

DEPARTMENT OF MINES
SOUTH AUSTRALIA

REPORT NO. 1

ON

A GRAVITY AND MAGNETIC SURVEY

OF THE

KOPI AEROMAGNETIC ANOMALIES

CENTRAL EYRE PENINSULA

by

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PLAN REFERENCES

<u>No.</u>	<u>Title</u>	<u>Scale</u>
61-624	Warramboo Aeromagnetic Anomaly. Comparison with Middleback Ranges and Kopi Group of Anomalies.	1" = 4 miles
62-573	Kopi Aeromagnetic Anomalies. Sketch Plan showing Results of Low Level Aeromagnetic Survey.	1" = 1 mile
63-664	Kopi Aeromagnetic Anomalies. Geophysical Traverses and Considered Drill Sites. Hds. Warramboo and Ulyerra.	1" = $\frac{1}{2}$ mile
S3536	Kopi Aeromagnetic Anomalies. Geophysical Traverses and Considered Drill Sites. Hd. Hambidge.	1" = $\frac{1}{2}$ mile
63-946 to 63-951	Kopi Aeromagnetic Anomalies. Gravity and Magnetic Profiles and Traverse Layouts.	1" = 500'
63-946	Anomalies A and D.	
63-947	Anomalies E and G.	
63-948	Anomaly F.	
63-949	Anomalies H(a) and H(b).	
63-950	Anomaly L.	
63-951	Anomalies N and S.	

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REPORT NO. 1

ON

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SUMMARY

Thirteen anomalies have been examined and 35 drill holes were considered to test a number of coincident gravity and magnetic peaks. Eleven holes have been drilled and indicate that the anomalies are caused by the occurrence of magnetite in Archaean metasediments. Recommendations are made for possibly drilling an additional 12 holes, and for more geophysical surveying.

1. INTRODUCTION

A gravity and magnetic survey was carried out by the Exploration Geophysics Section to examine four groups of aeromagnetic anomalies near Kopi, approximately 9 miles S.S.E. of Warramboo. It was necessary to recommend a number of drilling sites in the shortest possible time.

The relationship between these anomalies and the Warramboo Aeromagnetic Anomaly is shown by the high level aeromagnetic contours in Plan 61-624. The Warramboo Anomaly has been investigated by the Department and was chosen first for a number of reasons including its greater size, the relatively simple elongated shape, and the easier access. There was also the possibility of a greater depth to bedrock near Kopi as indicated by the Musgrave Bore approximately $1\frac{1}{4}$ miles N.N.W. of the Kopi Railway Station. Although the high level aeromagnetic survey gave the highest readings for the Warramboo Anomaly the low level survey gave the highest readings in the Kopi area.

Field work was carried out during August, October and November, 1962, by C.H. Baget, Geophysicist, assisted by the writer.

2. PREVIOUS GEOPHYSICAL WORK

A high level aeromagnetic survey covering the Kopi and Warramboo Anomalies was carried out during 1953-55 by the Bureau of Mineral Resources, at a height of 1500' and with a flight line spacing of 1-mile (See Plan 61-624). After an examination of this survey it was decided that the Kopi and Warramboo Anomalies should be covered by a low level aeromagnetic survey flown at a height of 300' and with a flight line spacing of $\frac{1}{2}$ -mile. This survey was flown for the Department in 1961 by Adastral Hunting Geophysics Pty. Ltd. and the reduction was carried out by the computers of the Exploration Geophysics Section of the Department. The results of the low level survey over the Kopi area are shown in Plan 62-573, where fourteen separate anomalies occurring in four major groups have been designated by the numbers A to S, excluding M. The plan also shows the six possible points of attack indicated in the initial recommendations, where the order of numbering was based on the difficulty of access and the complexity of the anomalies.

There had been no previous ground geophysical work done at Kopi, although 125 line miles of ground gravity and magnetic surveying had been carried out in the Warramboo area immediately to the north.

3. GEOLOGY

No outcrop or float was found in the area surveyed which is masked by a Recent cover of sand forming long narrow sub-parallel dunes running N.W.-S.E. and clayey sands in the interdune flats. The dunes are fixed by vegetation. Some of the anomalies occur in areas of thick mallee scrub and it was necessary to clear access and survey lines for Anomalies D, E and H (b).

Drilling in conjunction with the geophysical survey (Whitten, 1963)* has indicated a weathered bedrock of Archaean metasediments overlain by Recent and Tertiary sands, clayey sands, and clays, and Tertiary lignite and lignitic clays and sands. The depth to bedrock ranges from approximately 20' to 220' indicating the existence of Tertiary basins. The metasediment may contain feldspar, quartz, biotite, chlorite, magnetite, and garnet, and are weathered to depths ranging from 30' to 200'. Their dip varies from approximately 50° to 80° at Anomalies A, G and K, and from 15° to 40° at Anomaly H (a). Summarized drilling results are given in Table I.

TABLE I
SUMMARIZED DRILLING RESULTS

Name of Anomaly	Drill Hole and Site	Overburden Thickness in ft.	Weathered Bedrock Thickness in ft.	Percentage Magnetite in Bedrock		Probable dip.
				Weathered	Unweathered	
A	KR1(A110, 5000)	60	70	Trace	40	50°-55° 55°-70°
	KR2(A110, 4500)	61	206	-	-	
	KR3(A110, 5700)	21	66	-	-	
G	KR4(G110, 5000)	90	31	15	15	55°-60° 70°-70° 70°-80°
	KR5(G110, 5900)	120	130	-	-	
	KR6(G110, 4400)	140	45	-	-	
H(a)	KR7(H(a)115, 5000)	80	130	40	10-50	15°-30° 25°-25° 30°-40° ?
	KR8(H(a)115, 5700)	130	120	-	-	
	KR9(H(a)115, 6300)	220	66	-	-	
	KR10(H(a)115, 4400)	160	140	-	-	
K	KR11 (on Magnetic Peak)	160	140	?	5	65°-70°

Prior to this drilling programme the only known subsurface information came from the Musgrave Bore which passed through Tertiary sands, lignite, clays etc. into Archaean Metasediments at a depth of 346' (Whitten op. cit.).

* Whitten, G., 1963 - "Geological Report No. 1 on The Investigation of the Kapi Aeromagnetic Anomalies, Central Eyre Peninsula". Rept. Bk. No. 56/33, G.S. No. 2543.

4. FIELD METHODS

Because of the urgency of the survey the anomalies were examined independently.

A separate magnetic reconnaissance was carried out over each of the designated aeromagnetic anomalies except Anomaly B. This anomaly was omitted because of its similarity to Anomaly C which did not appear to warrant further examination. Two Jalandar magnetometers (Nos. 5797 and 57136) were used together, the operators carrying miniature transceivers. Initially, the peak values of the anomalies were located by finding the peak values on arbitrary traverses, then on perpendicular traverses through these peaks, and so on. A number of the anomalies were found to have two distinct peaks. After the peaks had been marked in the field, a number of traverses at right angles were run out from them until magnetic background was reached. This gave some idea of the extent and shape of each anomaly. In the case of Anomalies F, G, and K, an arbitrary background was contoured and marked in the field. This reconnaissance method was quick and probably sufficient in view of the urgency of the survey. However, it is possible that a number of peaks may have been missed. For example the peak in Anomaly N at the proposed drill site for hole KR17 (See Plan 63-951) was found after the initial reconnaissance.

Traverses were then laid out over all the designated anomalies except B, C, J and K (See Plans 63-664, S3536, and 63-946 to 63-951). In order to provide drilling targets as soon as possible, a baseline was established through the maximum peak and parallel to the general trend of each anomaly. A small number of traverses (1 - 8) was then laid out at right angles to the baseline with one of the traverses passing through this peak. These traverses were generally 500' apart and varied in length from 500 - 1000'. Each baseline was given the coordinate "5000" in feet, and the traverses were designated in hundreds of feet prefixed by the letter of the anomaly (e.g. F110). Stations were pegged at 100' intervals along all the traverses.

The vertical magnetic intensity was measured at all stations with the Jalandar magnetometers. To correct for diurnal drift, the readings were taken in a series of loops by going up one traverse and then coming down the next. The loops were then tied together with a single traverse along the baseline.

Gravity readings were taken along two traverses over Anomalies D, F and H(b) and along single traverses over the others. The readings were taken at the same stations as the magnetic readings; however the interval was increased from 100' to 200' over Anomaly F. A Worden and a World Wide (No. 38) gravity meter were used.

5. GEOPHYSICAL RESULTS

5.1. General

The results are presented as profiles of vertical magnetic intensity and Bouguer gravity anomaly (See Plans 63-946 to 63-951). Neither the gravity nor the magnetic results have been tied to any previously established station. Although the gravity results over each anomaly are independent, the magnetic results have been tied approximately. The gravity results were derived using an elevation correction of 0.6 gravity units per foot giving Bouguer values relative to a density of 2.67 gm./c.c. No terrain corrections were applied. The area is relatively flat.

5.2. Description of Results

The maximum residual gravity anomaly was found at G and is of the order of 10 gravity units, whereas the maximum magnetic anomaly was found at A and is of the order of 10,000 gammas (See Table II). The magnetic values given in this table are relative to a separate background value chosen for each anomaly.

In general the profiles indicate a number of coincident gravity and magnetic peaks. One exception occurs on Traverse F 100 where there are no definite gravity peaks. Anomalies D,

G, H(b), K, L and N have at least two separate magnetic peaks along their length, while Anomaly F appears to be a complex area with possibly more than four magnetic peaks.

The residual gravity values given for Anomalies L, N and S are unexpectedly small in view of the magnitudes of the associated magnetic anomalies. However, these residual gravity values were assumed to be superimposed on a marked regional gravity increase to the west of the order of 13, 10 and 20 gravity units per 1000' respectively, so that more information on this gradient is desirable.

Although it is obvious from the results that some of the traverses were too short, the survey did indicate, in the limited time available, a number of coincident gravity and magnetic peaks suitable for drilling targets.

6. INITIAL RECOMMENDATIONS

Following the geophysical survey of Anomalies A, F, G, H(a) and K during August, 1962, J.E. Webb (Senior Geophysicist) and G.F. Whitten (Senior Geologist) recommended 13 vertical drill holes (KR1 - KR13 in Table II) to test Anomalies A, G, H(a) and K in the order given. No recommendations were given for Anomaly F at this stage because of its relative complexity. One hole was recommended to test the maximum peak of each anomaly and two to test "background" each side of the peak. An additional hole was recommended for Anomaly H(a) to test a minor peak.

After the remaining anomalies had been surveyed and holes KR14- KR24 considered, Webb and Whitten recommended holes KR25 - KR32 and KR19 to test Anomalies H(b), E, D and N in the order given (See Table II). They also recommended that the proposed holes KR12 and KR13 on Anomaly K, and the holes KR14 to KR24 (except KR19) on Anomalies S, N and L, should not be drilled until the results from the other holes had been analysed.

7. DRILLING RESULTS

To date, holes KR1 to KR11 have been drilled and the results are recorded in Whitten's report (Whitten op. cit.). Summarised results are given in Table I, and have also been discussed under "GEOLOGY".

The drilling indicates that the magnetic anomalies are probably due to magnetite in a meta-sediment also containing feldspar, quartz, biotite, chlorite, or garnet. No magnetite has been logged in the "background" holes.

The encouraging results from Anomaly H(a) indicate that Anomaly H(b) is worth testing, especially as the two anomalies appear to form one simple elongated anomaly. However, the poor results from hole KR11 suggest that the proposed holes KR12 and KR13 should be given a low priority.

8. CONCLUSIONS AND FINAL RECOMMENDATIONS

The purpose of this survey was to indicate a number of drilling targets as soon as possible and to this end it appears to have been successful. However, the survey can only be regarded as a reconnaissance with insufficient cover for any detailed interpretation.

For a later programme, it is recommended that Anomaly H(b) be tested with holes KR25 - KR28 in the order given (See Table II). If the survey is to be continued as a reconnaissance then it is suggested that Anomalies D, E and N be tested with holes KR19 and KR29 - KR32. It is also recommended that Anomaly F should be tested with 3 holes KR33 - KR35. Table II lists priorities for this drilling.

However, if more time is available then the two complex anomaly groups comprising Anomalies D, E, F and G, and Anomalies L, N and S, should each be surveyed as a unit and adequately covered by carefully planned traverses. These complex groups may be related to structures favourable for the enrichment of an iron formation. The relatively simple anomalies such as A,

H(a), H(b) and K do not appear to indicate such structures and enrichment might not be expected.

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GEOPHYSICIST.

BGR:MIP/AGK
19/11/63

TABLE II**ASSESSMENT OF ANOMALIES**

Aeromagnetic Anomaly		Ground Geophysics				
Name	Peak Value in gammas	No. of Traverses and Lengths	Drill Hole Considered and Site	Magnetic Amplitude in gammas (1)	Residual Gravity in Gravity Units	Suggested Drilling Priority
A	5500	5 1200' - 1600'	KR1(A110, 5000)	10000	8	Drilled
			KR2(A110, 4500)	2900	0	Drilled
			KR3(A110, 5700)	0	1.5	Drilled
B	3700	Not Examined	-			
C	3500	Examined.	Testing Unwarranted			
D	4500	6 1000'	KR30(D115, 5000)	6600	9	5
			KR31(D115, 5500)	0	0	6
			KR32(D120, 4500)	300	-	7
E	5000	1 - 1000'	KR29(E100, 5000)	2900	7	11
F	4500	8 4000'	KR33(F110, 5200)	3500	9	8
			KR34(F100, 4200)	4500	7	9
			KR35(F110, 3000)	0	0	10
G	4500	6 500' - 1400'	KR4(G110, 5000)	7000	10	Drilled
			KR5(G110, 5900)	Approx. 300	-	Drilled
			KR6(G110, 4400)	0	0	Drilled

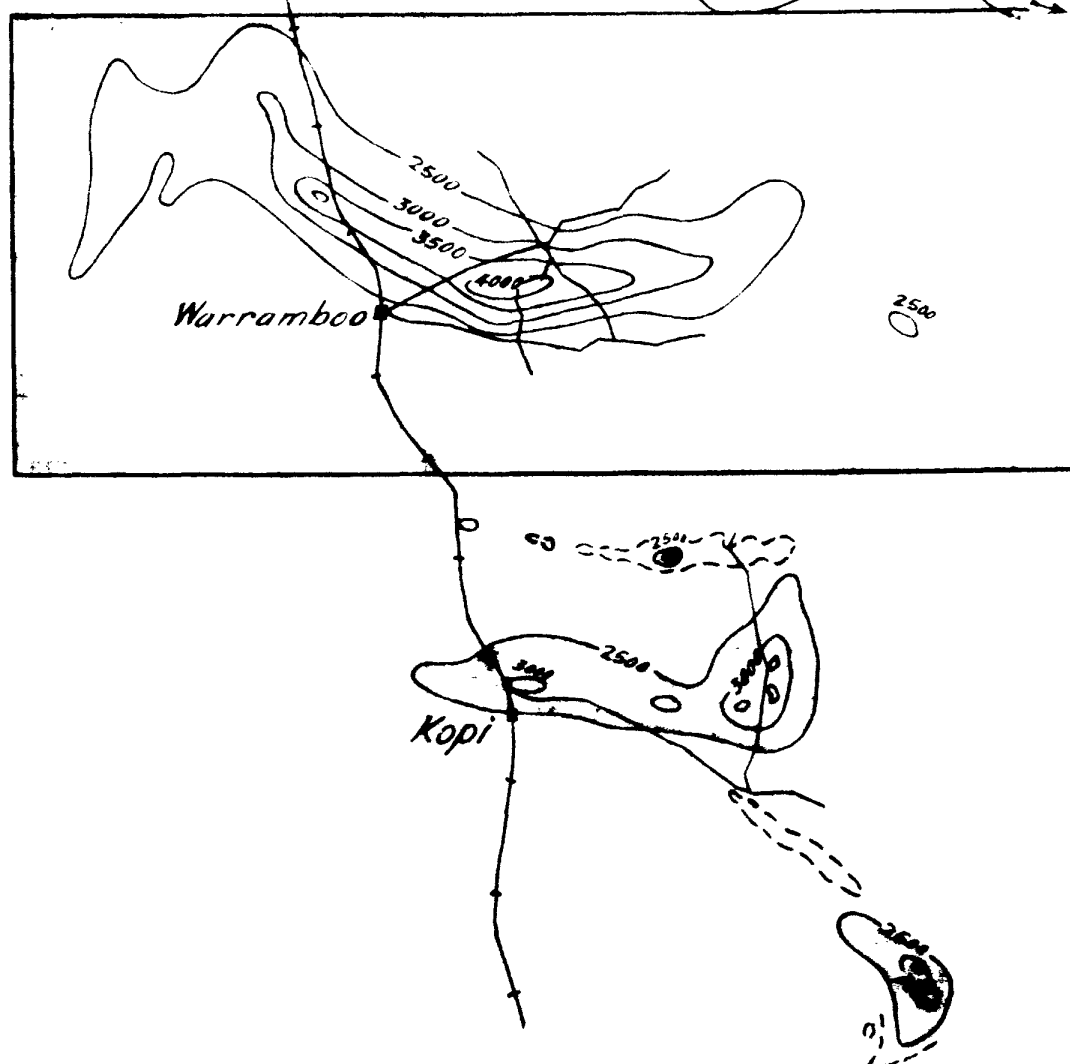
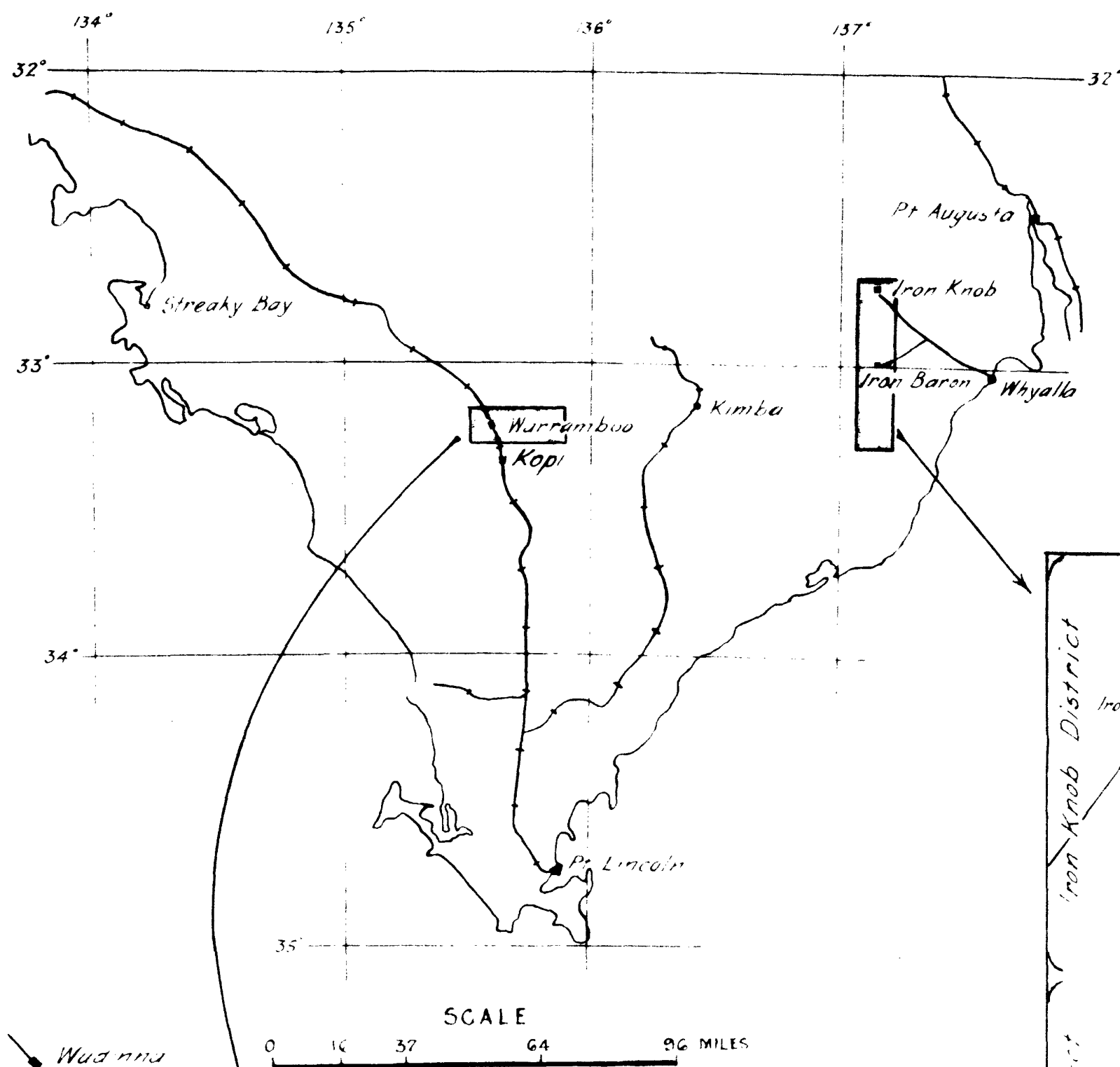
TABLE II. (contd.)

Aeromagnetic Anomaly		Ground Geophysics				
Name	Peak Value in gammas	No. of Traverses and Lengths	Drill Hole Considered and Site	Magnetic Amplitude in gammas (1)	Residual Gravity in Gravity Units	Suggested Drilling Priority.
H(a)	3500	6 1500'	KR7(H(a)115, 5000)	4300	8.5	Drilled
			KR8(H(a)115, 5700)	800	4.5	Drilled
			KR9(H(a)115, 6300)	-	-	Drilled
			KR10(H(a)115, 4400)	0	0	Drilled
H(b)	4500	6 1000'	KR25(H(b)109, 4900)	5600	6	1
			KR26(H(b)100, 5500)	0	0	2
			KR27(H(b)100, 4500)	1200	0	3
			KR28(H(b)100, 5000)	5500	4	4
J	3500	Examined	Testing Unwarranted	Approx. 4000		
K	5000	Background contoured	KR11(On Peak)	Approx. 6000	-	Drilled
			KR12(North of Peak)	0	-	Defer
			KR13(South of Peak)	0	-	"
L	5000	5 1600' - 2000'	KR21(L105, 5000)	5600	2	Defer
			KR22(L105, 5800)	200	0	"
			KR23(L115, 6750)	4100	-	"
			KR24(L120, 5400)	0	-	"

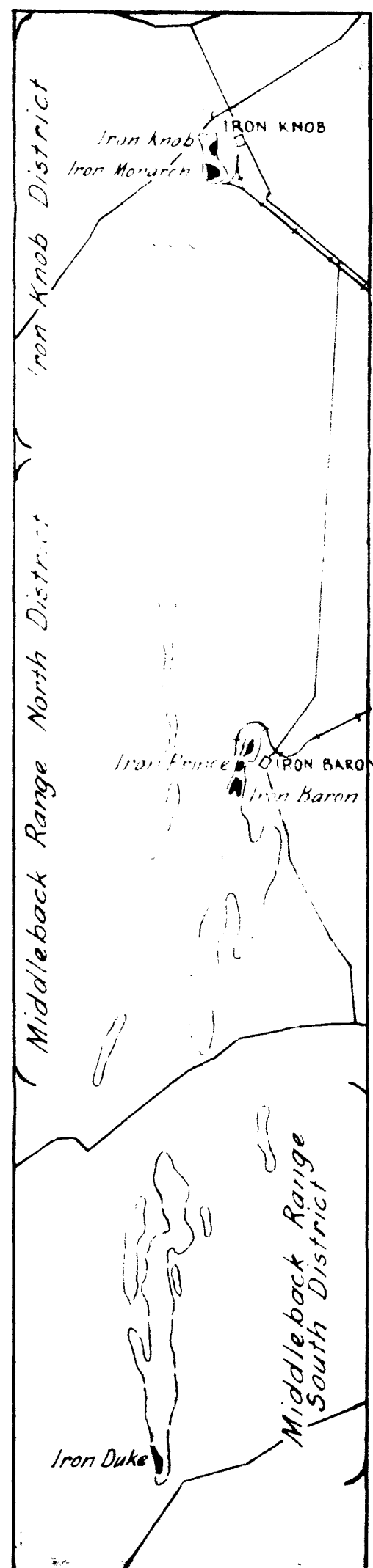
TABLE II (contd.)

Aeromagnetic Anomaly		Ground Geophysics				
Name	Peak Value in gammas	No. of Traverses and Lengths	Drill Hole Considered and Site	Magnetic Amplitude in gammas (1)	Residual Gravity in Gravity Units	Suggested Drilling Priority.
N	7000	4 1000' - 1500'	KR17(N98.5, 4000)	8400	-	Defer
			KR18(N100, 5500)	0	-	"
			KR19(N105, 5000)	9800	2.5	12
			KR20(N110, 4000)	2300	-	Defer
S	4000	4 1000' - 1500'	KR14(S105, 5000)	4400	2	Defer
			KR15(S115, 4500)	0	-	"
			KR16(S100, 4500)	0	-	"

(1) Magnetic amplitude in gammas above an arbitrary background.



WARRAMBOO AND KOPI AEROMAGNETIC ANOMALIES
SCALE: 4 MILES TO 1 INCH



MIDDLEBACK RANGE AREA
SCALE: 4 MILE TO 1 INCH

To accompany report by G.F. Whitten.

PLATE I

S.A. DEPARTMENT OF MINES

WARRAMBOO AEROMAGNETIC ANOMALY
COMPARISON WITH
MIDDLEBACK RANGES
AND KOPI GROUP OF ANOMALIES

Approved	Passed	Drawn	Notes As shown.
		Drn.	61-624
		Ten. R.R.	Dh 13
		Chf.	Date 31/8/61
Director		Eng.	

Amendment

Exd.

Date

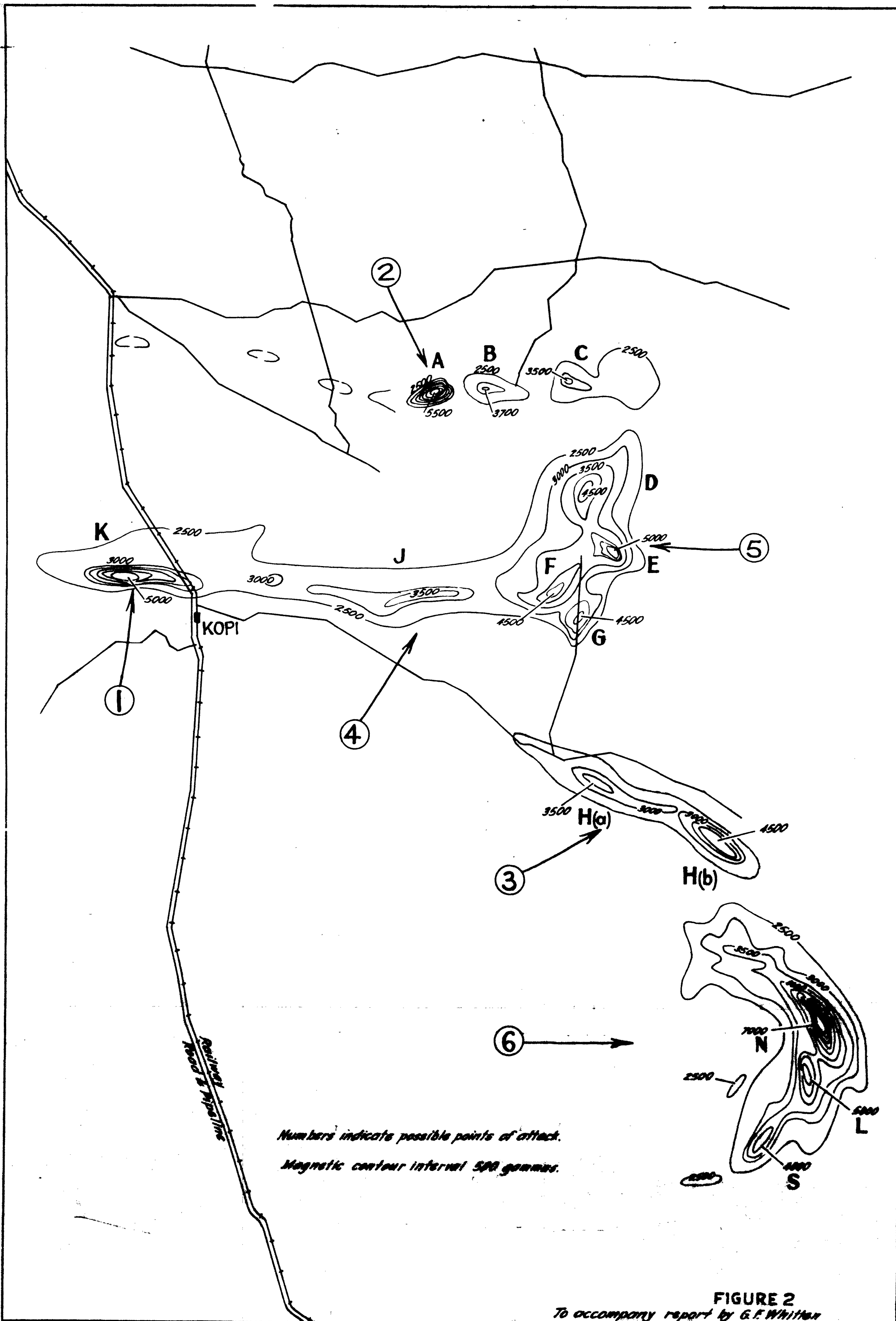


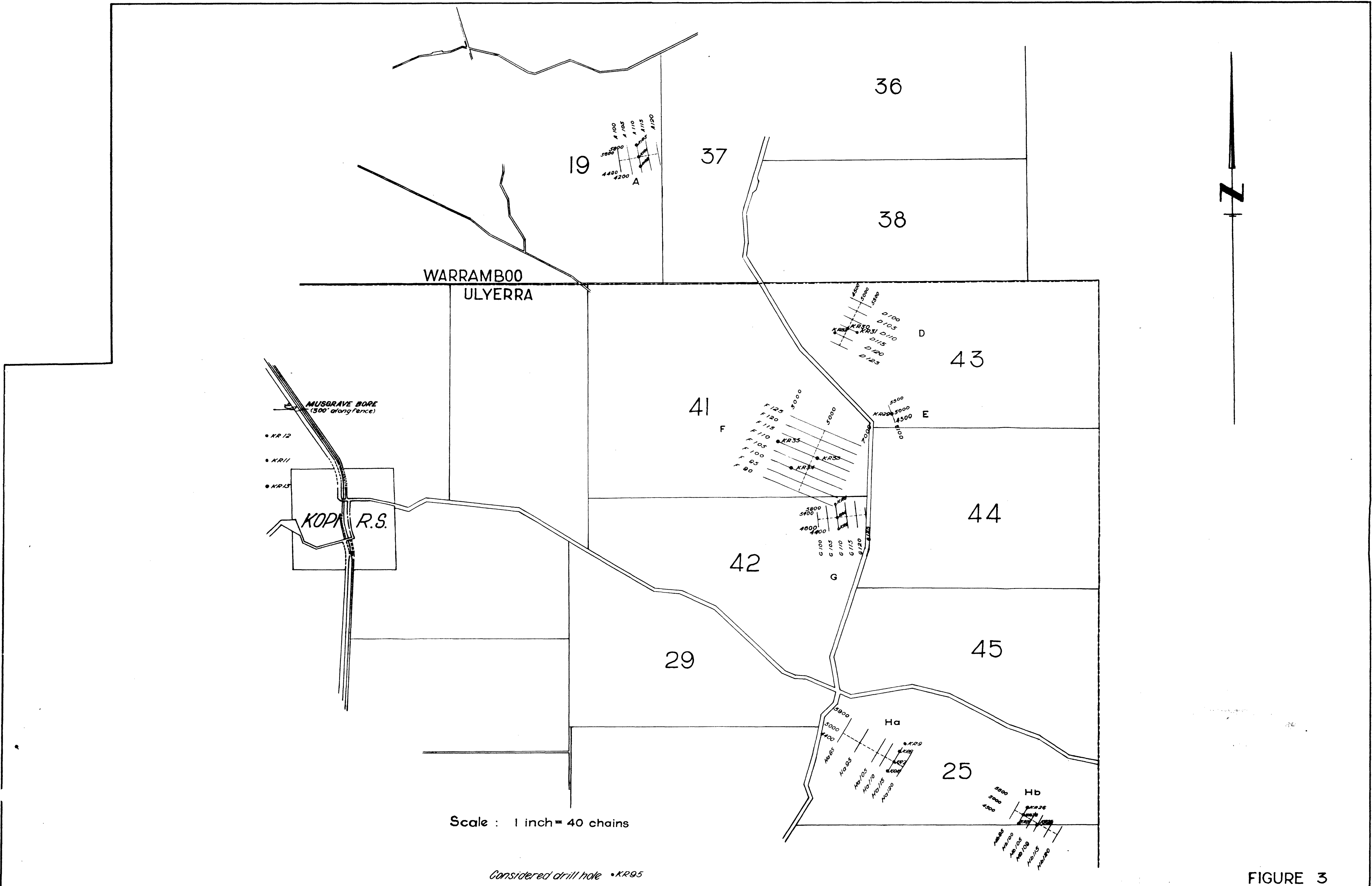
FIGURE 2
To accompany report by G.F. Whitham

S.A. DEPARTMENT OF MINES

KUPI AEROMAGNETIC ANOMALIES
SKETCH PLAN SHOWING RESULTS
OF LOW LEVEL AEROMAGNETIC SURVEY

No.	Amendment	Exd.	Date

Approved	Passed	Scale: 1 in. to 1 in.
		Drn. <i>[Signature]</i>
		Tcd. <i>MAL</i>
		Ckd. <i>[Signature]</i>
Director		Exd. <i>[Signature]</i>
		62-573
		DI 5
		Date 8-8-62



S.A. DEPT. OF MINES					Approved		Passed		Scale: 40ch to 1 inch	
KOPI AEROMAGNETIC ANOMALIES H ^{PS} WARRAMBOO & ULYERRA GEOPHYSICAL TRAVERSES & CONSIDERED DRILL SITES					Director of Mines		Dmn. Tcd. G.M. Ckd. Exd.		63-664	
									Dh+1	
Reg. No. D.M. Compiled from									Date 13-11-63	
Associated Drawing					No.		No.		Amendment	
					Exd.		Date			

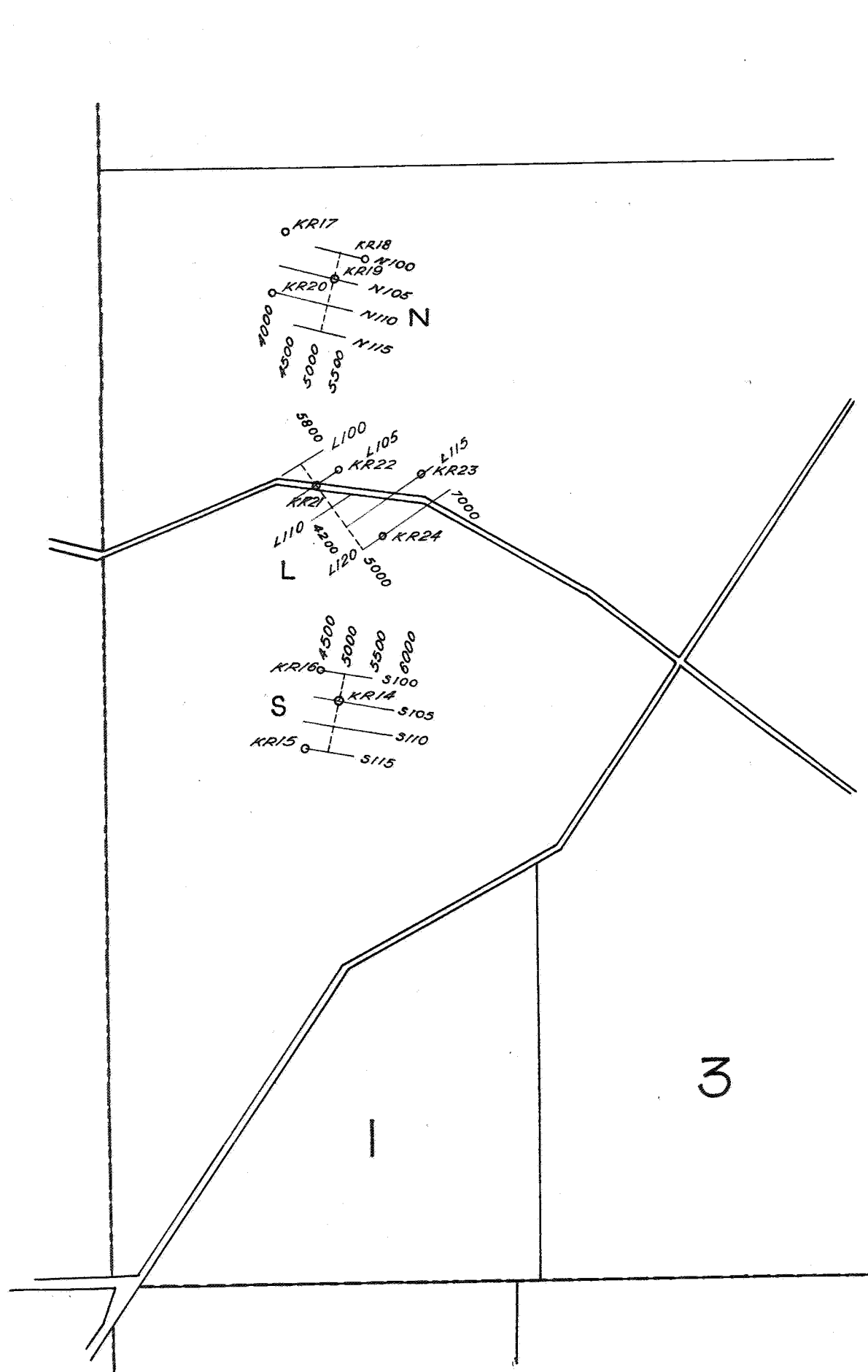


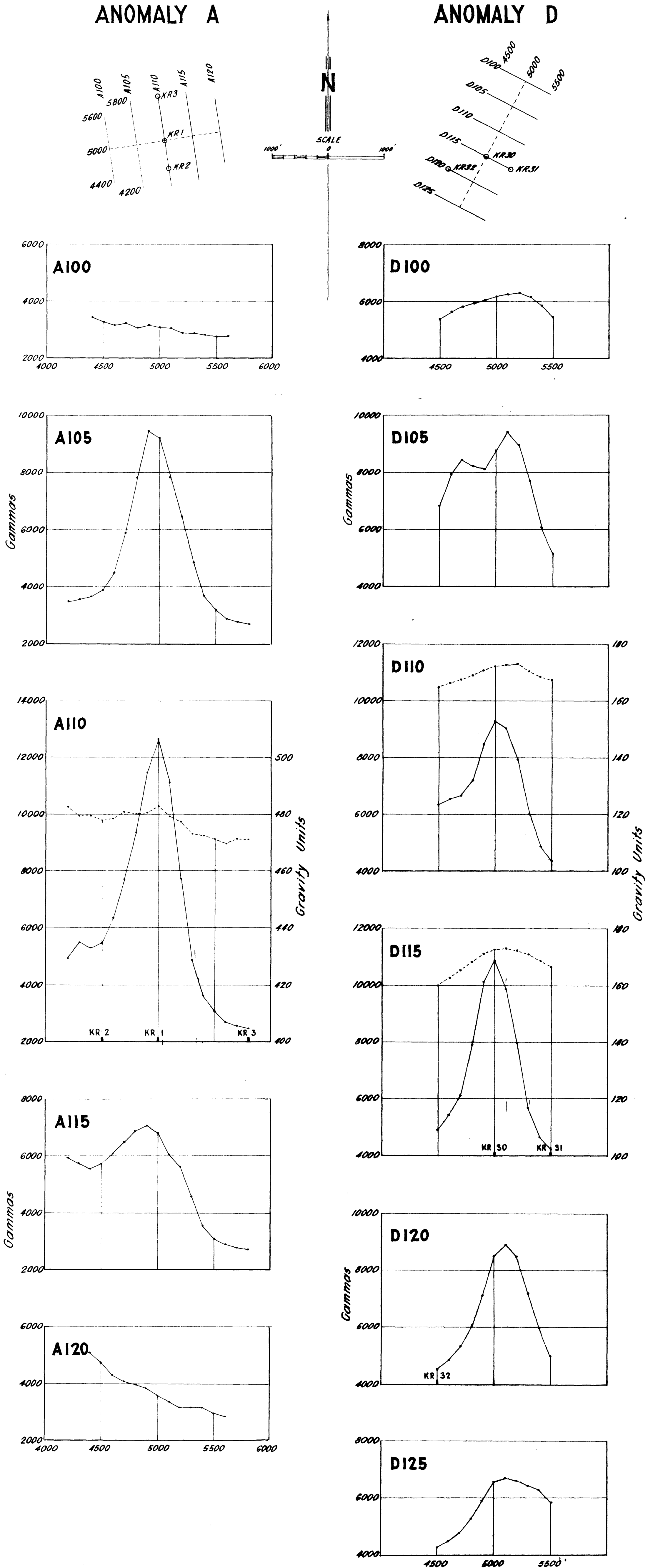
FIGURE 4

S.A. DEPARTMENT OF MINES

Approved	Passed	Drn.	KOPI AEROMAGNETIC ANOMALIES H ^D HAMBIDGE GEOPHYSICAL TRAVERSES & CONSIDERED DRILL SITES	D.M.	Scale 4.0 chns to 1"
		Tcd. <i>G.M.</i>		Req.	S 3536
		Ckd.			Dm 33
Director		Exd.			Date 14.11.63

ANOMALY A

ANOMALY D



S. A. DEPT. OF MINES
KOPI AEROMAGNETIC ANOMALIES
GRAVITY & MAGNETIC PROFILES
ANOMALIES A & D

Gravity profile
Magnetic profile (vertical field)
Considered drill hole ○ or ●
To accompany report by B.G. Risely.

ANOMALY E

ANOMALY G

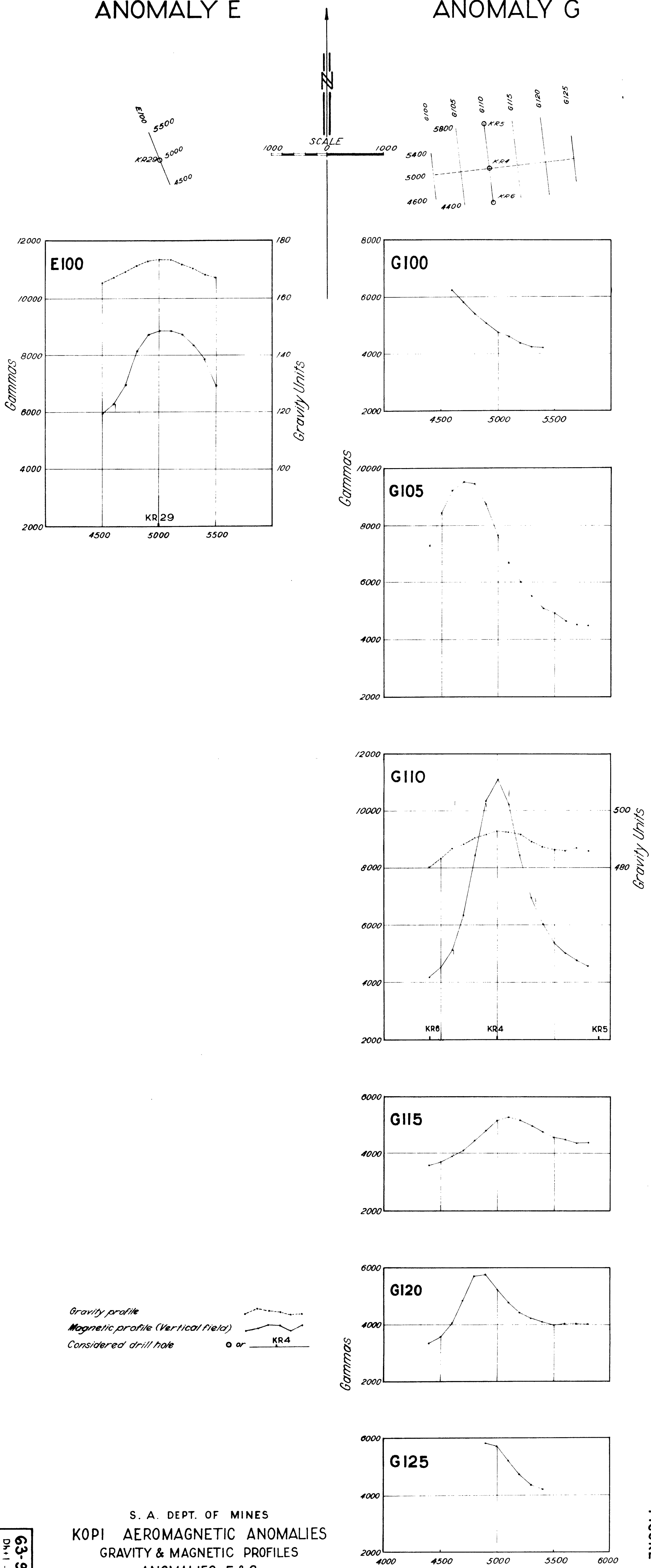
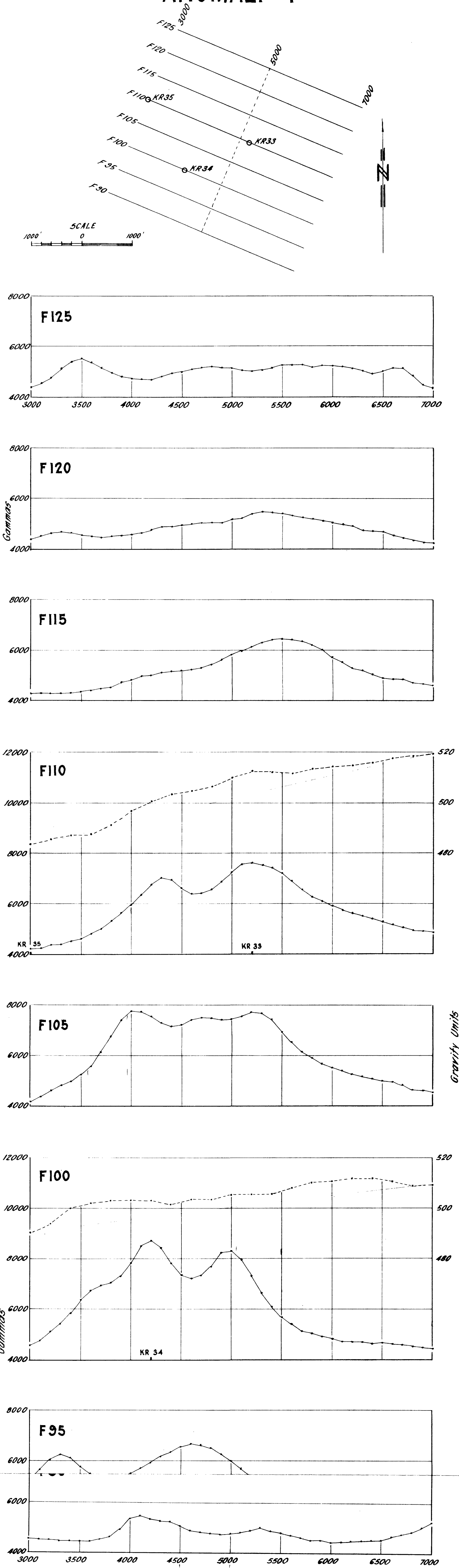


FIGURE 6

ANOMALY F



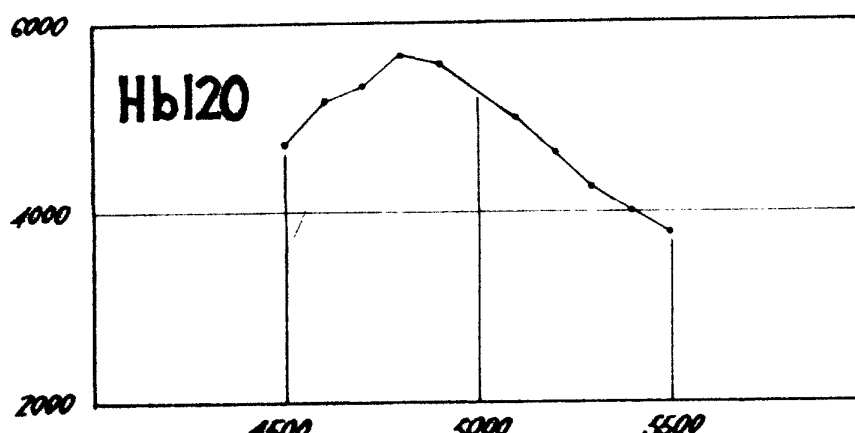
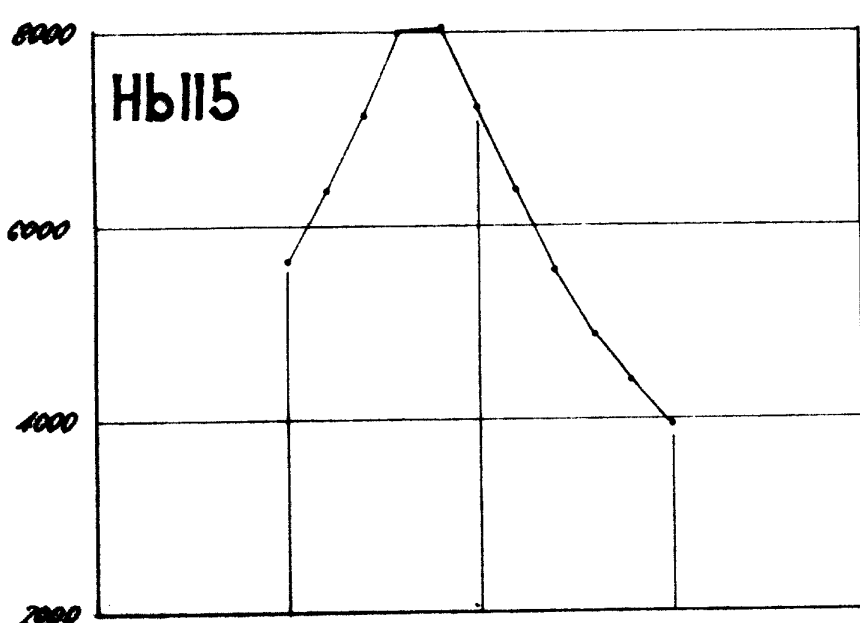
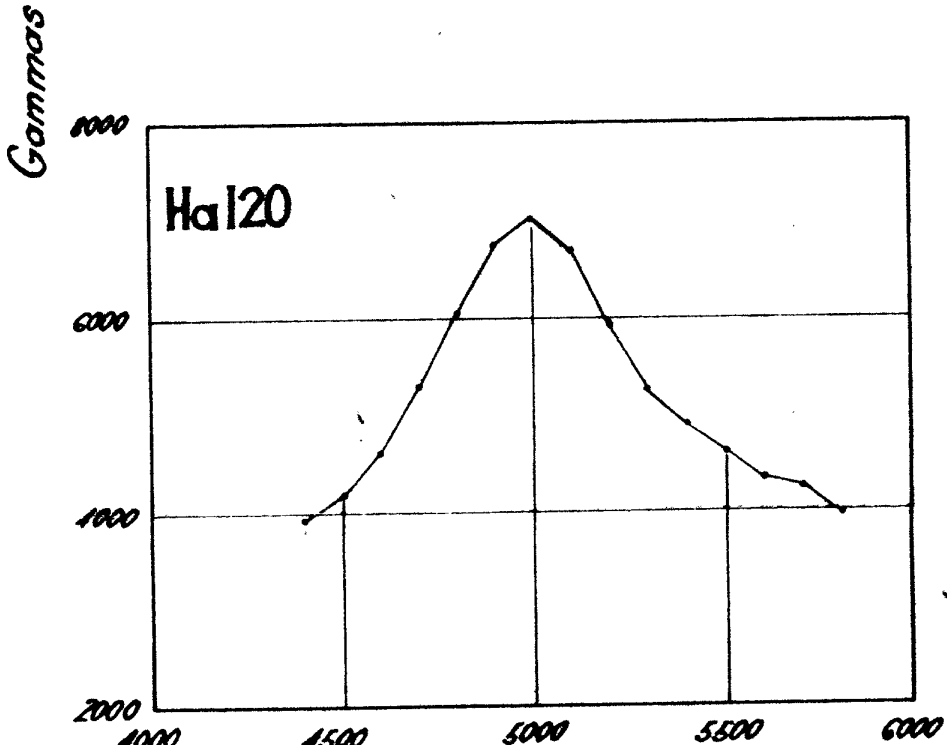
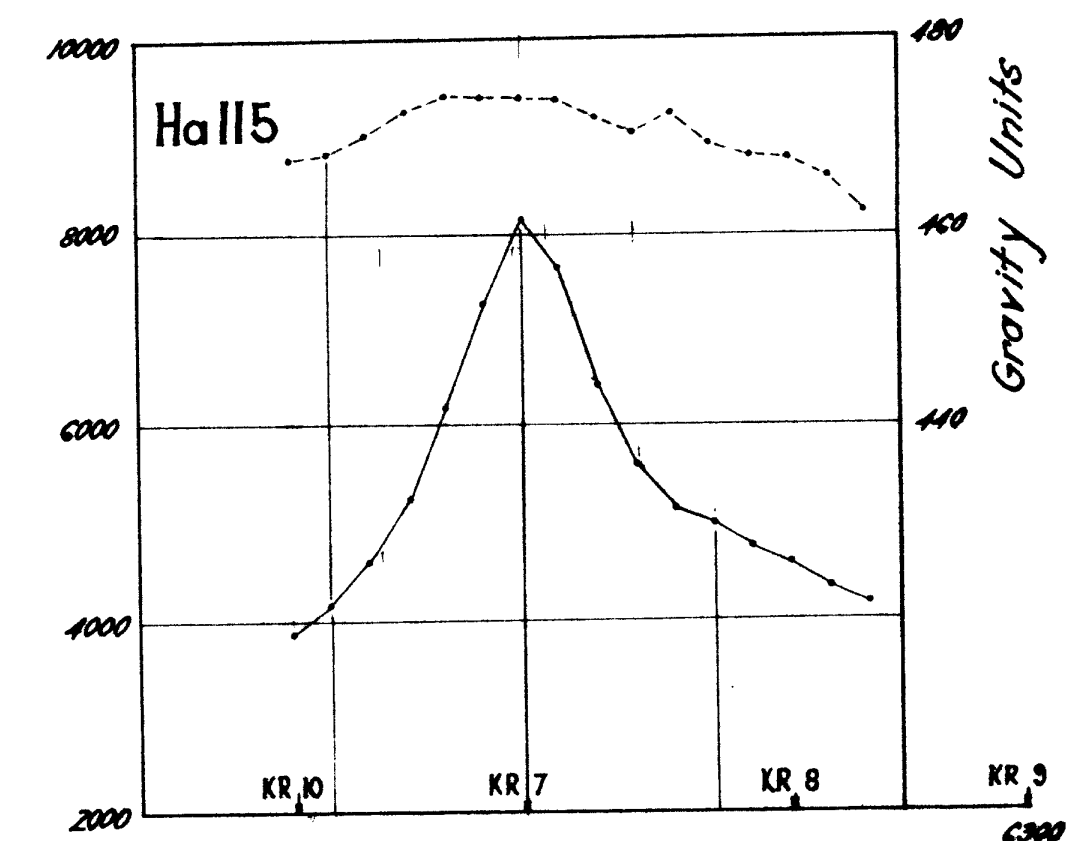
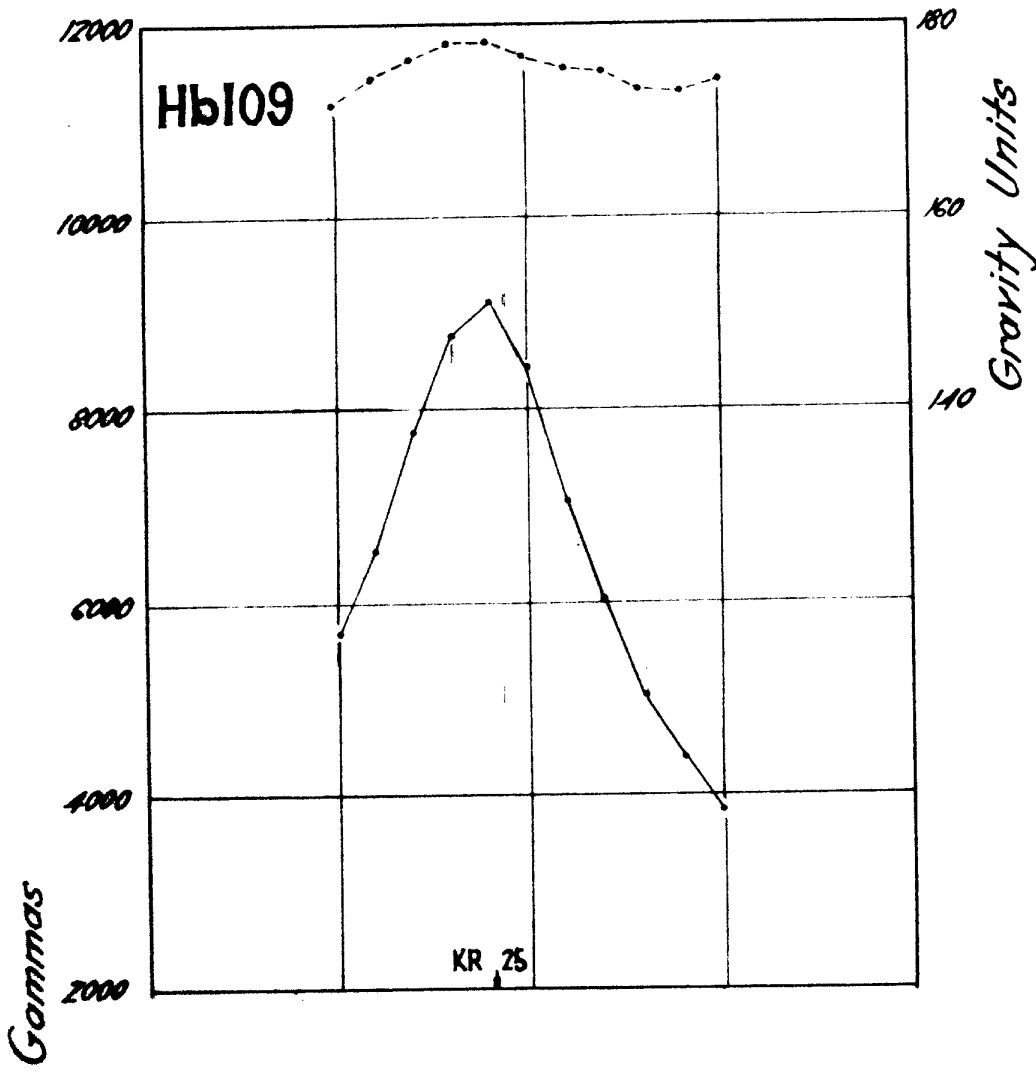
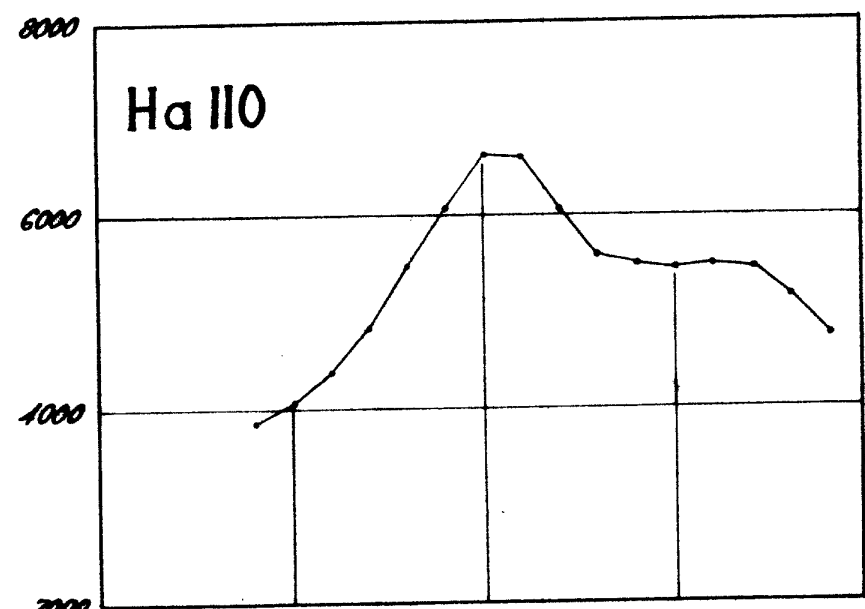
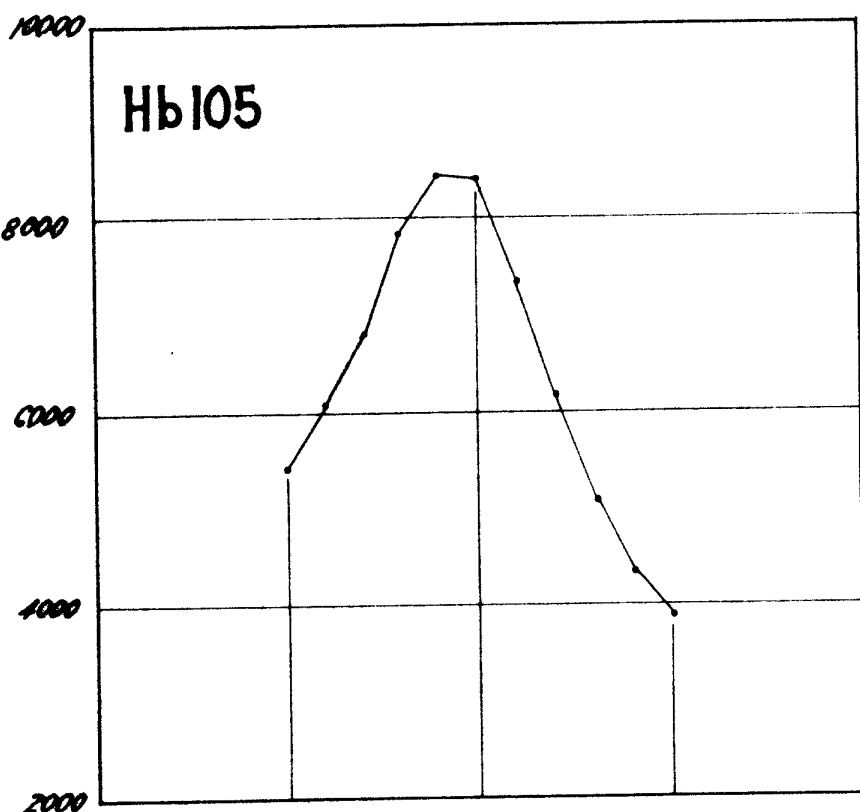
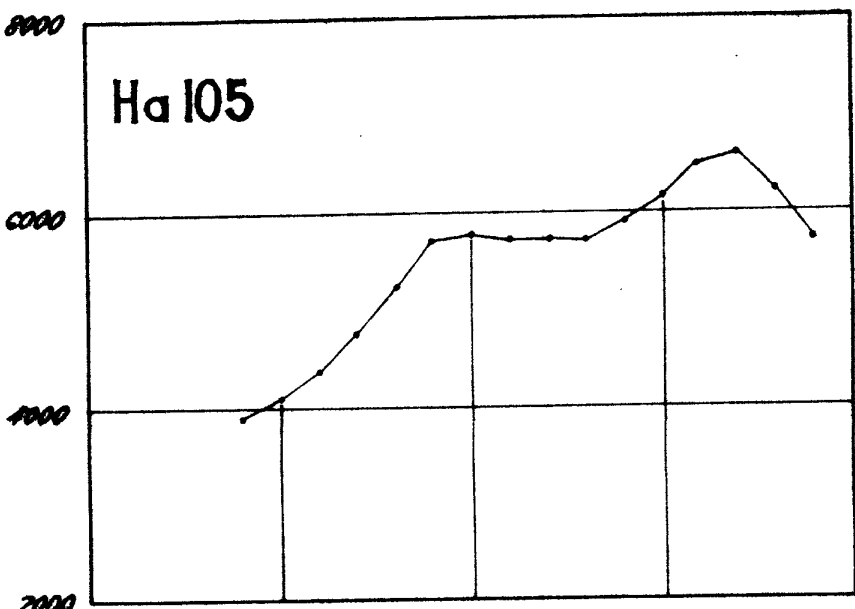
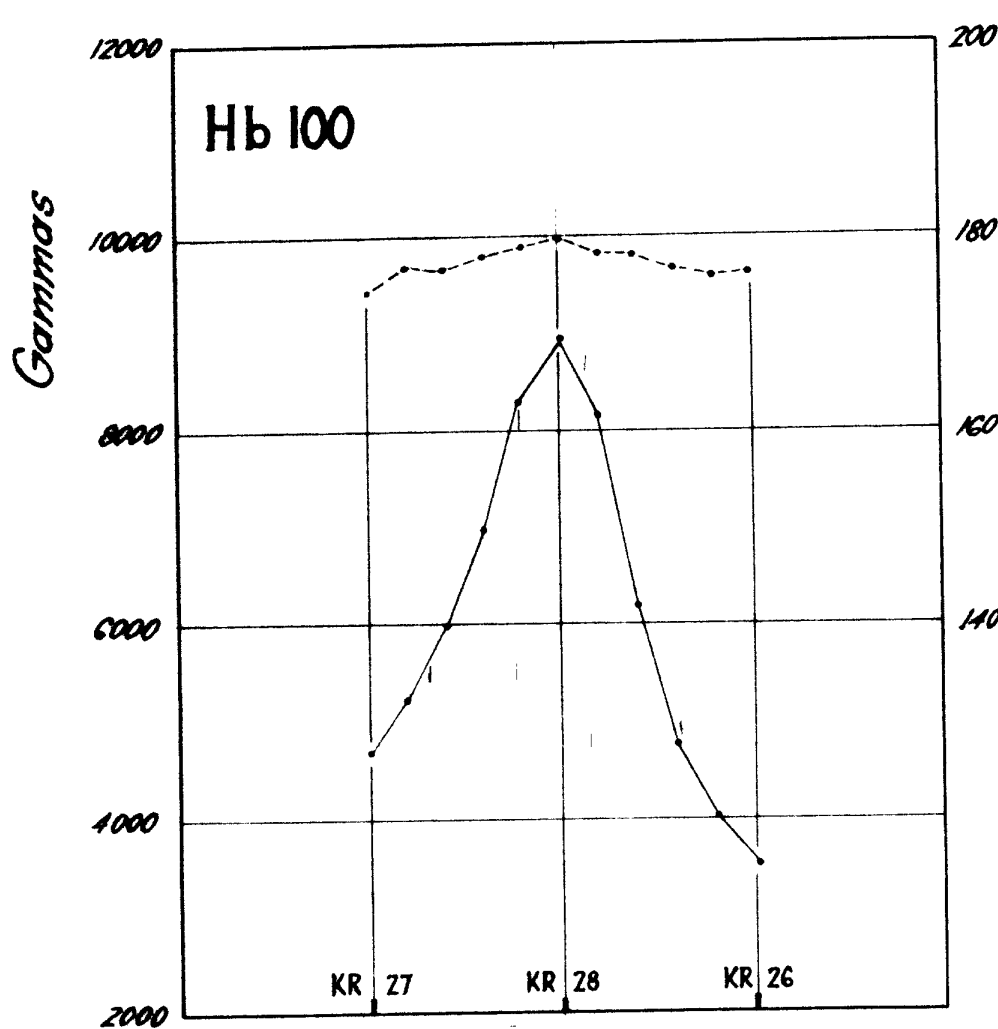
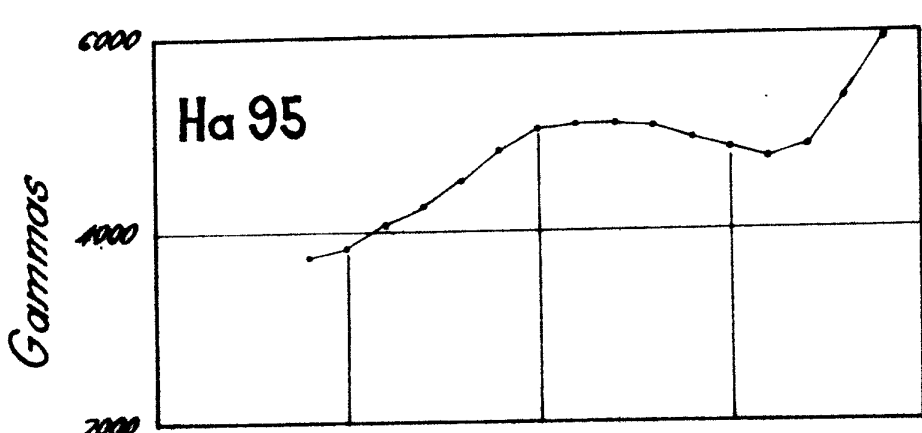
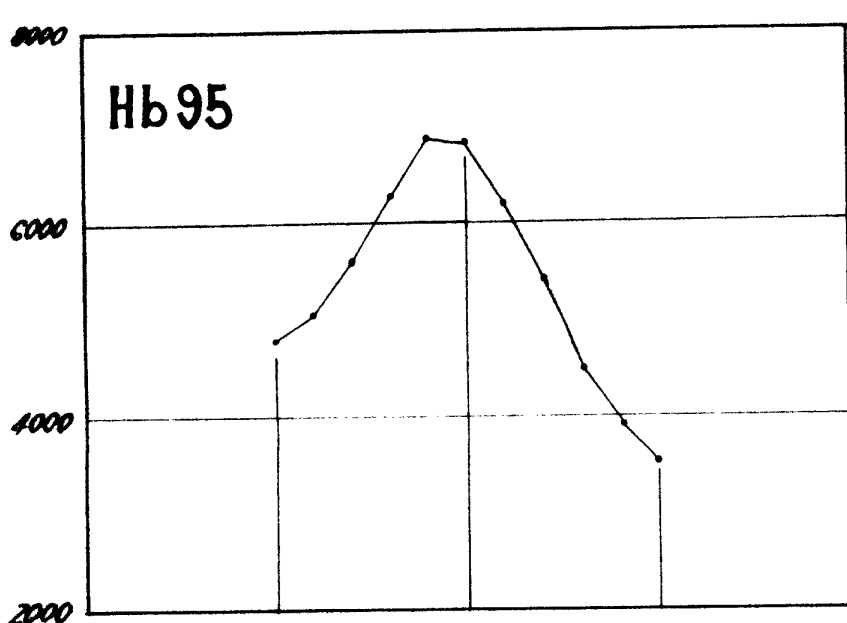
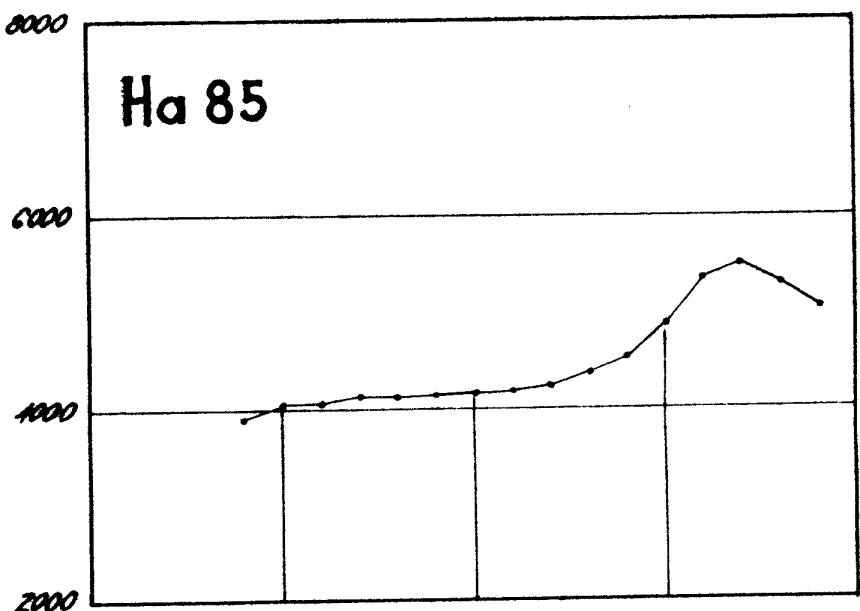
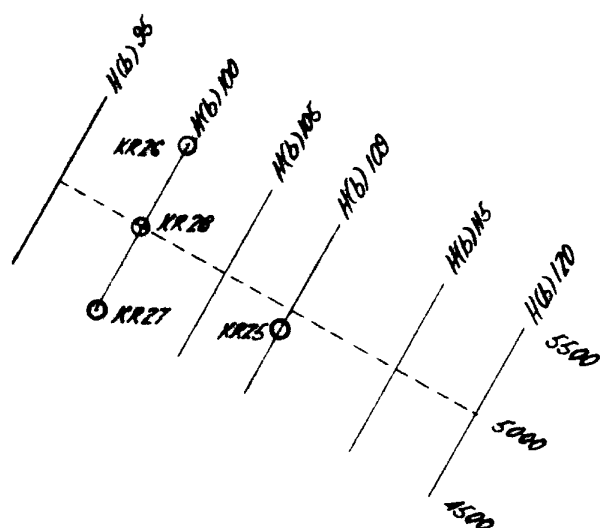
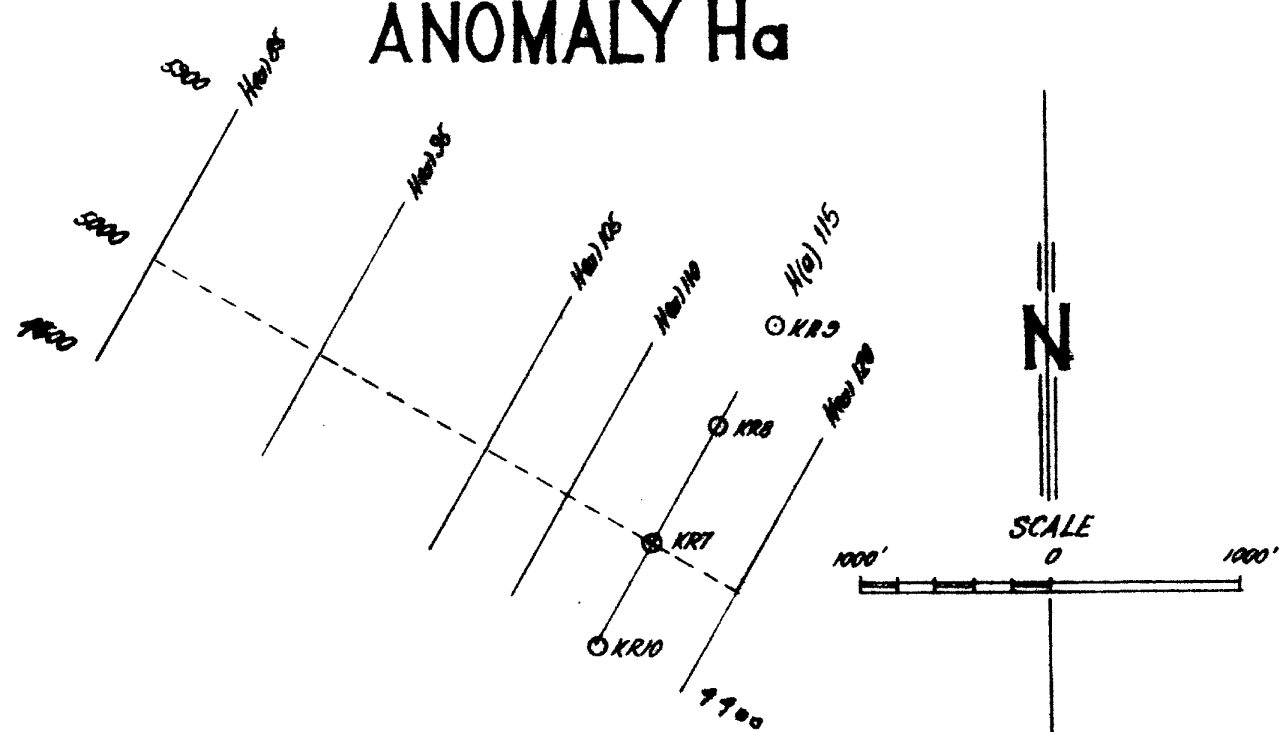
Gravity profile
Magnetic profile (vertical field)
Considered drill hole

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KOPI AEROMAGNETIC ANOMALIES
GRAVITY & MAGNETIC PROFILES
ANOMALY F

FIGURE 7

ANOMALY H_a

ANOMALY H_b

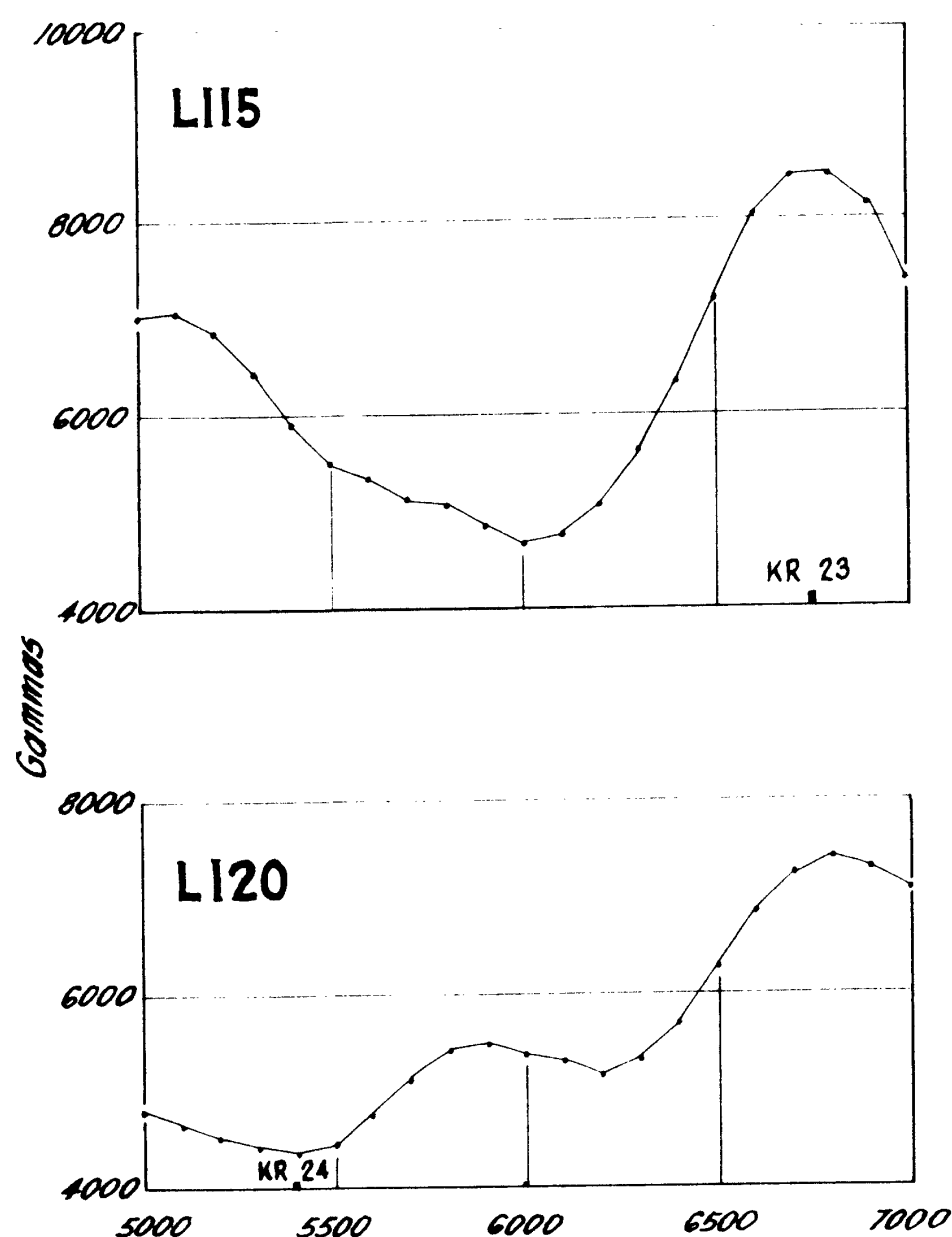
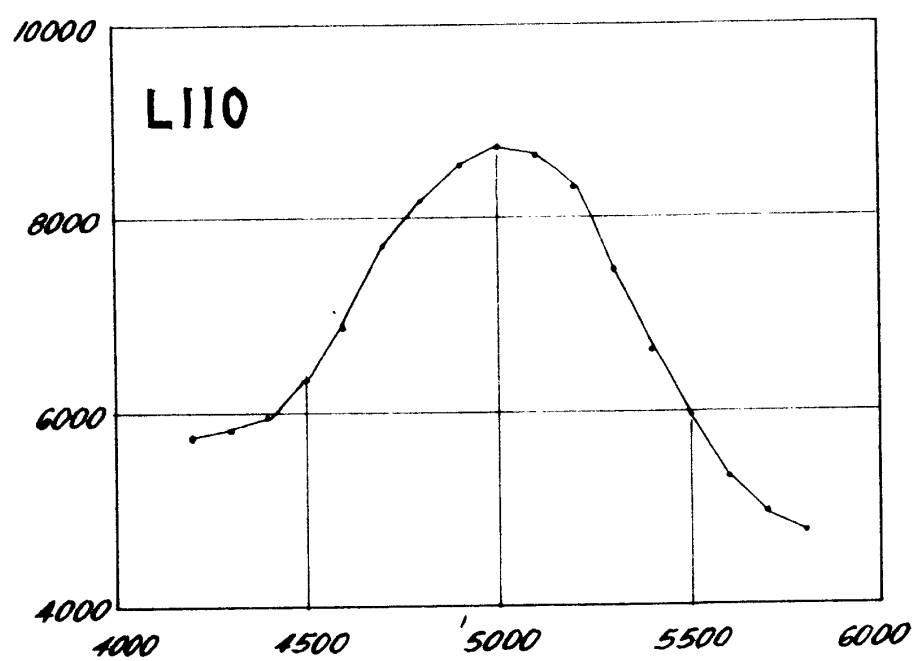
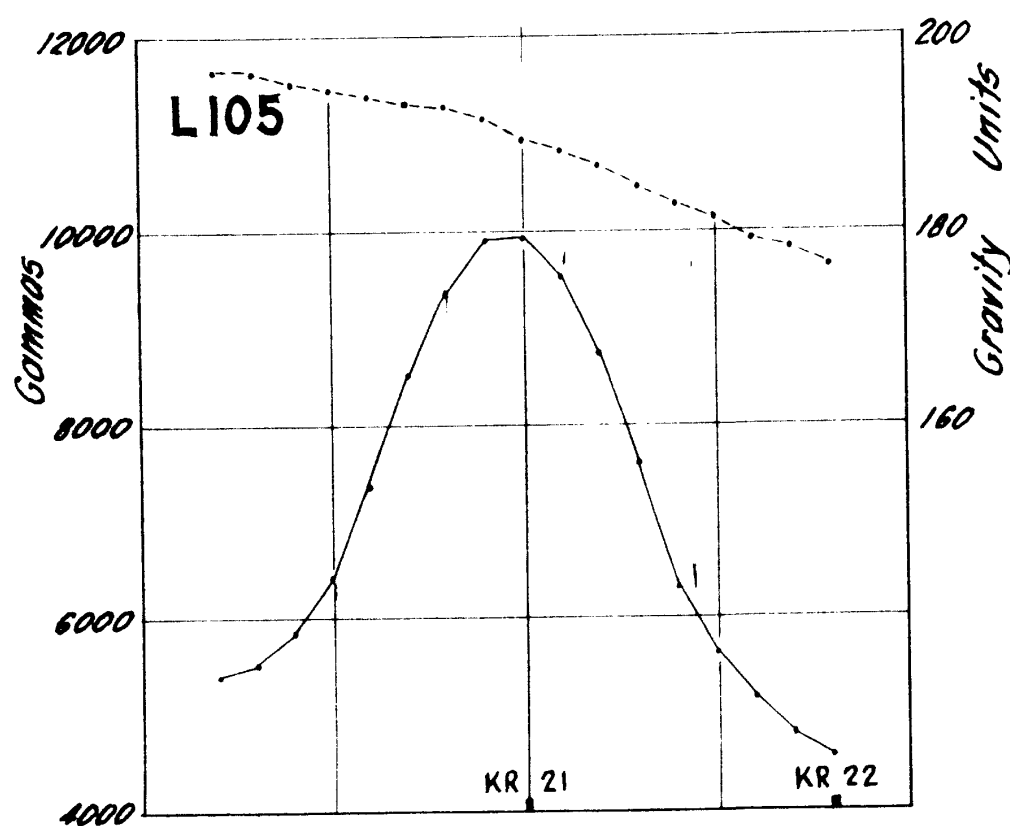
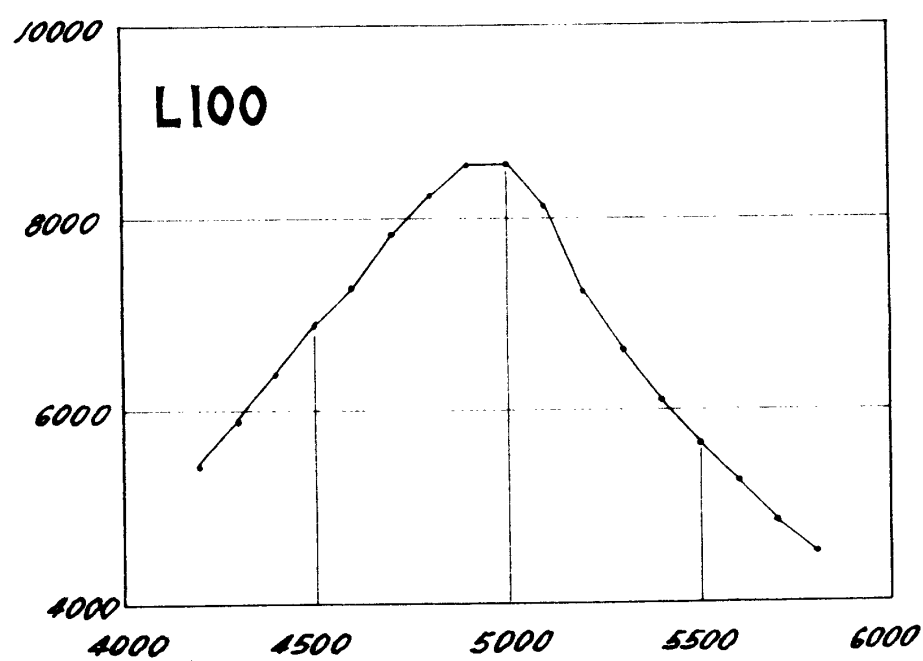
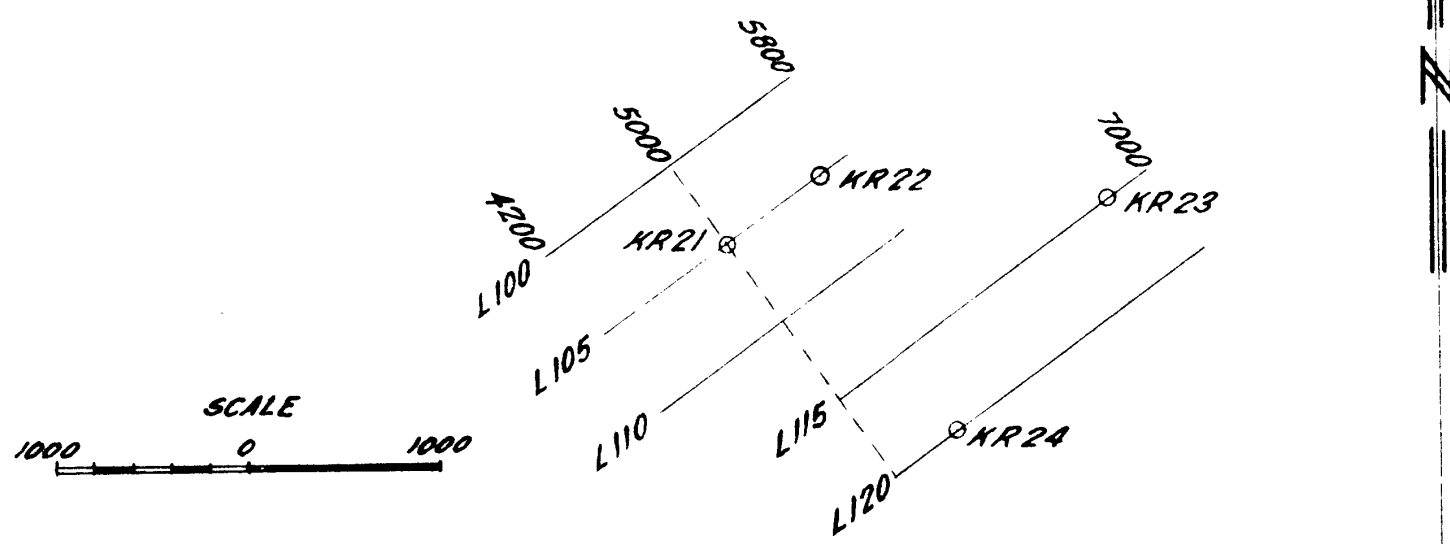


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KOPI AEROMAGNETIC ANOMALIES
GRAVITY & MAGNETIC PROFILES
ANOMALIES H_a&H_b

FIGURE 8

ANOMALY L

H^o HAMBIDGE



Gravity profile
Magnetic profile (vertical field)
Considered drill hole

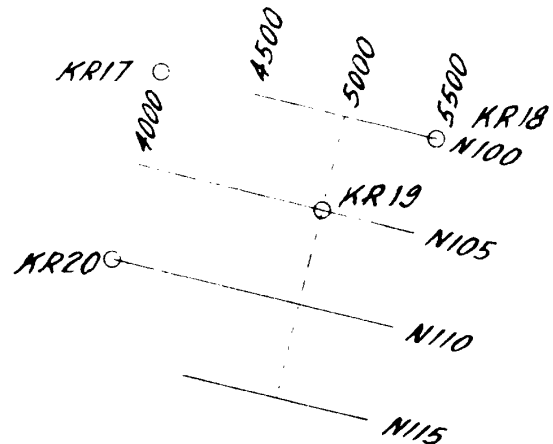
S. A. DEPT. OF MINES
KOPI AEROMAGNETIC ANOMALIES
GRAVITY & MAGNETIC PROFILES
ANOMALY L

FIGURE 9

63-950
Dm 83
Date 18-11-63

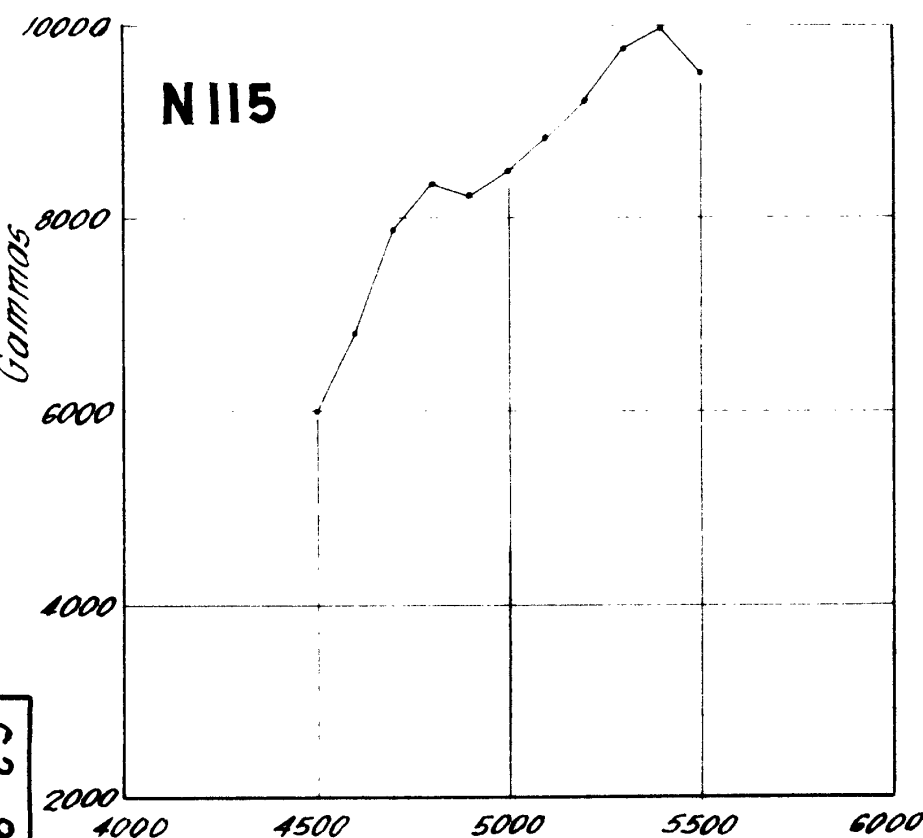
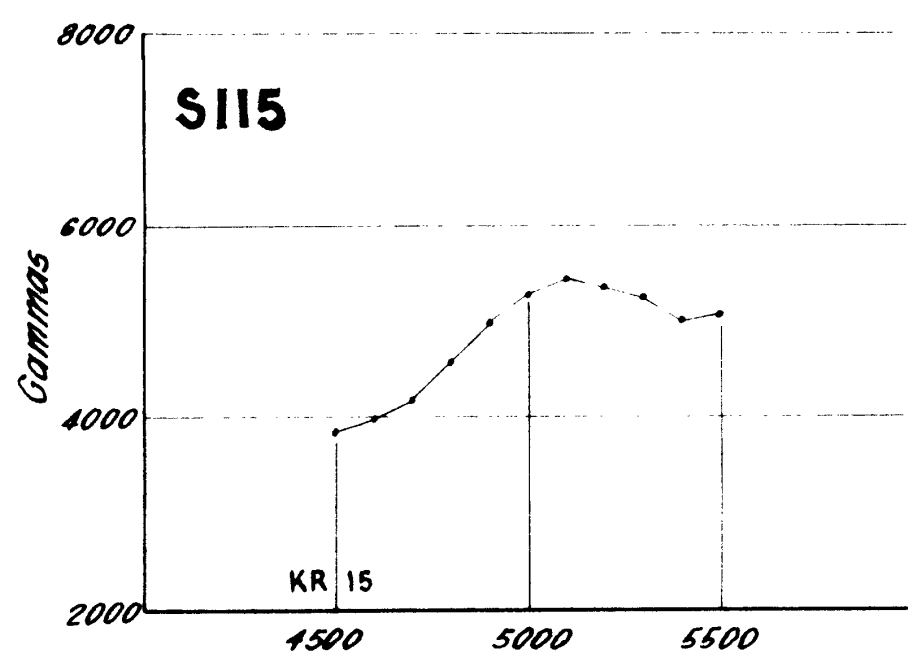
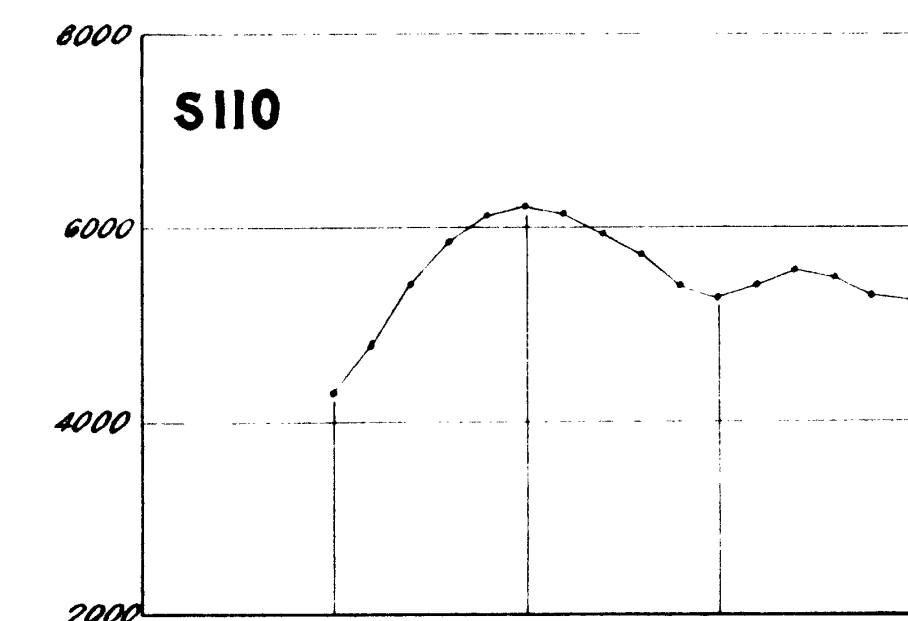
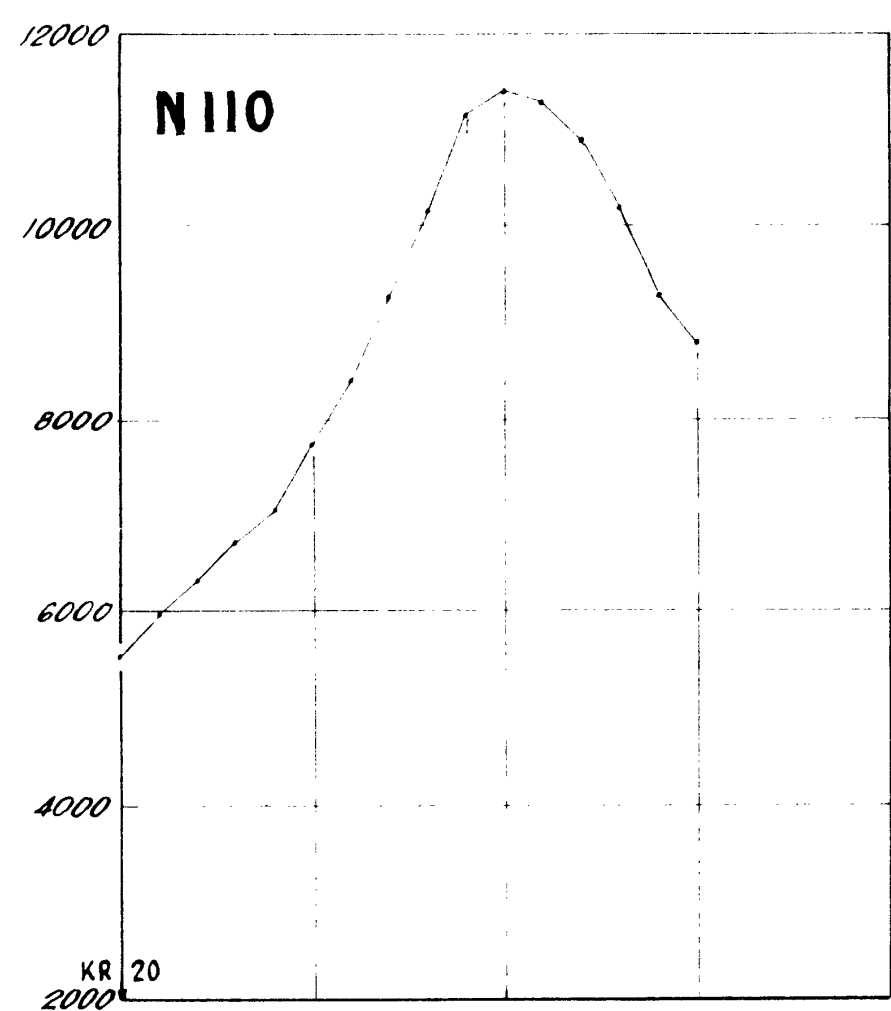
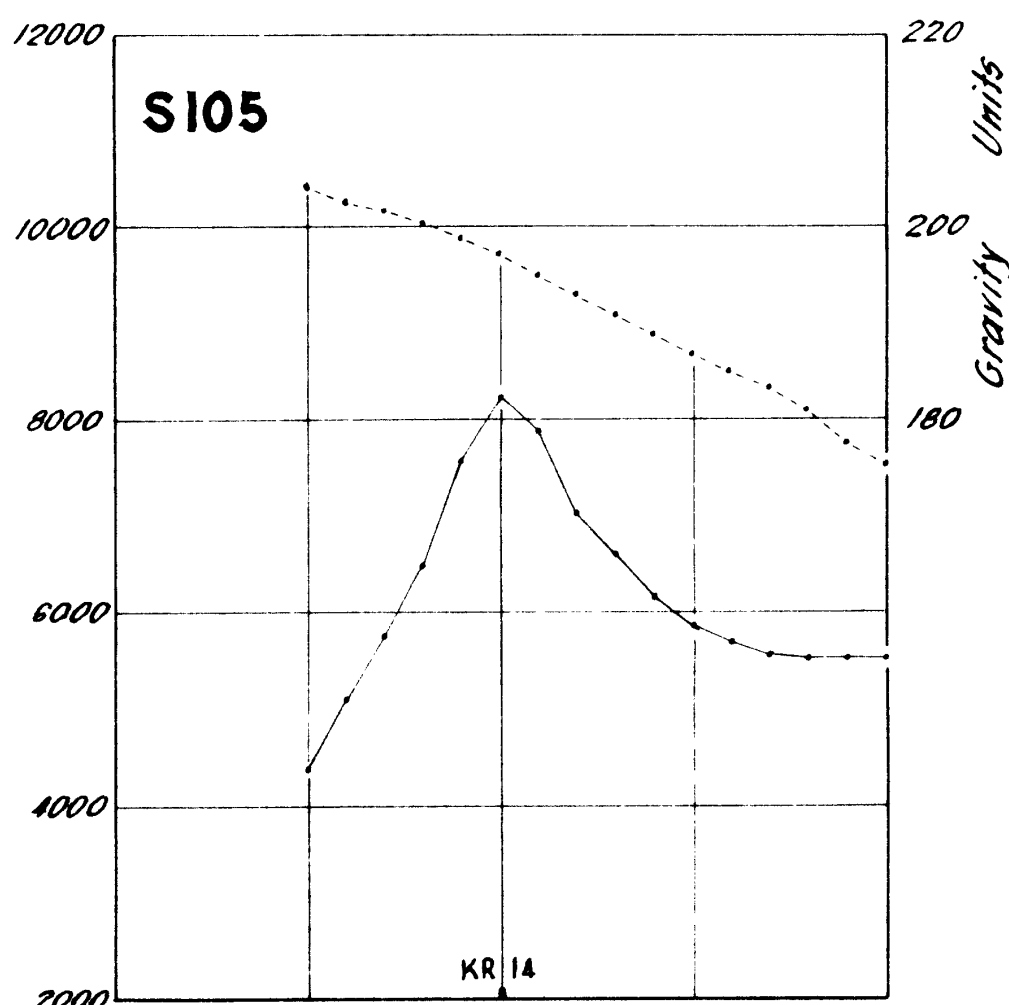
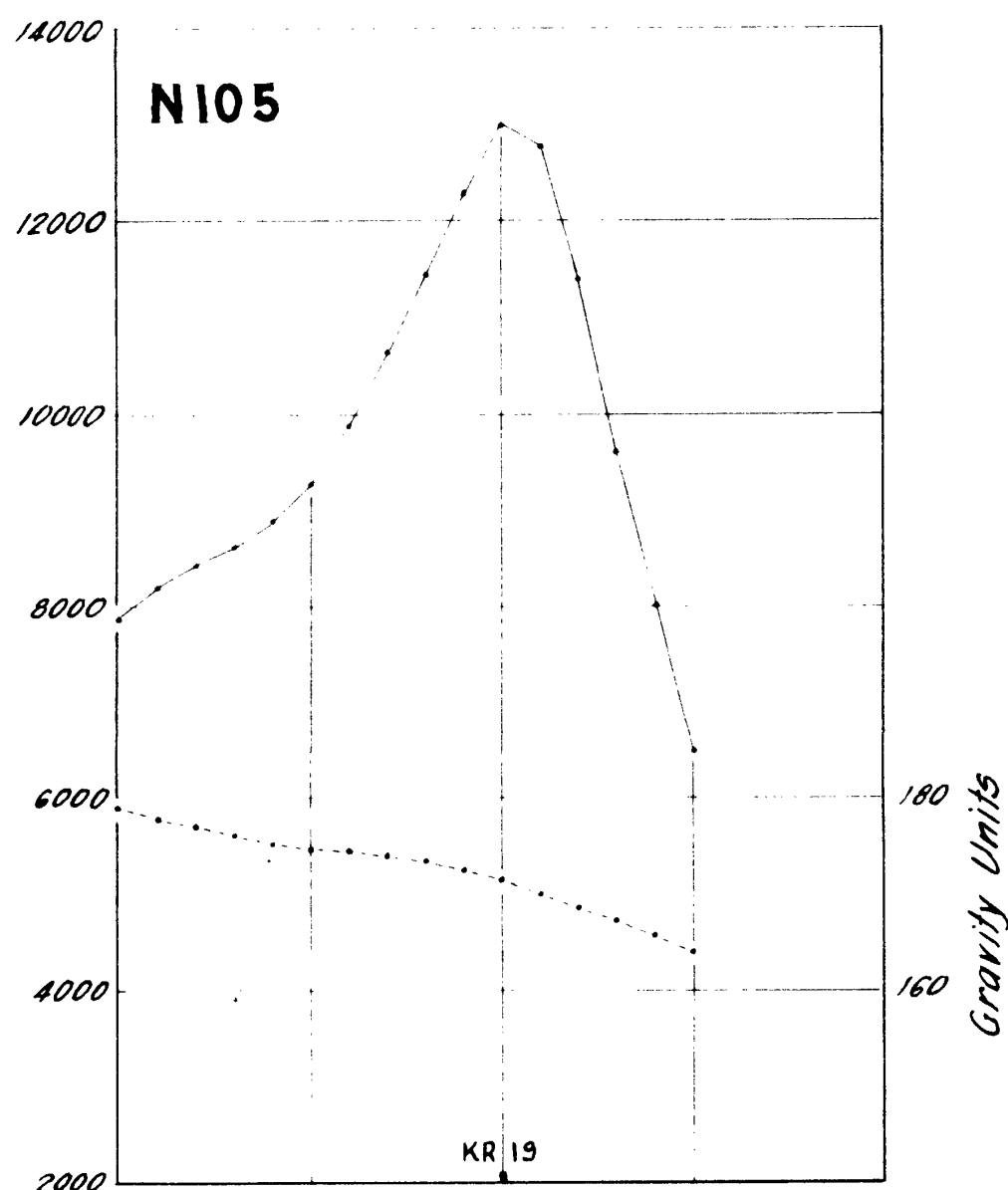
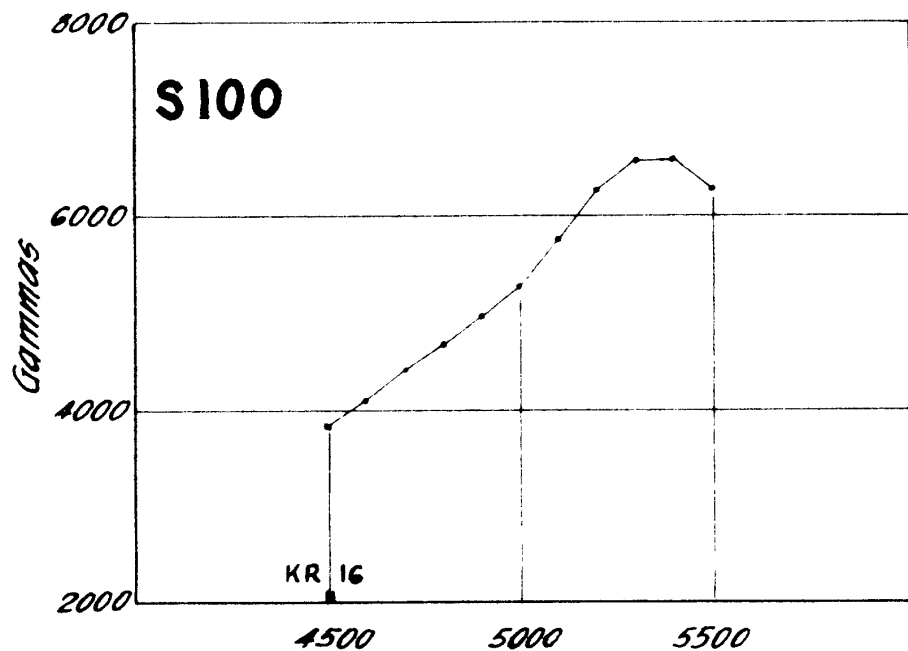
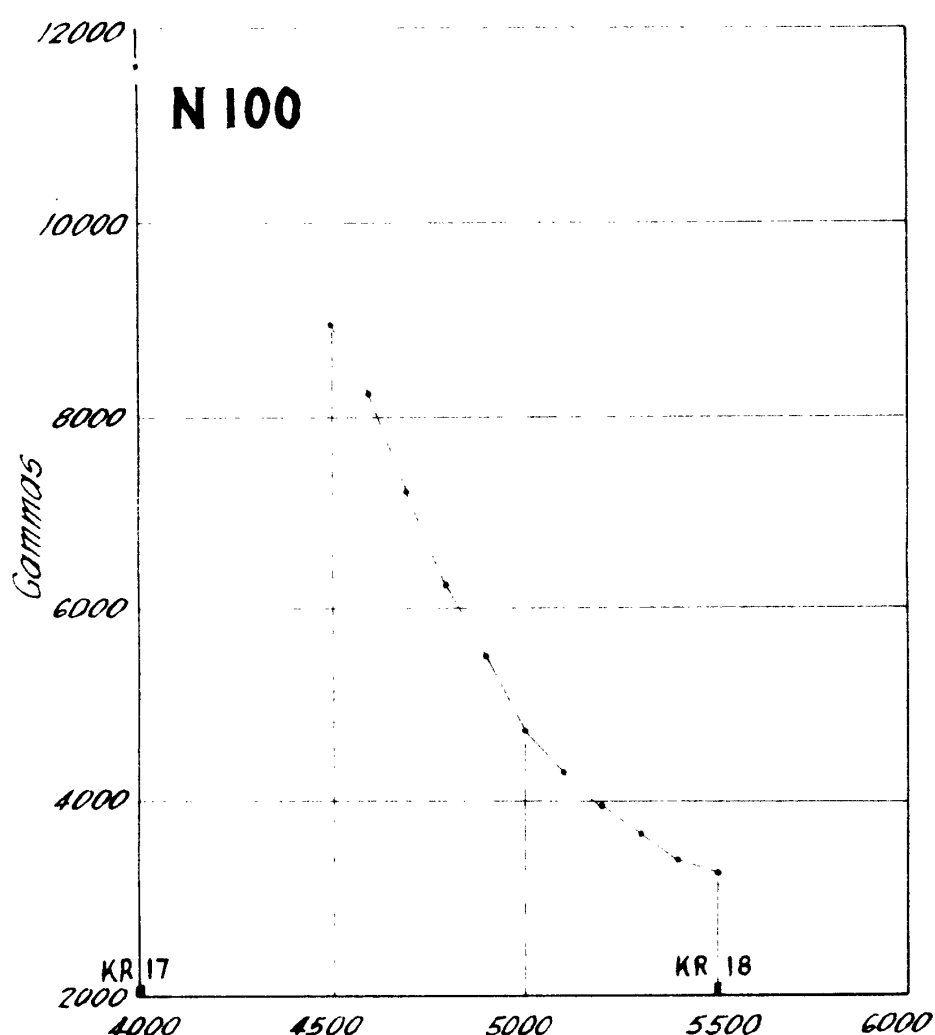
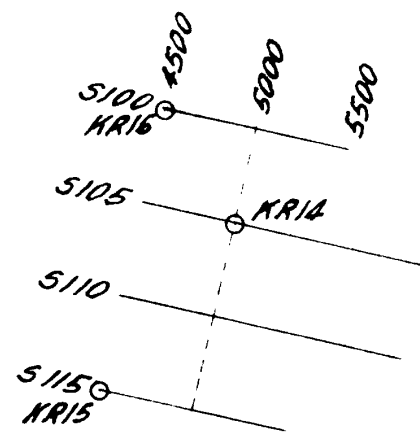
ANOMALY N

H^o HAMBIDGE



ANOMALY S

H^o HAMBIDGE



Gravity profile
Magnetic profile (vertical field)
Considered drill hole ○ or —

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GRAVITY & MAGNETIC PROFILES
ANOMALIES N & S

FIGURE 10

To accompany report by B.G. Risely.