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BABINE REVIEW

FOR

TWIN PEAK RESOURCES LTD.

MARCH, 1973

R. W. WOOLVERTON, P. ENG.

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SUMMARY

Between 1969 and 1972, the writer guided the evolution of a geologically controlled geophysical approach to reconnaissance in the Babine porphyry copper belt of central British Columbia. Current instrumentation includes a helicopter-mounted proton magnetometer and a portable pulse I.P. unit. Four significant anomalies have been located to date. Three of these were drill tested and sub-economic copper-moly zones located in each case.

Initially, the geophysical "sieves" were used to "find the easy ones." Recent géological research, however, suggests that relatively specific alteration halos can often be detected within almost a mile of the copper-moly cores of typical Babine porphyry environments. Thus, weak geophysical responses which were previously classified as background "noise" will become interesting if peripheral porphyry alteration is found.

BABINE REVIEW

Whitesail Mines Ltd., Twin Peak Mines Ltd., and Ducanex Resources Limited, initiated an exploration program in the Smithers area in 1970 which was entirely financed by Ducanex and involved both property work and grass roots prospecting. The program was managed by Evergreen Explorations Ltd., a private contracting company controlled by the writer who is also president of both Whitesail and Twin Peak, which have recently been amalgamated into Twin Peak Resources Ltd.

During 1969, several small drift covered areas adjacent to known porphyry mineralization were investigated by the writer with Lockwood's helicopter-mounted magnetic and electromagnetic survey equipment. Test profiles had also been flown over the commercial porphyry deposits of the district. One of the properties acquired following this work was the Dorothy Group.

Ducanex optioned the Dorothy property from Twin Peak in 1970. The claims were tested by a ground reconnaissance mag-I.P.-radem-soil survey (for the "Sabre" I.P. specifications, see Appendix III). The results of the survey and the peripheral geology indicated a porphyry environment. Moly-copper mineralization was uncovered by later bulldozing. The deposit was tested by about 10,000 ft. of diamond drilling and a large area of 0.3% Cu equivalent was outlined.

Also during 1970 and again in 1972 as part of the Dorothy option agreement, Ducanex financed more airmag surveying by Twin Peak along the Dorothy-Nakinilerak trend. An airborne mag unit was purchased and about 1,000 line miles, at either ¼ mile or 1,000 ft. line spacing, havebeen completed so far. Because of the extensive (although probably shallow) drift cover, the reconnaissance stream sediment sampling geochemical programs previously conducted by other groups in the area were probably ineffective. The Dorothy property lies within the area flown and is a good example of a porphyry deposit covered by 20 or 30 ft. of till which effectively eliminates a strong stream sediment geochemical anomaly.

Ground follow-up of the airmag during 1971 and 1972 located two new mineralized porphyries, the Lynn and the Friday Lake prospects. The Lynn prospect is covered by about 50 ft. of drift but gives a strong I.P. response, whereas the Friday Lake environment responded only weakly but may be capped by late basaltic flows and possibly late-phase (i.e. post mineral) extrusive biotite feldspar porphyry.

The primary ground follow-up tool for the above work was the battery powered "Sabre" portable pulse I.P. unit. For its specifications, please see Appendix III. In addition, ground magnetometer readings were taken and soil samples collected except at targets like Friday Lake, where soil sampling appeared useless.

In 1969 following air photo interpretation in the vicinity of old showings in the general Babine area, the writer staked some claims at Red Top Creek, about 9 miles north of Topley. Following a subsequent Government airmag release, overstaking tied the ground up in litigation and threats of litigation until early in 1972, when R. D. Westervelt managed to amalgamate the various holdings, which were then immediately optioned by Ducanex. A weak moly-copper zone in either an odd variety of the Topley "granites" or a member of the Omineca intrusives has since been outlined by 17 diamond drill holes. Percussion drilling is being contemplated.

Early in 1971, Dave Carson, a Noranda Exploration research geologist, requested and received access to the Dorothy deposit and data including drill hole logs and assays. He and Jambor of the G.S.C. were jointly studying the Babine porphyry alteration patterns. They wanted to compare a sub-economic deposit like Dorothy, with the Granisle deposit and the Newman and Morrison deposits (the writer was involved in the discovery and subsequent evaluation of the last two deposits). The results of their work, which were presented in an as yet unpublished paper at the April, 1972, C.I.M.M. in Ottawa, represent, in the writer's opinion, the beginning of a major breakthrough in the detailed geological understanding of the Babine porphyry copper model. A diagrammatic summary of their pertinant findings are included as "Carson's Model" in Appendix IV to this report.

Because of the recognition that the best grade Cu is always within the potash zone, diamond drilling costs can now be significantly reduced. The writer was able to test this approach during the current diamond drilling of the Lynn prospect and found that potash metasomatism can be qualitatively recognized in the field although a quantitative alteration study does require thin sections and a microscope, items which are now standard prospecting tools in Evergreen's field office at Smithers.

Unfortunately, the peripheral alteration typically found in the B.F.P.'s (biotite feldspar porphyry) can also be achieved by regional metamorphic processes; however, after studying numerous thin sections from both mineralized and unmineralized Babine porphyries, the writer feels that there are enough subtle differences between regional metamorphic effects and peripheral metasomatic effects to allow identification. Interestingly, the Friday Lake prospect would probably have remained undiscovered except that thin sections from angular "juicy" B.F.P. float revealed alteration suggesting adjacent potash metasomatism. Even if an I.P. survey had been run without the thin section back-up, the weak response found within the magnetic maelstrom, due to the basalt capping, could have been disregarded even though most of the weak chargeabilities do not correspond to mag highs.

As one can surmise from the Smithers-Babine notes in Appendix I, the geophysical "sieves" are relatively specific. Only those environments which appear to have at least 5% sulphides and 1% magnetite in a sub-circular pattern, are considered significant. This does not mean that the writer believes that all the economic porphyries within the Babine Camp will share these characteristics. It is merely a "find the easy ones first" philosophy and "don't get bogged down in the background noise" such as disseminated magnetite in sub-circular aureols around small plugs or in partly covered flow remnants, or in discontinuous weakly graphitic zones; however, "Carson's Model" gives us another sieve which allows us to rate our geophysical targets geologically even to the extreme of studying the angular float. Significantly, alteration suggesting an adjacent mineralized zone was noted in thin sections from angular float near the Lynn anomaly prior to drill discovery of the environment. More often, however, exposures of unmineralized but hydrothermally altered B.F.P. dykes can be found adjacent to covered mineralized porphyry environments.

Respectfully submitted,

R. W. WOOLVERTON, P. ENG.

APPENDIX I

SMITHERS - BABINE NOTES

SMITHERS - BABINE NOTES

1. There are 6 economically significant porphyry deposits in the area: Newman, Granisle, Morrison Lake, Hudson Bay Mountain, the Berg, and Bone Lake.

2. The porphyry "environments" of four of the above noted deposits were naturally exposed in areas of moderate to steep relief. Only the Newman deposit was completely covered.

3. The "blind" Newman deposit is also probably the highest grade (considering only Cu) due to secondary enrichment and lack of subsequent erosion.

4. The five "exposed" porphyries were found by stream sediment sampling or conventional prospecting.

5. Newman was found by a geophysical and to a lesser extent geochemical testing (August, 1962) of a geological idea as follows:

   (a) An old Pb-Zn-Cu vein was naturally exposed immediately adjacent to a slightly rusty shear zone on the shore of Babine Lake about ½ mile from the then undiscovered Newman deposit. Was this economically insignificant vein mineralization peripheral to a nearby porphyry?

   (b) The old showing was 5 miles from a known porphyry (Granisle) deposit. Porphyry deposits tend to occur in clusters.

   (c) To determine whether the vein was related to other adjacent but covered mineralization, the covered area immediately inland from the vein and along its strike projection was tested with a JEM survey. An en-echelon series of conductors parallel to the vein strike was outlined.

   (d) A soil survey (1963) outlined a weak Cx copper high adjacent to the third conductor, which was about ½ mile inland from the vein.

(e) The Newman breccia pipe, which was immediately adjacent to the third conductor, was apparently the late phase result of sub-volcanic intrusion and mineralization at the junction of two shatter zones in the centre of Newman Peninsula. One of the shear structures was intensely pyritized which accounted for the JEM response. This pyritized shatter zone also contained the vein deposit on the shore of Babine Lake.

6. To the writer's knowledge, the Newman deposit is the only one in the Babine area with a significant secondary zone. Many exotic copper minerals are present in the 50 ft. thick near-surface enriched zone. Considerable bornite occurs with the chalcopyrite to a depth of 500 ft. where the bornite zone abruptly stops. It is significant that Newman, which is in a relatively flat area close to lake level, is enriched whereas 4 miles to the southeast, the unenriched Granisle deposit was exposed naturally as a copper stained talus slope on a prominent hill.

7. Many large scale regional stream sediment sampling programs have been carried out over the past 10 years resulting in the discovery of most of the exposed porphyries. The remaining undiscovered porphyries probably share the following characteristics:

(a) A boulder till blanket of 10 to 100 ft. which drastically reduces or entirely eliminates a geochemical expression.

(b) Secondary biotite alteration with associated disseminated magnetite resulting in a

(c) moderate associated mag high on the ground and a magnetic "complex" from the air.

(d) A greater possibility of secondary enrichment because of their location in flat drift covered areas which may have escaped some of the glacial erosion of the Pleistocene.

(e) Fairly intense pyritization resulting in

(f) a moderate to strong induced polarization anomaly and sometimes (if the pyrite is massive enough),

(g) an EM response on the ground and from a helicopter-mounted 4,000 cps in-phase out-of-phase system.

The writer has test flown Hudson Bay Mountain, the Morrison Lake deposit, Newman, and Granisle with Lockwood's helicopter-mounted mag-EM system. A characteristic mag-EM "complex" was located in each case. Unfortunately, there are numerous graphitic zones which can give similar responses when associated with volcanics. Also, it is geologically quite likely that a porphyry will be found which does not have an associated weak conductor whereas there is probably only a remote possibility of finding a porphyry without secondary biotite and associated disseminated magnetite.

8. Based on the above description of the characteristics of the Smithers-Babine porphyries and the history of exploration work to date in the area, it appears obvious to the writer that the next deposits will be found by groups with the ability and tenacity to use geology and geophysics to test the low lying covered areas. The approach should include:

(a) The selection of covered areas "along trend" from known porphyries, and

(b) the selection of covered areas structurally (and therefore possibly geologically) similar to the northwest trending Granisle-Newman-Old Fort "trend."

(c) The testing of these areas initially by low level helicopter mag. (Some helicopter mag-EM may be warranted in areas of extreme magnetic background).

(d) Ground follow-up of all (even remotely) significant airborne complexes by:

(i) induced polarization with min. 200 ft. penetration;
(ii) ground mag;
(iii) ground EM to outline graphite zones (remembering that graphite has been found immediately adjacent to two Babine Cu-Mo zones so far); and
(iv) soil and stream sediment sampling in case the plumbing does daylight.

(e) Line drilling blind anomalies to establish the alteration pattern and its intensity.

(f) Detailed "sample" drilling to test the potash zone established above.

APPENDIX II

AIRBORNE MAGNETOMETER SPECIFICATIONS

Evergreen Explorations Ltd.

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  GEOLOGIST, P.ENG.
- R. C. O'BRIEN
  FIELD SUPERVISOR
- JOHN C. OSWALD & CO., C.A.'s
  ACCOUNTANTS:

  635 - 789 W. PENDER ST.
  VANCOUVER 1, B.C., CANADA

CONTRACT EXPLORATION

- 5424 HALIFAX ST., BURNABY 2, B.C., CANADA, PHONE - 299-6998
- P.O. BOX 604, SMITHERS, B.C., CANADA PHONE - 847-3523

Two additional techniques have been added to our exploration services in the Smithers area.

AIRBORNE MAGNETOMETER

The ELSEC PROTON PRECESSION (Type 592-F.S.) magnetometer measures the total magnetic field to better than one part in 100,000. It can be used in either a helicopter or light aircraft. At a flying speed of 60 mph and using a one second polarization time, readings are recorded automatically on a Bausch and Lomb continuous chart recorder at ground intervals of approximately 100 feet. Ground location points are visually located by the operator, plotted on a photo or map, and located on the mag tapes by an event marker. For low level helicopter surveys photo mosaics are desirable. Data reduction and interpretation can also be provided.

Specification & Operating Instructions

PROTON MAGNETOMETER

Type 592/J

The Littlemore Scientific Engineering Company,
Railway Lane, Littlemore, OXFORD.

Telephone: Oxford 78563 Cables: ELSEC, Oxford, U.K.

Specification Type J

Range:	24,000 to 70,000 gamma.
Sensitivity:	± 0.5 gamma, or better.
Absolute Calibration:	1 part in 50,000 over operating temperature range -10° C to +40° C.
Tolerable External Gradient:	200 gamma/metre for ± 0.5 gamma accuracy. 400 gamma/metre for ± 1 gamma accuracy. 800 gamma/metre for ± 2 gamma accuracy.
Count Duration:	256, 512, 1024, 2048 or 4096 proton pulses as selected by front panel switch.
Reading Repetition Rate:	Five automatic rates available between 1 per sec. and one per minute - selected by front panel switch. (For the fastest rate the sensitivity is ± 2 gamma). The instrument can also be switched to 'manual' in which case readings are initiated by push button (alternatively, by closure of external contacts for at least 1 millisecond.)
Display:	On meters graduated 0 - 9. (five meters). (a) Push button to initiate reading. (b) Function/Test switch with 5 positions: 1. Off or Charge battery. 2. Measure battery voltage. 3. Measure amplitude of proton signal. 4. Normal operate position. 5. Set meters to '9'. (c) Coarse tuning switch. (d) Fine tuning condenser. (e) Auxiliary fine tuning switch. (f) Dual concentric switch: upper part controls Count Duration and lower part controls Reading Repetition rate.
Weight of instrument:	12 lbs.
Weight of standard battery pack:	9 lbs.

Dimensions of instrument without batteries:	13" wide x $4\frac{3}{4}$" deep x $8\frac{3}{4}$" high.
Dimensions of instrument with standard battery pack in carrying case:	$13\frac{1}{2}$" wide x $5\frac{1}{2}$" deep x 14" high.
Finish:	Top panel Light Grey stove enamel. Cover box Hammer Grey stove enamel. All water-proofed and contained in a brown leather case with lock and key.
Operating temperature Range.	-10°C. to $+40^{\circ}$C.

DETECTOR BOTTLE (STANDARD)

Dimensions:	$5\frac{1}{2}$" x $3\frac{1}{2}$" diameter
Weight:	$5\frac{1}{2}$ lbs.

Connected to Control Panel of instrument by up to 200 ft. Coaxial Cable.

Freezing point of detector fluid:	-70°C.
Maximum heading error:	1γ – type MS

DETECTOR BOTTLE ("FAST")

This is advised for repetition rates faster than 1 per two seconds, and is only supplied on special request. It can also be used for slower rates, but the highest sensitivity is not then available.

Dimensions, weight and cable details are as for the standard detector bottle.

Freezing point of detector fluid:	-20°C.
Maximum heading error:	1γ – type MF

Note: Type MS detectors are supplied as standard unless another type is specified by the customer.

Special Note For simplicity, Sections I - III and Section VI of this handbook have been written for manual operation and a count duration of 1024 proton pulses (i.e. with lower part of concentric switch, S3, set to "F" and upper part to "C"). The use of automatic recycling and alternative count durations is described in Sections IV and V.

I INTRODUCTION

The ELSEC Proton Magnetometer type 592/J has been designed for measuring the total magnetic field to better than 1 part in 100,000 over the entire range of field strengths normally found on the earth's surface. The instrument itself measures the total magnetic vector; but when utilized in conjunction with Helmholtz coils the individual components may be determined.

The instrument is transistorised throughout and is arranged in package form for easy maintenance. The power supply is normally provided by an accumulator pack which fixes to the bottom of the instrument. This standard instrument plus accumulators is supplied in a stout leather case with carrying strap. However, any external supply (two 6 volt batteries or one 12 volt battery) may be plugged into the instrument if this is desired.

II PRINCIPLE OF OPERATION

The purpose of a magnetometer is to measure 'magnetic intensity' and for some applications an accuracy approaching 1 part in 50,000 is required. The magnetic intensity at any point may best be visualised as the force (strictly the torque) which tends to turn a magnetized needle placed at that point into line with the magnetic direction. A conventional magnetometer consists of just such a needle and with a delicately constructed instrument the necessary accuracy can be achieved. However, such an instrument requires levelling before making each measurement and the speed of operation attainable is consequently rather limited. The proton magnetometer, on the other hand, requires no such setting up and, its incomparably greater speed leaves no doubt of its superiority for geological and archaeological surveying.

The proton is an elementary particle identical with the nucleus of the hydrogen atom. Its behaviour in the proton magnetometer can be understood by regarding it as a tiny bar magnet spinning rapidly about its longitudinal axis; it therefore has the properties of both a magnetised needle and a gyroscope. Because of the former it tries to point along the lines of force, but its gyroscopic property prevents this temporarily and it performs gyrations while in the gradual process of achieving this direction. These gyrations are similar to those of a spinning top under the influence of gravity. The important thing is that the speed of gyration (or frequency of precession) is exactly proportional to the magnetic intensity. This frequency is about 2000 gyrations per second for an intensity of 48,000 gamma. For example; if it is exactly 2000.00 c/s at one measuring station, then at another station where the magnetic intensity is higher by 1 gamma the precession frequency there will be 2000.04 c/s.

Since hydrogen is a constituent part of water and organic liquids a large number of protons (about 10^{25}) are conveniently obtained in a quarter-pint bottle and this forms the detecting element. The gyrating protons induce an e.m.f. of about a microvolt in a coil wound around the bottle and this e.m.f. is passed to the instrument for amplification and frequency measurement. The gyrating protons will only induce an e.m.f. if there is a preferred phase and this is obtained by preceding each measurement by a polarizing period (automatically sequenced after pressing the start button). During this period a current of an amp is passed through the measuring coil thereby creating a magnetic field of several hundred gauss along its axis, and this produces a net proton magnetic moment in that direction; when the polarizing current is cut off the gyration of these protons <u>en masse</u> induce the detectable e.m.f. already mentioned. The axis of the coil should be very roughly East-West.

The proton magnetic moment builds up to saturation in about 5 seconds of polarisation. During the subsequent gyrations the protons gradually get out of phase and the induced e.m.f. decays away also in about 5 seconds. Strong magnetic gradients (100 gamma per foot and upwards) cut down this decay time seriously and because of this possibility the frequency measurement is made within the first second of gyration.

After selective amplification (see Fig.1) the signal is squared and then frequency-divided by 1024 (10 binary stages). The resultant square wave is used to open and close a gate, which once closed remains locked until the 'START' button is next pressed. When the gate is open the output of a 100 kc/s crystal-controlled oscillator is allowed through to the decade chain and the final states of the five decade units, shown on the respective meters, indicate the number of oscillator cycles occurring during 1024 gyrations.

The only action required of the operator is to press a push button momentarily; the polarizing period is automatically sequenced and after about 5 seconds the meters indicate a five figure number which is a measure of the magnetic intensity wherever the water-bottle is placed. The magnetic intensity equals $\frac{24051.1}{\text{meter count}}$ oersted. For most uses it is more convenient to know the field intensity increase that corresponds to a decrease of 1 unit on the most sensitive meter. This is easily worked out; typical values are:-

H = 0.6 oersted, 1 unit ≡ 1.5 gamma

H = 0.5 oersted, 1 unit ≡ 1.04 gamma

H = 0.24 oersteds 1 unit ≡ 0.24 gamma

Electrical power is obtained from an 8 ampere-hour 12 volt accumulator and this lasts for 12 hours continuous operation and up to 4000 polarisations before recharging is necessary. Recharging can be done either from a 12 volt car battery or indirectly from the mains.

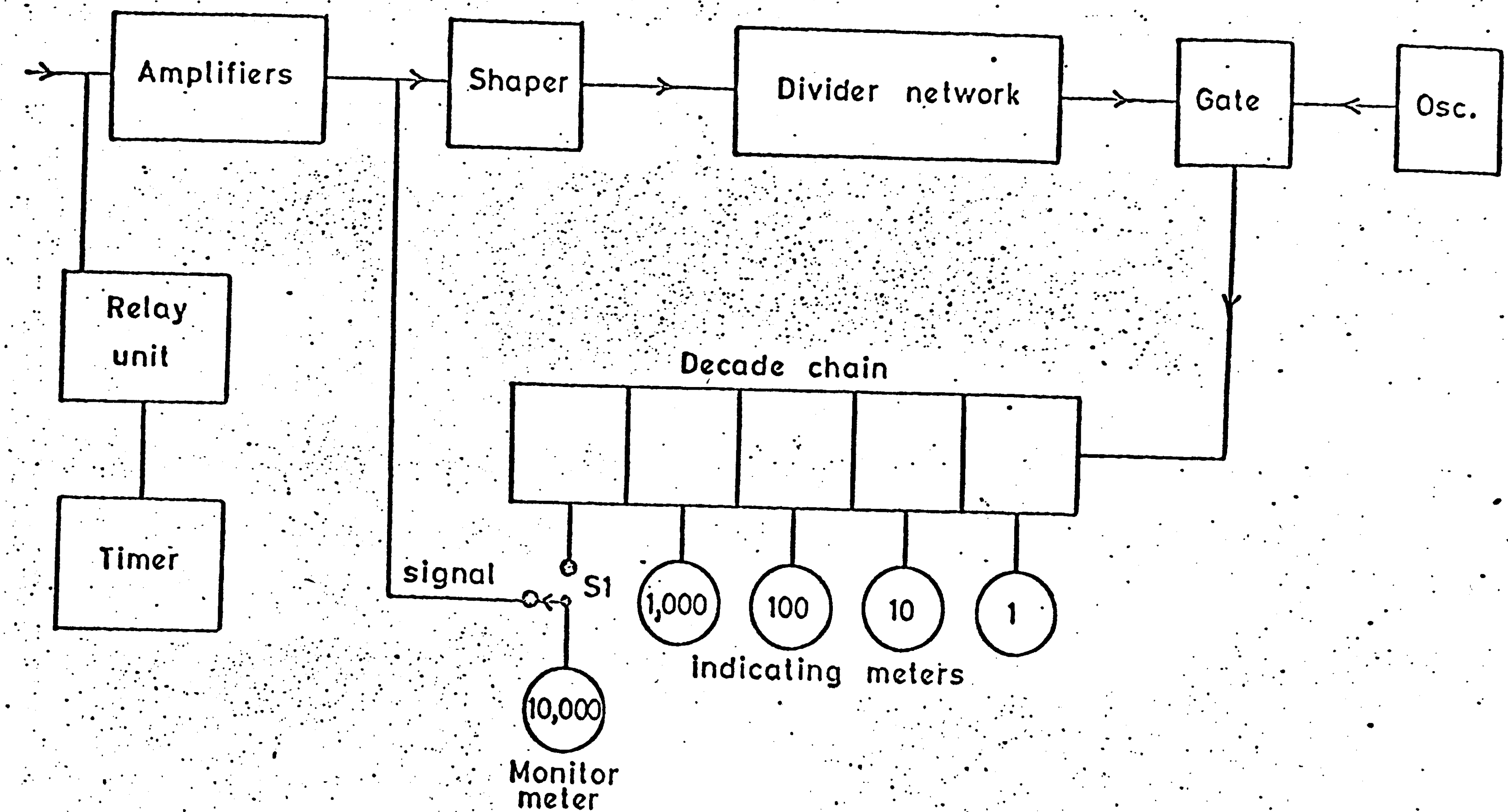


Fig 1. MAGNETOMETER BLOCK DIAGRAM.

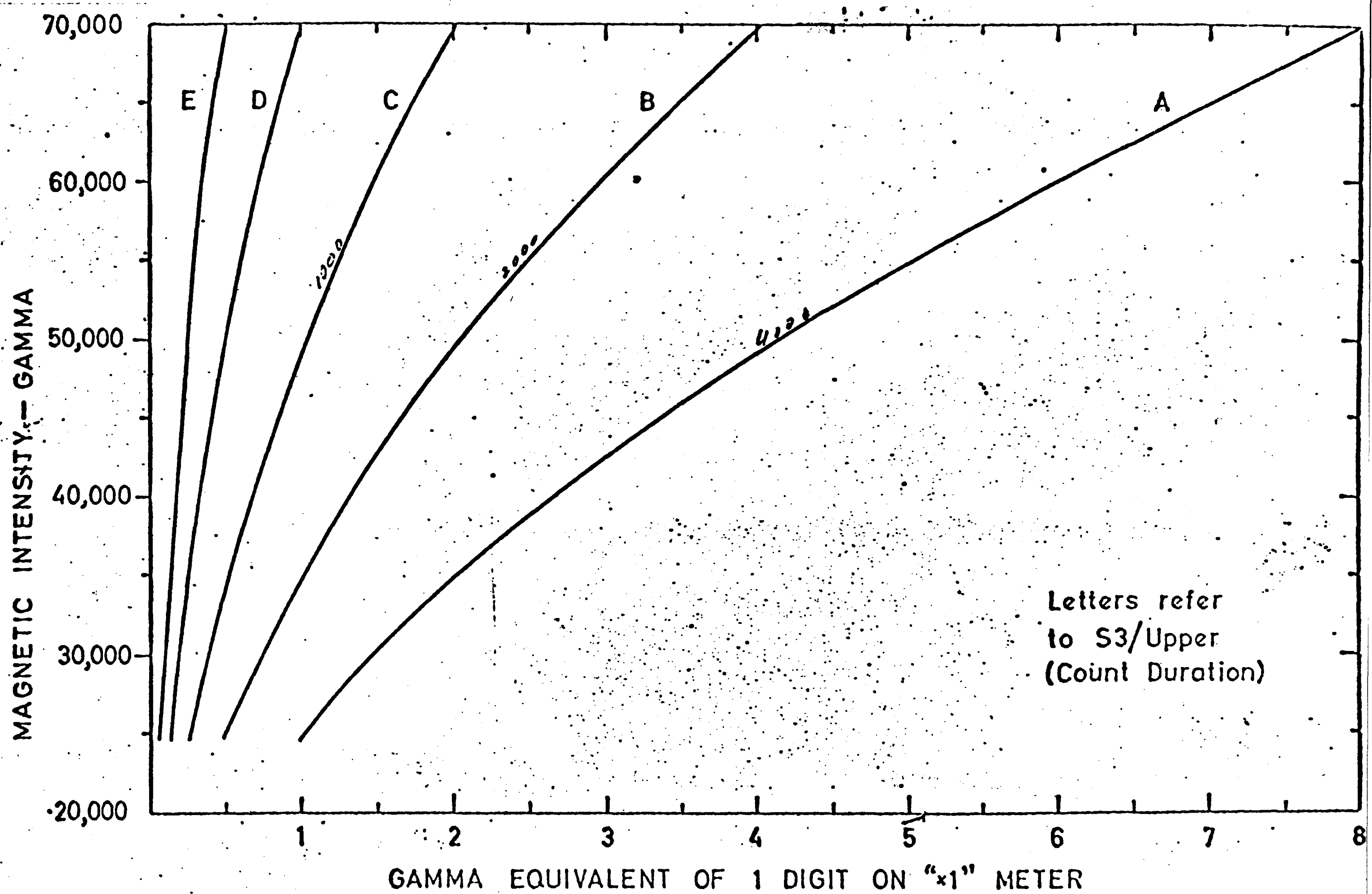


Fig 3. SENSITIVITY VS INTENSITY FOR DIFFERENT COUNT DURATIONS.

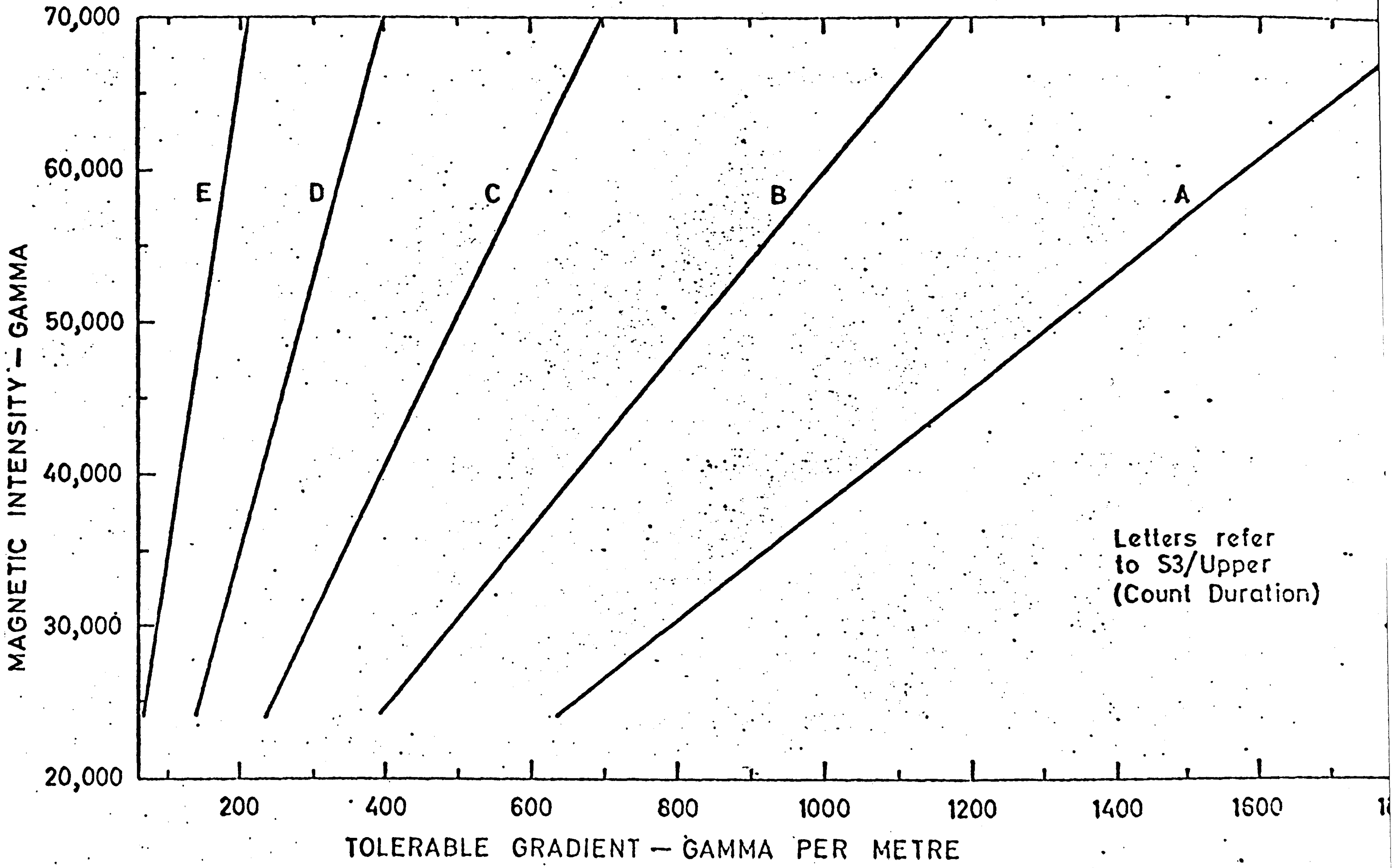
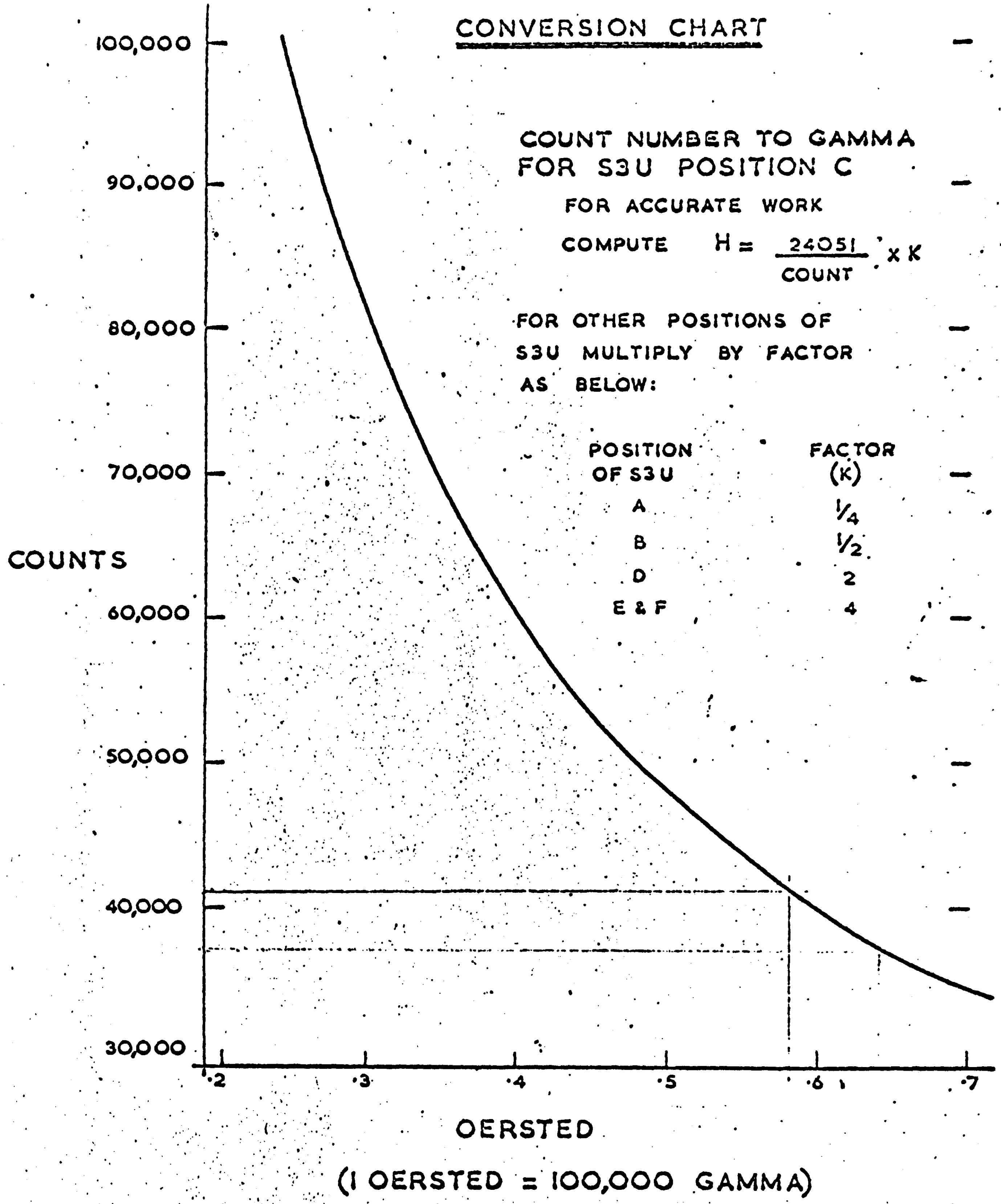
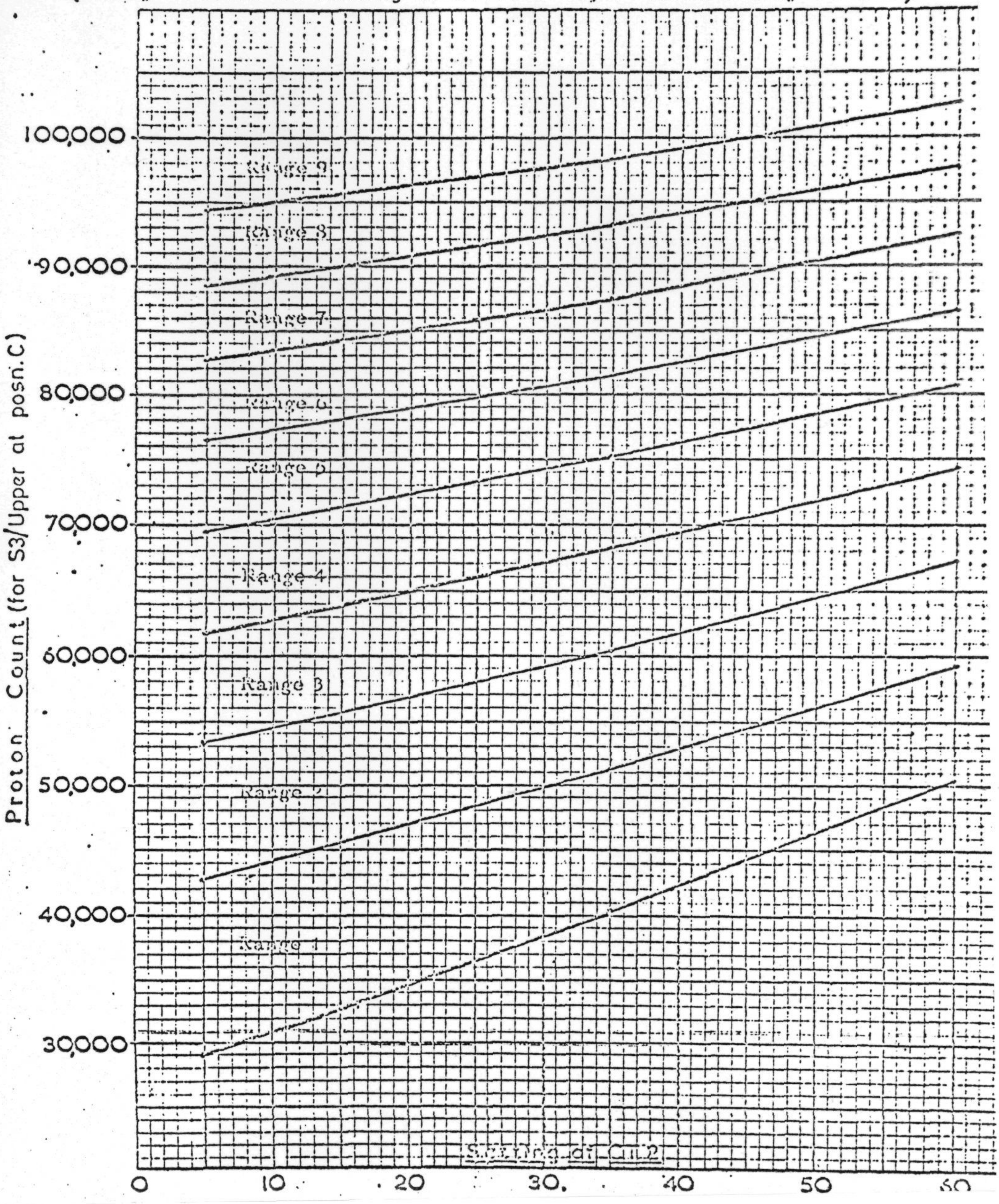


Fig 4. ESTIMATED TOLERABLE EXTERNAL GRADIENT.

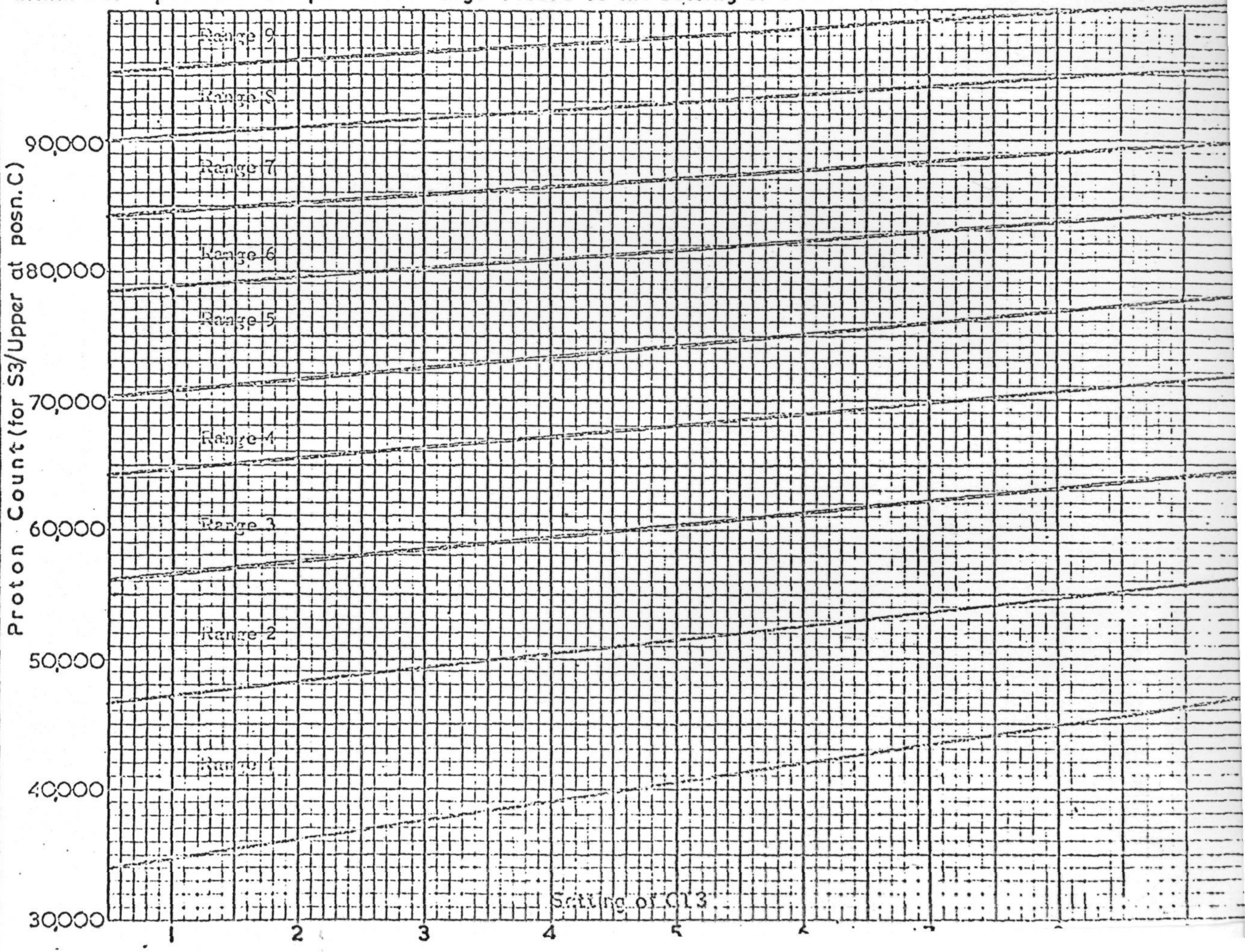

CONVERSION CHART
COUNT NUMBER TO GAMMA
FOR S3U POSITION C
FOR ACCURATE WORK
COMPUTE $H = \frac{24051}{COUNT} \times K$
FOR OTHER POSITIONS OF
S3U MULTIPLY BY FACTOR
AS BELOW:
POSITION OF S3U
FACTOR (K)
A
1/4
B
1/2
D
2
E & F
4
COUNTS
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
·2
·3
·4
·5
·6
·7
OERSTED
(1 OERSTED = 100,000 GAMMA)

[illegible] S/N [illegible] – Amplifier Tuning (C12)

("Range" refers to setting of CTI. the right-hand tuning control)



ELSEC S/N 294 :- Fine tuning for Bottle (CT3) The chart shows the optimum setting of CT3 for various proton counts. Accurate measurements will be obtained as long as the setting is within 2 or 3 positions of optimum. "Range" refers to the setting of CT1.



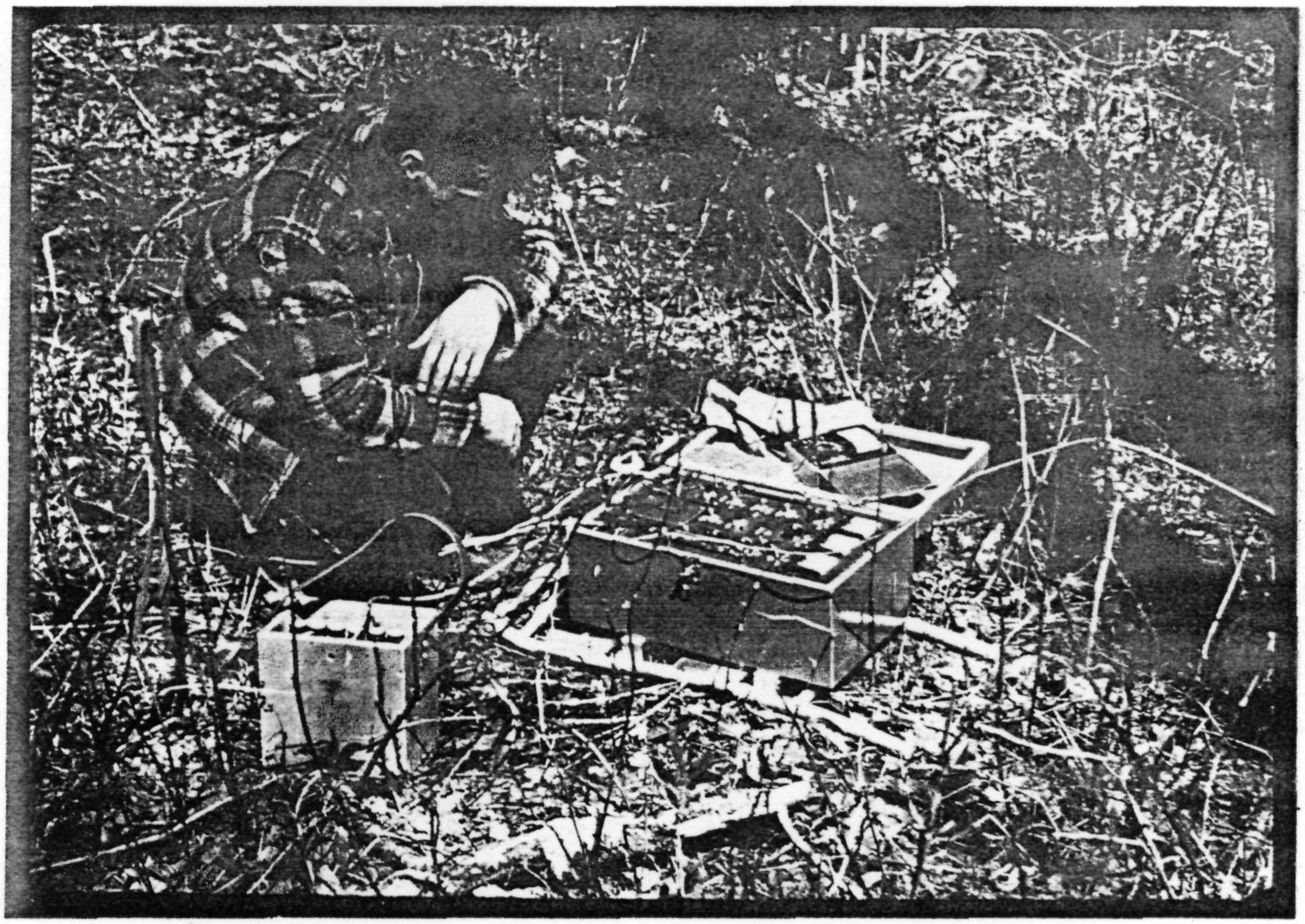
APPENDIX III

"SABRE" I. P. SPECIFICATIONS

INDUCED POLARIZATION

The "Sabre" portable pulse-type instrument is a 500 watt unit capable of 300 to 400 ft. of penetration, as shown on the accompanying profiles. Very little reduction in anomaly intensity was noted over the northern limb of Noranda's Newman ore body, where it is covered by 100 ft. of glacial till.

Because of its light weight, the "Sabre" is ideal for reconnaissance work. Using a 400 ft. Wenner Array, radem (V.L.F./EM), and magnetometer readings can be taken, soil samples collected, and the chargeability and resistivity determined simultaneously by a 4-man crew in open bush without pre-existing lines. Cut lines are necessary only in areas of high magnetic intensity where it is impossible to maintain a straight line by compass.



THE "SABRE" AT NEWMAN

Although the "Sabre" is very mobile and therefore excellent for reconnaissance work because of its light weight, its low power creates a signal to noise ratio problem which makes it impossible to obtain readings if there are any telluric currents present as a result of rapid fluctuations in the earth's magnetic field. Fortunately, geomagnetic forecasts from WWV in Boulder, Colorado, can be received in the field on a normal shortwave radio. Time loss due to telluric noise can be kept to a minimum by scheduling non-instrument work on those days which are forecast to be poor or sometimes, even on days when the field is unsettled, a little patience and numerous check readings produce good data if surveying is started early, stopped for several hours around "solar noon," then continued into the evening. The I.P. crew of 4 and their equipment can be moved in 1 load with a Jet Ranger or Beaver.

Alternatively, the "Sabre" could be converted to, say, a 2,000 watt instrument to enable operation on noisy days but it would have to be stationary due to the generator. Also, the weight and amount of wire is drastically increased producing considerably more bullwork and weight.

APPENDIX IV

CARSON'S MODEL

CARSON'S MODEL

MINERALS IN UNMINERALIZED PORPHYRY	PSEUDOMORPHIC EQUIVALENTS IN A METASOMATIZED PORPHYRY		
	POTASSIC ZONE	PROPYLITIC ZONE	
Hornblende	Biotite	Chlorite	Carbonate and epidote
Primary biotite	Remains fresh	Fresh	To chlorite, epidote and carbonate
Plagioclase	Remains fresh		
No original K-spar	May have secondary K-spar	No K-spar	
	May have gypsum		

[Carbonates tend to be concentrated peripherally except for siderite in potash zone at Newman]

[Deuteric alteration (?) of hb.→bio.(→chl.→carb.) noted in equigranular Tertiary intrusive N. of Old Fort Mountain by N.C. and R.W.]

[R.W. and N.C. occasionally noted carbonate after mafics - either weathering or regional metamorphism]

[R.W. and N.C. noted more secondary silica within all zones of the economic environments when contrasted to the uneconomic ones.]

NOTES

1. Economic Cu-Mo zone always within the potash-sericite zone.
2. Chlorite often within potash ("K") zone as well defined crystals as opposed to the messy variety present in the propylitic zone.
3. All clay alteration and most sericite noted in the Babine deposits are probably supergene.
4. R.W. and N.C. noted a propylitized dyke well within the Granisle pit so that the model can be complex.
5. R.W. and N.C. noted carbonate and, to a lesser extent, disseminated epidote can be ubiquitous.

APPENDIX V

AUTHOR'S QUALIFICATIONS

AUTHOR'S QUALIFICATIONS

The writer is 40 years old, a 1960 UBC graduate, and a registered P. Eng. in the Province of British Columbia. His experience is:

1. Three years as field assistant or prospecting partner prior to graduation. A vendor's interest in the Kennedy Lake Iron Mine was gained during this period.

2. Geologist for Noranda after graduation until 1967 including:
   (a) pre-production work on the Kennedy Lake iron deposit;
   (b) winter drilling and geophysical surveying in Ontario and Quebec;
   (c) Party Chief for Noranda's Norpex Syndicate which found the Newman and Morrison porphyry copper deposits in the Babine Camp in August, 1962;
   (d) resident geologist in charge of Noranda's Smithers Office from 1964 to 1967.

3. Field geologist for a syndicate managed by U. S. Smelting in 1967 and 1968 working in the Dease Lake area of northern B. C.

4. Explorationist-entrepreneur in the Babine Camp from 1969 to the present as controlling shareholder of:
   (a) Evergreen Explorations Ltd., a private contracting company, and
   (b) Twin Peak Resources Ltd., a public B. C. company.