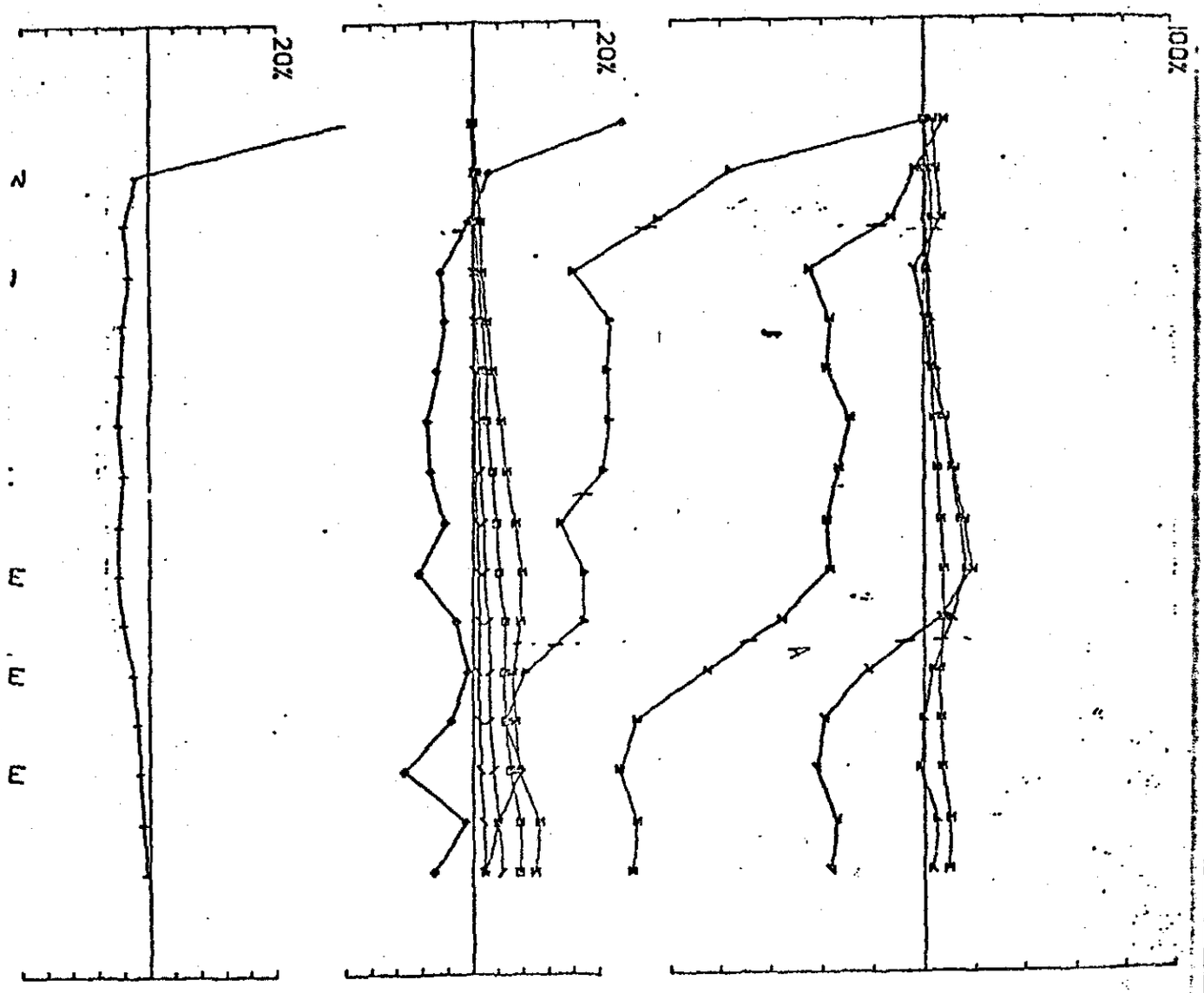
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130055

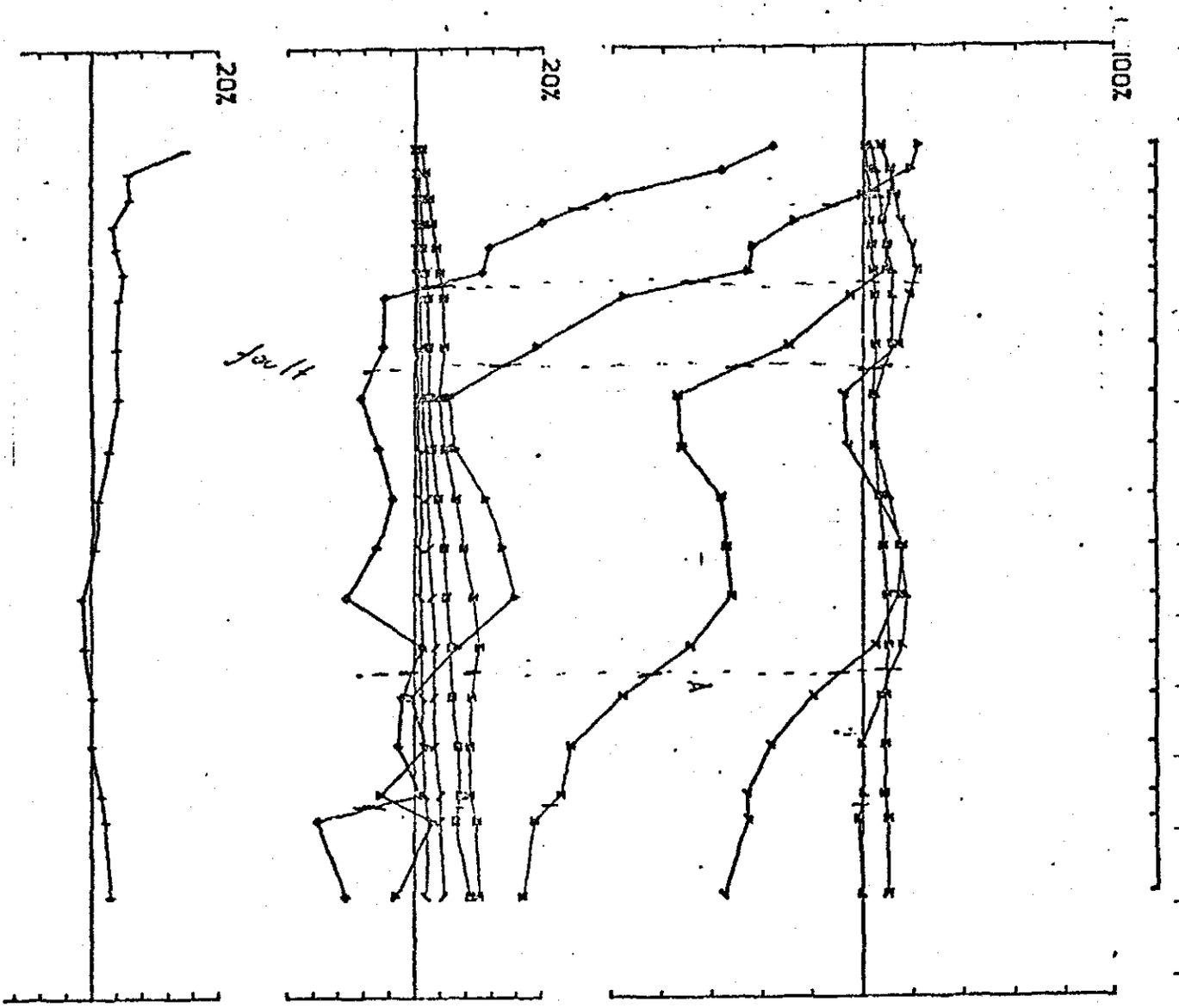


CLEVELAND 25.50 HZ C-P)/P C-C1)/C1 Hz RA18 4N

130056



CLEVELAND 25.50 HZ C-P)/P C-C)/C Hz RA21 2N



EVELAND 25.50 HZ C-P)/P C-CI)/CI Hz RA25 0 862

130058

056

APPENDIX III

Diamond Drill Logs for C1285, C1290

057

130059 49.

Comineo

DIAMOND DRILL LOG

Hole No 1290 Page No 1

Feature : Bedding, Foliation, Fragment - size & shape, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1 - 5%, Common 5 - 15%, Abundant 15 - 60%, Massive > 60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	DEPTH m	MINERALIZATION
	10	NO CORE RECOVERY			
0.35 0.79 0.44 0.19 0.20 0.42		BASALT (Vb) - From 10.00 m - 27.00 m The Vb is generally weathered, core recovery is poor and most of the core is broken up. Iron staining (pyrite) is quite common. Vb textures are poorly preserved.			
0.77 0.34 0.70 0.24 0.17 0.05 0.75 0.15 0.55 0.77	20				
change of rock 1.07 2.25 1.5	30	From 27 m. recovery is better and the Vb is a massive dark olive green chlorite rimed. Fine carbonate spotting common.			
0.7	35	Bleached zone at 34.05 - plag. calcite vein - FAULT - 30° to C.A. Shearing along chlorite veins common in vicinity of fault.			
1. 0. 1.	40	The Vb is massive olive green variably chlorite veined. - rare carbonate veinlets and segregations.			
2.9 1.2 2.2		Shearing common parallel to chlorite veining. Rare calcite veining.			
2.	50	FAULT. 48.70 - calcite ch vein & slickensides - 25° to C.A. From 53.80 - 53.63 The Vb is very fine grained with rare chlorite veins becoming quite regular towards base lower contact 45° to C.A.			
2.	53.63				
change of rock	55	BASALT (Vb) - massive, mildly fine grained with thin chlorite filled fractures grading into typical Vb with abundant chlorite veins. Rare irregular calcite veins & some epidote alteration. Dark olive green in colour.		57.2	
2.	60				

Comanco

DIAMOND DRILL LOG

Hole No 1290 Page No 2

Feature : Bedding, Foliation, Fragment - size & shape D%; Shearing, Fault F, Vein c carbonate q quartz

Mineralization : Trace 1-5%; Common 5-15%; Abundant 15-60%; Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
3.21		Vb as above, abundantly veined by chlorite - rare calcite veining. Dark olive green, massive.							
3.11									
3.10	70	Lower contact sharp, slight bleaching of Vb - 35° to C.A.							
change of rock	70-70.40	Vb grading into TUFF SST - 45° to C.A.							
70.40-71.06		TUFF SST - partly laminated pale grey/green 45° to C.A.						70.53	
2.10		TUFF SHALE (VC) - fine grained grey brown to grey shale - well bedded 45° to C.A. Rare calcite veining and re'd. calcite. Lower contact sharp. 40° to C.A.							
71.80									
3.10	75	BASALT (Vb) As previous units - massive fine to medium grained, olive green in colour - common chlorite veining. Rare irregular calcite veins and segregations.							
2.10		Chlorite spotting or infill in amygdules is common towards base.							
2.90	80	Calcite veining becomes more prominent - generally irregular and sub parallel to C.A. - segregations also common.							
3.05		Lower 30 cm is slightly bleached as a result of proximity to calcite vein.							
		Lower contact not well defined							
	85	FSX - calcite veined, fractured						84.75	
0.42		TUFFACEOUS SHALE (VC) - fine grained grey/pale green, generally well bedded 55° to C.A. Lower contact sharp						85.02	Calcite vein 0.12 - 85.12 core broken - possible fault
0.78	86.34								F.g. segregations, bedded 55°
1.08		CHLOR. SHALE							
		Massive, fissile, fine grained chocolate brown coloured shale.							
2.82	90	Calcite veining variable, generally as thin stringers cross cutting core rarely as discontinuous blebs. More abundant 91.05 - 91.90.							

Cominco

DIAMOND DRILL LOG

Hole No 1290 Page No 3

Feature : Bedding, Foliation, Fragment - size & shape, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
0.67		Rounded greenish chloritic blebs common generally less than ½ cm in diameter ranging to 2cm.							
2.35		Lower 22cm sees a gradual change to greenish brown to greenish shales, quite likely with more tuffaceous content. Contact with unit below appears to be FAULTED.							
	94.50	65° to C.A. – Bed'g. 45°							
2.95	95	GREY - GREY GREEN TUFFACEOUS SHALE (VE). Fine grained foliated greyish green to grey buff shales - well bedded 35° to C.A. Rare calcite veins – gradual change to grey black shales below.	F						
	97.00								
2.46		GREY - BLACK SHALES (Shg) Mid grey to black fine grained shales, generally well bedded with some brecciated sections, fracturing common – Bed'g. 45° to C.A. Calcite veining irregular and patchy. Lower contact not seen but likely to be gradational as above.							Rounded patches of fine grained aggregates of fsp. with some fsp. layers 1½ to bedding. Total content less than 1%.
	100								
2.04	101.90								
7.48		GREY TUFFACEOUS (?) SHALE (VE). Fine grained pale grey to grey well bedded shales with probably a high tuffaceous content. Calcite veining is sporadic in occurrence, being limited to the lighter grey shales. Bed'g is generally uniform - about 40° but can vary to 55° Silicified shale chert 107.00 - 107.23 Base of sequence shows a gradual colour change to greyish brown then to chloritic shales, contact. 45° to C.A.							syngenetic(?) fsp. dissemination through lighter coloured shales.
1.57	105								
3.13								108.25	calcite vein containing 20% fsp., 2 cm wide, 60° to C.A.
	108.34								
2.66		CHLOR. SHALES. Fine grained generally well bedded chloritic brown coloured shales. Bed'g quite uniform. 55° to C.A. Some sandier sections. 112.50 - 112.62, 113.10 - 113.35. Graded bedding well developed, shows younging up the hole. Brecciated calcite veins, and sedgedykes are common. Re-crystallized calcite occurs within the buff ash units.							
	110								
3.08									
4.10	115								

Command

DIAMOND DRILL LOG

Hole Nº 1250 Page Nº 4

Feature : Bedding, Foliation, Fragment - size & shape D%; Shearing, Fault F, Vein c carbonate q quartz

Mineralization : Trace 1-5%; Common 5-15%; Abundant 15-60%; Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
	116.40	Alteration and veining/fracturing developed towards base of sequence with last 5 centimetres resulting in a gradational hard/soft contact							
2.80	117.65	TUFFACEOUS SHALE (Vt) - generally well bedded, slightly sheared, stained, f.g. hard/soft fracturing common. bed'g. 30° to C.A.							
	118.25	CHOC. SHALES - Massive moderately well bedded - 43° to C.A.							
		TUFF SHALES - moderately to poorly bedded green							
	118.75	CHOC SHALES - massive moderately bedded 43°							
1.35	119.20	TUFF SHALES Massive poorly bedded generally fractured - silicified, proximal to fault @ 120.19, 2.5cm wide, calcite veining. 35° to C.A.							
3.41		CHOC. SHALES							
1.92		Moderately well bedded chocolate coloured fine grained shales - generally uniform in composition calcite veining is variable, appears to be concentrated over the last three metres, where they are thin and erratic in orientation.							
3.23	125	Tuff sandstone units or layers are often interbedded, being brown in colour.							
2.38		Bedding overall is quite uniform ranging from 20° - 50° to C.A.							
		Purply brown shales from 132.63 - 133.26 - carbonate segregation common in this interval.							
3.12	130	Finely laminated towards the base of the sequence, with a gradational hard variation towards lower contact. Lower contact 45° to C.A, but not too well defined.							
3.10	135								
	135.35	TUFFACEOUS SHALE (Vt) - pale green f.g. well bedded tuffs. Calcite veining with stringers proximal to lower contact							
	136.6	BASALT (Vb) Massive olive green f.g. Vb - Initially fractured appearance with no calcite veins. From 137.94 - 142.60 - abundant erratic chlorite veins. Lower sequence moderate development of chlorite							
3.03	140								

061

130063 53.

Commence

DIAMOND DRILL LOG

Hole No 1290 Page No 5

Feature : Bedding, Foliation, Fragment - size & shape 0.5, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		Calcite veining is generally restricted to fault(?) zones & otherwise as thin cross-cutting veinlets. FAULT - calcite vein with slickensides seen with at 138.12, 30° to C.A. Section of calcite veins 139.88-140.00 includes slickensides - FAULTS. Sand variation towards base. Contact 45° to C.A.							
3.05	145							145.12	
2.20	146.23	TUFFACEOUS SHALE (VC) - f.g. well bedded tuffs, greenish grey in colour - 45°							Rare calcite veining Calcite vein 1cm wide 50° to C.A. no movement 145.66
3.11	149.19	CALC SHALES. Finely bedded chocolate coloured fine grained shales. Initially sand content is high. Calcite veining is common generally crosscutting, occasionally erratic. Rare green alteration patches? Contact sharp 50° to C.A.							
1.32	150.35	PURPLE / BROWN TUFF SHALES (VC) Finely bedded, purple, brown, grey tuffs. - bed 45° to C.A.							
	152.27	CALC. SHALES. Moderately well bedded f.g. shales with minor purple shales Calcite veining erratic. Possible fault at 152.07							
2.02	154.29	TUFFACEOUS SHALE (VC) greenish grey f.g. well bedded shales minor calcite veining.							
3.60	155	CALC. SHALES. Fine grained massive to moderately well bedded and foliated chocolate coloured shale. Irregular blebby light green alteration patches common Thin carbonate veinlets rare. Initially massive, grading into well bedding then to chaotic, irregularly foliated. Bed'g. 46° to C.A. Lower contact sharp 45° to C.A.							
157									
3.05	159.92								
162	160	PURPLE / BROWN SHALES. Initially erratically foliated and laminated purple / brownish coloured f.g. shales - generally chaotic, with rare 10cm well bedded sections. From 163.08 to base of segment the shales are less chaotic, more massive, grading into well bedded shale - Bed'g. 48° to C.A. Carbonate present in thin fractures and as micro veinlets. Blebby debris common in more disrupted sections. Finely bedded over final 3cm.							
2.19									
165	165								

062

130064 54.

Cominco

DIAMOND DRILL LOG

Hole No 1290 Page No 6

Feature : Bedding, Foliation, Fragment - size & shape 0%, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		Contact zone from 165.45' to 165							
1.61	165.25	BASALT (Vb) Massive f.g. chlor green Vb. Initially 165.25 - 169.50 the Vb is amygdular, with chlorite filling the 1mm diameter amygdules. Fine scale chlorite veining is common. Irregular carbonate veinlets occur generally 0.1mm in width rarely to 1cm. Carbonate segregations occur The Vb is generally highly magnetic (due to mag'te from 169.50 - 173.02 - amygdules are rare, carbonate is finely distributed and occurs also as irregular veinlets Epidote occurs in bands at 171.30 & 171.45 Contact very sharp 55° to c.a.							Disseminated fg. less 1%.
1.66									
2.39									
1.69									
2.97	172								
1.72									
	173.02								
3.02		GREY CONGLOMERATE SEDIMENTS - Well bedded f.g. grayish green & chloritized shales probably bedding - bed 3.60° to c.a.							
	177.11								
		PORPHYRITIC BASALT (Vb)							
1.75	175	Highly porphyritic fine grained grey greenish Vb. The feldspars (?) are generally to 1mm in length and vary from irregular to euhedral, usually angular. The Vb has a very variable transition from grey green to olive green, usually as rounded continuous zones (alt?) Irregular carbonate veinlets and segregations are common. Disseminated carbonate present, magnetite (?) Epidote alteration around some carbonate veins. Chlorite veining rarely seen. Lower contact not seen.						175.0	Weakly carbonate veinlets.
2.91								176.55	2cm wk. qtz vein & abundant epidote alteration - fabric in Vb altered to a parallel direction
1.78									
3.00									
change in scale 121.00	180								
3.02								183.0	Sm qtz, carb, chlorite vein & stringers - parallel 45° to c.a.
136.00								185.21	Wm. carbonate qtz vein, comb texture, chlorite at margins - parallel (?). 45° to c.a.
2.98	187.00								
187.00									
	187.21	Vb + fine grained calcite stringers							
3.01	190.01	BASALT (Vb) - fine grained, mostly irregularly patchy grey green to olive green colored Vb. Carbonate veining sporadic. Minor development of phenocrysts. Irregular carbonate veining at 193.60 - 193.70. Chlorite veining moderate Contact 45°						187.12	
190.00	190								
3.03									
193.00									
2.94	195.03								
196.00									
		PORPHYRITIC BASALT (Vb)							
2.96		Fine grained olive green Vb - altered green & mottled, pseudo fragmental appearance with grey green & olive green inclusions. The Vb is highly porphyritic with clots ranging from 2mm to 1cm in length.							Irregular carbonate veining quite common throughout the sequence. Epidote commonly associated
199.00									
	200								

063

Comaco

DIAMOND DRILL LOG

Hole No 1290 Page No 7

Feature : Bedding, Foliation, Fragment - size & shape D%; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
2.94		Intense epidote developed around vein at 205.52 alteration tapers off ↓ chlorite amygdules visible at 206 metres. Lower contact moderately sharp 45° to c.a							
2.97	205.43								
3.01	206.44	SILICIFIED TUFF? some VB fragments dark grey/black							Calcite vein at 206.35°. Other thin carbonate veins.
	206.44	BASALT (VB). Fine grained dark olive green massive VB. Chloritic alteration veinlets and patches do not occur, carbonate veinlets common and generally erratic in orientation. Epidote alteration common around some of the veins. The VB becomes more porphyritic from 210.0, but generally not well developed. Carbonate segregations common.							
3.00	210								
3.00								213.14	FAULT, thickness 45° to c.a
								213.72	Calc. qtz/fold fault - thickness
3.00									
2.90		VB remains porphyritic to 220.93, phenocrysts are generally up to 2mm in length, commonly 1mm. Terminates at a carbonate vein.						220.0	FAULT - small scale - calc/fol.
2.95	220	From 220.93 - 224 the VB is f.g. non-porphyritic with minute chlorite filled fractures and minor carbonate veining.							
		Lower contact sharp. 65° to c.a							
	224.00								
3.02	224.58	TUFF SST. fine to m.g. grey/light green to brown green massive VB locally bedded.							
	225	TUFFSTONE / TUFF SST - closely interbedded f.g. brown shale and m.g. sst - brown to green/grey							
	225.74	TUFF SST. M.g. moderately well bedded tuff - ranging from grey/green brown to green. Minor lithic fragments around 229. Bed.g. 75° to c.a. Minor thin carbonate veins. Lower contact sharp/irr to c.a							
3.04									
	229.78								
	229.84	ULTRAMIC TUFF/TUFF SST - green/grey/black/brown							FAULT - 229.92 - shearing below
2.95	230	BASALT (VB). Fine grained massive VB with no chlorite down to 232.00 Olive green in colour.							Minor pyrite disseminations/grain veinlets.
3.07		Chlorite veining begins at 232.00 and becomes very common after 235. The VB changes in colour to a pale greenish (maybe due to epidote ?) Carbonate veining common, generally erratic in orientation. Carbonate spotting common from 238 - 241.0.							
4.75	240								

064

130066 56.

Comineco

DIAMOND DRILL LOG

Hole N° 12-90 Page N° 8

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c. carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	DEPTH m	MINERALIZATION
4.98		Ruggy around . 242.35 , 242.50 FAULT(?). or 2ths pervad by chlorite veins . From 245.00 - 251.20 the Vb is massive , chlorite not developed . Carbonate veining common . Possible fault 244.9 , 45° to c.a. chlorite filled stringers . Contact with unit below erratic, with some Vb fragments found in huffs.			
4.98	250				
	251.20	TUFF SHALE (pyritic)			
5.00	251.61	BASALT (Vb) . Variable massive f.g. chlorite green Vb . Moderately chlorite veined to 255.36 Calcite vein & stringers at 254.92 the Vb is disrupted - series of calcite vein 255.26 - 255.36 and siliceous huffs. Possible fault but not visible stringers. Porphyritic Vb from 255.36 - 259.22. Finely spotted Vb (carbonate) from 259.22 - 260.30 . The basalt then becomes porphyritic with phenocrysts up to 0.5 cm in length. Core lost 262.33 - 262.45 - FAULT(?). Variability in distribution of phenocrysts. Decrease in porphyritic texture from 277.7 until at 280.20 No phenocrysts are seen . Irregular chlorite veins become common , generally alteration around fractures and consisting carbonate veinlets . Network of calcite veins at base of sequence . Lower contact very sharp . 55° to c.a.		255.36	fg, chl, occasional pg(?) in carb veins .
5.03				256.32	fg, carb, epidote vein
				258.36	fg, carb vein 15° to c.a. & stringers.
	260				
4.57					carb
				262.52	calcite vein & open cavities.
4.84					
	270			270.34	fg, chl, carb vein 15° to c.a.
3.69				270.34	fg, carb vein 20° to c.a.
				271.34	fg, carb vein 75° to c.a.
4.92				272.61	fg, carb vein 80° to c.a.
				273.53	vein fg, carb, chl, epidote selvages of vein possible fault 15 - 20° to c.a.
	280				
3.08					
	293.2				
4.88	293.68	TUFF-SST. fine to m.g. brownish green well bedded tuff-sst, bed @ 55° to c.a.			
		TUFFSST / TUFF-SHALE - interbedded brownish green tuff-sst and chocolate coloured			
	295				

065

130067 57.

Cominco

DIAMOND DRILL LOG

Hole No 129c Page No 9

Feature : Bedding, Foliation, Fragment - size & shape, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG (TRACE / COMMON / ABUNDANT / MASSIVE)	DEPTH m	MINERALIZATION
		Intermediate - bed'g. regular, 55° to c.a. Minor calcite veining.			
	226.35	TUFF-SST - fine brown g. well bedded greenish brown			bff. bed'g. 55°
28.0'		LITHIC TUFF Medium grained buff, green in colour ± 1mm. lithic fragments.			calcite veining with minor sericite alteration.
	237.11	Intermediate / fine. tuff. TUFF - f.g. basic buff			± bleached in buff tuff.
	237.44	BASALT (Vb)			
4.04		Massive fine grained basic volcanic, olive green in colour, homogeneous in texture -			
	290	Irregular carbonate veining. Chlorite filled fractures and veins and aggregates are common. Slippage along chlorite veins quite common.			
295.0					
4.98					
295.0		FAULT at 300.40 - 5cm wide - qtz, carbonate filled with some open cavities and slickensides. 70° to c.a.			
4.02					
299.70	300	The Vb becomes fine grained with little chlorite and carbonate veining towards base - slight silicification.			
4.89		Contact sharp - 75° to c.a.			
	305				
4.87					
	307.98	Lithic tuff - grey green - lapilli to 2 mm.			
	308.21	Tuff - grey green - laminated - 75° to c.a.			
	308.41	Tuff-sst - greyish green - medium to fine grained - bed'g moderately well developed. 60° to c.a. minor lithic fragments			
309.2'	309.78				
	310	Intermediate / fine. as above, with chocolate brown buff/black interbeds - bed'g. 70° to c.a.			
	310.44				
2.70		Tuff - light brown coloured bed'd tuff			
	311.03	Tuff - a fine grained greenish brown tuff		311.45	
		Tuff - as above - bed'g. 70° to c.a. - grading to grey		311.90	
312.0'	312.25	Intermediate - fine grained green tuff		312.10	
		BASALT (Vb)			
		Massive homogeneous olive green fine grained basic volcanic. Finely disseminated carbonate and magnetite (not visible). Carbonate veinlets are common - generally			
	315				

066

Cominco

DIAMOND DRILL LOG

Hole No 1290 Page No 10

Feature : Bedding, Foliation, Fragment - size & shape (0%), Shearing, Fault (F), Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
4.89		erratic in distribution - Albite is present within fractures and as veinlets and aggregates. Decrease in abundance below 317.00 Ub is very fine grained to aphanitic brn - siliceous(?) - fractured w. proximal to contact below.						315.6	carbonate vein 40° to c.a.
317.00									
2.85	320								
	320.85	TUFFACEOUS SST - fn.g. fgy green/grey laminated tuff - non lithic fragments generally disrupted with elongated clasts/lapilli							Fault boundary 45° to c.a.
?	321.70								
1.69		TUFFACEOUS - fine grained dull greenish grey well bedded tuff. Generally siliceous throughout. Bed'g - uniform at 90°. Lower contact moderately sharp						321.8	2cm. qtz, carb filled fault fracture. 65° to c.a.
323.39	323.50								
2.55	325	CHLOR. SHALES Fine grained chocolate brown colored shales - initially siliceous, massive to moderately well bedded finely disseminated carbonate occurs through the sequence. Carbonate veinlets common Even alteration zones and patches are frequent. proximal to carbonate veins & veinlets. lower contact is predicted with shales changing to a brown grey then to grey.							
325.94									
3.46									
	329.51								
0.71	330	BANDED GREY - GREEN CHLOR. SHALES - more evenly layered in this section - shades from l.g. purple grey - green grey - to brown grey							qtz vein (ragged) at 330.45 Fault (?) carbonate vein generally even.
330.42	330.72								
1.86		CHLOR. SHALES Massive chocolate chlor. colored fine grained shales to 333.80 From 333.80 - 337.20 the shales are irregularly foliated with pale green chloritic alteration common around the carbonate veins and as blebbs and patches. Secondary carbonate is common, as x'ing as rounded clusters and fine grained disseminations. From 337.20 to 347.75 the shales are massive, bedding is not well developed. Alteration is still common resulting in irregular patches.							
333.80									
4.79	335								
337.59									
0.91									
338.50	340								

067

Cominco

DIAMOND DRILL LOG

Hole No 129C Page No 11

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG (TRACE / COMMON / ABUNDANT / MASSIVE)	DEPTH m	MINERALIZATION
2.36		and bands of lithics giving an impression of bedding, although in general cross cut bedding. Bed'g not loc. A at 343.5. Carbonate veining is rarely seen. From 343.50 the shales are in a massive, alteration virtually non-existant. Lower contact gradational and the unit below is banded and between chlor. shales & tuffs.			
343.00					
3.70	345				
	347.75	PYRITIC SHALY SILTSTONE - foliated smoke shale			
4.81	350	INTERMEDIATE SILTSTONE Massive, occasionally foliated dark greenish grey buff shales and grey tuffs. Carbonate veining generally minimal, with only a few areas of veining and carbonate aggregates from 351.45 to 352.75. Lower contact not seen as core is broken up.			
352.25					
353.16	1.97	352.75 SILTSTONE m-g grey greenish chlor. buff			Minor disseminated Py.
		CHLORITE SILTSTONE - dark green shale, foliated		353.0	
	0.78	TUFF SILTSTONE - massive grey green f.g.		353.40	
	0.50	Shale - minor buff at dark 2" 8cm unit.			
	0.65	355			
354.44		CHLORITE SILTSTONE		354.50	
	0.39	Massive fine grained chlor coloured shale. Thin irregular calcite veins, minor alteration. Bed'g not well defined.			
356.22					
	1.77	357.90			
358.20		358.00 CHLORITE SILTSTONE			
	1.18	CHLORITE SILTSTONE thinly, foliated chlor coloured shale. Thin carbonate veinlets common as are irregular segregations.			
359.46					
	0.79	360		359.9	
360.25		CHLORITE SILTSTONE - foliated			
	0.65	360.74 TUFF SILTSTONE.		360.10	
360.90					Disseminated syngenetic Py.
	0.85	Massive greyish green, weakly foliated fine grained buff.			
361.75					
	0.46	Lower contact gradational.			
362.83					
	1.71	363.15 CHLORITE SILTSTONE massive fine grained poorly foliated chlor. coloured shale			
		Contact Hairline - carbonate veins.			
364.54		365 LITHIC TUFF/TUFF SST/TUFF SILTSTONE (VC) Interbedded m-vg. lithic buff green in			

068

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DIAMOND DRILL LOG

Hole No 1290 Page No 12

Feature : Bedding, Foliation, Fragment - size & shape (0.5), Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		colour, 2-3 cm (rarely to 1 cm in length - e.g. white, buff sst, and f.g. dark brown shales (buff?) lower contact sharp 60° to c.a							
4.96	364.75	TUFF SST.							
		Medium grained generally massive greenish brown to green coloured tuffaceous sst. The brownish coloured tuffs are more carbonate rich.							
369.80		A fine layering is often seen generally low angle to core axis 10-20°.							
	370	Minor brown shaly lithic fragment occur.							
4.93		Contact with basalt is foliated sheared green thin and quite irregular							
374.43	374.43	BASALT (VB)							
	375	Massive fine grained olive green VB - carbonate veining rare, and occur as thin irregular cross cutting veins. Chlorite filled micro fractures common.							Py aggregates and veinlets common < 1%.
4.99									
379.4		Minor patchy epidote alteration proximal to carbonate veins and within fractures.						380.2	1cm qtz, carb vein 35° to c.a
4.98		From 379 carbonate veining becomes more common - and from 381							
384.38	385	Intense carbonate veining, closely associated with qtz veins and qtz, carb. veins.						384.5	2cm carb, qtz vein - 20° to c.a
0.38								385.2	carbonate VB breccia (?).
385.4		From 389.45 incidence of veining decrease						385	2cm qtz breccia vein. 30° to c.a.
4.92		Most veinlets are upto 1 cm in width - generally erratic and cross cutting.							Patchy and veiny Py occurs sporadically.
		Chlorite veining rare.							
	390	Lower contact sharp 65° to c.a							
390.4	392.15								
		CHL. SHALES							
3.19		Massive, fine grained, generally poorly bedded dark to olive coloured shale. Irregular carbonate segregations occur along with thin carbonate veinlets - Cross cutting alteration(?). uncommon - Bed, 45° to c.a							
393.5									
0.75									
394.25		From 394.25 rounded carbonate							
0.55	395								

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DIAMOND DRILL LOG

Hole No 129C Page No 13

Feature : Bedding, Foliation, Fragment - size & shape 0%, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	DEPTH m	MINERALIZATION
395.20		aggregates and segregations become more frequent the shale becomes more disrupted. Lower contact is gradational with gradual color change to green buffs.			
1.30					
396.5					
5.66	397.13	TUFFACEOUS SHALE (VK). Fine grained greyish green to grey well bedded buffs. Thin irregular black shales occur. Carbonate veining minimal. Bedding uniform 50° to c.a. Lower contact sharp. 37° to c.a.			Fine grained syngenetic fg aggregates and cryptals occur. Total less 1%.
	400				
	402.03				
401.2		CHLORITIC TUFF SST. Interbedded chl. shale, l.g. massive and medium grained buff sst and shales - minor lithic fragments occur within sst. Lower contact sharp. 65° to c.a.			
3.33	403.75				
404.70	405	BASALT (VB) - siliceous, porphyritic VB. Phenos to 2 mm in length.			Minor, fg sulphides & chalcopyrite
	405.22	TUFFACEOUS SHALE - l.g. buff green shale			
3.08		BASALT (VB) Fine grained massive olive green basalt. Chlorite filled amygdules common from 407.0 - 407.70 - in the same segment many smoke carbonate veins 1/2" to core axis. VB becomes fine grained siliceous proximal to contact 35°			
407.78	408.8				
	409.19	CHLORITIC TUFF SST - minor green grey buff			
4.90	409.74	CHLORITIC SHALE Moderately well bedded fine grained shale - Bedding 45° to c.a.			
	410				
	410.25	TUFF SST. Fg, light brown grey fine sst. minor thin shale partings			
	413.69	TUFFACEOUS SHALE - l.g. greenish grey buff to brownish			
412.70	414.65	CHLORITIC SHALE			
3.48		Massive to chaotic fine grained olive brown shale - bedding not well developed. From 415 - 412.5 the shales are irregular and chaotic, at times with a pseudo fragmental texture (i.e. 418.50 - 419.90)			
416.20					
1.51					
417.70					
3.05	418	Fine scale calcite veining generally sporadic in occurrence. Purple brown shale unit 416.20 - 416.40. (with finely interbed carbonate).			
420.75					
3.35		Alteration proximal to veins and fractures. Lower contact not seen core is ground slightly.			
424.0					
424.3	0.65				
1.23	424	TUFF SHALE Pale greenish grey fine g. well bedded buffs. Bed'g. 30-40° to c.a. Varying to dk brownish grey.			
	425				

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DIAMOND DRILL LOG

Hole N° 1240 Page N° 4

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
425.55		Lower contact not visible.							
426.03	0.48	425.55 BASALT (VB). The basalt is initially massive olive green with numerous ank carbonate veins and							qtz-calc veins 425.72 - 426.00
426.30	0.75								qtz-calc vein 10° to c.a 426.50 - 427.40 - roughly in place.
427.45									3cm qtz-calc vein 10° to c.a from 428.00 - 428.50
	3.15	lower thin mine veins. Minor chlorite filled amygdules. Core generally		F					Fault at 427.85, calc. del. filled, slickensides 50° to c.a.
431.20		broken over inital 2m.							Minor fine grained epidote in fractures and vein walls.
		Scattered phenocrysts from 429.44-428 and rounded chlorite filled amygdules.							
	4.93	The basalt becomes highly amygdaloidal from 433.00-435.40. Thin lava							
	435	amygdules - finally almost free of amygdules - contact is gradational							
436.20		with phenocrysts increasing slightly. 436.73							
		PORPHYRITIC BASALT (VB).							
	4.55	Massive olive green fine grained basalt with abundant pale white green feldspar(?) phenocrysts generally							
440.75		upto 3 cm in width - chlorite filled amygdules are common							
		Carbonate veining erratic with							50 cm long qtz/chlorite carbonate vein parallel to c.a & slickensides - FAULT
	5.02	fine scale criss crossing veins common							
445.75	445	Lower 35 cm siliceous fine grained and devoid of phenocrysts - abundant							
	446.49	carbonate veinlets and segregations							
		TUFFACEOUS SHALE (TUFFSST).							
	4.24	Predominantly fine grained dark oily brown Siliceous shales.							
449.70		interbedded with grained brown medium grained tuffsst.							
	4.92	Bedding is variable from 45° at 446.50 to 25° at 451.50.							
		Thin carbonate veinlets common.							
	455	Rare lithic tuff units - 10 cm wide							
		Fault - 448.00, 15° to c.a. calc chlorite with slickensides.							
	4.01	Lower contact sharp. 45° to c.a.							
457.46									
		LITHIC TUFF. Greenish grey lithic tuffs with minor tuffsst and tuff shales. Fragments comprised of lts, shales, dac. clasts range from 0.25 cm							
458.70		to 1 cm. Fine carbonate veining. Rusty/pink calcite clasts are common.							
	460	Contact erratic with clasts in sst.							
460.58									
	4.22	460.77 TUFFACEOUS SHALE / TUFFSST							
		Fine grained massive dark brown red shales, no bedding except in thin 2 cm wide tuffsst beds - 35° to c.a.							
	461.75	Carbonate filled fractures.							
463.0		LITHIC TUFF Medium grained greenish coloured tuffs - fragments range from 0.1 mm to 2 cm, comprise VB in the matrix, green			F				
	464.45	tuffs, dac. clasts.							
		TUFFSST - m.t. grey brown very indurated & minor shales - sharp 45°							Faulted contact 35° to c.a.
	465								
	4.70	BASALT (VB)							

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DIAMOND DRILL LOG

Hole N° 1290 Page N° 15

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz); chloc - chloritic

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		Medium to fine grained olive green massive basalt - chlorite frequent in fractures + carbonate veining fractures and as thin cross cutting veinlets. Lower contact sharp. 20° to C.A.							
	467.35								
467.7		CHLOC. SHALES.							
	4.80	Initially erratic reddish, brown shales with minor patchy alteration grading into more massive structureless fine grained shales. Thin stringers like green chloritic alteration.							
	470								
472.5		The shales become coarser grained from 472.5 - down to 475.67							
	3.88	Splotchy alteration is quite common							
475.3		Carbonate veining sporadic.							
	0.62								
476.7		From 476.10 the shales become moderately well bedded - bedg. 60° to C.A - Rare carbonate veining							
	4.55	Irregular wavy chloritic alteration occurs intermittently.							
	480								
481.2		The shales are well bedded from 435.35 - 437.35 - Bedg 35° to C.A.							
	4.44	Remainder to 492.26 Fine moderately well bedded							
485.7		Finely disseminated carbonate from 490 to base of sequence.							
	1.74	Pale green alteration patches and segments after chlorite, and surrounding carbonate veins.							
487.7									
	490								
	5.08	The latter part of the unit is transitional to that below becoming silicified.							
492.7		Contact arbitrarily at a grey silicified shale contact.							
	493.71								
		SILICIFIED TUFF SHALES Reddish brown and pale green highly silicified tuffs - disseminated carbonate common. Rare carbonate veinlets.							
	4.93								
	495								
	495.50								
		CHERTS Initial more probably highly silicified shales (tuffs) with interbedded cherts. Well bedded 45°. From 497.00 the cherts become fine grained pale greenish in colour, moderately well bedded with fine scale fracturing.							
497.7									
P.S. 499.02									
5.08	500	The cherts and highly silicified shales vary in colour from light							

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DIAMOND DRILL LOG

Hole No 1296 Page No 16

Feature : Bedding, Foliation, Fragment - size & shape (0%), Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE / COMMON / ABUNDANT / MASSIVE	DEPTH m	MINERALIZATION
502.70		green to greeny grey and grey. Bedding is variable with the better bedded units probably represent the silicified shales (tuffs) and the more massive, microfractured rocks being the true clasts. Carbonate veining rare. Bed'g uniform 30–40°.				
3.18						
505.93	0.25					
506.37	0.28					
506.90	0.33					
507.23	0.16					
507.38	0.15					
507.71	0.33					
508.05	0.46	From 510 the clast/shale are very well bedded, and therefore most likely highly silicified huffaceous shales – resemble some of the previously logged huff/shales. Lower contact sharp 40° to c.a.				
510						
510.9					511.9	2mm min with 3% galena
511.00	0.17					
2.78					512.45	1cm wide calcite vein + qtz and minor galena 30° to c.a.
514						
514.23		LIMESTONE – mid grey, m-g, well bedded, medium				of fine scale grains & fragments
514.60						
RQT 514.30						
3.03	515	LIMESTONE – Medium grained clastic limestone made up of fine carbonate clasts, well bedded – 40° to c.a. – some thin non calcareous partings. Minor carbonate veining				
	516.18					
		TUFFACEOUS SHALES grey/dk green to grey well bedded shale (tuffaceous) bed'g 40° to c.a.				Minor carbonate veining.
517	517.1					
2.40		LIMESTONE/SHALE Predominantly erratic fine and medium grained fragmented limestone and dark associated pale grey fine grained shale – flat broken up by carbonate.				Fine grained aggregate bedded fg and pebbly fg aggregates. <1%.
	519.2					
519		LIMESTONE. Massive fine grained grey to grey black limestone. Fine wispy black shaly (?) clasts are common. Bed'g. weakly developed – generally a bed variation – 45° to c.a. Carbonate aggregates occur Minor carbonate and qtz carbonate veining. The unit is well bedded from 523.5 – base of sequence. This interbedded shale units common towards base. Lower contact sharp. 35° to c.a.				Upto 1% fg developed sphaerulitic fine grained aggregates of grey. Some veins crackled, pebbly inclusion to rounded aggregates. 1cm wide bands parallel to bedding (aggregates) 520.92 – 0.5cm qtz, calc vein + fg, weak py, assoc fg. 15° to c.a. 523.24 qtz, calc vein + minor py 523.83 qtz, calc vein + py assoc fg.
520	XS206 FET.					
2.99						
523						
2.97	525					
526						
2.89						
529						
	529.45					
	530	GREYWACKE – fg, sandy to well bedded. LIMESTONE/SHALE				

073

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DIAMOND DRILL LOG

Hole No 1290 Page No 17

Feature : Bedding, Foliation, Fragment - size & shape 0%; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%; Common 5-15%; Abundant 15-60%; Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
3.02	532.0	Regularly interbedded dark grey fine grained siliceous shales and limestones. The limestones vary from m.g. well bedded clastic lst. to massive fine grained lst (siliceous shales?). Fine scale carbonate veining common generally parallel to bedding - 30-40° to C.A.							Segregations (parallel to bedding) of fine grained py and aggregates of py occur in these sediments. The vein selvages vary from 1mm to 10cm in width. Total sulphide upto 1%.
2.97	535.0	(Tuff).						534.95	
	535.0	SHALE - fine grained well bedded siliceous dark grey shale, hot 5cm carbonate rich. Bed. 35°							Rimmed by bands or patches with reaction rims.
3.13	536.71	LIMESTONE - Dark grey black fine grained - massive, poorly bedded. Minor shaly beds towards base.							Finely disseminated py.
	539.84	SHALE - Siliceous fine grained chalky shale moderately well bedded, dk grey on fresh surface, 10cm dark bands. Bed. 30° to C.A.							
	539.9	LIMESTONE - dark grey black fine grained.							f.g. patchy disseminated py.
3.03	540.0	SHALE / LIMESTONE - Interbedded mid to light grey fine grained shale and grey to black fine grained limestone. Erratic carbonate veining is very common predominantly in the shales. The shales are well bedded - 60° - 35° to C.A. Contact 45° to C.A.							Finely disseminated py less 1% in limestone?
	543.03	LIMESTONE - Massive dark grey black f.g. finely bedded limestone - minor fractures and carbonate veining							Patchy fine and f.g. pyrite, total sulphide 2%
2.97	544.0	CHERT - Highly silicified shales and chert, mid grey medium - lower contact jagged and inclined 60°							
	544.92	LIMESTONE (Minor Shale). Predominantly limestone, m.g. and fine grained varities - with f.g. mid grey clastic shale interbeds. Erratic carbonate veining and segregations common. Lower contact erratic and gradational.							Fine grained pyrite py less than 1%.
3.01	545.93	CHLORITIC SHALE - strong grey clastic and disturbed fine grained shale. Contact 35° to C.A.							
	549.0	MASSIVE SHALE dark grey banded massive shale						549.82	Minor py.
3.00	550.14	CHERT (Chalky shale). F.g. fractured and angular massive chert, mid grey in colour, together with fine grained highly silicified shales (chalky shales) generally dark grey-black in colour.							Pyrite on joint planes minor chlorite, on cleavage and joint planes.
0.57	553.14	Lower contact banded normal to C.A.							
	555	CHERT / LIMESTONE Interbedded f.g. shale upto 10cm							

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DIAMOND DRILL LOG

Hole N° 1290 Page N° 18

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive <60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		with sst clasts, then brown grey sst, mid grey medium to coarse grained with some shale interbeds and irregular wispy partings. Minor carbonate veining in sst. Contact fairly arbitrary.						556.62 557.17 561.3 561.7	fg, calcareous 35° to c.a, cross cutting fg veinlet. fg carb vein 30° to c.a & galena fg, calcareous 25° to c.a. fg, calc. & fg 35° to c.a
559		SANDSTONE. Massive medium to coarse grained mid grey sst. Bedding not defined, minor carbonate veining. 1cm shale at 561 to. 11cm shale band 564.63. Lower contact sharp. 35° to c.a.						561.63 562.72	3cm fg, calc vein 15° to c.a & fg, fg, assoc fg (:). dk, calc vein & shale wisps, fg (minor).
565.15		SHALE - mid grey - smectic (calcite)							poor sst clasts
566.13		SANDSTONE / SHALE. Massive sandstone, mid grey in colour, medium grained - smectic carbonate veins and rounded to sub rounded carbonate segregations. Wispy smectic shale interbeds predominating around 570.						570.44	bleached fg, calc vein. shale.
		SANDSTONE. Massive medium grained mid grey sst - minor carbonate veining fairly bedded - rounded to irregular 1" ± carbonate clasts. Contact sharp - 65° to c.a.						570	1.5cm mid fg, carbonate vein sub parallel to c.a ~ 10°. minor secondary shale.
571.43 573		CHAOTIC SANDSTONE / SHALE Massive mid grey m.g. sst with interbedded shale, ranging from cm units to irregular disturbed wispy flakes and partings. Very minor carbonate veins.							
572.5		E.O.H. Alex Keddie. 3/1/73.							

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DIAMOND DRILL LOG

Hole Nº 1285 Page Nº 1

Feature : Bedding, Foliation, Fragment - size & shape 0% | Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5% | Common 5-15% | Abundant 15-60% | Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		NO CORE - TRI-CONE							
	6.00								
1.00		BASALT (Vb)							
2.73	10	From 6.00 to approximately 45.00 the basalt is extremely weathered to a orangy colour - Rare sections are fresh and these are a pale olive green colour. In the fresher parts chlorite veining is often seen and carbonate filled amygdules							
1.10									
1.53									
0.38									
0.72									
0.38		Core recovery is very poor with a majority of the core being fragmented and broken up.							
0.32	20	The Vb is oxidized & iron stains common on joints.							
0.40									
2.43		Brown shale unit 22.70 - 23.50. The core is broken up.							
0.80		From 27.90 - 28.40 - clayzone & Vb and chocolate shale fragments							
1.38	30								
1.10									
0.30									
0.17									
1.52	40	Change of scale							
0.62									
0.43									
0.97		Dark olive green massive Vb & fine chlorite filled amygdules. Minor chlorite alteration and veining.							
1.43		- Vb -							
1.22	45								

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DIAMOND DRILL LOG

Hole Nº 1285 Page Nº 2

Feature : Bedding, Foliation, Fragment - size & shape, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
1.45	46.80	Vb.							
0.55	47.50	TAN SHALE - Fine grained massive tan coloured shale. - Bed'g. 45° to C.A.							
0.95	48.23	BASALT - F.g. weath. brownish to olive green in colour - lower contact not seen							
0.50	48.60	BROWN SHALE - Weathered I.S. shale							
0.40	49.00	BASALT - Porphyritic weathered Vb.							
0.40	49.40	JUSP SST - grained wet banded buff - minor fine scale crossbed'g. Bed'g 70° to C.A.					V	49.34	qtz vein 60° to C.A.
0.57	50	BROWN SHALE - broken up core consisting of red brown siliceous shale. Lower contact faulted at 50.1 - qtz vein, open voids.							
1.00		PORPHYRITIC BASALT - Fine grained greeny grey massive Vb with abundant feldspar phenocrysts (1) - generally quite regular in size, at times rounded. Initial 2 metres is a weathered brownish colour. Fractures are common, with alteration proximal to them.							
1.43									
1.01									
0.73									
0.9	55	Lower contact appears to be faulted - there is a rusty qtz vein and broken core below							
	55.60								
0.55	56.35	BROWN SHALE - Siliceous fine grained massive brown shale - Lower contact not seen							
0.24		BASALT (Vb). Fine grained weathered olive green in colour massive Vb. Very fine scale chlorite filled amygdules. Fracturing common as are veins. The veins are filled with qtz, chlorite and iron oxides. No discernible major chloritic veining or alteration.							
0.60									
1.59									
1.11	60	Breccia Zone - 60.60 - 60.58 - fracturing and open cavities associated with it. 55° to C.A.							
1.47									
1.65	63.54	Lower contact not seen but could be faulted as the core is broken and there are open cavities with oxides, chlorite.							
2.94	65	PORPHYRITIC BASALT. Fine grained massive dark green porphyritic basalt. The phenocrysts (1) are regularly spaced and generally subhedral to sub-rounded varying in size from 1mm to 0.5 cm. Epidote rich breccia between 64.13 - 64.28. 45° to C.A. Bleaching above possibly associated with fault.							
0.75									
2.22	PBT 69.06	There is an irregular network of veins immediately below the Br. Weathering and bleaching 66.54 - 68.60. Broken core around 67.80 FAULT (?) Qtz segregations around 69.60.							
	70								

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DIAMOND DRILL LOG

Hole Nº 1285 Page Nº 3.

Features : Bedding, Foliation, Fragment - size & shape (0%), Shearing, Fault (F), Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
1.95		Bleaching and brn from 72.16 - 73.65 associated with 1cm qtz vein, some thin sills. FAULT. at 72.36. Less porphyritic towards base of sequence. - fine scale qtz/carbonate veining - chlorite filled amygdules.							
	73.62	FAULT - 5x10 qtz vein.							
2.97	73.70	BASALT (Vb) Fine grained massive olive green Vb. Moderately chlorite veined and traversed by irregular calcite veins. Pale alteration associated with qtz vein at 74.50. Chlorite alteration at 75.80-76.00 associated with fractures and calcite veins. Intensely chloritized zone 5x1 between 77.49 - 77.59, 60° to C.A. Contact with sequence below chloritized and slightly fractured. 60° to C.A					V	74.50	7cm qtz, carb vein 45° to C.A.
	75							76.43	irregular qtz carb vein 10° to C.A.
2.0	77.37								
	77.42	PORPHYRITIC BASALT. Chloritic fine grained porphyritic Vb - phenocryst content decreasing to base with fine 20 cm zone thinned and having 1x1's carb.					V	78.67	qtz, carb vein 1cm wide 80° to C.A.
3.00	80	RED (SEDIMENTARY) SHALE - Plasma reddish brown to grey brown shale, partly bedded and fine grained. Lower contact 48° to C.A.							
	81.25								
1.84		BASALT (Vb) - generally fine grained massive, chloritic, with rare chlorite veins. Fine carbonate veining common. Occasional feldspar phenocrysts. Last metre is pale greyish blue green chloritized.							
	83.52								
2.05	85	ALTERED BASALT (Vb) Brownish green fine grained altered basalt - altered due to faults - Thin faults 84.90, 85.00, 85.05 Core intensely broken 85.25 - 85.35 - pyrite & qtz vein, 10cm contact							
	85.30								
4.59		BASALT (Vb) Fine grained olive green massive Vb - Rarely seen any chlorite veins. Generally erratic thin calcite veining - Possible minor faults at 86.94, 87.00, 87.72, 88.37 - usually 60° to C.A. Lower contact sharp with a step in it 45° to C.A.							
	89.07								
3.05	90	TUFFACEOUS SANDSTONE (Vt) Massive medium grained greenish to reddy brownish tuffaceous sandstone with rare red shaly lithic fragments. Thin criss-crossing calcite veins are common, as are irregular qtz, carbonate segregations. Carbonate clots or spots are frequently seen. Minor fine grained red shale interbeds. From 95.68 the tuffaceous sandstone grades into a medium grained lithic sandstone, with red shale fragments.					V	90.31	qtz vein 30° to C.A & brecciated
	PBT 94.25 95								

078

130080 70.

Cominco

DIAMOND DRILL LOG

Hole No 1296 Page No 4

Feature : Bedding, Foliation, Fragment - size & shape (C%), Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
2.91	96.20	becoming more fragmental towards the base of the unit. Lower contact 45° to C.A. but slightly irregular.							
		LITHIC TUFFS (Vt) – Coarse grained lithic tuff grading into a medium grained " tuff with ~1 tuff clasts. Lower contact 45° to C.A.							
	97.76								
3.02		BASALT (Vb)							
		Fine grained massive olive green basic volcanic. Quite homogeneous in character. Chlorite patches or segregations are common and appear to be evenly spaced.					V	98.21	0.5cm qtz-carb vein 35° to C.A.
Change of Scale	100	Rare massive clots of chlorite.							
3.04		Fine scale calcite veining, generally quite erratic is usually seen.							
3.01		Several veins are dolomite and parallel to the C.A. and at times forming discontinuous segregations							
3.02		Fine carbonate spotting usually seen around carbonate veins (boundary X's)							
Change of Scale.	110	Epidote associated ± qtz vein 25° to C.A at 114.71					V	110.15	qtz vein ± slickensides fault(?) 25° to C.A.
3.06		From 112.75 to base of sequence the Vb is almost devoid of chlorite rare clots, chlorite filled amygdules. Minor calcite veining – appears to become siliceous towards base.					V	111.71	qtz-epido vein 25° to C.A.
2.93		Lower contact 60° to CA.							
	115							114.98	
		LITHIC TUFF (Vt) – Mainly m.g. lithic tuff ± lower interbedded tuff shales, 75° to CA							
3.03	117.46	TUFFACEOUS SHALE (Vt) Fine grained moderately well bedded tuff grades from tan-grey brown in colour. Bed's 45° to C.A. Lower contact gradational with tuffs becoming sandier							
		TUFFACEOUS SHALE (Vt) Medium grained reddish brown green tuff/sst. with minor criss cross carb. veinlets – lower contact possibly FAULT				F			qtz-chlorite vein ± slickensides
	118.63								
	119.24	LITHIC TUFF SHALE – Fine grained tuff/shale and lithic tuff – lower contact 60° to C.A.							
	119.74	BASALT (Vb) – Fine grained massive Vb, contact 105° to C.A.							
	120	TUFFACEOUS SHALE – minor lithic tuff							
	120.29	BASALT (Vb) – The mafic 1-2 metres are foliated and altered, epidote and chlorite rich – a result of faults at 120.14 2cm wide, 45° to C.A, 121.14 – 3cm wide 45° to C.A.				F			qtz-ch vein epidote.
3.09		BX between 122.30 – 122.40.				BX			
		Large chlorite clots. 123.00 – 123.45.							
		Fractured, calcite veined and chlorite veined Vb from 123.45 – 126.25							
2.91	125	qtz segregations are common							

079

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DIAMOND DRILL LOG

Hole N° 1236 Page N° 5

Feature : Bedding, Foliation, Fragment - size & shape D's; Shearing, Fault F, Vein c carbonate q quartz

Mineralization : Trace 1-5%; Common 5-15%; Abundant 15-60%; Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		Lapsible fault at 126.25 (Slickensides) 60° to C.A.							
		From 126.30 to 134.60 the VB is fine grained olive green and very homogeneous. Minor calcite veining and rare intense developed Minute chlorite filled amygdules common.							
3.6		134.60 – 134.77 – 3cm qtz vein with chlorite fractured by several thin qtz, carbonate veins, VB is chloritized and altered – maybe healed FAULT(?).							
3.1	130	The VB from 134.77 to the base of is shattered by thin tension cracks and abundant irregular chlorite dots and veins.							
3.0		Lower contact is sharp. 45° to C.A.							
2.1	135								
	137.0								
	137.5	BROWN SHALE – f.g. massive poorly bedded shale – thin tension cracks							
	137.66								
1.5		BASALT (VB) Fine grained massive VB olive green in colour, ~ fine scale calcite veining common chlorite + qtz, cbl vein at 139.02. Lower contact 45° to C.A						133.4	
	140								
		TUFF SHALES (VE) Well bedded h/g brownish in colour grading to chloritic fractured and chloritized green h/g. Bed'g. 45° to C.A. Lower contact sharp 60° to C.A							
	141.8								
3.2		CHOC – PURPLE BROWN SHALES (VE) Massive f.g. erratic poorly bedded shales with common chlorite veining. 45° to C.A							
		TUFF SST (VE) – medium grained brownish red h/g sst. with minor f.g. well bedded h/g shales, bed'g. 47° to C.A.						144.7	
	145								
2.8		PURPLY BROWN TUFF SHALE (VE) – fine grained purplish to ruby brown well(ss) bedded h/g's. Pockets of re'x'ed carbonate are common at times having a radiating structure. Fine scale calcite veining common. Lower contact gradational, core broken at contact.							
	147.55								
		CHOC SHALES Massive, weakly foliated choc coloured fine grained shales. Irregular green patchy alteration occurs. Rare fine calcite veining. FAULT – slickensides, qtz. cbl veins 147.83, 4cm wide 80° to C.A – Contact irregular							
	150	PURPLE BROWN SHALES –						149.8	

080

Commico

DIAMOND DRILL LOG

Hole No 1285 Page No 6

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
	150.60	Weakly foliated and slightly altered shales Lower contact 70° to c.A.							
1.99		CHOC SHALES Fine grained massive poorly bedded choc coloured shales, abundant fine scale erratic calcite veining 0.25 in purple brownish shale unit - Rare irregular patchy chloritic alteration. Lower contact 65° to c.A.							
1.11	153.28								
3.01	155	CHOC SHALES / TUFF SST / LITHIC TUFF / PURPLE BROWN SHALE - Interbedded sequence of f.g. massive choc. shales, medium grained sporadic brown tuff sst, lithic tuffs with fragments to 0.5 cm Minor purply brown f.g. shales. Bedding is generally seen between units, usually 45°-30° to c.A. Lower contact sharp 40° to c.A.							
	157.59								
3.02		BASALT (Vb) Fine grained dark olive green massive Vb - Very fine carbonate spotting common. Occasional calcite veins. Thin chlorite veining rare becoming more common towards the base. Appears to be a slightly brec'ed lower contact			c			160.05	1 cm, long vein 15° to c.A containing qtz carbonate.
Change of Scale	160				c				
3.05	164.65								
2.05		PORPHYRITIC BASALT Fine grained grey green to olive green massive highly porphyritic (?) - feldspar - basic volcanic. The phenocrysts are quite regular in size, generally 2mm. Rare fine amygdules filled with chlorite. Carbonate segregation, irregular veins and veinlets are very common with secondary carbonate associated with them. The feldspars have a slight colouration to them occassionally Chlorite veining rarely seen. Qtz/carb, Vb BX, 4cm wide at 165.07 followed by 1cm qtz vein 45° to c.A. Fine carbonate spotting adjacent to some veins. Epidote associated with veins in lower half of sequence. Bx (?). 168.70 - 168.80, 171.92 - 171.98 The Vb becomes less porphyritic towards the base of the unit from 181.70 Lower contact sharp 30° to c.A				Bx		165.21	qtz vein 45° to c.A.
2.05								166.20	qtz, carb vein 25° to c.A.
2.05					c			167.25	qtz, carb vein 20° to c.A.
2.05	170								
2.05								171.35	qtz, carb, epidote vein 45° to c.A.
						Bx		171.90	Irregular qtz vein minor carb 25° to c.A close to breccia.
2.07								174.35	Epidote & minor qtz, carb.
3.00									
3.00	180								
Change of Scale.									
3.00						F(?)		181.05	Locum qtz, chl, carb, vein may be fault (?). 40° to c.A.
3.02	183.09								
		CHOC. SHALE Massive poorly bedded fine grained choc. coloured shale Very fine calcite veins - rare - Thin fault at 183.04, 35° to c.A. Contact 42° to c.A							
	184.66								
	185	TUFFACEOUS SANDSTONE. Medium grained				Bx			

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DIAMOND DRILL LOG

Hole No 1285 Page No 7

Feature : Bedding, Foliation, Fragment - size & shape 0%, Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
3.05	185.70	carbonate rich brownish grey hyff sst. ISX at 184.91, 6 cm wide - Contact 40° to C.A							
2.30		CHLOC. SHALES Generally massive weakly layered fine grained choc. coloured shale. Rare thin calcite veins - minor green altered interbeds. Initial 90cm characterized by abundant recrystd secondary carbonate. Patchy green altered shales towards base of sequence. Lower contact gradational.							
	190							190.10	
2.04	190.76	CHLOC SHALE / GREEN TUFF SHALE - interbedded choc coloured shales and erratic green hyffs.							
		DOLOMITIC TUFF SHALE irregular carbonate (lst) fragmental hyff							
1.58	191.27	CHLOC SHALES Massive fine grained generally erratic to poorly bedded choc. coloured shales - calcite veining and secondary X'ls common. Irregular blebby and patchy green alteration zones common. From 196.20 to base of sequence the shales become a darker greeny brown and are grey green at contact with underlying unit.							
	195								
	196.85	Lower contact sharp 45° to C.A. slickensides (possible FAULT)							
3.05		GREY / GREY BROWN SHALE - DOLOMITIC. Disrupted sequence of fine grained slumped greyish green to grey brown shales with medium grained dolomitic shales. First 1 m is mainly dolomitic shales, generally erratic. R'x'ed carbonate at base. Contact sharp 80° to C.A.							
	199.75								
2.00		GREY BROWN SHALE Massive fine grained choc. grey brown shale with very minor calcite veining. Lower contact irregular and possibly silicified & Bx'ed.							
	201.75								
3.12	202.14 to 202.63 RET	LIMESTONE. Chaotic fragmented limestone with minor grey black shale interbeds. Fragments are subrounded to rounded and generally fractured by calcite veins. Strips vary from 1cm to 2cm in width. Lower contact not well defined.						202.37	Calcite veining 30° to C.A & Galena, fs s/h, chpy.
	203.81								
	205	GREY SHALE Fine grained erratic poorly bedded med grey coloured shale. Thin fractures filled w/ calcite. Lower contact sharp 45° to C.A.							Minor fine grained py crystallized in folds.
3.05	205.10 to 205.60 TET	LIMESTONE. Massive black fine grained limestone, generally well bedded Bed'g. 35° to C.A.							
	206.85	Lower contact contorted, slickensides FAULT							
0.92		CHERT Fine grained very hard mid grey, generally well bedded chert. Bedding varies from 11 to core axis to 25° to C.A. Minute tension cracks are common, more so in the less well bedded sections.							
1.00	210								

130084

082

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DIAMOND DRILL LOG

Hole Nº 1295 Page Nº 8

Feature : Bedding, Foliation, Fragment - size & shape; Shearing, Fault, Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	TRACE	COMMON	ABUNDANT	MASSIVE	DEPTH m	MINERALIZATION
		The lower metre is generally fractured up with fine scale tension cracks. Although bedding is still preserved.							
2.51	211.95	FAULT - broad, shale/chert breccia		Bx					
	211.20	CHERT / SHALE / SST - siliceous erratic.							
	211.55	BROWN SHALE - micaceous fine grained.							
3.52		CHERT - fine grained massive clast fractured grey to green chert. Lower contact faulted (slickensides 20° to c.A							
	213.75								
1.75		SHALE / CHERT / SST / CHERT - f.g. green shale & fractured shale, carbonate rich sandstone. Lower contact gradational							
	215								
1.75		BROWN / GREY SHALE - Massive chaotic brownish to grey poorly bedded shale. Bx 215.35 - 215.45 - silicified. From 217.07 to 217.40 the shales are grey with carbonate rich sst(?) clasts. Lower contact faulted (slickensides) 60° to c.A			Bx				
	217.40				F				
3.01		SANDSTONE (sst) - Medium to coarse grained grey to mid grey massive poorly bedded sst. It is carbonate rich and occasionally veined by calcite. Lower contact sharp 50° to c.A.							Minute chip galena detected in thin calcite vein.
	220								
3.--	220.37	GREY SHALE - fine grained chaotic poorly bedded grey shale - rare calcite veins. Lower contact not seen.							
	221.70	SANDSTONE - Medium to coarse grained mid grey massive sst. Carbonate rich with wisps carbonate clasts and minor calcite veining. Lower contact sharp 60° to c.A.							
2.51	224.12								
		SHALE / SANDSTONE - Grey chaotic shale with carbonate rich sandstone interbeds. Lower contact not seen.							
	225								
	225.65	GREY BROWN SHALE - Fine grained chaotic rusty purple brown shale with minor calcite veins.							
3.--	227.								
		CHAOTIC LIMESTONE / SHALE - fragmented zone							
	227.40	SANDSTONE / SHALE - M.-f.g. carbonate rich sst and f.g. chaotic shale, FAULT, Slide's 228 Lower contact 65° to c.A.			F				
	228.32								
		GREY BROWN SHALE Massive f.g. erratic grey/brown shale - Lower contact 70° to c.A							
	231.13								
	231.43	SANDSTONE - Carbonate rich m.g.							
3.--	230	GREY BROWN SHALE - f.g. siliceous shale & 15cm chert band at 229.77 Lower contact 65°							
	230.05	SANDSTONE - m.g. carbonate rich						230.33	
	230.55	GREY BROWN SHALE Massive fine grained poorly bedded erratic brownish grey shale. Rare thin carbonate veins. Lower contact not seen.							
	232.87								
2.31	233.42	SANDSTONE / SHALE - m.g. sst & siliceous grey shale - irregular fault, 40 ves. 60°			F	(F)			
		SANDSTONE m.g. mid grey carbonate rich							
		SANDSTONE, CHERT, CARBONATE VEINED Bx - Slickensides				Bx			Galena in calcite vein.
1.--	235	CHERT. Fine grained massive to							

083

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DIAMOND DRILL LOG

Hole N° 1255 Page N° 9.

Feature : Bedding, Foliation, Fragment - size & shape (Ds), Shearing, Fault (F), Vein (c carbonate, q quartz)

Mineralization : Trace 1-5%, Common 5-15%, Abundant 15-60%, Massive >60%

CORE REC'D	DEPTH m	GEOLOGY	VISUAL LOG	DEPTH m	MINERALIZATION
2.5		well bedded whitish grey to black. Bed's usually varies between 25°-60° to c.a. Fine scale fracturing very common. Very minor calcite veining. At times the chert is very irregular.			
5.7		Lower contact not seen.			
0.1		~~EUHEDRAL SPARE - boem~~			
1.9	240	SANDSTONE (SST) - medium grained mid grey massive sst. carbonate rich. Rare thin calcite vein.			

TRACE COMMON ABUNDANT MASSIVE

084

130086

- LEGEND -

ss	Micaceous sandstone, or as defined.
vb	Basic volcanic probably lavas, spilitic mineralogy.
vt	Basic tuff, includes tuffaceous shales, lithic & lapilli beds, tuff breccias & volcanic arenites.
sh	Shale.
shg	Grey shale or mudstone.
slt	Siltstone.
shb	Brown & purple shales or mudstones.
lst	Limestone.
ch	Chert, undifferentiated, or as defined.
ub	Rocks of ultrabasic affinity, includes serpentinite, pyroxenite, gabbro, dolerite, both coarse & fine grained occasionally amygdaloidal, probably related to Heazelwood River Complex.
serp	Serpentinite.
ba	Dominantly dark to black argillites containing rarer arenaceous layers & micaceous varieties.

cpy = chalcopyrite	py = pyritic	fsp = feldspar	pb = lead
ag = silver	zn = zinc	sn = cassiterite	qtz = quartz
cg = coarse grained	mg = medium grained	fg = fine grained	c̄ = with
weath = weathered	undiff = undifferentiated	bx́ed = brecciated	re-xed = recrystalized
			intb́d = interbedded

183635 - Petrological sample.

400 - Contour lines.

PWT/AH6 / RL 520·0 - Grid lines.

vb - Rock outcrops.

vt - Distribution of float on grid lines.

40° - Dips on bedding.

72° - Dips on faults.

- Dips on cleavage.

30° or 30° - Fold, foldaxes.

10 sn
280 cu
100 zn - Geochemical sample points and analyses.

vb - Creeks with rock outcrops indicated.

C88 -40° - Location and dip of diamond drill holes.

79-1391

Map 3

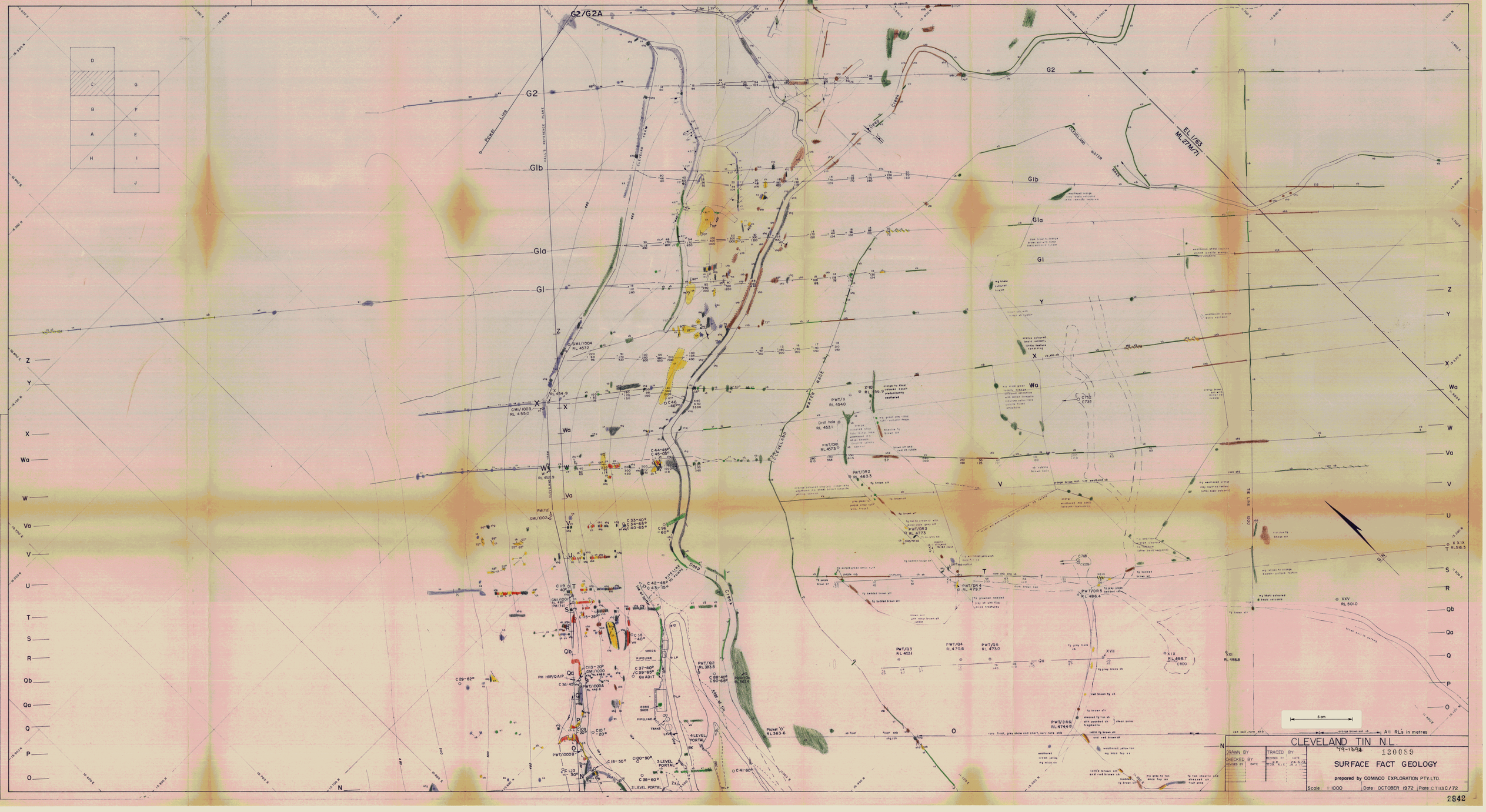

TAILINGS DAM AREA
Whyte River
GODKIN TRACK
ML 27M/71
EL 1763
PWT/T1 RL 3190
PWT/T RL 3672
PWT/T2 RL 3300
PWT/58 RL 3256
PWT/58 RL 3252
PWT/58 RL 3180
PWT/59 RL 3178
PWT/59 RL 3198
PWT/59 RL 3163
ANFO SHED
EXPLOSIVES SHED
DETONATOR SHED
MAGAZINE
Chert exposed in dozed area
Sheet diagram
All RL's in metres
CLEVELAND TIN N.L.
130087
SURFACE FACT GEOLOGY
prepared by COMINCO EXPLORATION PTY. LTD.
Scale 1:1000
Date: NOVEMBER 1972
Plate: CT113A/72
2340

Map 3

All RLs in metres

CLEVELAND TIN N.L.			
DRAWN BY	TRACED BY	130088	79-1591
CHECKED BY	REVISED BY DATE	SURFACE FACT GEOLOGY	
REVISED BY DATE		prepared by COMINCO EXPLORATION PTY. LTD.	
		Scale: 1:1000	Date: OCTOBER 1972 Plate: CT113 B/72

2841



CLEVELAND TIN N.L.

79-1594

130059

SURFACE FACT GEOLOGY

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Scale: 1:1000 | Date: OCTOBER 1972 | Plate: CTIISC/72

2842

Map 3

EL 1/63
ML 27M/71

EL 1/63
ML 27M/71

G5

G4a

G4aa

G4

G3b

G3a

G3aa

G3

G2a

G2/G2A

G2

Deep Creek

SOKKIN TRAN

Sheet diagram

D		
C		G
B		F
A		E
H		I
	J	

130090

5 cm

2843

CLEVELAND TIN N.L.

79-1941.

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY. LTD.

DRAWN BY		TRACED BY	
CHECKED BY		REVISED BY	DATE
REVISED BY	DATE	K.E.	24.8.72

Scale: 1:1000 Date: NOVEMBER 1972 Plate: CT113 D-72

Map 3

TIE LINE

SOUTHERN BASE LINE

AR

AS

AU

RA1

RA2

RA3

RA4

RA5

RA6

RA7

RA8

RA8/275m E
RL 433.4

RA8/475m E 570
RL 426.3

RA8/600 m E
RL 471.9

RA8/700m E
RL 507.0

RA8/750m E
RL 529.4

RA8/850m E
RL 536.0

RA8/1025
RL 549.8

RA8/1150m E
RL 546.7

PWT/R7
RL 436.2

PWT/R8
RL 431.5

PWT/R9
RL 399.7

PWT/R10
RL 412.9

PWT/R11
RL 485.2

PWT/R12
RL 523.8

PWT/R13
RL 528.6

PWT/R14
RL 528.2

PWT/R15
RL 537.7

PWT/R16
RL 543.8

PWT/R6
RL 427.8

Sheet diagram

D
C G
B F
A E
H I
J

130091

5cm

All RL's in metres

CLEVELAND TIN N.L.

79-1501

DRAWN BY:	TRACED BY:
CHECKED BY:	REVISED BY: DATE
REVISED BY DATE	" E 15 5 73

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY. LTD.

Scale: 1:1000 Date: JANUARY 1973 Plate: CT 113 E/73

2844

EL 1/63
ML 27/M/71

LEGEND

- ss — Micaceous sandstone
- vb — Basic volcanic, probably lavas, spilitic mineralogy
- vt — Basic tuff, includes tuffaceous shales, lithic & lapilli beds tuff breccias & volcanic arenites
- shg — Grey shale or mudstone
- shb — Brown & purple shales or mudstones
- ch — Chert, undifferentiated
- ub — Rocks of ultrabasic affinity, includes serpentinite, pyroxenite, gabbro, dolerite, both coarse & fine grained occasionally amygdaloidal probably related to Herzelwood River Complex
- bs — Dominantly dark to black argillites containing rarer arenaceous layers & micaceous varieties

- Grid lines
- Rock outcrops
- Distribution of float on grid lines
- Dips on bedding
- Dips on faults
- Dips on cleavage
- Fold axes
- Geochemical sample points and analyses
- Creeks with rock outcrops indicated
- Location and dip of diamond drill holes

Sheet diagram

D
C G
B F
A E
H I
J

120092

5 cm

All RL's in metres

CLEVELAND TIN N.L.			
79-1391			
DRAWN BY	TRACED BY		SURFACE FACT GEOLOGY
CHECKED BY	REVISED BY	DATE	
REVISED BY DATE	R. R.	15.5.73	prepared by COMINCO EXPLORATION PTY.LTD
Scale 1:1000	Date JANUARY 1973	Plate CT.113.F/73	

2845

Map 3

G2

W

Q9

EL 1/63
ML 27M/71

AB

L

AH

TIE LINE 1300

Q2

GA 55
RL 717.4

PMT/Q10
@RL 713.5

GA 54
RL 695.9

PMT/Q9
RL 685.8

GA 53
RL 648.8 @

PMT/Q8
@RL 614.6

PMT /Q7
RL 603.1

PMT/Q6
RL 556.4

quartz veined vb

XL II
RL 530.8 @

XXVIII
RL 520.6
@

XXIII
RL 525.8
@

XXXI
RL 526

XXIX
RL 516.3

PMT/TL1

TL 7
@RL703.6

PMT/TL2
RL 686.7

PMT/TL3
RL 684.1

AH 50
RL 700.1

PMT/AH1
RL 666.3

PMT/AH2
RL 634.2

TL/AH 1P
RL 638.6
@ AH9

PMT/AH 3
RL 609.1

PMT/AH 4
RL 593.5

@ TL 525 P
RL 641.9

Sheet diagram

D		
C		G
B		F
A		E
H		I
		J

120093

5cm

All RL's in metres

CLEVELAND TIN N.L.

79-7591

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY. LTD.

DRAWN BY	TRACED BY
CHECKED BY	REVISED BY DATE
REVISED BY DATE	R.E. 15.3.73

Scale: 1:1000 Date: JANUARY 1973 Plate: CT113 G/73

2846

ML 27M/71
EL 1763

ML 27M/71
EL 1763

RA 3

RA 4

RA 5

RA 6

RA 7

RA 8

RA 11

RA 10

RA 11

RA 12

'WASHINGTON'
WORKINGS

WASHINGTON
MINE

GODKIN TRACK

SOUTHERN BASE LINE

HALLS REFORM FAULT

Sheet diagram

D
C G
B F
A E
H I
J

130094

5 cm

All RL's in metres

CLEVELAND TIN N.L.

'79-1971

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY LTD.

Scale: 1:1000 | Date: JANUARY 1973 | Plate: CT 113 H /73

2347

RA6
RA7
RA8
RA11
RA12
RA13
RA14
RA15
RA16
RA17
RA18
RA19

FALLS CREEK
SOUTHERN BASE LINE
TIE LINE
Waterfalls

PWT/R1 RL 376.6
PWT/R2 RL 383.0
PWT/R3 RL382.2
PWT/R4 RL407.9
PWT/R5 RL 420.2
PWT/R6 RL427.8
PWT/R7 RL436.2
PWT/R8 RL 453
RA6/75e E RL382.3
RA6/275mE RL 453.4
PWT/13 RL 362.0

Sheet diagram

D
C G
B F
A E
H I
J

120095

5 cm

All RL's in metres

CLEVELAND TIN N.L.

DRAWN BY:	TRACED BY:	
CHECKED BY:	REVISED BY	DATE
REVISED BY		18.9.73
DATE		

YA-13.91

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY LTD.

Scale 1:1000 Date JANUARY 1973 Plate CT113 1-73

2848

RA 14
RA 16
RA 17
RA 18
RA 19
RA 20
RA 21
RA 22
RA 23
RA 24
RA 25
SOUTHERN BASE LINE
TIE LINE

Sheet diagram

D
C G
B F
A E
H I
J

130096

5 cm

G.N.

CLEVELAND TIN N.L.

79-1391

SURFACE FACT GEOLOGY

prepared by COMINCO EXPLORATION PTY. LTD.

DRAWN BY:	TRACED BY:	
CHECKED BY:	REVISED BY: K.E.	DATE: 15.5.74
REVISED BY: DATE		

Scale: 1:1000 Date: MARCH 1973 Plate: CT 113-J-73

2849

9000 E 10000 E 11000 E 12000 E 13000 E 14000 E 15000 E 16000 E 17000 E 18000 E 19000 E 20000 E

20000 N 19000 N 18000 N 17000 N 16000 N 15000 N 14000 N 13000 N 12000 N 11000 N

367020, 5410575
12,000 , 19,500

366750, 5408550
12,125 17,550

363255, 5409015

E.L. 1/63-1

LUINA

To SAVAGE RIVER

CLEVELAND MINE

WASHINGTON HEY MINE

WHITE RIVER

371050, 5410020
15975, 19775

370760, 5408050

To WARATAH

E.L. 1/63-2

370500, 5403150
17100, 13,100

362'640, 5404255
9040, 12425

TN

— LEGEND —

- Granite
- Black argillite and arenite (magnetic)
- Serpentinite
- Dolerite, picritic basalt, gabbro, microgabbro
- Dolerite, gabbro (magnetic)
- Tuffaceous sequences, shales, lapilli tuffs, tuff breccias
- Brown shale dominant, only minor other rock types
- Brown shale, grey shale, limestone beds, brown chert, black chert, sandstone unit
- Purple shale, purple green tuff, lithic tuff Basic volcanics dominant, spilitic mineralogy, probably lavas, minor brown shales, tuff shales, lithic tuffs
- Black chert unit Mica sandstone dominant, minor grey shales, brown shales, chert
- Grey shale and chert dominant, minor brown shale
- E.L. Boundary
- Road
- River or creek
- F——F Fault
- D——D Basic volcanic dyke

5 cm

0 500 1000 1500 2000

SCALE IN METRES

CLEVELAND TIN LTD

CLEVELAND MINE AREA
INTERPRETIVE GEOLOGY

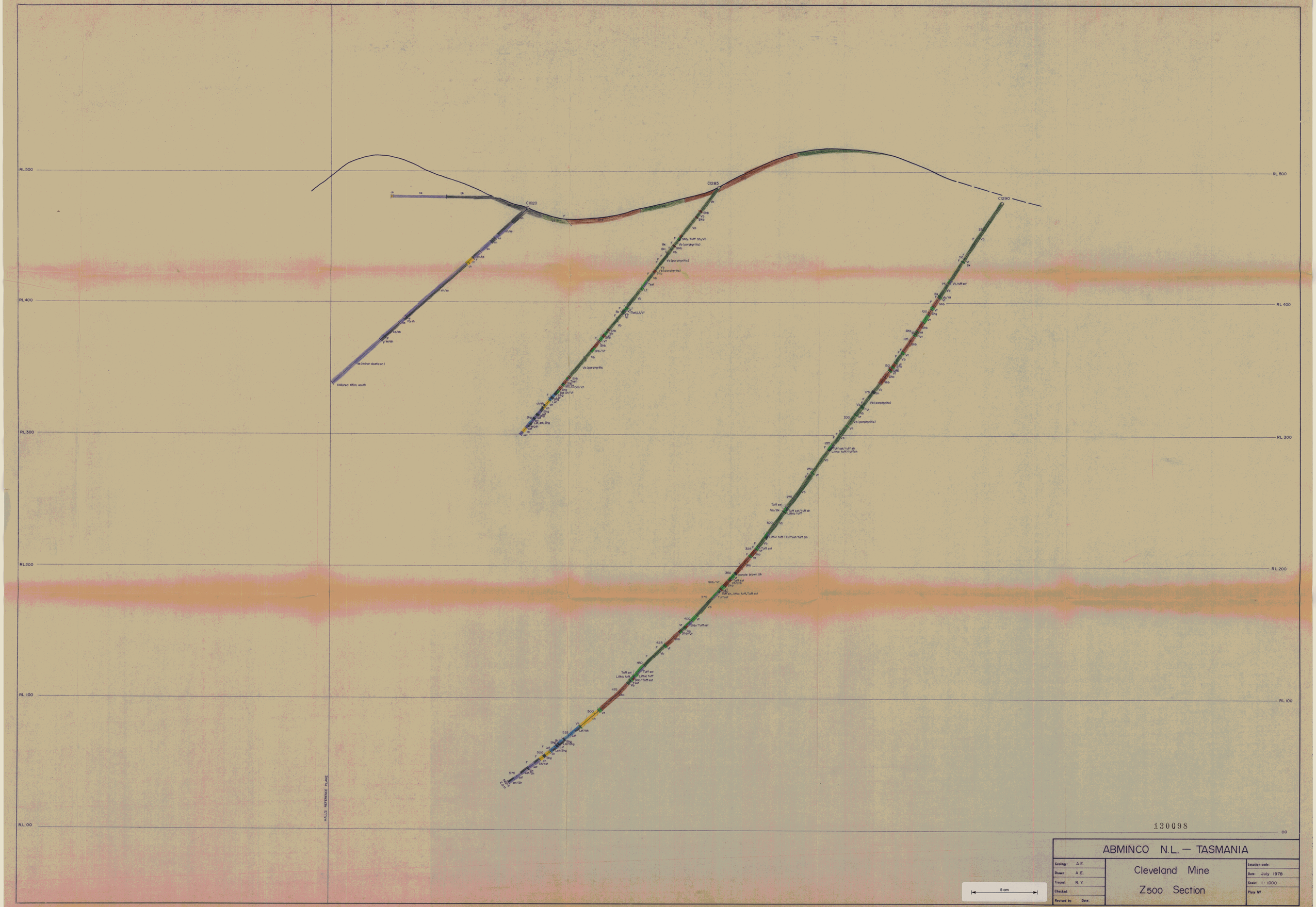
DRAWING N° SG-1-P-25000-601

DRAWN	DATE	SCALE	SHEET
RJR	8-8-79	1:25,000	

79-1391

130097

2850



130098

ABMINCO N.L. — TASMANIA

Geology: A.E.	Cleveland Mine	Location code:
Drawn: A.E.	Z500 Section	Date: July 1978
Traced: R.Y.		Scale: 1:1000
Checked:		Plate No
Revised by: Date:		

49-1391.

2651