COMMONWEALTH OF AUSTRALIA
MINISTRY OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

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FIRST PROGRESS REPORT ON THE

GEOPHYSICAL SURVEY OF THE ASTROLABE MINERAL FIELD, PAPUA

by

HUGH OLDHAM

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LIST OF PLATES

1. INTRODUCTION

The areas included in the geophysical survey, namely Laloki, Moresby-King and Dubuna leases, are among those held by Mandated Alluvials N.L., and lie in the Astrolabe Mineral Field. The positions of the leases held by the Company are shown in Plate G73-1.

Laloki, the main producer of copper, is situated 20 miles by road from Port Moresby, near the junction of Sapphire Creek with the Laloki River. The Bureau was requested by Mandated Alluvials to carry out a geophysical survey in the vicinity of the known deposits and in adjacent areas.

Both Laloki and Moresby-King mines had been in production up to the time when the war in New Guinea caused a suspension of operations. During the war the mine workings and much of the plant were completely destroyed. When consideration was given to the best method of reopening the mines it was decided that, if a large enough tonnage of ore could be proved sufficiently close to the surface, it would be most profitable to continue open-cut mining, and possibly install a flotation concentrator to avoid the troubles that had always accompanied smelting.

The aim of the geophysical survey was, therefore, to locate a body of ore large enough to justify the adoption of these mining and treatment methods.

2. SUMMARY OF OPERATIONS

Geophysical work commenced towards the end of May 1949. The party consisted of Messrs. W.H. Oldham and K.H. Tate, geophysicists of the Bureau of Mineral Resources.

Throughout the survey the party was based at Mandated Alluvials "Sapphire" Camp which is on the main road from Port Moresby to Rouna Falls, and 17 miles from Port Moresby. Acknowledgement is due to Mandated Alluvials representative Mr. A.E. Blumson, whose cooperation helped to expedite the survey. A number of natives employed by the company were made available to help in the clearing, surveying and geophysical work. They quickly adapted themselves to this type of work and were of great assistance, particularly in carrying instruments on steep slippery ground.

Laloki was chosen for commencement of the survey. This lease seemed the one most likely to be of immediate use to the Company as it was accessible, the mining information available was fairly complete, and it was known that there was a considerable ore reserve. A Vertical Force Magnetic Survey was carried out with some interesting results, and then some Self-Potential readings were taken, but this latter method was shown to be unsuited to the conditions. An Equi-Potential Line Survey attempted later was almost immediately abandoned.

Work was then begun on the Moresby-King leases. This was a smaller area, and was covered with Magnetic and Self-Potential readings.

A short time remained before the party was to return to Melbourne, so some magnetic and Self-Potential work was done in a limited section of the Dubuna area. During this short period a temporary camp was established about one mile from the lease.

3. LALOKI LEASE

(1) Geology

This lease lies in the valley of Sapphire Creek about two miles by road from its junction with the Laloki River. Fisher (1941) conservatively estimated the ore reserves of the mine to be 265,000 tons averaging 4.57% copper and 4.13 dwts. of gold.

The country rock of the area forms part of the Eriama Series, and presents the appearance of a highly sheared and broken shale. Into this series have been injected large masses of gabbro.

In the vicinity of the ore-body the country rock dips to the north of N.-N.W. at angles varying from 10° to 70°, and there is evidence of considerable crumpling and folding. A mass of gabbro outcrops about 400 feet from the ore-body in a northerly direction, and it is assumed that this intrusion is responsible for the mineralisation.

Surface features of the area, and the geophysical survey lines are shown in Plate G73-10.

(2) Magnetic Survey

A detailed Vertical Force Magnetic Survey was conducted over an area roughly 1400 feet square, with less detailed work over a much larger area. The results of this survey are shown in the form of magnetic profiles in plates G73-11 and G73-12. It has been necessary to use different magnetic scales in these two plates.

The very large anomalies towards the northern end (Plate G73-12) are caused by a body of gabbro. It is not expected that ore would occur within the gabbro.

The main feature of the magnetic profiles is the series of anomalies in the vicinity of the known sulphide occurrence. Plate G73-13 illustrates these anomalies in the form of magnetic contours, superimposed on an outline of the ore-body drawn from the mining plan of the 137 ft. level. It is seen that the anomaly agrees well with the position of the ore-body at its south-western end, and suggests that there is little or no extension of the body in this direction, except perhaps at much greater depth.

The magnetic intensity rapidly decreases towards the north. The depth of overburden here is greater, and the body may be a little smaller in section, but this great diminution in magnetic intensity is rather puzzling. However, a well defined anomaly may be seen centred at 202 N / 205,50 E. The maximum strength is only 120 gammas, and there are much stronger anomalies a little further to the north, which are known to be caused by igneous rocks. But it is felt that this particular anomaly may well be due to a sulphide body, as it appears to be somewhat separated from those anomalies of igneous origin, and lies directly in the path of the northern strike of the known ore-body. No mineralisation has been reported from this locality, and it seems that this anomaly warrants further investigation.

The only other items of interest are found on traverse 194 N. One is a very strong, rather narrow anomaly centred about peg 193 E and the other broader but less intense at peg 194 E. This latter may arise from igneous bedrock effects, but the anomaly at 193E is not easy to explain. It is intended that some additional magnetic work be done here to establish the origin of these effects.

(3) Self-Potential Survey

An area 800 ft. by 1200 ft. was covered by the S.P. Survey. Results are shown in the form of S.P. profiles in Plate G73-14. It will be seen that the only anomaly recorded was on traverse 197 N, with its centre at peg 206 E, where the traverse crosses the floor of the open-cut and the sulphide ore is actually exposed. This suggests that the water table in the Laloki area is so near the surface that the remainder of the ore-body is below water level, and therefore is not being oxidised. For this reason the S.P. method can be of little assistance in locating sulphide bodies under these conditions.

(4) Equi-Potential Line Survey

A short trial was sufficient to indicate that this method has no application in the Laloki area. Steep slopes covered with thick scrub, bamboo or Kunai grass make it impracticable to follow equi-potential lines. It is therefore necessary to adoptgeophysical methods in which instrument readings may be taken along survey lines previously cleared for the purpose.

4. MORESBY-KING LEASE

(1) Geology

The Moresby-King mining area, about a mile north-west of Laloki, is near the top of a series of small hills roughly 1000 ft. high, and the terrain generally is flatter and more cleared than at Laloki. The rich oxide ore had been largely worked out and mining had revealed that the underlying sulphide was very much lower in grade than the oxide.

At Moresby-King the geological picture is similar to that at Laloki but with the country rock dipping more gently - usually less than 45° and in a north or south direction. Gabbro outcrops are indicated in Plate G73-20 which shows also the surface features of the area and the geophysical traverses used in the survey.

(2) Magnetic Survey

Plate G73-21 shows the magnetic profiles obtained during the survey. Comparing this figure with the surface plan it is seen that small anomalies were recorded over several of the old mine workings. Evidence from the geological report by Fisher (1941) suggests that the sulphide ore (which was not mined to any extent) was fairly rich in pyrrhotite, which, if present in a large mass, would be expected to give rise to a moderate anomaly. Hence it may be suspected that the bodies of sulphide underlying the oxidised zones are not large.

It will be noted also that the magnetic intensity rises considerably as one approaches the gabbro formations, as might be expected. In fact the magnetic survey affords good evidence that the small body of gabbro shown on the eastern side of the field swings across in a north-westerly direction to link with the main mass to the north. Even if there are no outcrops to confirm this, it may be assumed that the gabbro is there, not far below the surface. This fact agrees well with the contention that the sedimentary formations in which the mineralisation occurs constitute a roof pendant resting on a very large mass of gabbro.

The western portion of the gabbro outcrop, as we follow it south, swings somewhat to the east, and it may be an offshot of the gabbro mass involved in this trend which gives rise to the anomaly centred at about 219 N / 153 E. On the other hand this anomaly could be caused by a sulphide body. There are no records of ore having been found in this vicinity.

(3) Self-Potential Survey

This embraces the same area as the magnetic survey, and is similar in that small anomalies were found over some of the mine workings, notably at 224 N / 155 E and 232 N / 156 E. These may be seen on the profiles, Plate G73-22.

No S.P. anomaly was found in the neighbourhood of the magnetic anomaly at 219 N / 153 E. But this fact does not preclude the possibility of there being a sulphide body in that position, for it may be recalled that at Laloki no S.P. result was obtained over a large sulphide body, except where it actually outcropped.

5. DUBUNA LEASE

(1) Geology

The Dubuna lease is three miles due south of Laloki, but twelve miles by a very bad road from Sapphire Camp. The area is hilly and thickly wooded, and no mining has been done here for many years.

As at Moresby-King the mineralisation occurs in sedimentary rocks, but of a rather more calcareous nature. Dips are moderate to steep, mainly to the south-west. Gabbro or similar igneous rock may be found outcropping along the eastern edge of the area covered, and at a rather greater distance on the western side. Plate G73-30 shows a contact between igneous and sedimentary formations. This line has been drawn from geophysical evidence and only a few observed outcrops. The same plate shows also the surface features of the area and the geophysical traverses used in the survey.

(2) Magnetic Survey

The survey covered an area about 900 ft. by 1000 ft., and the profiles drawn from magnetic readings are shown in Plate G73-31. This magnetic record is rather unsatisfactory, because the natural magnetic gradient due to rather deep-seated igneous rocks is so steep that it is difficult to estimate the size of anomalies caused by sulphide ore, and these may be obscured completely. The magnetic values along the eastern edge of the area are extremely erratic, and this fact has been used, as already mentioned, to plot the contact between the igneous and sedimentary formations. Many of the other small anomalies arise, no doubt, from old iron buried in the alluvium.

A prominent line of anomalies may be noticed in the south-western portion of the area. These occur towards the top of a sharp ridge, and are thought to be due to a gabbro mass, although no such outcrops have been found to support this view.

(3) Self-Potential Survey

This covers the same area as the magnetic survey, and the S.P. profiles are shown in Plate G73-32. A series of small anomalies has been recorded, suggesting two lines of mineralisation which may meet. Except for those on traverses 197 N, 198 N and 199 N the anomalies are very small, and would be of little significance if it were not for the fact that they lie along fairly definite lines.

It is noted that each of the small anomalies on traverses 194 N, 195 N and 196 N occurs on or near the site of a prospecting pit. There is a line of such pits extending still further, beyond the limits of the survey, but it is not known whether these have adequately tested the possibility of there being a mineral body in this locality.

The distinct anomaly at 199 N / 101,50 E lies not far from the floor of the open-cut, and the smaller anomalies on lines 200 N and 201 N suggest that the body producing this effect may extend into the hill in a northerly direction. It is hard to tell whether any mining has been done here, but there is a collapsed adit which could perhaps lead to mine workings in this vicinity.

6. SUMMARY AND CONCLUSIONS.

The survey has revealed a marked anomaly over the known sulphide lode at Laloki. Another smaller anomaly a little further north is regarded as being worthy of closer investigation.

The Moresby-King area has been examined in detail by magnetic and S.P. surveys but the results offer little hope of there being a useful sulphide lode here. The only feature of interest is the magnetic anomaly at 219 N / 153 E, which may indicate either a sulphide body or an offshoot of the gabbro formation.

It has already been mentioned that the magnetic survey at Dubuna is somewhat unsatisfactory because of the steep magnetic gradient throughout the area. However, it is unlikely that this effect would mask the anomaly which would be expected to arise from a sulphide body sufficiently large to be useful to the Company.

After examination of the self-potential results in the three areas the conclusion is drawn that this geophysical method is not well suited to the conditions in the Port Moresby area, where water level is too near the ground surface to allow sulphide lodes to oxidise rapidly enough to produce useful ground potentials.

Arrangements have been made for a continuation of work in the Port Moresby area. An A.C. Potential Ratio survey is to be conducted at Laloki, covering the mine area and the area of magnetic interest at 202 N, in an attempt to confirm the suggestion that there is an extension of the main ore-body in this direction. If this method proves to be satisfactory it may be applied in the Moresby-King and Dubuna areas. In addition the magnetic survey at Laloki is to be extended, to throw light on the unexplained anomalies on line 194 N. Later, new areas such as Pari and Mount Diamond may be tested.

Reference

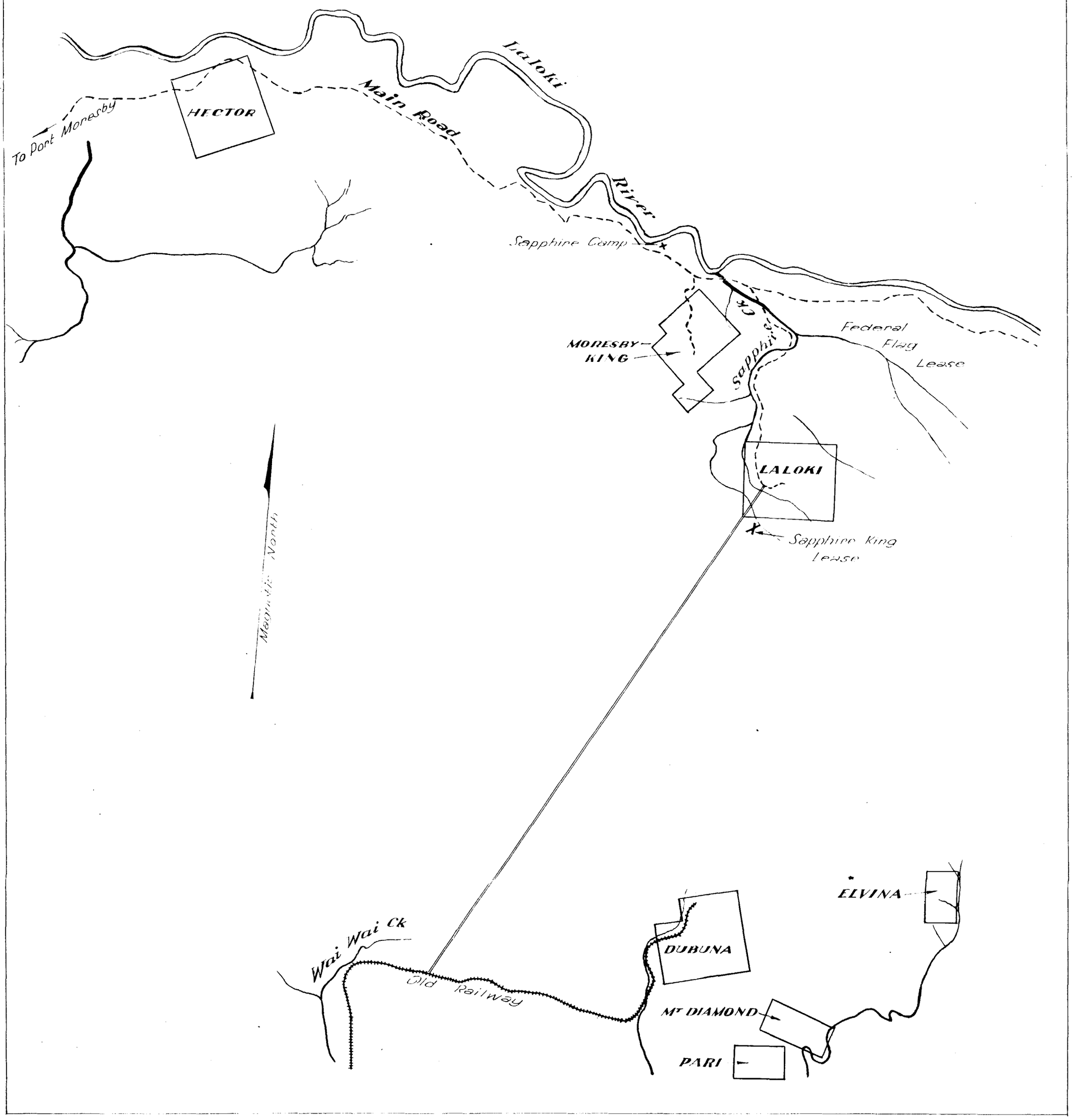
Fisher, N.H., 1941 - Geological report on the Sapphire-Moresby King, Laloki and other mines, Astrolabe Mineral Field, Papua (unpublished).

Hugh Oldham
Geophysicist.

Melbourne

28/2/50.

Note: "Eldorado" "A&E" & "Mt Cook" leases are north of the Laloki, River, but have not been surveyed



SCALE

1/2 . 0 1/2 1 1½ MILES

Note:- Positions and sizes of leases are approximate only, as all leases have been re-pegged but not subsequently surveyed.

Hugh Oldham
Geophysicist
10.2.50

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

SHOWING

ROUGH LOCATIONS

OF

LEASES.

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

G.73-1

176 E 180 E 184 E 188 E 192 E 196 E 200 E 204 E 208 E 212 E 216 E

212 N 210 N 208 N 206 N 204 N 202 N 200 N 198 N 196 N 194 N 192 N 190 N

Base Line North
True Brg 022°40'

Gabbro
Contact (Very roughly)

Creek

Sapphire

Simsons Creek

Trig Stn A
20902-37

Gabbro

Gabbro

22°40' True

Air Shaft
Boiler
House

LINE

Sulphide
OPEN CUT AREA

BASE

Boy House
(Approx)

Bin

Bridge

X Tower
(Approx)

Sapphire Creek

Trig Stn B
19111-41

8 40'

LEGEND

Creeks
Roads
Gabbro Outcrops

SCALE

200 0 200 400 600 800 FEET

Geophysicist
14-2-50

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA

LALOKI AREA

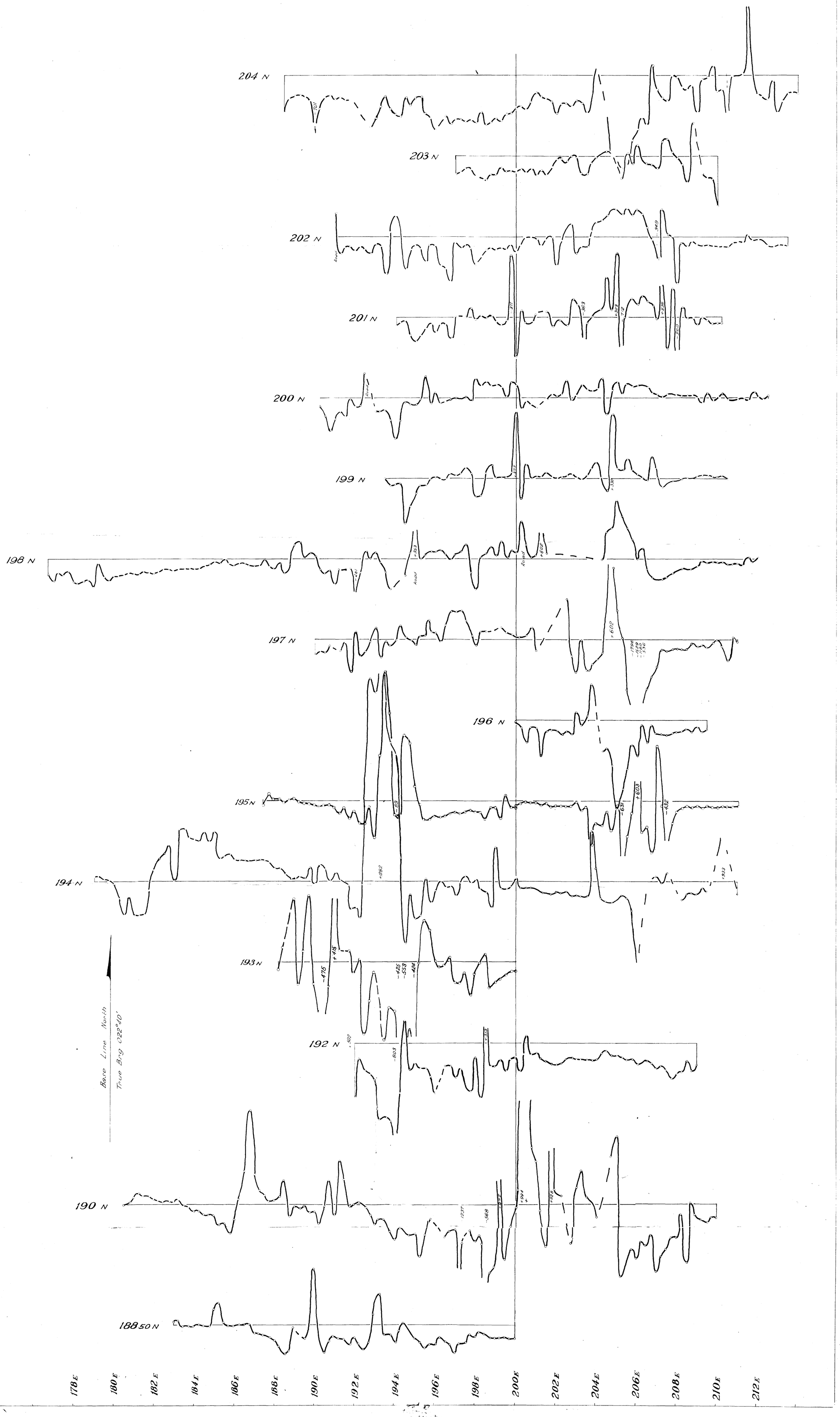
SHOWING

SURVEY TRAVERSES & SURFACE FEATURES

G73-10

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

PLATE 4



SCALES

Vertical / Horizontal: 200 0 200 400 600 800 Gammas / Feet

Note:- Vertical spacing of profiles not to scale.

K St Seite
Geophysicist
5·7·51

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA

LALOKI AREA

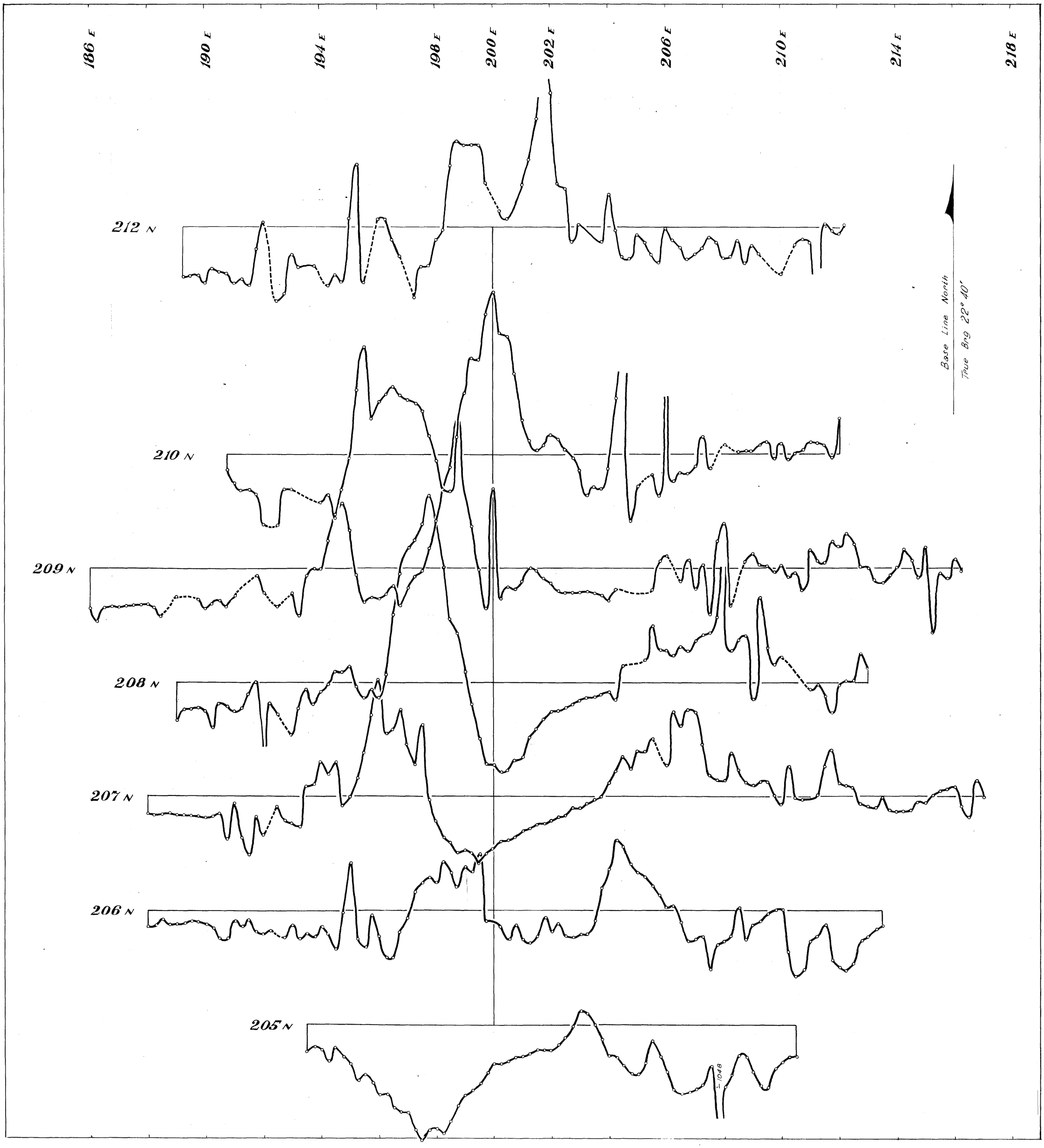
MAGNETIC VERTICAL FORCE PROFILES

ON TRAVERSES 18850 N TO 20400 N

(After H Oldham, 1950)

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics

G 73-11



GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

LALOKI AREA

MAGNETIC VERTICAL FORCE PROFILES

ON TRAVERSES 205N TO 212N

(After H. Oldham, 1950.)

SCALES

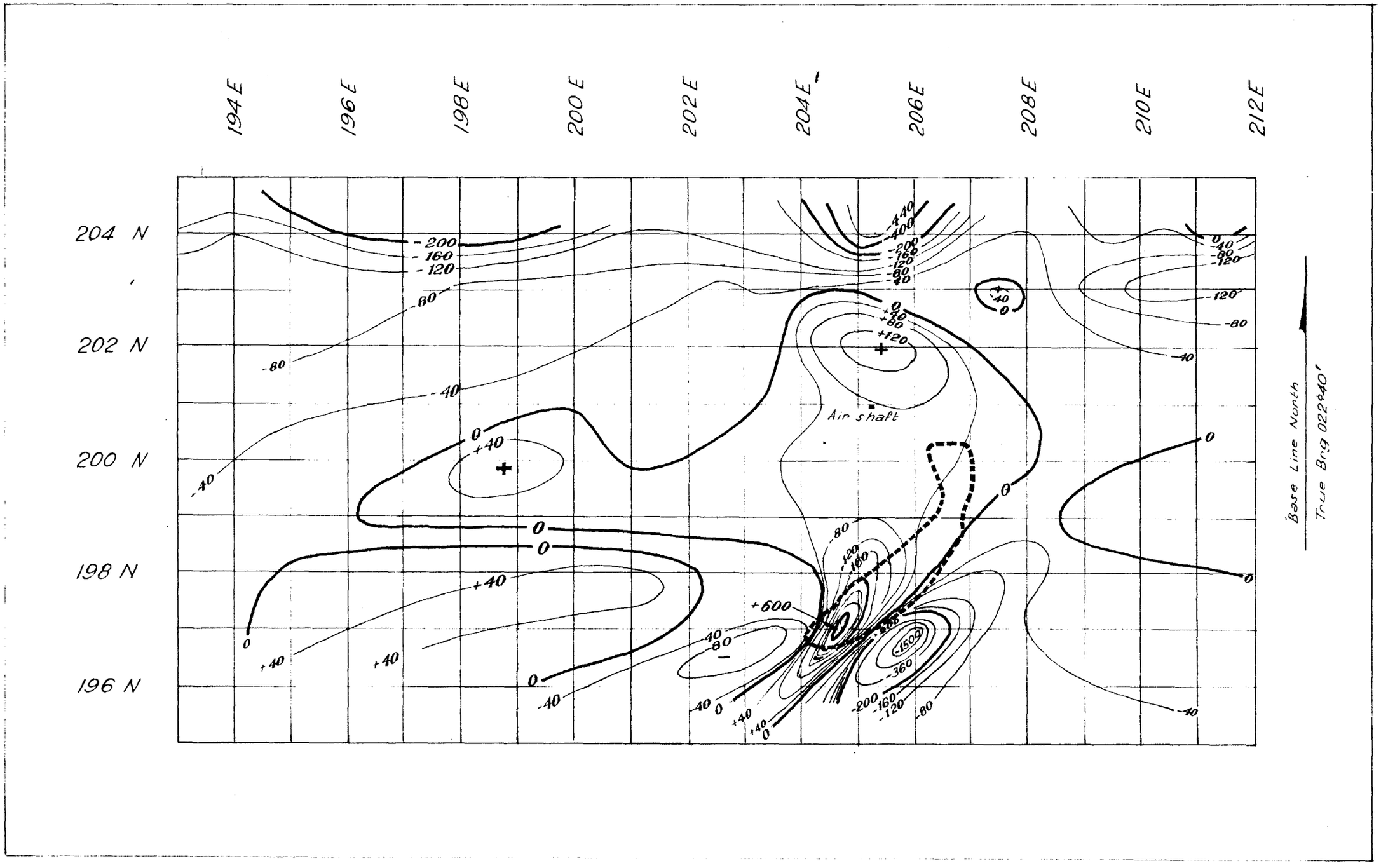
	200	0	200	400	600	
Horizontal						Feet
Vertical						Gammas
	500	0	500	1000	1500	

Note - Vertical spacing of profiles not to scale.

K. H. Jate
Geophysicist
5.7.51

G.73–12

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics



LEGEND

—80— Magnetic Contours

------ Outline of ore body

SCALE

200 0 200 400 FEET

Magnetic values in gammas.

Hugh Oldham

Geophysicist

9.2.50

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

LALOKI AREA

SHOWING

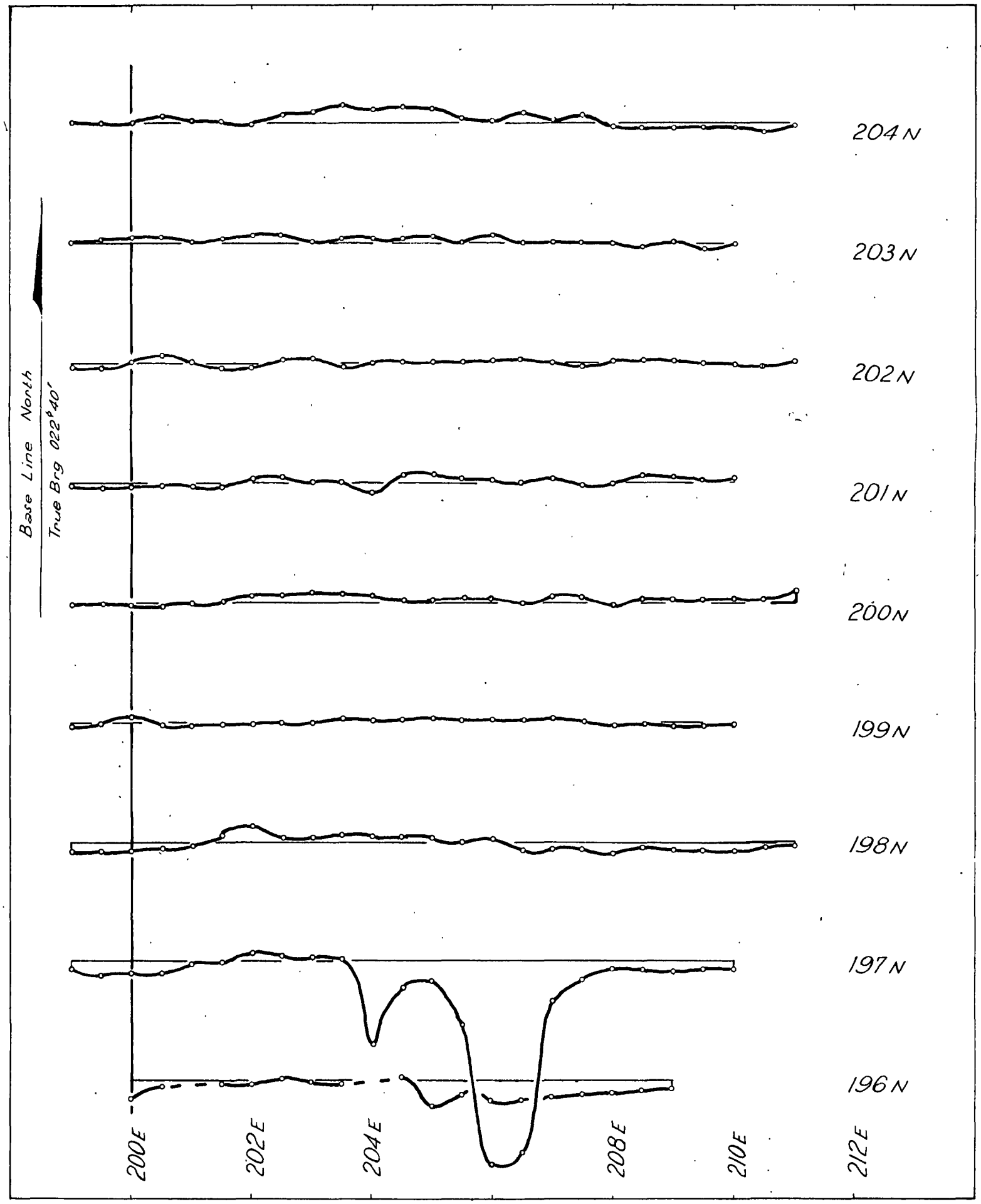
MAGNETIC VERTICAL FORCE CONTOURS

IN RELATION TO

OUTLINE OF OREBODY AT 137 FT. LEVEL.

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics G.73—13

PLATE 6



GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

LALOKI AREA
SELF-POTENTIAL PROFILES

(AFTER H. OLDHAM, 1950)

SCALES

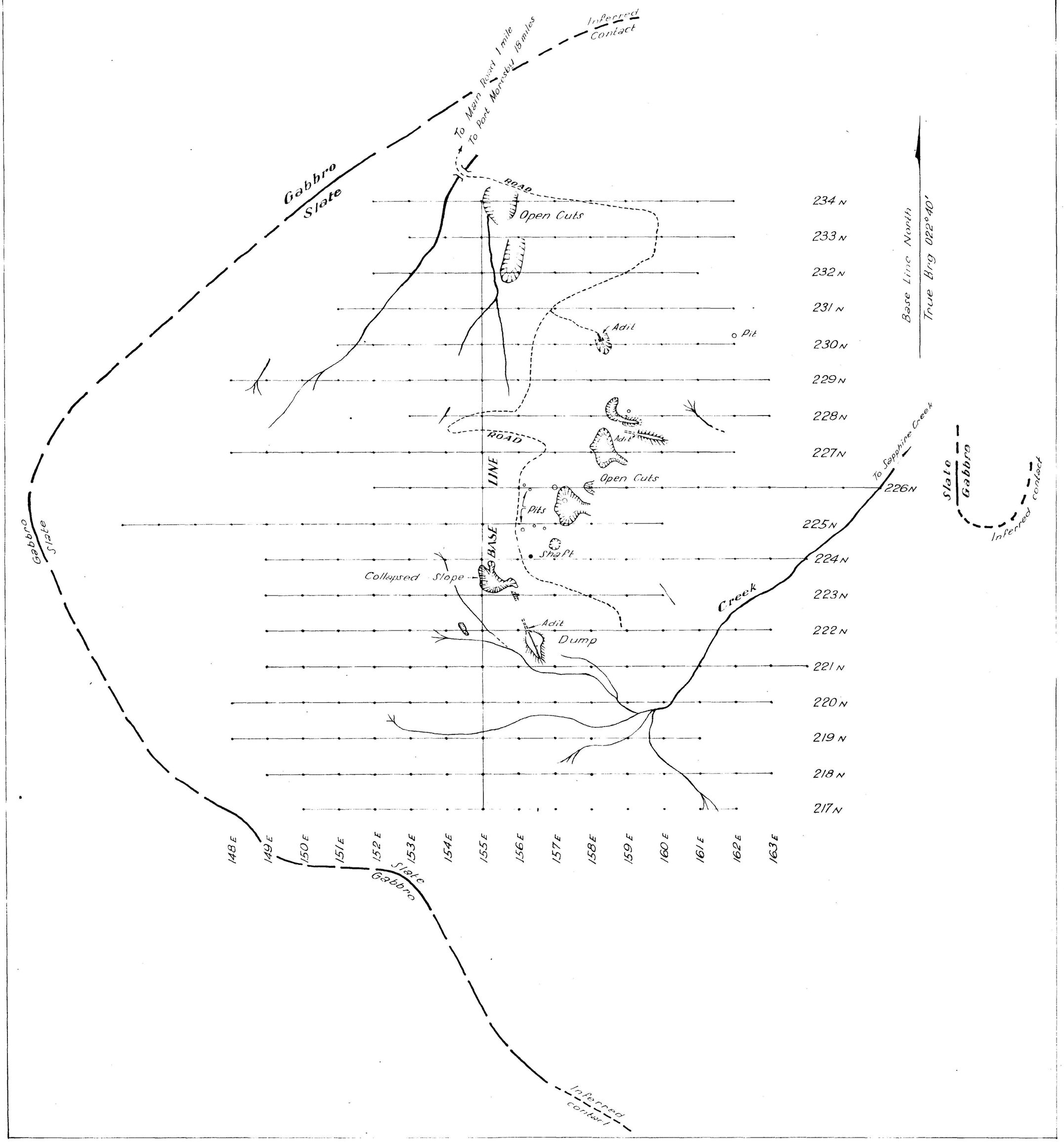
Horizontal: 200 0 200 400 600 Feet
Vertical: 50 0 50 100 150 Millivolts

Note: Profiles are double spaced vertically for clarity.

K. H. Jate
Geophysicist
5.7.51

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

G.73-14



SCALE

200 0 200 400 600 FEET

Hugh Oldham

Geophysicist

1o 2·5o

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

MORESBY-KING AREA

SHOWING

SURVEY TRAVERSES

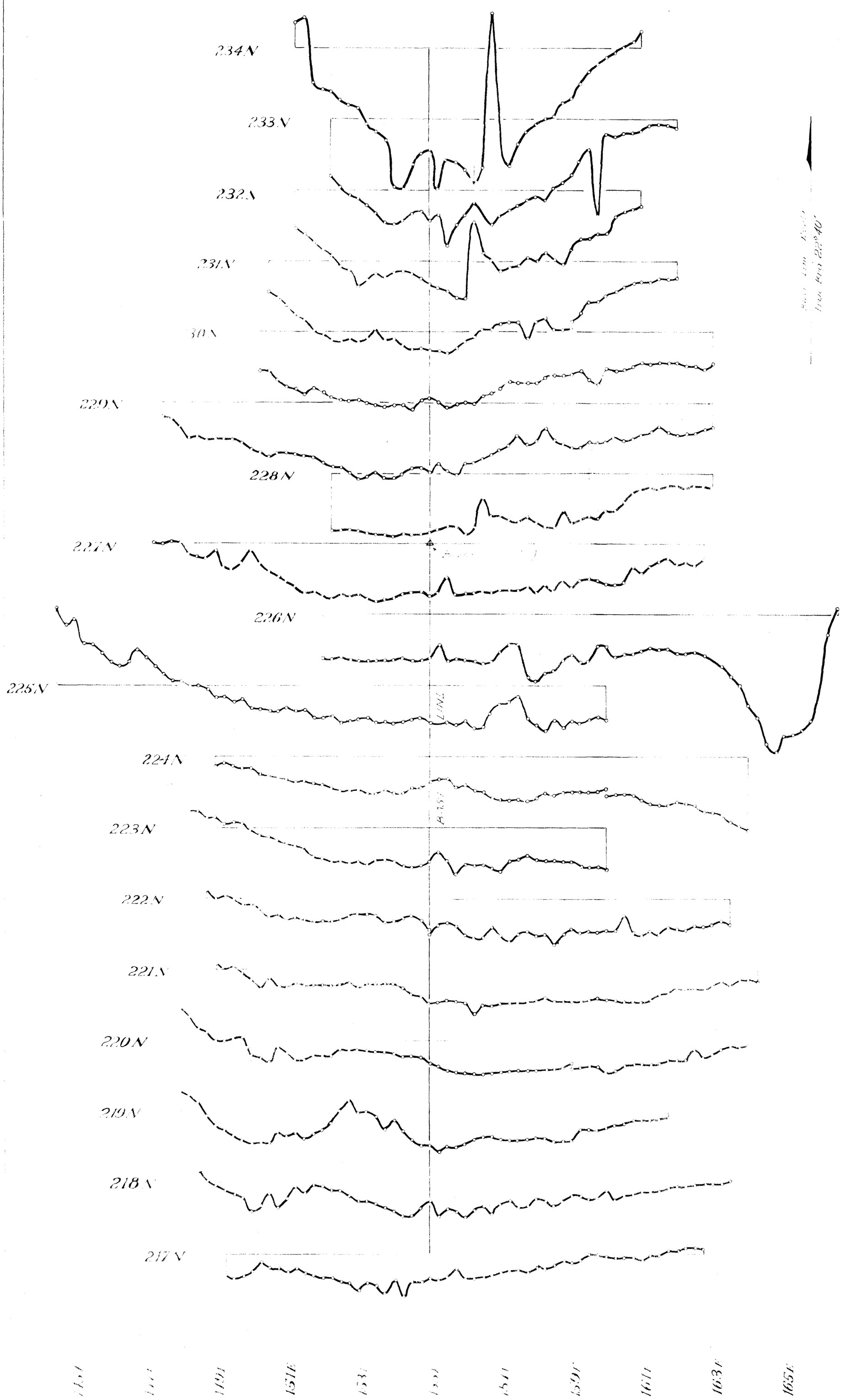
AND

SURFACE FEATURES.

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics

G.73-20

PLATE 10



SCALES

K. H. Sachs
Geophysicist
5-7-71

PHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

MORESBY KING AREA

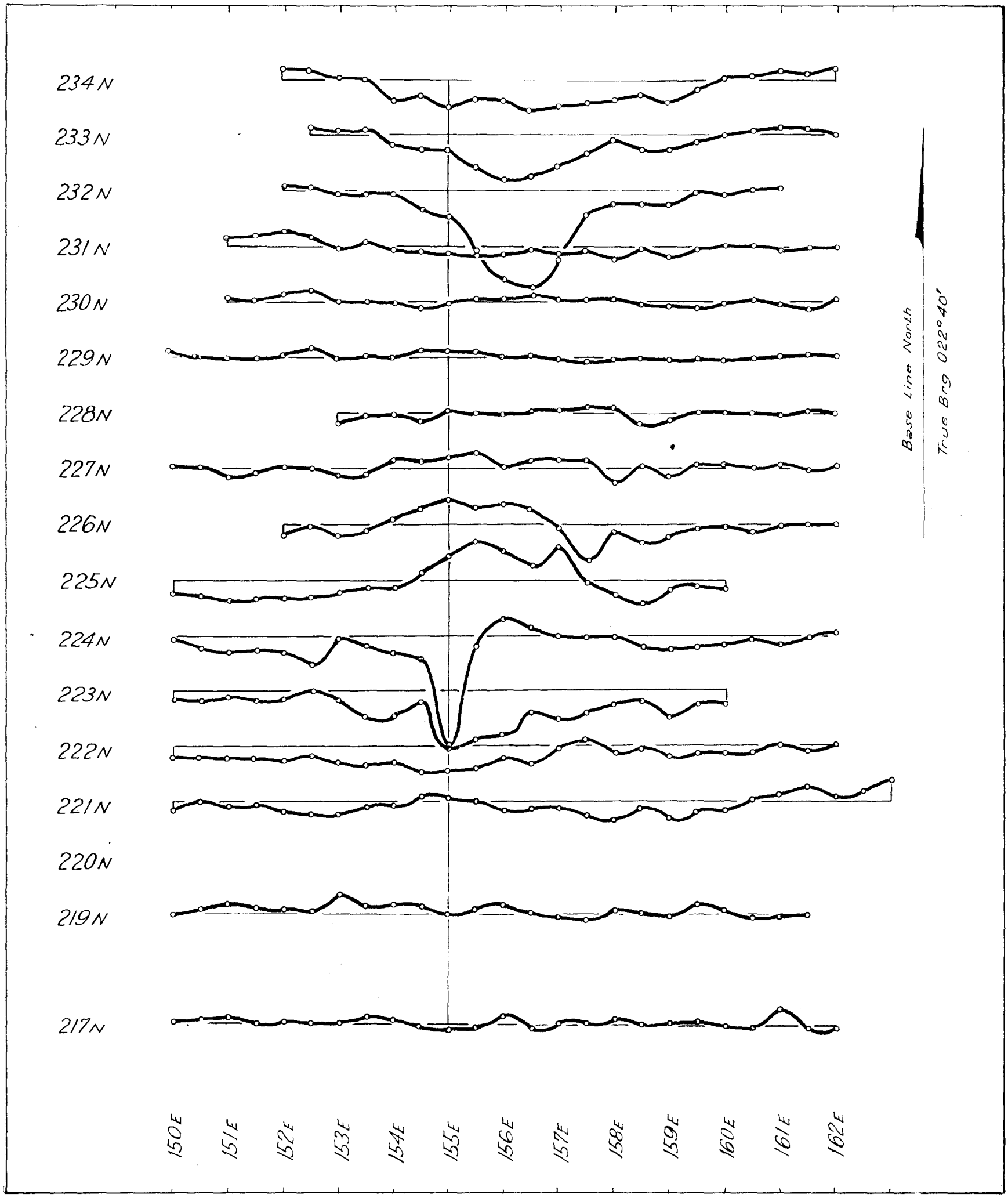
MAGNETIC VERTICAL FORCE PROFILES

AFTER H. OLDHAM, 1950.

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics.

G.73-21

PLATE 12



GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

SCALES

Vertical 50 0 50 100 Millivolts
Horizontal 200 0 200 400 Feet

K H Tate
Geophysicist
5·7·51

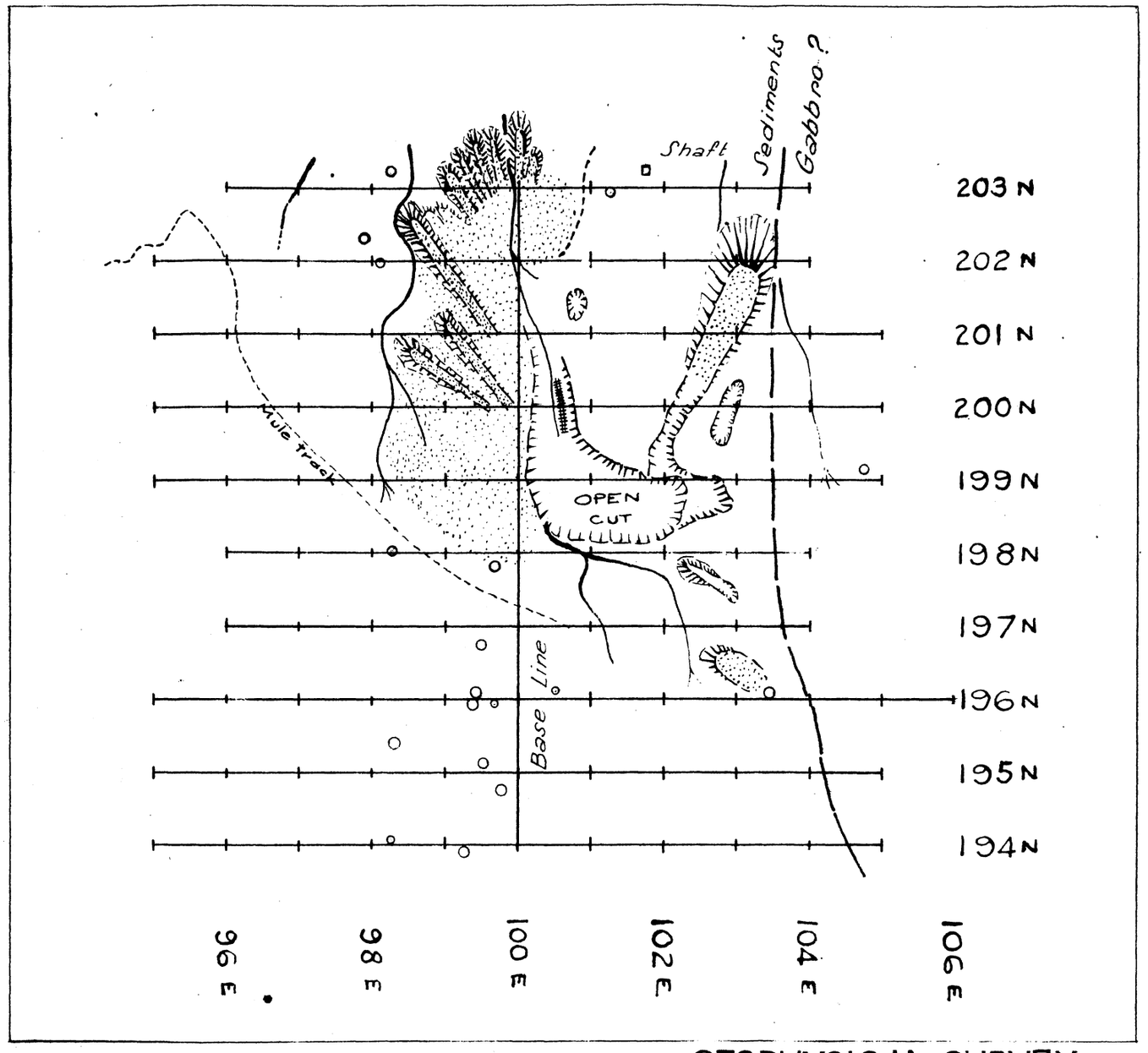
MORESBY KING AREA

SELF-POTENTIAL PROFILES.

AFTER H. OLDHAM, 1950.

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

G.73-22



Base Line North
Mag Brg 324°

GEOPHYSICAL SURVEY

ASTROLABE FIELD, PAPUA.

DUBUNA AREA.

SHOWING

SURVEY TRAVERSES AND SURFACE FEATURES.

G.73–30

LEGEND

- Spoil-covered areas
- Water courses
- o Prospecting pits
- Contact inferred from magnetic results.

SCALE

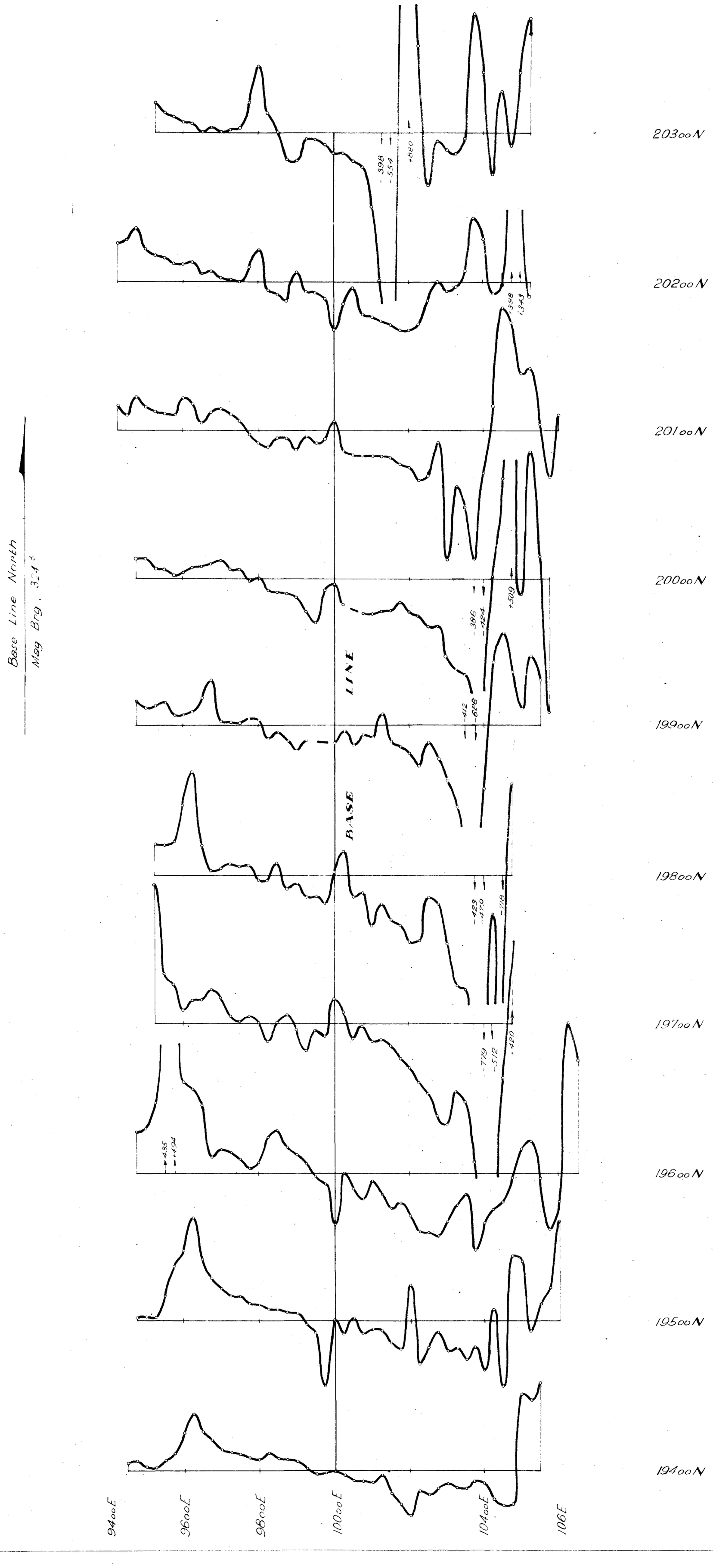
200 0 200 400 FEET

Hugh Oldham

Geophysicist

9-2-50

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics



SCALES

200 0 200 400 Yards
Horizontal
Vertical
200 0 200 400 Feet

Note -- Vertical spacing of traverses is expanded for clarity

Hugh Oldham

Geophysicist

9-2-50

GEOPHYSICAL SURVEY OF ASTROLABE FIELD, PAPUA.

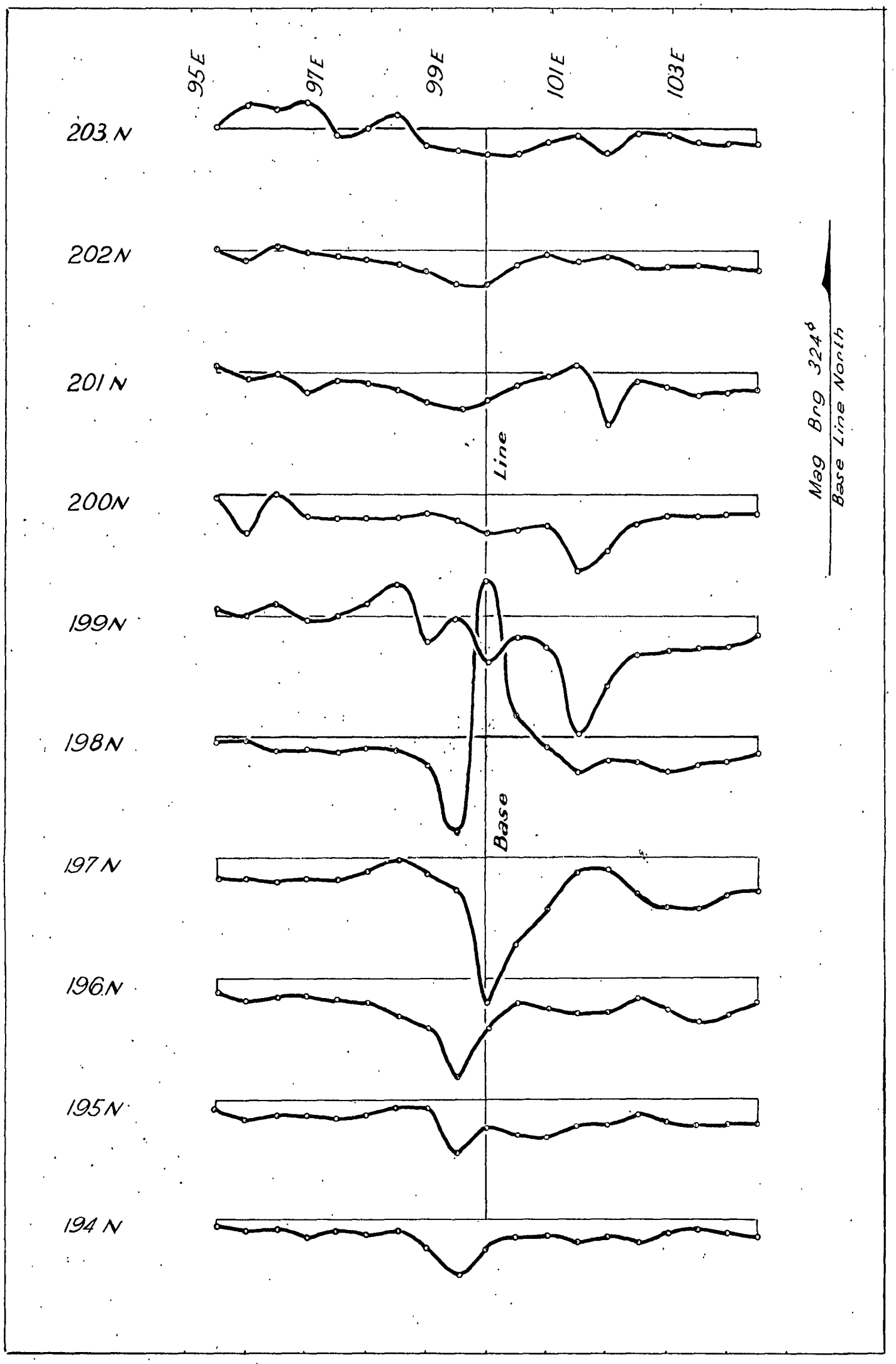
DUBUNA AREA

SHOWING

MAGNETIC VERTICAL FORCE PROFILES

G.73—31

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.



SCALES

Horizontal 50 0 50 Millivolts
Vertical 200 0 200 Feet

Note:- Profiles double spaced vertically for clarity

Hugh Aldham

Geophysicist

9-2-50

GEOPHYSICAL SURVEY

AS.TROLABE FIELD, PAPUA.

DUBUNA AREA

SHOWING

SELF-POTENTIAL PROFILES.

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics G.73-32