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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1969 / 87

Tennant Creek Ground Magnetic Survey
Northern Territory 1967

by

J.E. Haigh

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SUMMARY

Ground magnetic surveys were conducted over selected aeromagnetic anomalies in the Tennant Creek mineral field. The results were interpreted using several different quantitative methods. Comparison of these methods showed the curve-fitting method of interpretation to be preferable in all cases, but proof of the validity of the interpretations must await drilling results. Twelve diamond-drill holes and six waggon-drill holes are recommended to test the anomalies.

1. INTRODUCTION

In 1966 and 1967 the Bureau of Mineral Resources (BMR) conducted detailed aeromagnetic surveys over selected areas of the Tennant Creek mineral field, as part of a programme of further investigation of promising areas delineated by its earlier high-level aeromagnetic work (Finney, 1967; Shelley & Browne-Cooper, 1967). From August to October 1967, a ground magnetic survey was made to locate and test specific anomalies detected during these airborne surveys. The present Record describes that ground magnetic survey. In addition, magnetic and gravity work were done over already existing grids in the Burnt Shirt Anomaly 4 area and the Great Western geochemical grid. The work at Great Western is described here but the Burnt Shirt area will be the subject of a separate report.

The areas surveyed are shown in Plate 28 in relation to the township of Tennant Creek. The areas where traverse layouts are shown are those in which ground magnetic work was carried out in 1967. All areas at the time were covered by government reserves. Since the completion of the survey, the size of the reserves has been reduced to cover only those areas immediately surrounding anomalies where further investigation is proposed.

The ground party consisted of one geophysicist (J. Haigh), one geophysical assistant, two field hands, and one cook; one surveyor and two chainmen were supplied under a Department of the Interior contract, by Kent & Curdie, Pitt Street, Sydney.

Two main mining companies operate in the Tennant Creek field: Australian Development N.L., operating the Nobles Nob Mine, and Peko Wallsend Ltd, operating the Peko, Juno, Orlando, Ivanhoe, and Warrego mines.

Australian Development and Geopeko Ltd, a subsidiary of Peko Wallsend, are both conducting intensive exploration programmes.

2. GEOLOGY

The geology of the Tennant Creek field has been described by Ivanac (1954), Crohn & Oldershaw (1964), Crohn (1963), and Dunnett and Harding (1965). Comprehensive summaries are given by Finney (1967) and Shelley and Browne-Cooper (1967).

The area contains Lower Proterozoic greywackes and shales of the Warramunga Group, intruded by quartz-feldspar porphyry and containing lodes of ironstone. These lodes consist of quartz-magnetite, which is usually oxidised to quartz-haematite above the water-table. The origin of the ironstone lodes is not entirely clear. However, it is obvious that in most cases the mineralisation has been controlled by favourable beds and by shear zones. Economic concentrations of gold, bismuth, and copper are often associated with the ironstones, and the purpose of the geophysical survey was to locate suspected ironstone bodies for testing by diamond-drilling.

Six major mines operate around Tennant Creek. The major gold producers are Nobles Nob and Juno, while Peko, Orlando, Ivanhoe, and Warrego are predominantly copper producers. Mining depth is shallow: the deepest level at present is 1200 feet, in the Peko Mine.

3. PREVIOUS GEOPHYSICAL SURVEYS

The discovery of at least three economic gold or copper mines (Orlando, Ivanhoe, and Warrego) may be directly attributed to the success of the magnetic method in the Tennant Creek field. The first major investigation of the area was carried out in 1935-1937 during the Aerial, Geological and Geophysical Survey of Northern Australia, (AGGSNA). The magnetic results obtained have been discussed in detail by Daly (1957). Since that time a large number of geophysical investigations, using almost every known geophysical method, have been carried out by the Commonwealth Government and by private companies.

Perhaps the most significant contribution was the high-level aeromagnetic and scintillometer survey of the whole of the Tennant Creek sheet, by the Bureau of Mineral Resources in 1956-1960. The results are extensively used, and most subsequent geophysical investigations have been based on anomalies delineated by this survey.

Within the areas relevant to the present survey (Plate 28), only Area 2 (Finney, 1967), Area C11, and Great Western have been the subject of previous ground surveys. Portions of Area 2 were covered during the AGGSNA (see Plate 28), and the western portion was gridded by Geopeko Ltd on mining leases taken out prior to the application of Government reserves. The central portion of the Great Western grid was covered by AGGSNA. The eastern portion (Shelley's anomaly C13) of area C11 was gridded and drilled by Geopeko Ltd; barren ironstone was encountered, and the lease was later abandoned.

4. GEOPHYSICAL METHODS

It was intended that measurements of the vertical magnetic intensity should be taken in all areas, and that horizontal intensity measurements should be made on the central traverses of each anomaly. For reasons described later, measurements of horizontal intensity could not be made. Gravity readings were taken in two areas to give a comparison of the magnetic and gravity methods.

For measurement of the vertical magnetic intensity, Sharpe MF1 and McPhar M700 vertical fluxgate magnetometers were used. Both instruments were satisfactory for the purpose, although the McPhar tended to have a lower drift than the Sharpe meter, and was therefore preferable. In the McPhar meter, warm-up drifts up to 150 gammas occurred within the first half hour, but after this period they were typically less than 10 gammas per hour and were often zero. By contrast, the Sharpe meter had warm-up drifts up to 200 gammas and typical drifts of 20-30 gammas per hour.

A disconcerting difference between the two instruments was their opposite reading polarity: where the Sharpe meter registered a positive anomaly, the McPhar meter registered a negative one. The problem arose because the Sharpe meter has a removable polarity card which may be set for the southern hemisphere so that increasing intensity was recorded as a positive anomaly. The McPhar meter on the other hand has fixed scales, and anomalies of increasing intensity in the southern hemisphere will always be negative (the absolute vertical field in the southern hemisphere is negative). Both systems have advantages and disadvantages: readings from the Sharpe meter may be directly plotted to give a profile of conventional appearance; the McPhar meter has the advantage of absolute settings, but the readings must be plotted negative upwards. The Sharpe system is perhaps slightly more convenient in the field, but the McPhar system is to be recommended because it gives readings of the correct absolute polarity. The inconvenience of plotting negative upwards is slight.

The aeromagnetic anomalies were located on the ground by scaling from the maps and aerial photographs. In some areas this was far from simple. In Areas A1 and A2, the only reference point was a trig. station almost five miles away, and a chain and compass traverse had to be cut through heavy undergrowth from this station. To locate anomaly C5 a traverse 6000 feet long had to be cut through extremely heavy undergrowth from a road to the south. Once in the general area of the anomaly, traverses 400 feet apart were read at 100-foot intervals until the centre of the anomaly was located. It was often found that one of the initial traverses was sufficiently near the centre to serve for interpretation, but if necessary a central traverse was read, reducing the station interval where necessary over high gradients.

As already mentioned, it was intended to take measurements of the horizontal intensity over the central traverse of each anomaly. A Watts horizontal variometer (No. 61911) was tested, but proved to be unsatisfactory. Initially the latitude adjustment had to be changed, and this also altered the temperature coefficient by an unknown amount. However the most serious fault was erratic jumps of several hundred gammas in the readings, presumably due to chips on the knife edges. Towards the end of the survey a horizontal head attachment for the McPhar magnetometer was received and tested. Initially it had to be returned to the makers for removal of steel components from the mounting tripod. Upon its return to the field party with an additional horizontal head it was found that both heads had random levelling errors up to 300 gammas. The equipment was again returned to the makers, and the horizontal intensity measurements were abandoned.

Gravity readings were taken on two traverses in Area 3 and two in Area C11 for comparison with the magnetic results. A Worden gravity meter (No. 260) with a scale value of 0.10909 mgal/div was used, and readings were taken every 100 feet. Because no elevation datum was available near the traverses, only relative levels were obtained.

5. COMPUTATION AND INTERPRETATION PROCEDURES

Magnetic method

Drift corrections were applied to all readings in steps of 5 gammas, which is equal to the maximum reading accuracy of the instruments. The results were plotted as profiles and hand smoothed. In areas where sufficiently close traverses were available the results were also contoured. Two main quantitative methods of interpretation were applied to the results: calculations based on the values of certain discrete points, and comparison of the whole profile with theoretically derived standard curves. In general the latter method will be the more reliable, or will at least give a better idea of the reliability of the method.

Of the discrete point methods, the half width (Dobrin 1952, p.311), half maximum slope (Peters, 1949), and sphere (Daly, 1957) interpretations were applied. The field profiles were compared with standard curves for infinite dykes (Gay, 1963), finite dykes (Haigh & Smith, in prep.), and spheres (Haigh, 1969). The two methods based on the assumption of a spherical body (Daly, 1957; Haigh 1969) apply the same basic theory, and should give identical results. However, this is not always so, and the curve-fitting method has been given preference because of its better reliability.

The biggest single problem in magnetic interpretation is that only rarely are the anomalies simple ones due to a single body in a uniform background field. More often the effect of a magnetic body is superimposed upon the effects of adjacent bodies, changes in the depth to basement, and variations in the properties of the host rock. Thus even with the best interpretation techniques there will rarely be a unique solution. In general, the location of, and depth to, the body are the most important unknowns; knowledge of the dip, shape and susceptibility of the body is desirable but not necessary, particularly in view of the uncertainties that must always apply to such determinations.

An estimate of the size of the body may be made if the effective susceptibility is known. Daly (1957) has discussed the likely values of the effective susceptibility K^1 for ironstone bodies in the Tennant Creek field. He concludes that the upper limit for K^1 is 0.8 c.g.s. units, and that a reasonable mean value is 0.1 c.g.s. units. There is no obvious lower limit, because this will depend on the degree of dissemination and oxidation of the magnetite. Anomalies can also be produced by basic igneous rock and by variations in the susceptibility of sedimentary and metamorphic rocks.

By assuming various values (e.g. 0.5, 0.1, 10^{-3}) for the effective susceptibility, it is possible to obtain maximum and minimum probable values for the size of the body.

Gravity method

Gravity results were corrected for instrument drift, and the relative Bouguer anomalies for eleven densities from 1.90 to 2.90 g/cm^3 were calculated and plotted. The profiles were inspected for obvious elevation effects as a guide to the density value that should be used for Bouguer corrections. Because the relief along the traverse was low, there was no obvious effect, and a background density of 2.60 g/cm^3 was chosen. In all profiles there is a strong pseudo-regional gradient to the north. This was removed and the residual anomalies were interpreted by the numerical methods of Dobrin (1952, p. 22).

6. DISCUSSION OF RESULTS

Area 2

This area was flown in 1966 (Finney, 1967) and several anomalies were delineated as suitable for further investigation. However, the most promising anomalies were in the western half of the area and at the time of the 1967 ground survey they had already been investigated by Geopeko Ltd. A large grid in the central part of the area (Area 2C, Plate 28) was surveyed and several small anomalies were delineated. Because the area was generally disturbed, the large grid was necessary to be certain that the anomalies detected were actually those sought. It was difficult to apply quantitative interpretation to any of the field profiles. Profile AA' was constructed from the field contours (Plate 1) and quantitative interpretation was attempted (Plate 2). Poor reliability was obtained in all cases. The results are shown in Table 1. If the anomaly is due to an ironstone body, it would have a probable radius of 150 feet ($K^1 = 0.1$). Although a drill hole is specified in Table 1, further investigation of this anomaly is not recommended at present, because of its relatively large depth.

Area 3

This area was recommended by Finney (1967) for further investigation. It is a flat alluvial plain with moderate to heavy scrub cover. A traverse plan and contour map of the magnetic results are shown in Plate 3. The anomaly is interpreted as due to a faulted dyke striking NW. The anomaly separates naturally into two parts, and profiles 4800W and 6400W are shown in Plates 4 and 5. Over the whole length of both profiles, there is a consistent regional gradient to the north of about 30 gammas per 1000 feet. This gradient was extracted from the field readings before quantitative interpretations were attempted. The results of interpretation from these two traverses are shown in Table 1. The anomaly on Traverse 6400W fits reasonably well to the theoretical curve for a sphere, and the radius may be calculated by assuming a value for the effective susceptibility. Taking the reasonable limits as 10^{-1} and 10^{-3} c.g.s. units (Daly 1957, pp.10-12) the range of the radius of the body is 80-140 feet.

Gravity profiles for Traverses 5000W and 6600W are shown in Plates 6 and 7. Bouguer anomaly profiles for a density of 2.6 g/cm^3 and Bouguer anomaly profiles corrected for regional gradient are shown.

Traverse 6600W has an anomaly of 0.5 milligals centred on 4000N. The gravity effect of a sphere at a depth of 400 feet, as interpreted from the magnetic results, was calculated taking density contrast limits of 1.0 and 3.0 g/cm^3. The limits of the radius thus calculated are 210 and 120 feet.

The agreement between the gravity and magnetic interpretations is reasonable considering the inherent inaccuracies, and the radius of the sphere is expected to be in the range 100-200 feet.

The gravity anomaly on Traverse 5000W is much broader and extends over most of the length of the traverse. This probably reflects both sections of the faulted body, and no quantitative interpretations were attempted.

Area 4

Plates 27, 8, and 9 show the traverse plan of Area 4. Profiles of the central traverses from each of the main anomalies are shown in Plates 10 to 14, together with interpretation curves. The anomaly on Traverse 800E at 4000N (Plate 12) does not fit even approximately any of the standard curves. It seems likely that this anomaly is due to a thick tabular body. Strangway (1965) has produced anomalies of similar shape from such bodies. No further quantitative interpretation was attempted. The results from the interpretations are compared in Table 1. It seems probable that all the anomalies in Area 4 are due to similar types of bodies. Although Table 1 shows recommendations for drilling most anomalies, it is obvious that initial testing should be confined to one anomaly. When the economic significance of this first body has been determined, the remaining drilling recommendations would be treated accordingly.

Area 5

Anomaly C5 (Shelley & Browne-Cooper, 1967) is a very broad anomaly near the centre of Area C. It is distant from recognisable landmarks, the nearest one being a road about one mile to the south (Plate 15). A track shown on the map to the east of the anomaly proved impossible to find. The area is one of extremely heavy undergrowth, and a long traverse was cut from the road to the approximate position of the anomaly. Its centre was then located by four traverses. Magnetic profiles of Traverse 2000W and Traverse 4000N are shown in Plate 16.

The anomaly is very broad and of low amplitude. Because the aeromagnetic contours are almost circular it was assumed that the anomaly was due to a deeply buried spherical body. If this is so, then the depth to the centre of such a sphere is approximately 2000 feet. However, the centre of the anomaly is just to the east of a north-striking quartzitic ridge, which extends almost exactly the length of the anomaly. It is possible that the anomaly is associated with this ridge, but to test such a hypothesis, east-west traverses would be required, and the single east-west traverse was not long enough to allow reliable interpretation. The source of the anomaly must be relatively deep, and there are many promising sites for investigation of shallow space bodies, but the anomaly could warrant future investigation as a large deep-seated body.

Areas C6, C7, C8

Areas C6, C7, and C8 comprise an interconnected grid in the vicinity of the Jubilee mine. The traverse plan is shown in Plate 17. Profiles in areas C7 and C8 are all very disturbed, and no regular anomalies are recognisable. Traverse 1200W (C6) is shown in Plate 18, and the quantitative interpretation in Table 1.

Area C11

Anomalies C11, C12, and C13 (Shelley & Browne-Cooper, 1967) were surveyed using a grid with the origin near the centre of anomaly C11 (Plate 19). Central traverses over the three anomalies are shown in Plates 20 to 22. The area is flat alluvium covered with moderate to heavy scrub cover. The easternmost anomaly was drilled by Geopeko Ltd, and ironstone was intersected at a depth of 460 feet. Assays showed no economic gold values in this drill hole but drilling is recommended (Plate 22) to further test the gold content and also to give information on the size and dip of the body. Interpretation of the westernmost anomaly (Traverse 00) proved unreliable because of irregularities on the profile. But these irregularities indicate that the top of the body is very shallow, and this body can easily be tested using a waggon drill. Interpretation results and drilling recommendations are shown in Table 1.

Gravity readings were taken over Traverses 3600E and 8400E and the results are shown in Plates 23 and 24. A regional gradient was extracted from the profiles. The residual on Traverse 3600E shows a small anomaly (0.2 mgal) centred on 1600N, and on Traverse 8400E a broad anomaly (0.6 mgal) is centred on 2700N. In both cases the gravity anomaly coincides with the magnetic anomaly. No further interpretation of the gravity results was attempted.

Areas A1 and A2

These two anomalies are located in the western half of Shelley's Area A. The area is very flat, with moderate to heavy scrub cover, and the nearest landmark was a trig. station almost five miles to the south-east. A long traverse was cut from this station to locate the anomalies concerned (Plate 25). They are both very broad and of low amplitude, and correspond on the ground with outcrops of porphyry. It is suggested that the anomalies are due to the difference in the magnetic properties of the porphyry and sediments, and no further testing is recommended.

Area A5

This anomaly is located almost due north of the trig. station in Area 5 (Plate 27). Unfortunately the traverse was not extended sufficiently far to the south to cover the whole of the anomaly and quantitative interpretation is not reliable. However, the anomaly appears to be due to a shallowly north-dipping sheet with the apex approximately at 750N and about 400 feet deep. Before any drilling investigations are commenced it is recommended that further ground magnetic work should be carried out.

Great Western area

During a regional geochemical survey by Dunnett and Harding (1965), anomalous copper values were detected near the Great Western mine. The area was recommended for detailed geochemical sampling, and a grid 6000 feet square was pegged at 200-foot intervals along traverses 400 feet apart. The Great Western mine is near the centre of the grid. Magnetic readings had been taken in the area immediately around the mine during the AGGSNA (1935-1937). That survey indicated general magnetic disturbance due to near-surface ironstones, but no recognisable deep-seated anomalies. It was decided to utilise the existing geochemical grid to extend the magnetic survey of the area.

Unfortunately, the traverses in the area run E-W, and since the major strike of the country is E-W, profiles along the traverses are not suitable for direct interpretation; the traverses are too widely spaced (400 feet) to allow construction of N-S profiles. The traverses were read at 100-foot intervals, and where practicable a contour map was constructed from the results (Plate 26).

The profiles are generally disturbed on the western end and smoother to the east. The area shown on the map as magnetically disturbed is that area where the profiles are too irregular to allow valid smoothing. It coincides roughly with the area of surface and near-surface ironstone bodies. To obtain any further interpretation, N-S magnetic profiles would need to be read, and it is doubtful whether this is warranted in the present situation.

7. CONCLUSIONS

The magnetic method is by far the most successful method of exploration in the Tennant Creek field. However, the gravity method may prove useful in helping to define the bodies located by magnetic methods. It seems possible that with a little more research the gravity method could help to distinguish between ironstone bodies and basic igneous bodies. One serious disadvantage of the gravity method is that it is affected by the large porphyry bodies which are present throughout the area.

Further testing of anomalies by drilling is recommended in Areas 3, 4, C6, and C11. In all, twelve diamond-drill holes and six waggon-drill holes are recommended. Where there is no direct evidence about the dip of the bodies concerned, vertical drill holes have been proposed There are disadvantages in vertical drill holes, particularly where near-vertical bodies are possible. However, in the cases where vertical holes are chosen the bodies are probably nearer spherical, and the location of the target in plan is more precisely known than the depth

The priority listing for the drilling programme is indicated by the drill hole number.

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TABLE 1 SHEET 1

AREA	TRAV.	PARAMETERS	Infinite Dyke	Finite Dyke	Sphere	Half Max Slope	Half Width	Drill Hole No.	Target Location	Target Depth	Collar Position	Bearing	Depression	Target Position Down Hole	Proposed Drill Hole Length
		INTERPRETATIVE TECHNIQUES						**DRILLING RECOMMENDATIONS**							
		Location		*See Plate 2*	*See Plate 2*										
		Depth		*1000'*	*1450'*	*900'*	*800'*								
2	AA'	Dip		-	-	-	-	*DDH 12*	*200W / 190S*	*1100'*	*720W / 270N*	*130°*	*60°*	*1300'*	*1800'*
		Depth Extent		*300'*	-	-	-								
		Reliability		*Fair*	*Poor*	*Poor*	*Poor*								
		Location		*2800N*		*2900N*	*2900N*								
		Depth		*345'*		*L 280' R 500'*	*400'*								
3	4800W	Dip		*90°*		-	-	*DDH 6*	*2800N*	*430'*	*2500N*	*24°*	*55°*	*520'*	*700'*
		Depth Extent		*3000'*		-	-								
		Reliability		*Good*		*Poor*	*Poor*								
		Location			*4000N*	*4100N*	*4100N*								
		Depth			*800'*	*L 320' R 680'*	*450'*								
3	6400W	Dip			-	-	-	*DDH 7*	*4000N*	*800'*	*3800N*	*24°*	*75°*	*860'*	*1000'*
		Depth Extent			-	-	-								
		Reliability			*Good*	*Poor*	*Poor*								
		Location		*2420N*	*2460N*	*2500N*	*2500N*								
		Depth		*200'*	*400'*	*L 120' R 180'*	*220'*								
3	4000W	Dip		*90°*	-	-	-	*Nil*							
		Depth Extent		*600'*	-	-	-								
		Reliability		*Good*	*Fair*	*Poor*	*Poor*								
		Location	*4000N*		*3850N*	*4000N*	*4000N*								
		Depth	*400'*		*800'*	*280'*	*500'*								
4	800E	Dip	*50°S*		-	-	-	*Nil*							
		Depth Extent	*Infinite*		-	-	-								
		Reliability	*Poor*		*Poor*	*V.Poor*	*Fair*								
		Location	*10820N*	*10820N*	*10800N*	*10800N*	*10800N*								
		Depth	*200'*	*200'*	*450'*	*200'*	*300'*								
4	800E	Dip	*70°S*	*70°S*	-	-	-	*DDH 11*	*10760N*	*360'*	*10630N*	*0°*	*70°*	*390'*	*550'*
		Depth Extent	*Infinite*	*20,000'*	-	-	-								
		Reliability	*Good*	*Good*	*Good*	*Fair*	*Fair*								
		Location	*1210S*			*1150S*	*1150S*								
		Depth	*300'*			*L 150' R 300'*	*300'*								
4	2000E	Dip	*60°S*			-	-	*DDH 9*	*1270S*	*400'*	*1500S*	*0°*	*60°*	*470'*	*550'*
		Depth Extent	*Infinite*			-	-								
		Reliability	*Good*			*Fair*	*Good*								
		Location	*4820N*			*4800N*	*4800N*								
		Depth	*200'*			*150'*	*200'*								
4	2400E	Dip	*30°S*			-	-	*DDH 8*	*4760N*	*230'*	*4600N*	*0°*	*55°*	*280'*	*350'*
		Depth Extent	*Infinite*			-	-								
		Reliability	*Good*			*Poor*	*Poor*								
		Location	*2750S*	*2720S*	*2830S*	*2700S*	*2700S*								
		Depth	*400'*	*400'*	*740'*	*500'*	*400'*								
4	1600W	Dip	*70°S*	*60°S*	-	-	-	*DDH 10*	*2850S*	*600'*	*3000S*	*0°*	*75°*	*640'*	*850'*
		Depth Extent	*Infinite*	*4000*	-	-	-								
		Reliability	*Fair*	*Fair*	*Fair*	*Fair*	*Good*								

(Based on G29-62)

To accompany Record No.1969/87

E53/B7-81

TABLE 1 SHEET 2

AREA	TRAV.	INTERPRETATIVE TECHNIQUES						DRILLING RECOMMENDATIONS							
		PARAMETERS	Infinite Dyke	Finite Dyke	Sphere	Half Max Slope	Half Width	Drill Hole No.	Target Location	Target Depth	Collar Position	Bearing	Depression	Target Position Down Hole	Proposed Drill Hole Length
C6	1200W	Location			6140N										
		Depth			320′										
		Dip			–			DDH 5	6140N	320′	6000N	0°	65°	340′	400′
		Depth Extent			–										
		Reliability			V.Good										
C11	00	Location						WDH 1	400W / 1100N	100′	400W / 1100N		90°	100′	200′
		Depth						WDH 2	200W / 1100N	80′	200W / 1100N		90°	80′	200′
		Dip						WDH 3	00 / 1100N	60′	00 / 1100N		90°	60′	200′
		Depth Extent						WDH 4	200E / 1100N	100′	200E / 1100N		90°	100′	200′
		Reliability						WDH 5	00 / 1200N	60′	00 / 1200N		90°	60′	200′
								WDH 6	00 / 1000N	60′	00 / 1000N		90°	60′	200′
C11	3600E	Location	1650N			1650N	1650N								
		Depth	200′			L 160′ R 220′	220′	DDH 1	1610N	280′	1440N	0°	60°	320′	400′
		Dip	60° S			–	–								
		Depth Extent	Infinite			–	–	DDH 2	1550N	390′	1440N	0°	75°	400′	450′
		Reliability	V.Good			Fair	Good								
C11	8400E	Location	2860N	2860N		2900N	2900N								
		Depth	260′	260′		210′	340′	DDH 3	2800N	370′	2580N	0°	60°	435′	500′
		Dip	60° S	60° S		–	–								
		Depth Extent	Infinite	3000		–	–	DDH 4	2750N	460′	2580N	0°	70°	490′	600′
		Reliability	Fair	Fair		Good	Fair								
		Location													
		Depth													
		Dip													
		Depth Extent													
		Reliability													
		Location													
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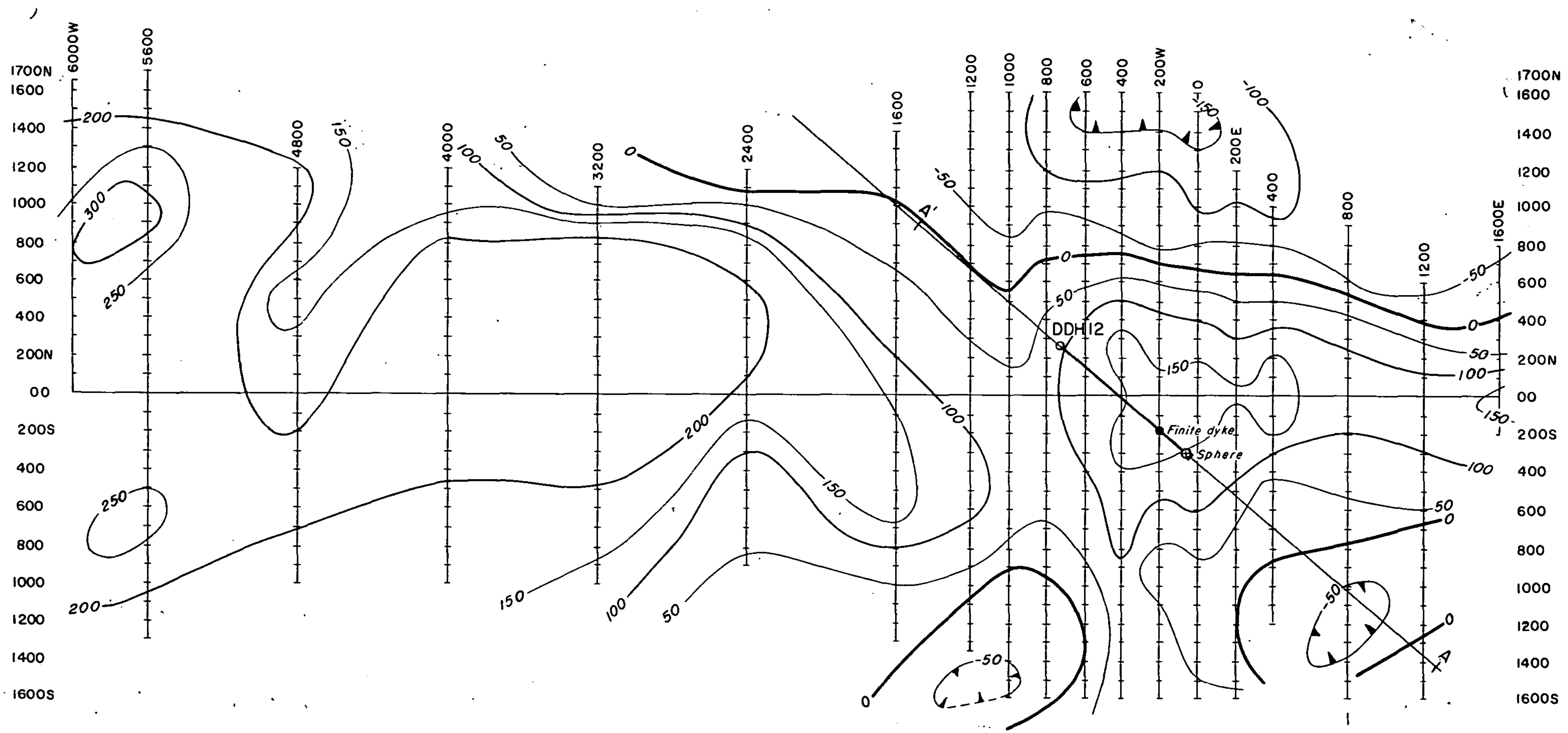
(Based on G29–62)

To accompany Record No.1969/87

E53/B7-82



TENNANT CREEK AREA 2C (Eastern part)

TRAVERSE PLAN AND MAGNETIC CONTOURS

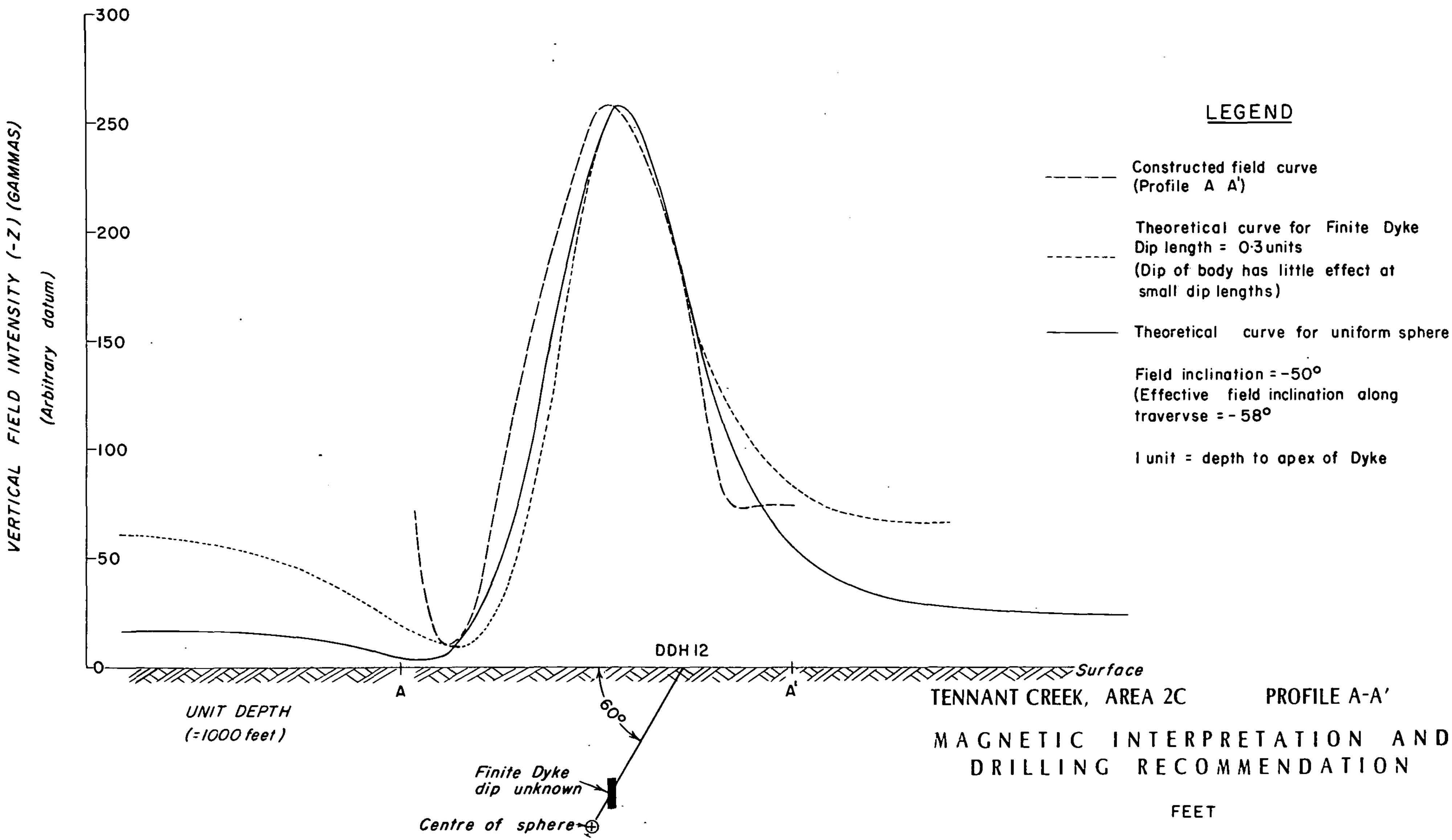
FEET

800 400 0 800 1600

PLATE 1

E53/B7-98

TO ACCOMPANY RECORD No.1969/87



TENNANT CREEK, AREA 2C PROFILE A-A'

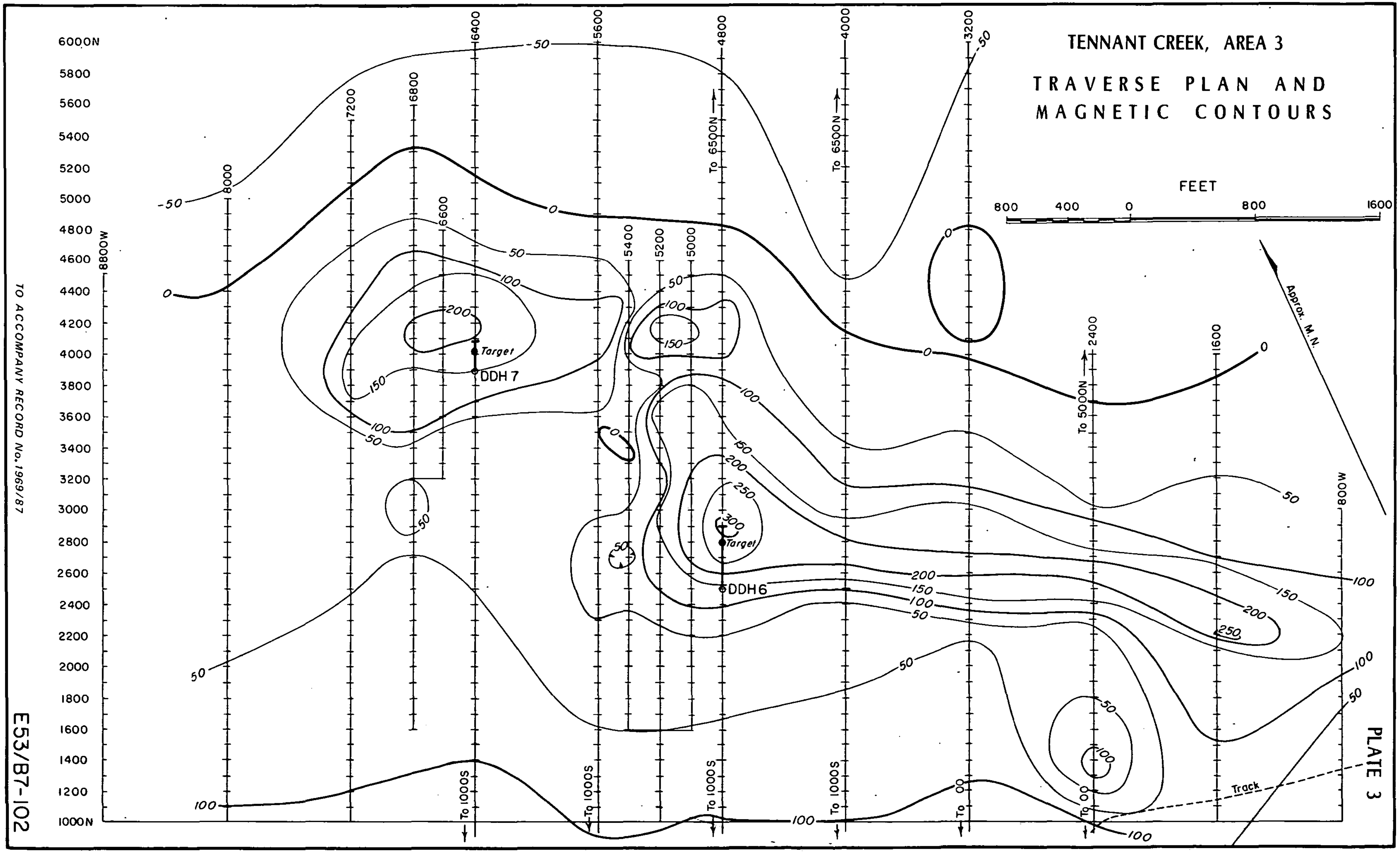
MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

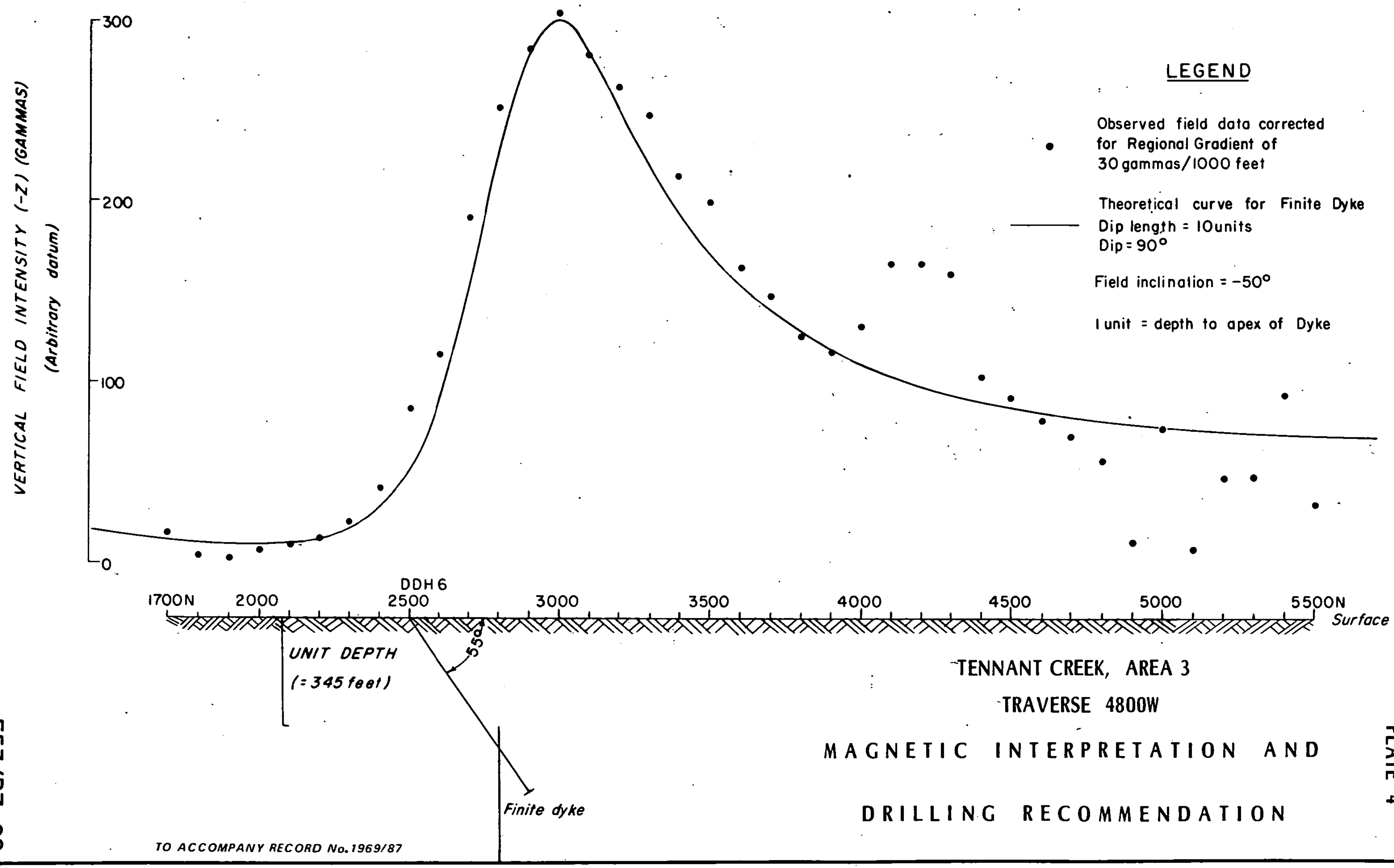
TO ACCOMPANY RECORD No. 1969/87

E53/B7-91

PLATE 2

TENNANT CK. N.T. 1967





TENNANT CREEK, AREA 3

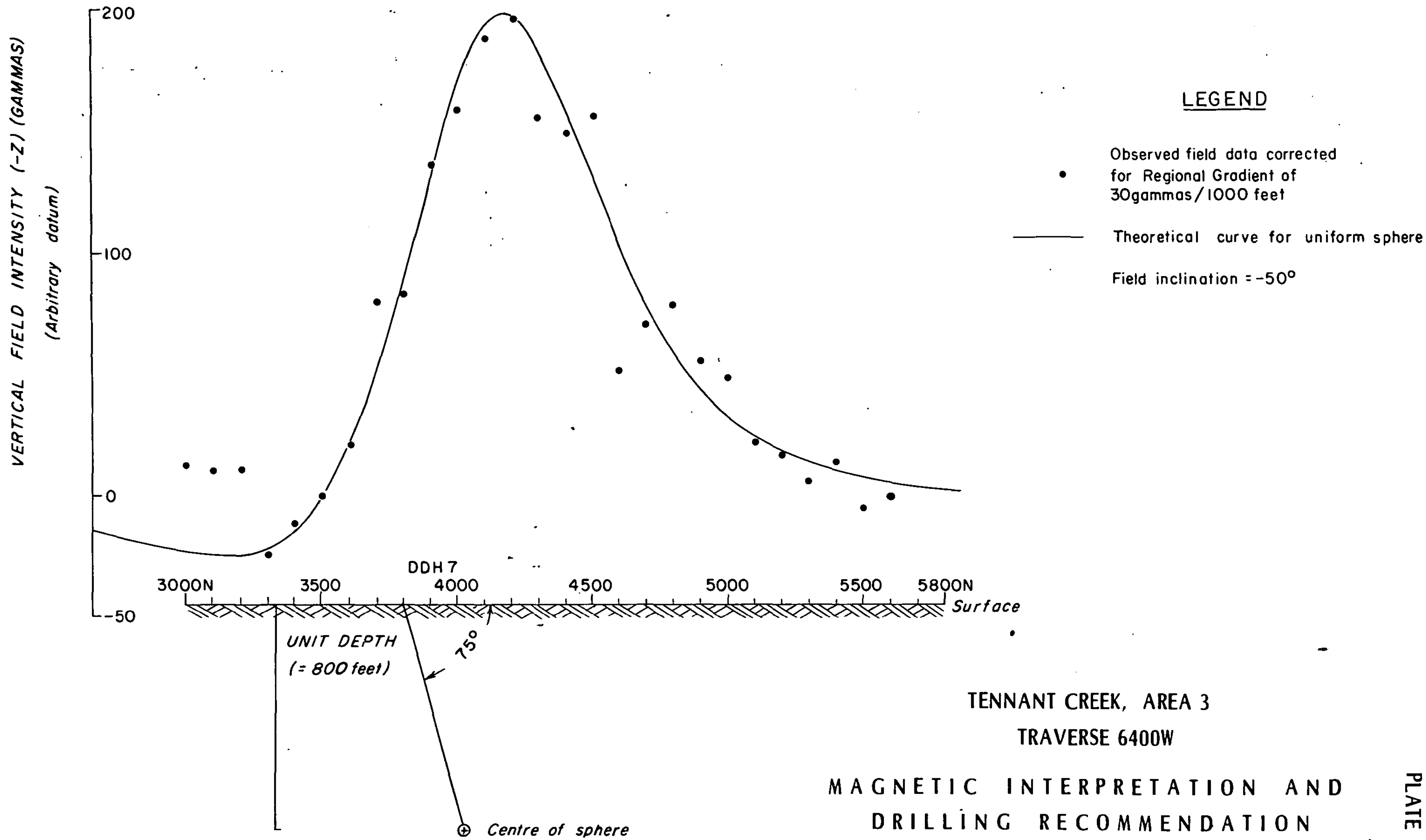
TRAVERSE 4800W

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 4

E53/B7-92

TO ACCOMPANY RECORD No. 1969/87



TENNANT CREEK, AREA 3

TRAVERSE 6400W

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 5

E53/B7-93

TO ACCOMPANY RECORD No. 1969/87

To accompany Record No. 1969/87

TENNANT CREEK AREA 3 — TRAVERSE 5000W

GRAVITY PROFILES

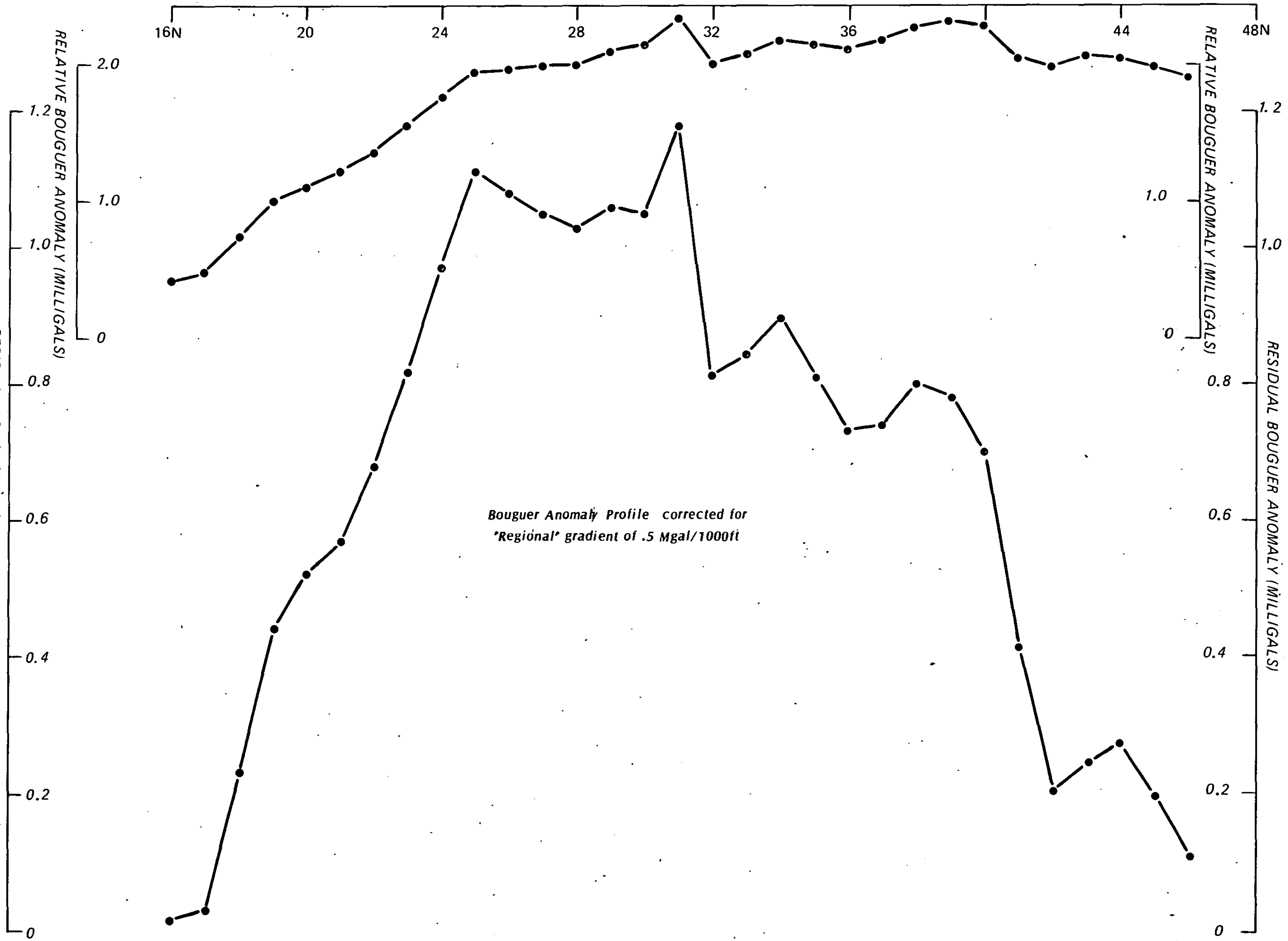
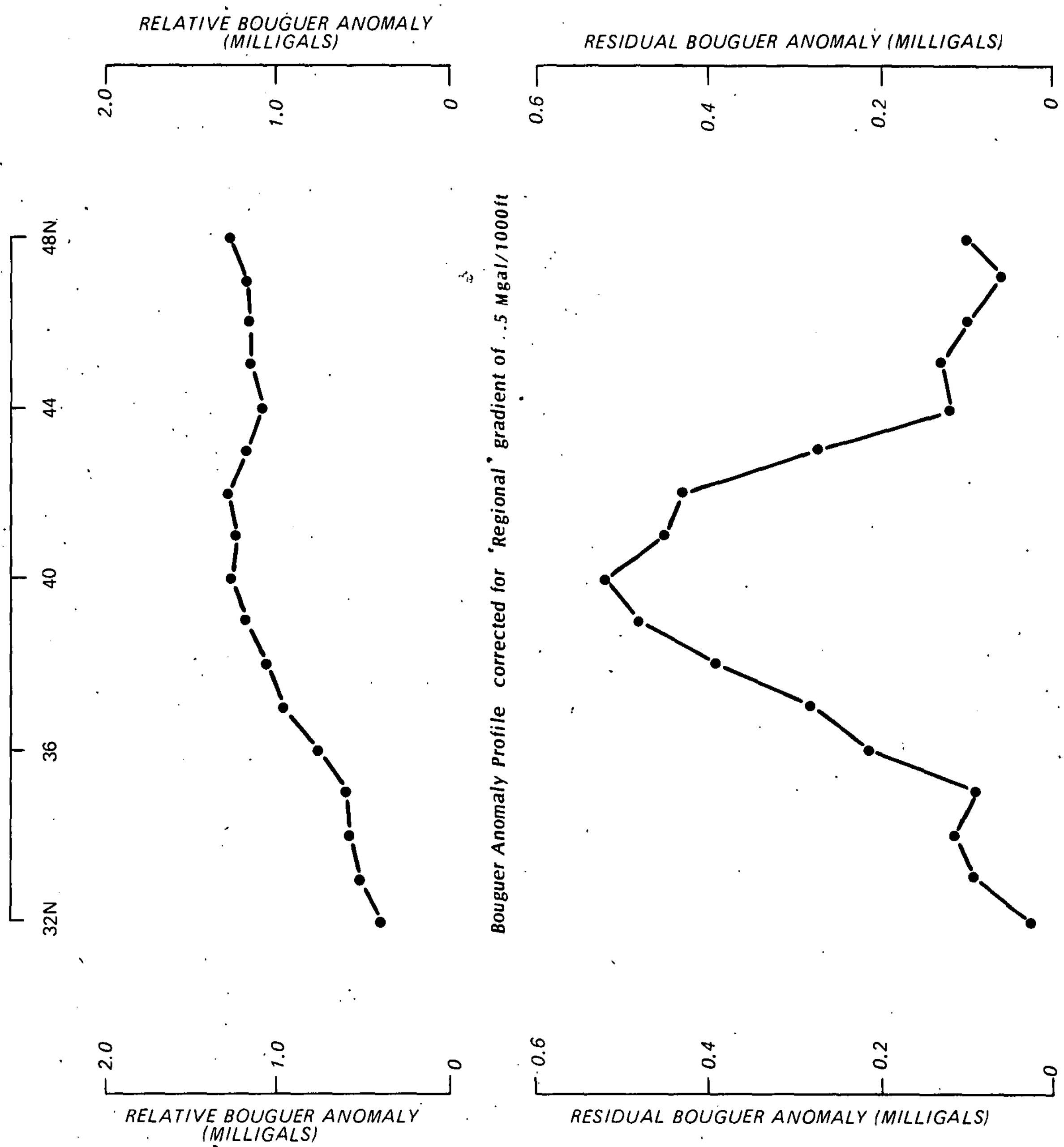


PLATE 6

E53/B7-84

PLATE 7



TENNANT CREEK AREA 3 — TRAVERSE 6600W

GRAVITY PROFILES

To accompany Record No.1969/87

E53/B7–85

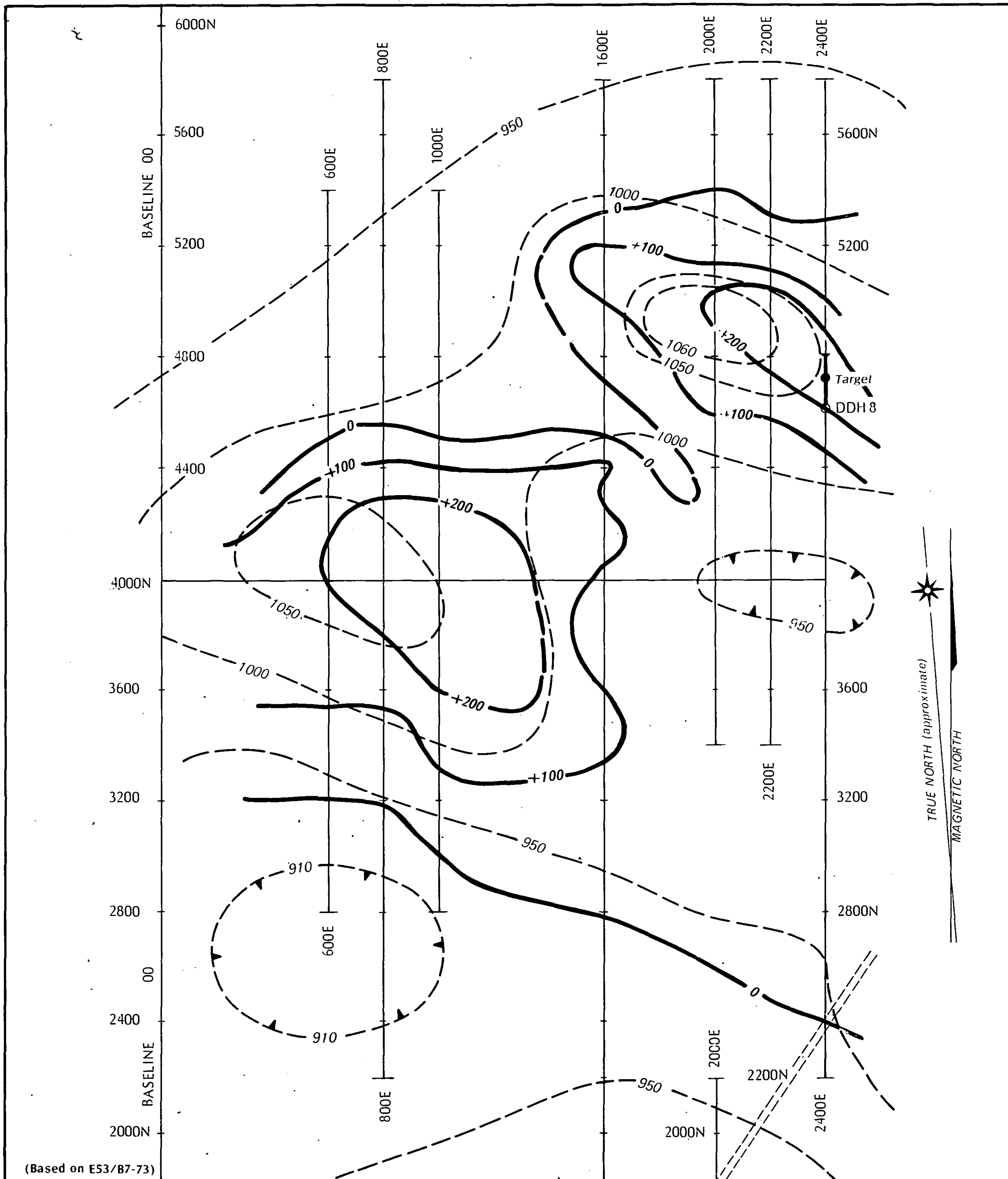


PLATE 8

Track

Ground Traverse

Aeromagnetic contour

Aeromagnetic contours taken from BMR map E53/B1-39 (position approximate)

Ground magnetic contour

Ground magnetic contours are based on arbitrary datum which is not necessarily the same as in other parts of Area 4

Magnetic 'low'

FEET

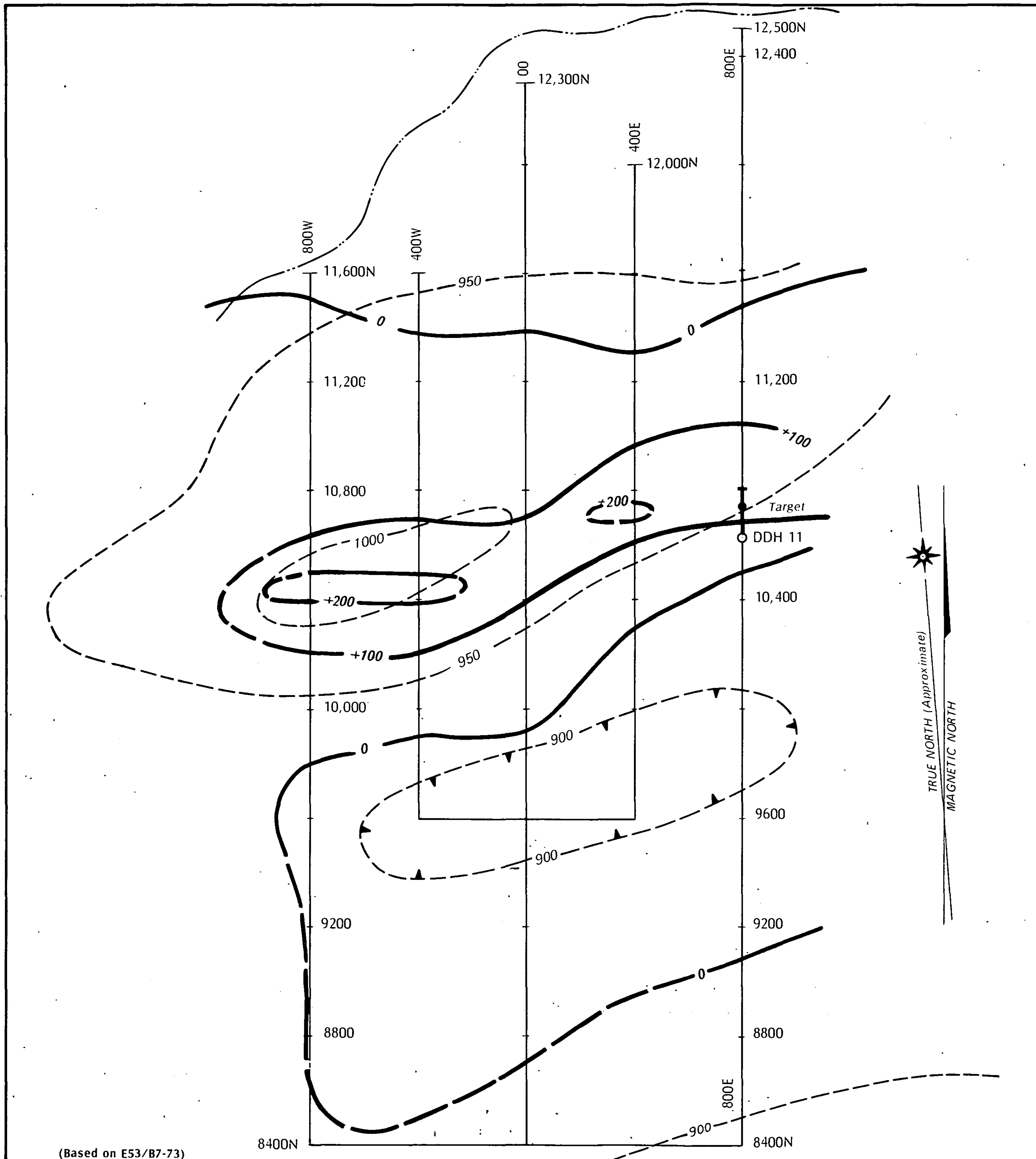
400 0 400 800

TENNANT CREEK NT AREA 4, CENTRAL PART

TRAVERSES SHOWING AEROMAGNETIC AND GROUND MAGNETIC CONTOURS

To accompany Record No. 1969/87

E53/B7-75



(Based on E53/B7-73)

Creek

Ground traverse

950 Aeromagnetic contours

Aeromagnetic contours taken from BMR map E53/B1-39 (position approximate)

+200 Ground magnetic contours

Ground magnetic contours are based on arbitrary datum which is not necessarily the same as in other parts of Area 4

Magnetic 'low'

FEET

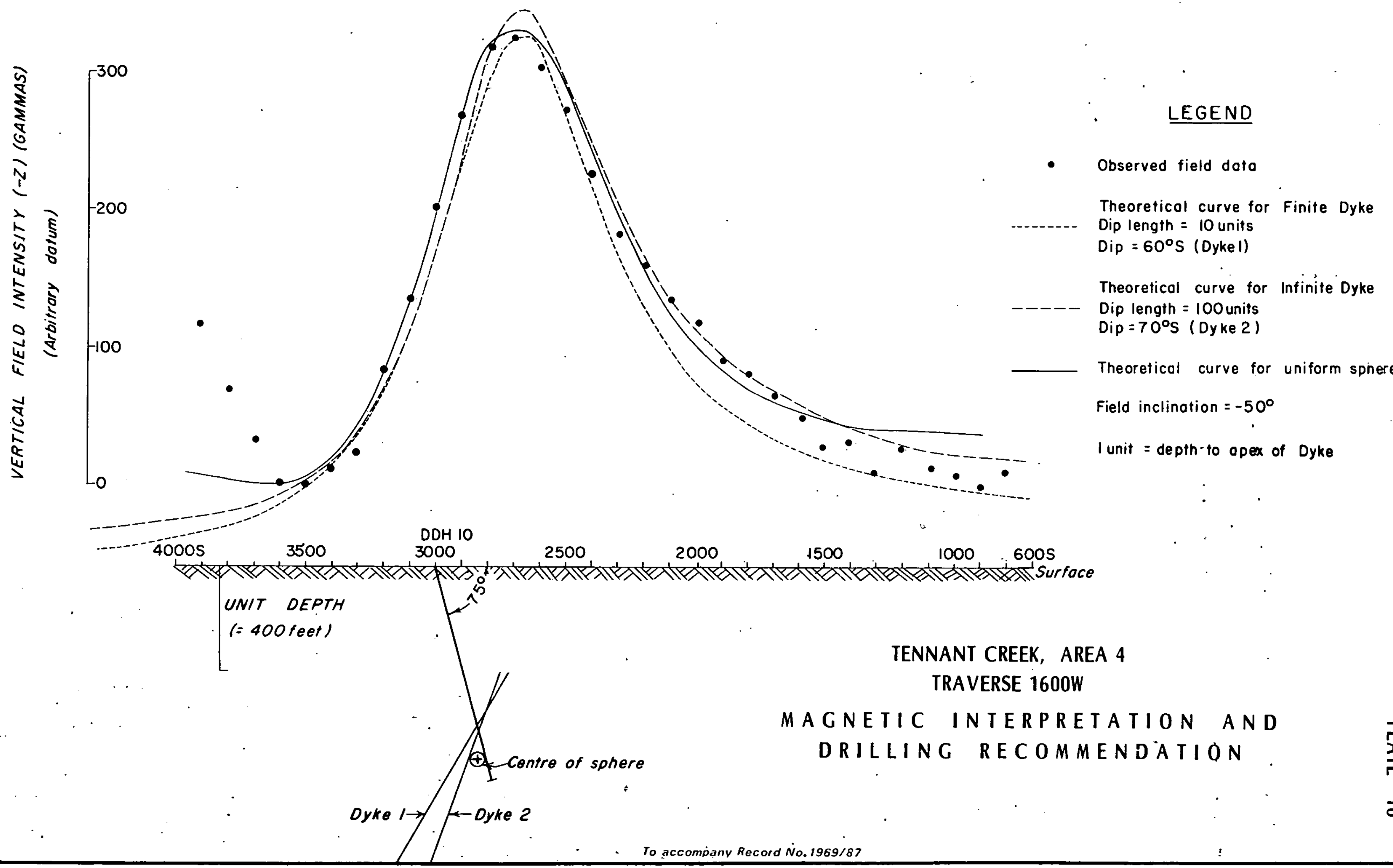
400 0 400 800

TENNANT CREEK NT AREA 4, NORTHERN PART

TRAVERSES SHOWING AEROMAGNETIC AND GROUND MAGNETIC CONTOURS

To accompany Record No. 1969/87

E53/B7-76



TENNANT CREEK, AREA 4

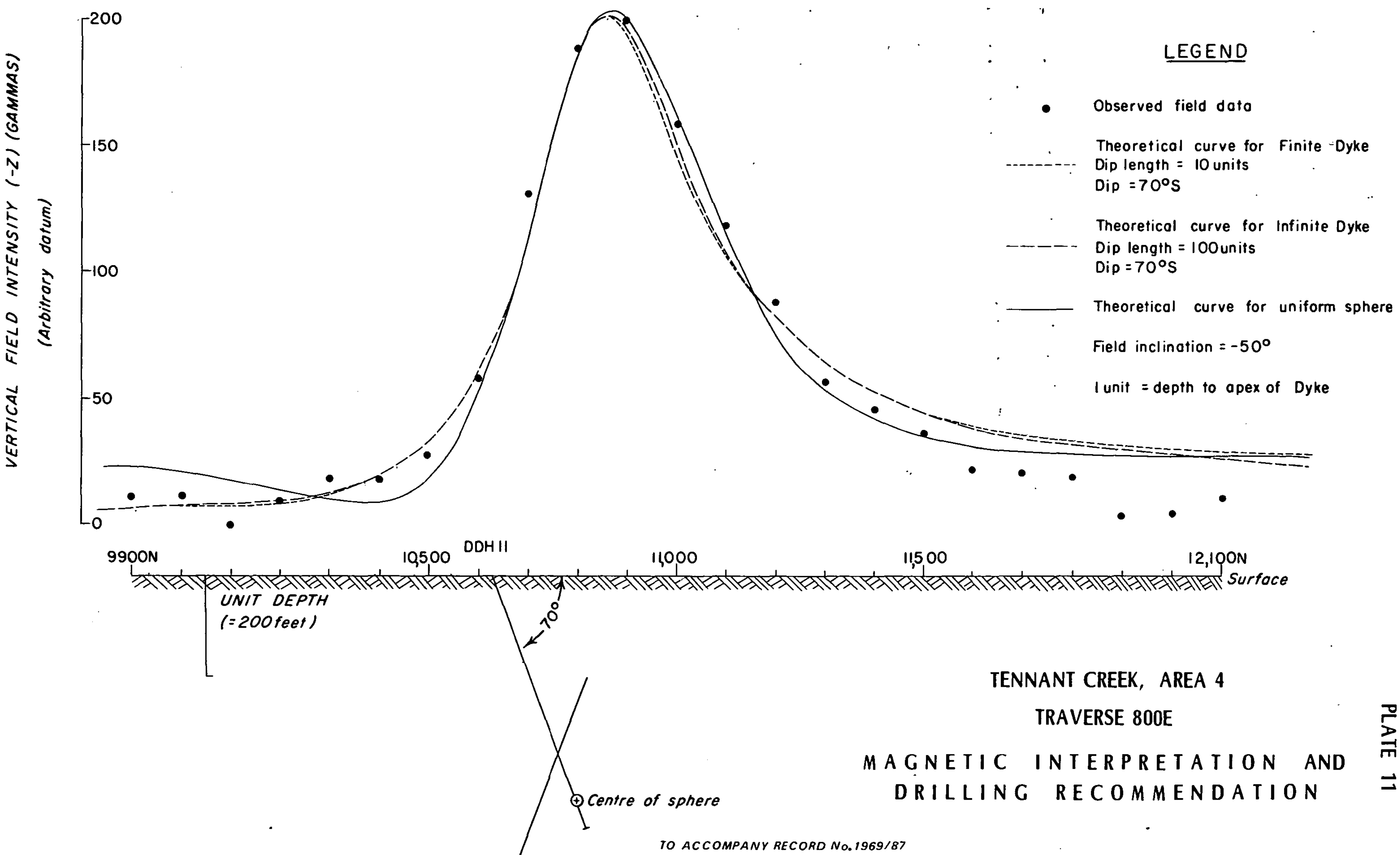
TRAVERSE 1600W

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

E53/B7-78

PLATE 10

To accompany Record No. 1969/87



TENNANT CREEK, AREA 4

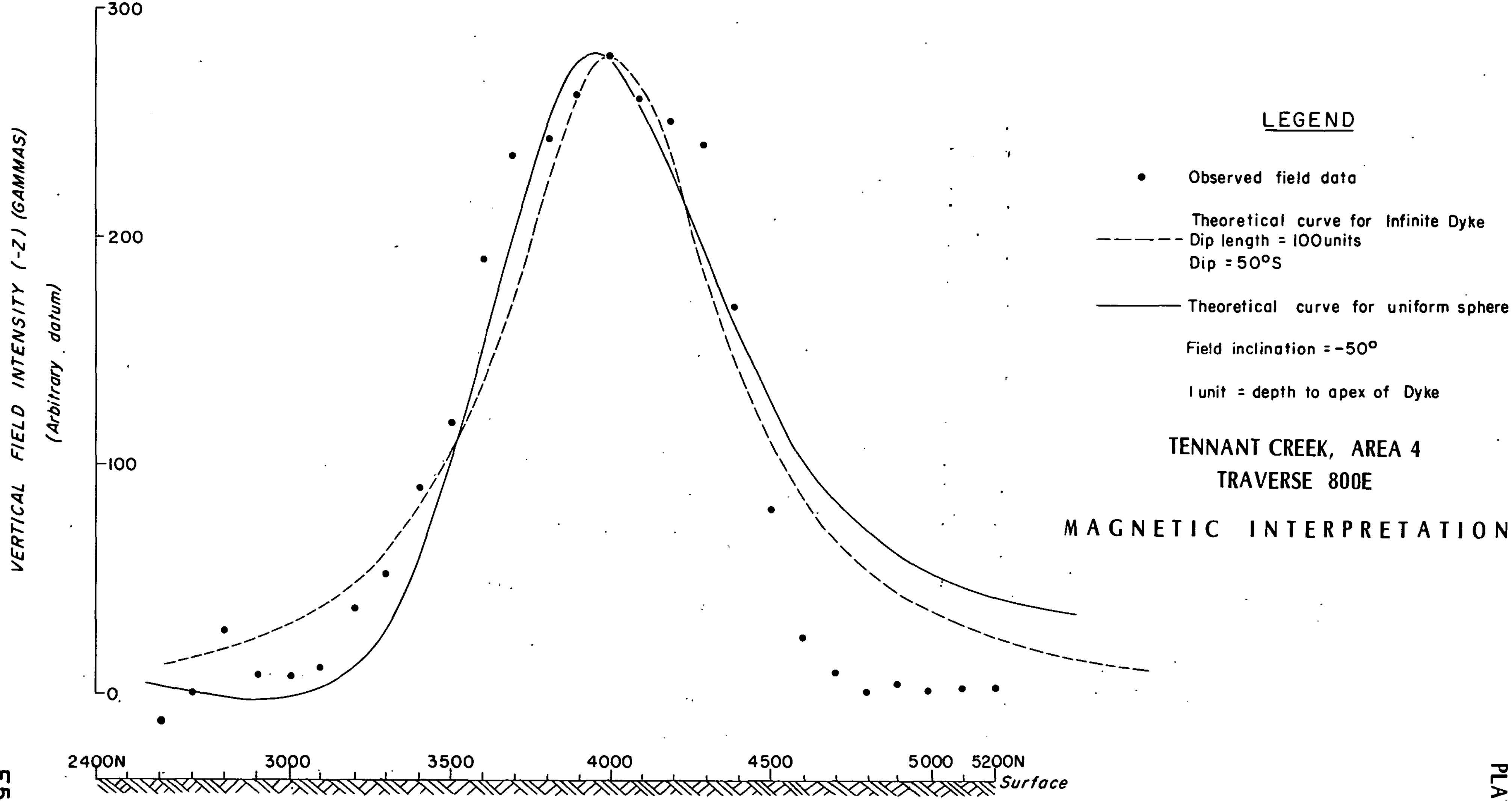
TRAVERSE 800E

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 11

TO ACCOMPANY RECORD No. 1969/87

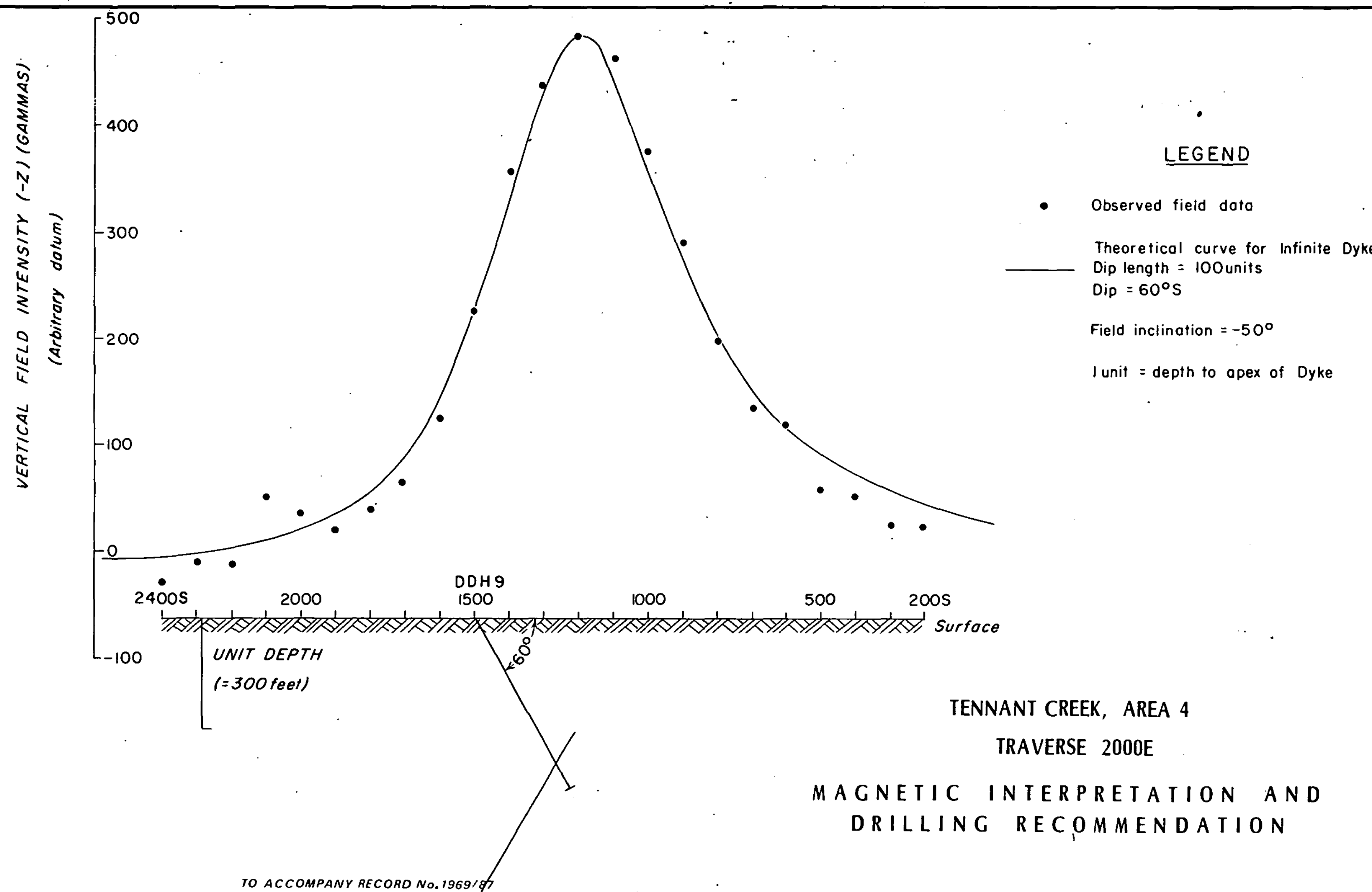
E53/B7-96



E53/B7-97

PLATE 12

TO ACCOMPANY RECORD No.1969/87



TENNANT CREEK, AREA 4

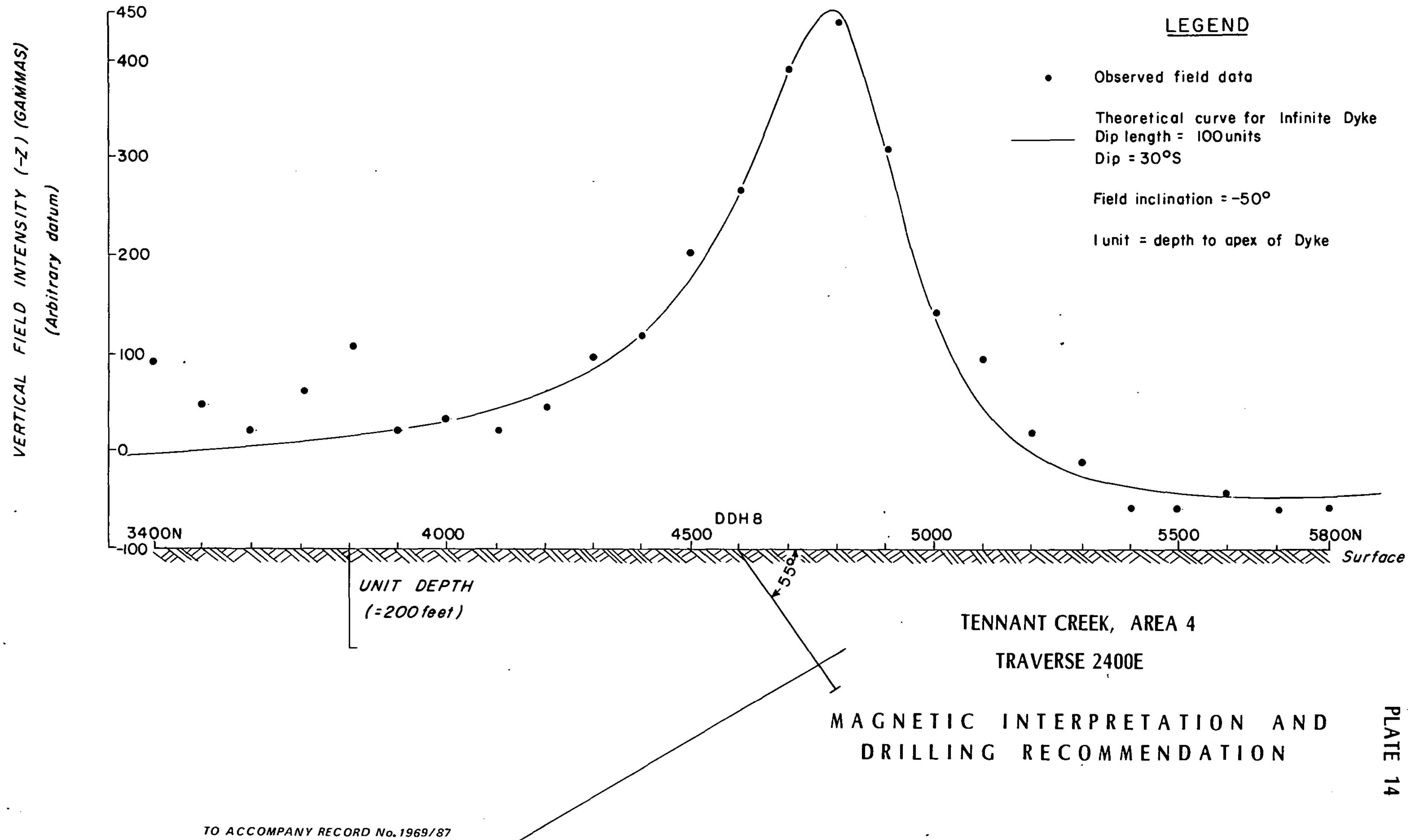
TRAVERSE 2000E

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 13

TO ACCOMPANY RECORD No. 1969/87

E53/B7-95



TENNANT CREEK, AREA 4

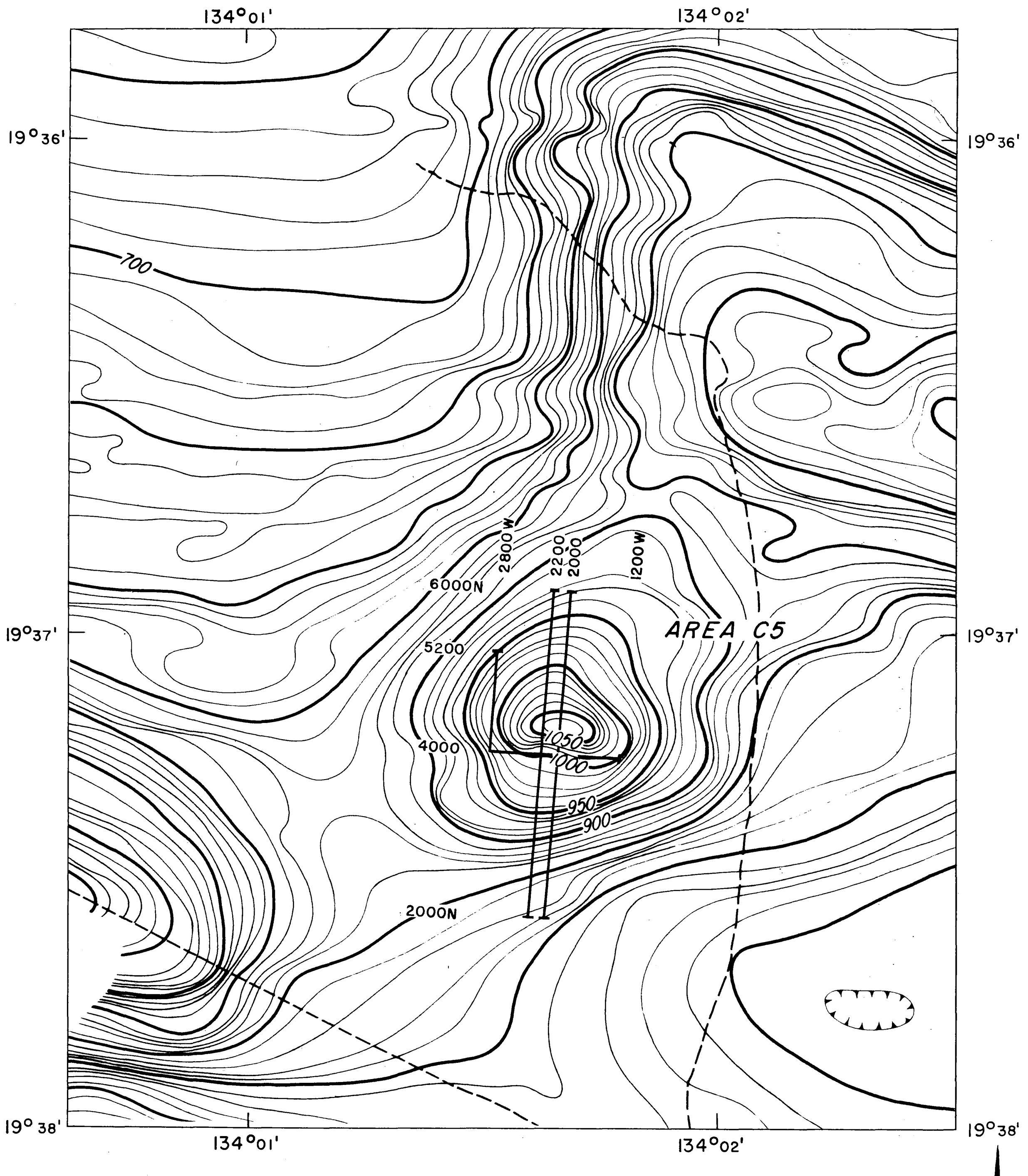
TRAVERSE 2400E

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 14

E53/B7-94

TO ACCOMPANY RECORD No. 1969/87



TENNANT CREEK, AREA C5

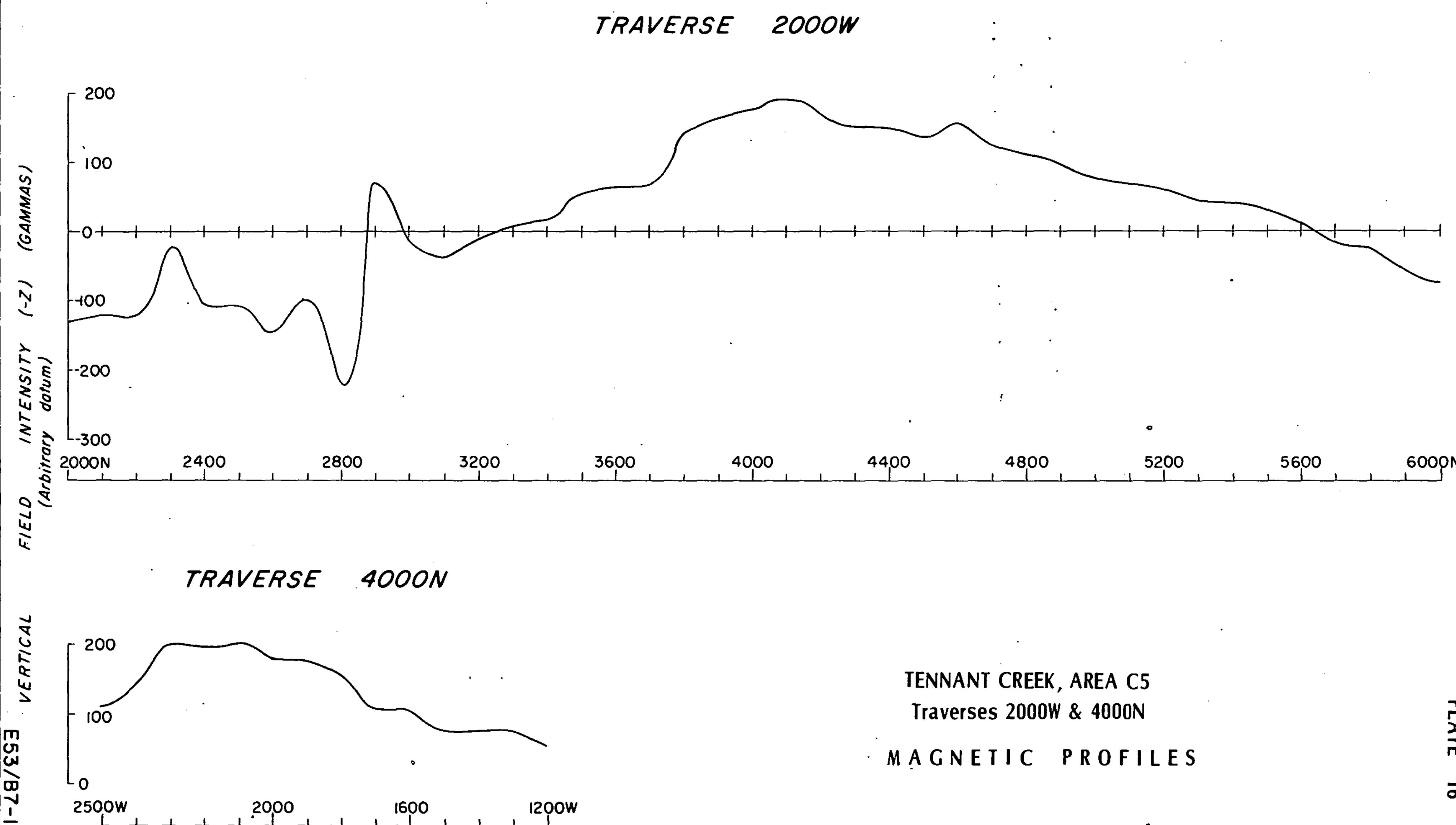
TRAVERSE PLAN AND AEROMAGNETIC CONTOURS

MILES

1 0 1

To accompany Record No.1969/87

E53/B7-105



TENNANT CREEK, AREA C5
Traverses 2000W & 4000N

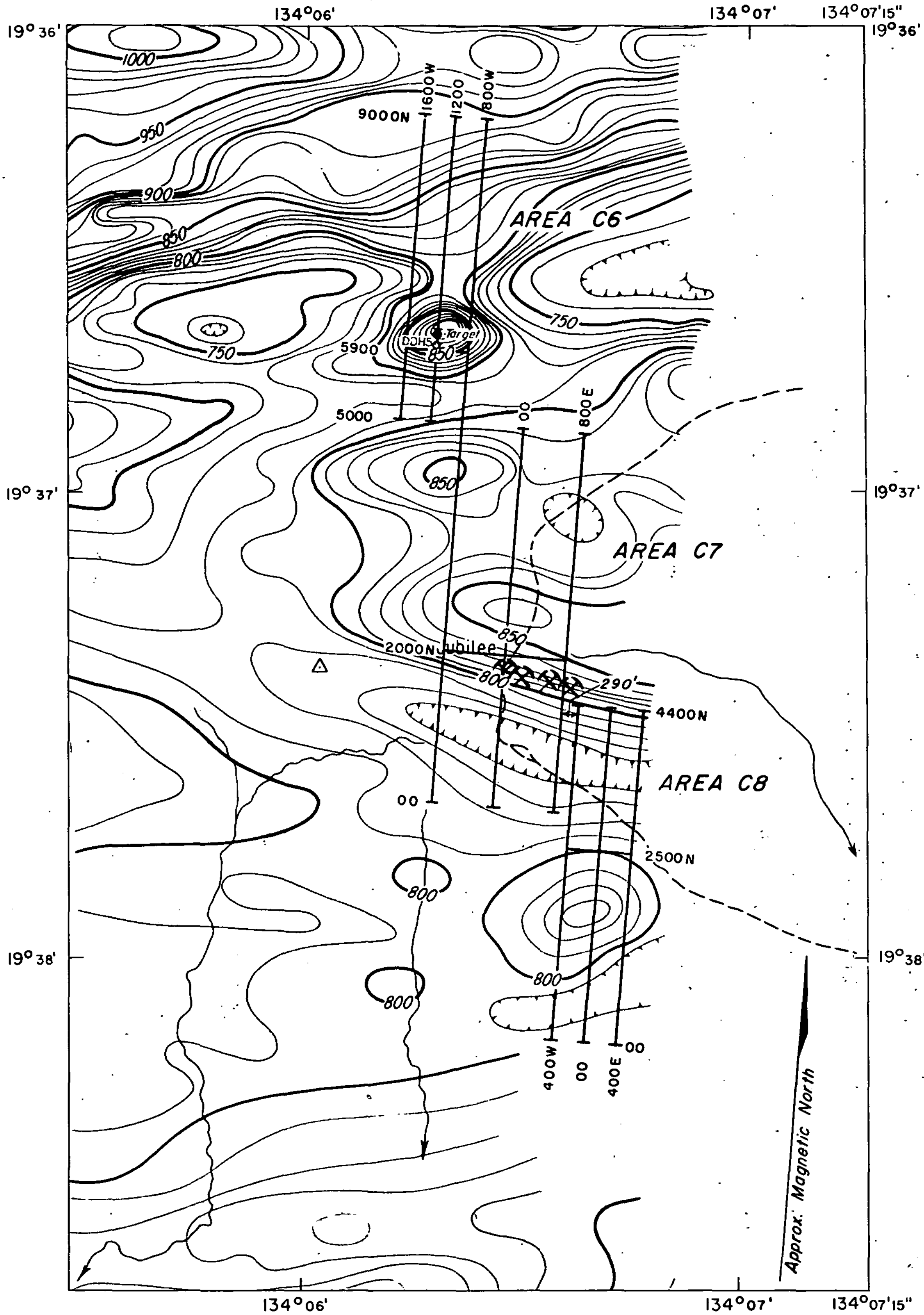
MAGNETIC PROFILES

PLATE 16

TO ACCOMPANY RECORD No. 1969/87

E53/B7-103

PLATE 17



TENNANT CREEK - AREAS C6, C7, AND C8

TRAVERSE PLAN AND AEROMAGNETIC CONTOURS

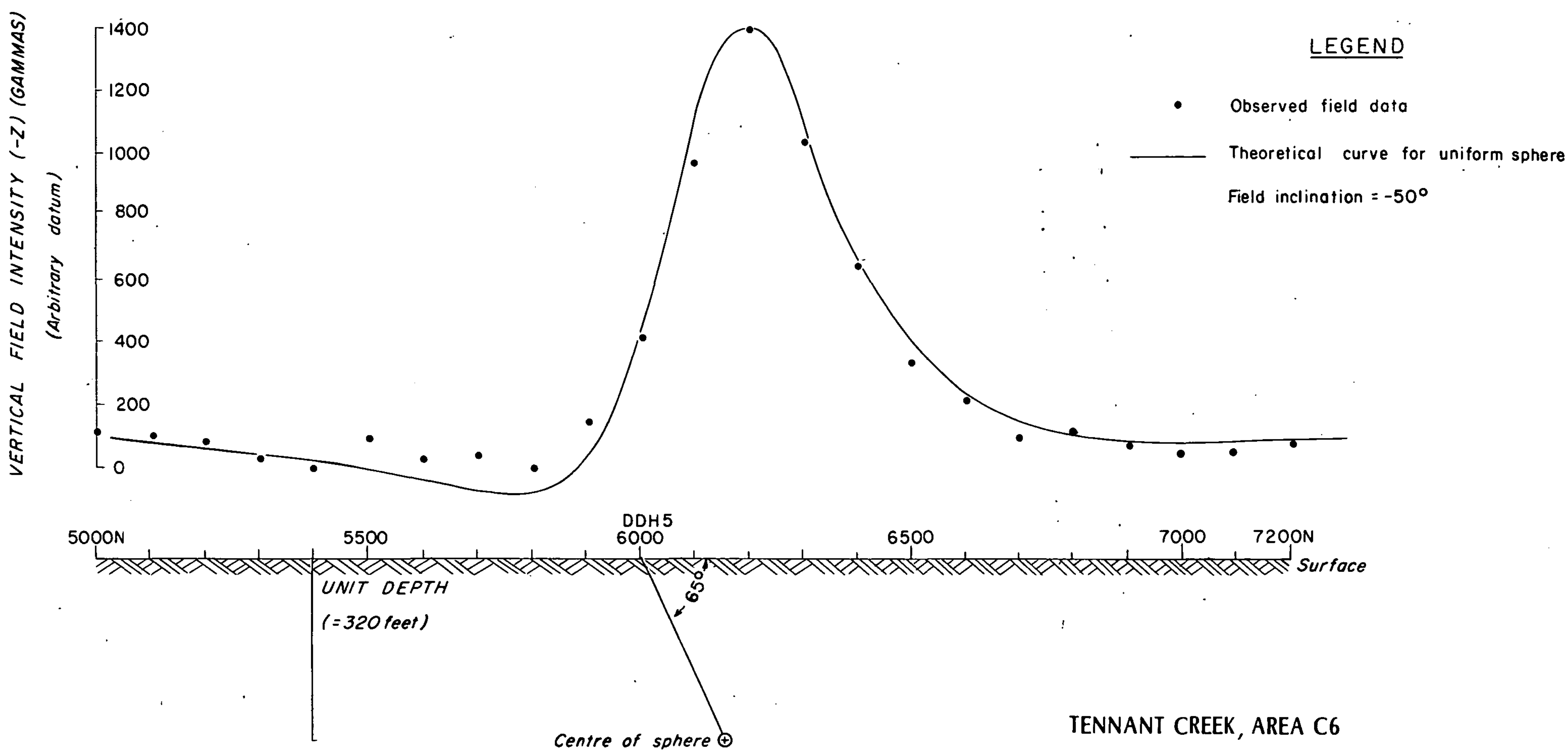
MILES

0

TO ACCOMPANY RECORD No.1969/87

E53/B7-106

TENNANT CK. N.T. 1967



TENNANT CREEK, AREA C6

TRAVERSE 1200W

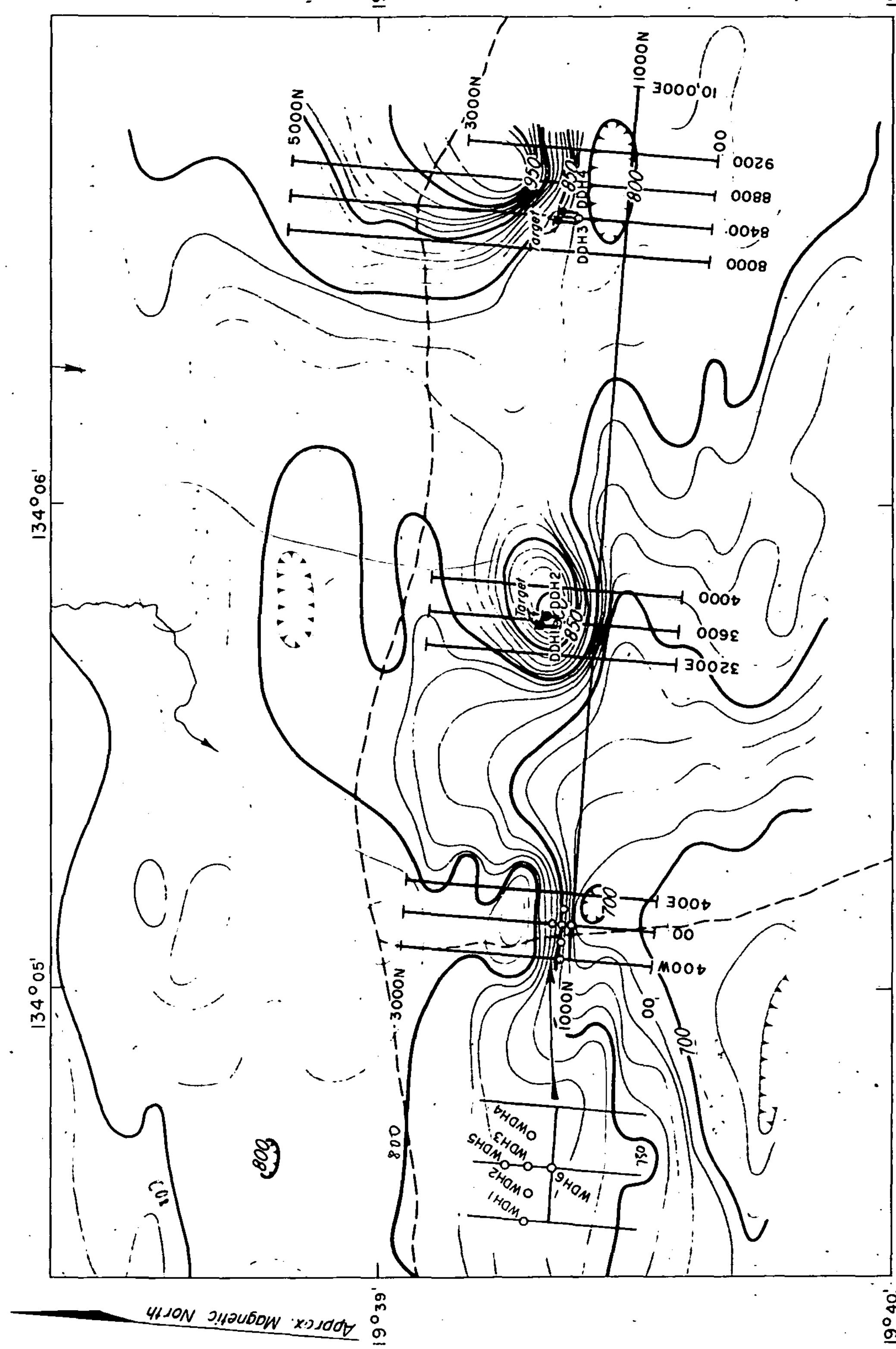
MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATION

PLATE 18

E53/B7-88

TO ACCOMPANY RECORD No. 1969/87

PLATE 19



TENNANT CREEK, AREA C11

TRAVERSE PLAN AND AEROMAGNETIC CONTOURS

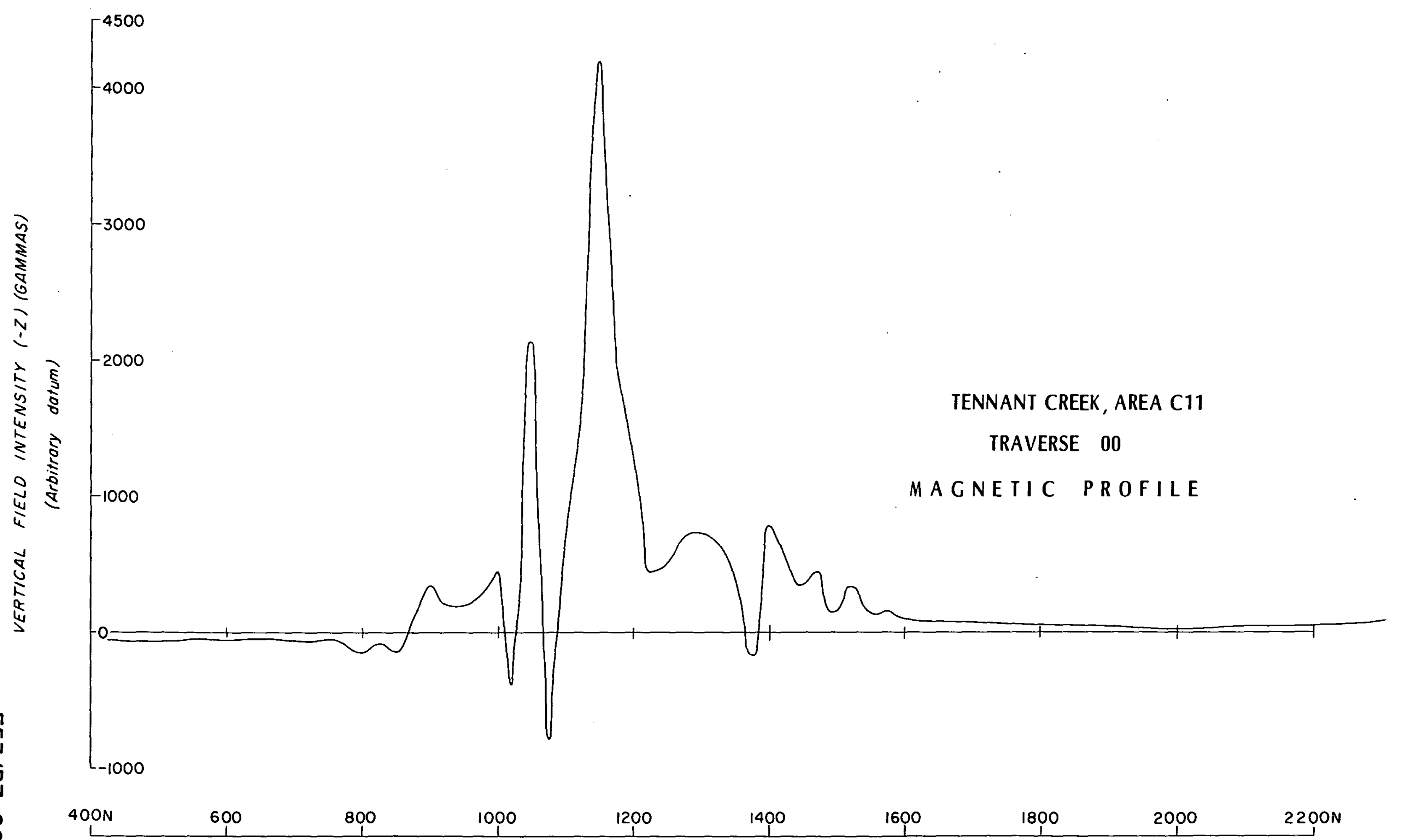
MILES

0

TO ACCOMPANY RECORD No. 1969/87

E53/B7-107

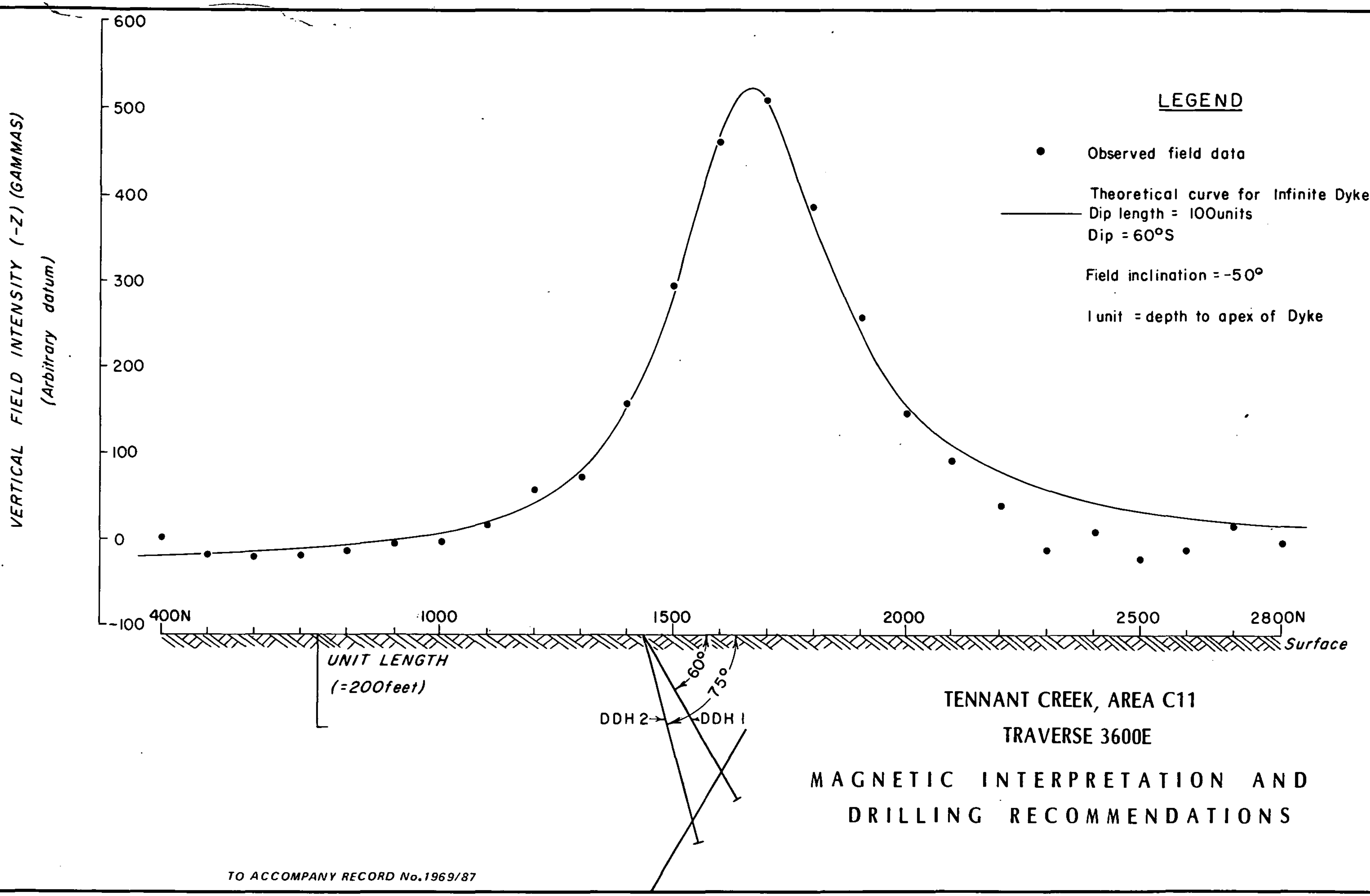
TENNANT CK. N.T. 1967



TO ACCOMPANY RECORD No.1969/87

E53/B7-89

PLATE 20



TENNANT CREEK, AREA C11

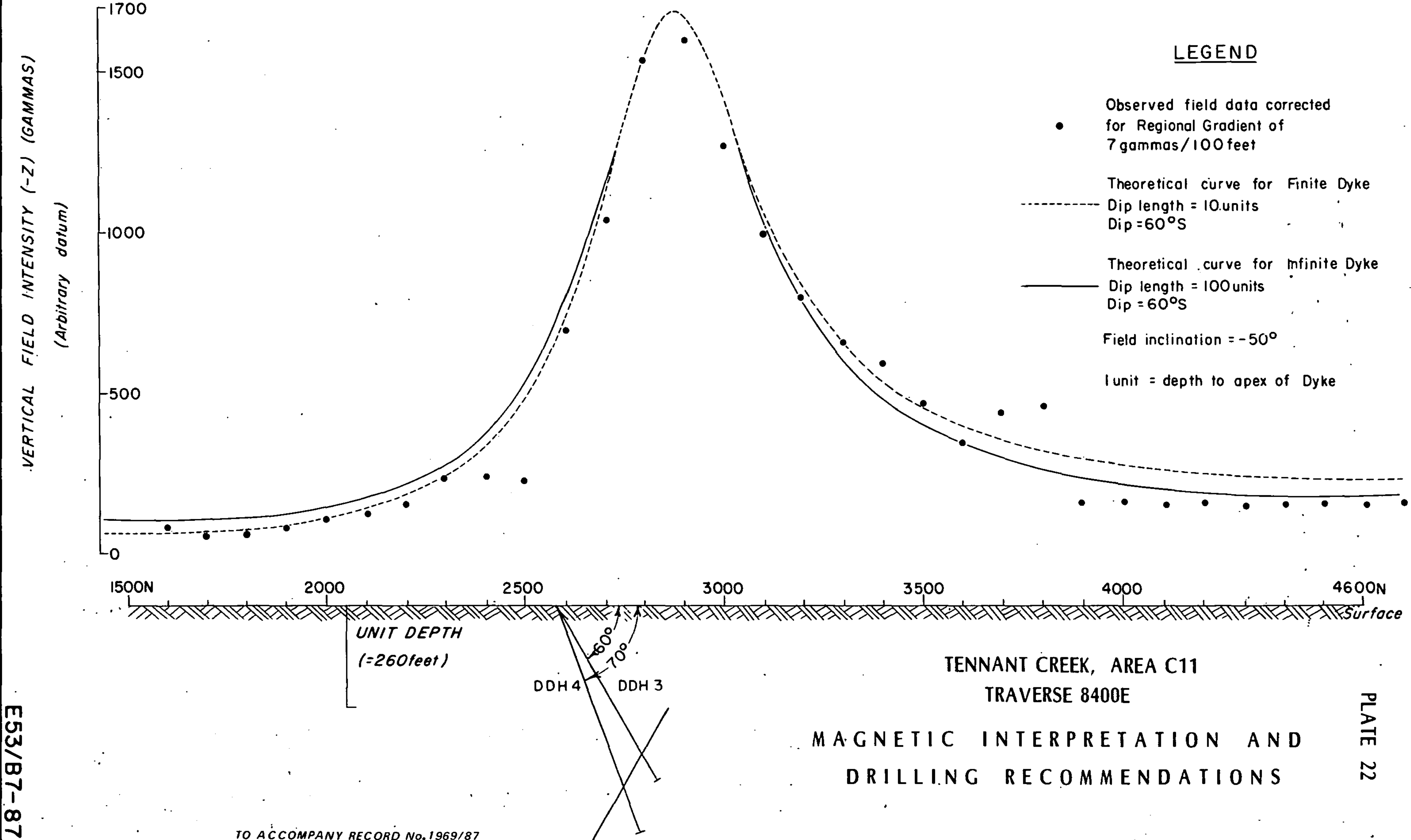
TRAVERSE 3600E

MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATIONS

PLATE 21

TO ACCOMPANY RECORD No.1969/87

E53/B7-90



TENNANT CREEK, AREA C11

TRAVERSE 8400E

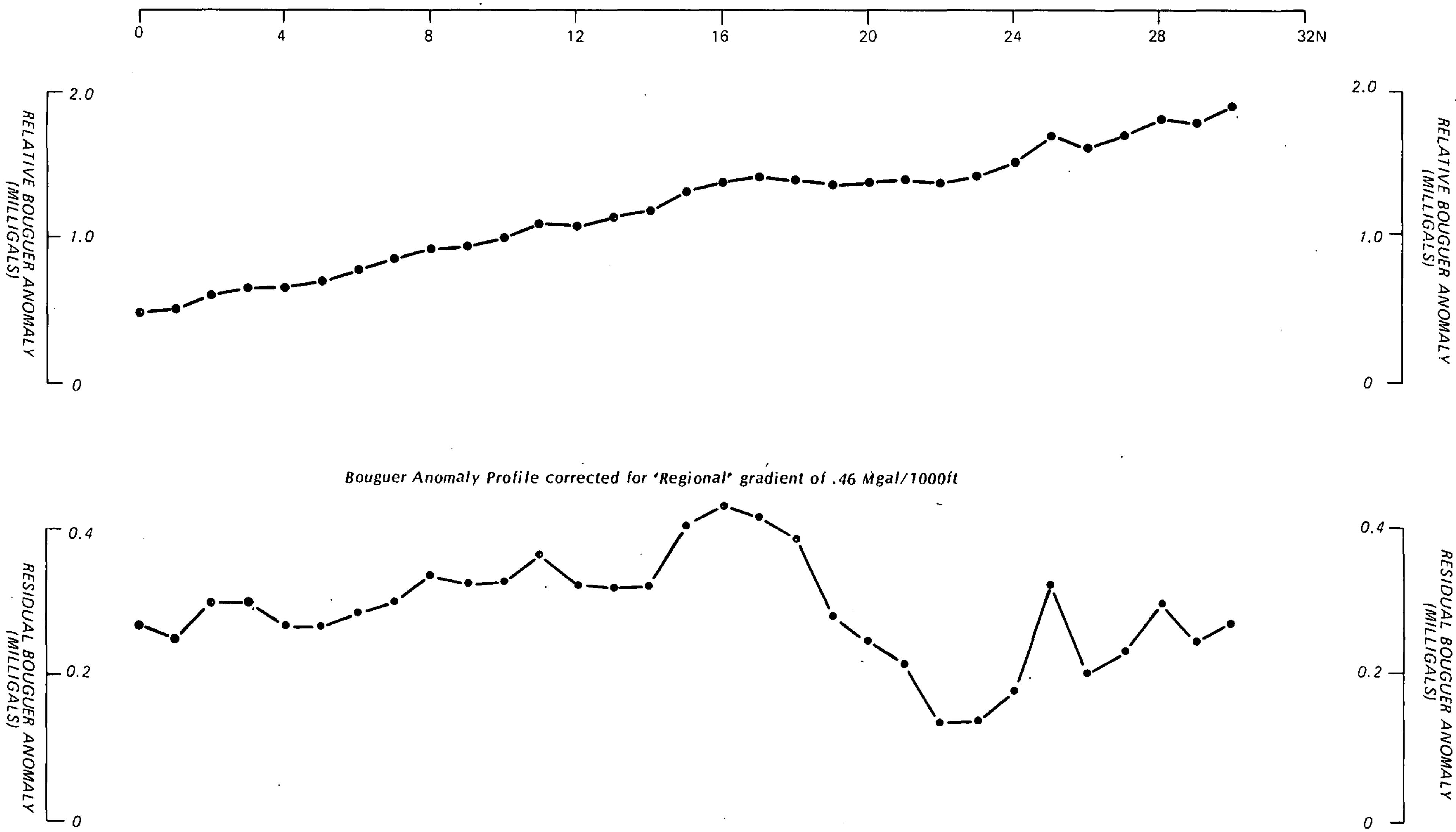
MAGNETIC INTERPRETATION AND DRILLING RECOMMENDATIONS

PLATE 22

E53/B7-87

TO ACCOMPANY RECORD No. 1969/87

TENNANT CREEK AREA C11 – TRAVERSE 3600E
GRAVITY PROFILES



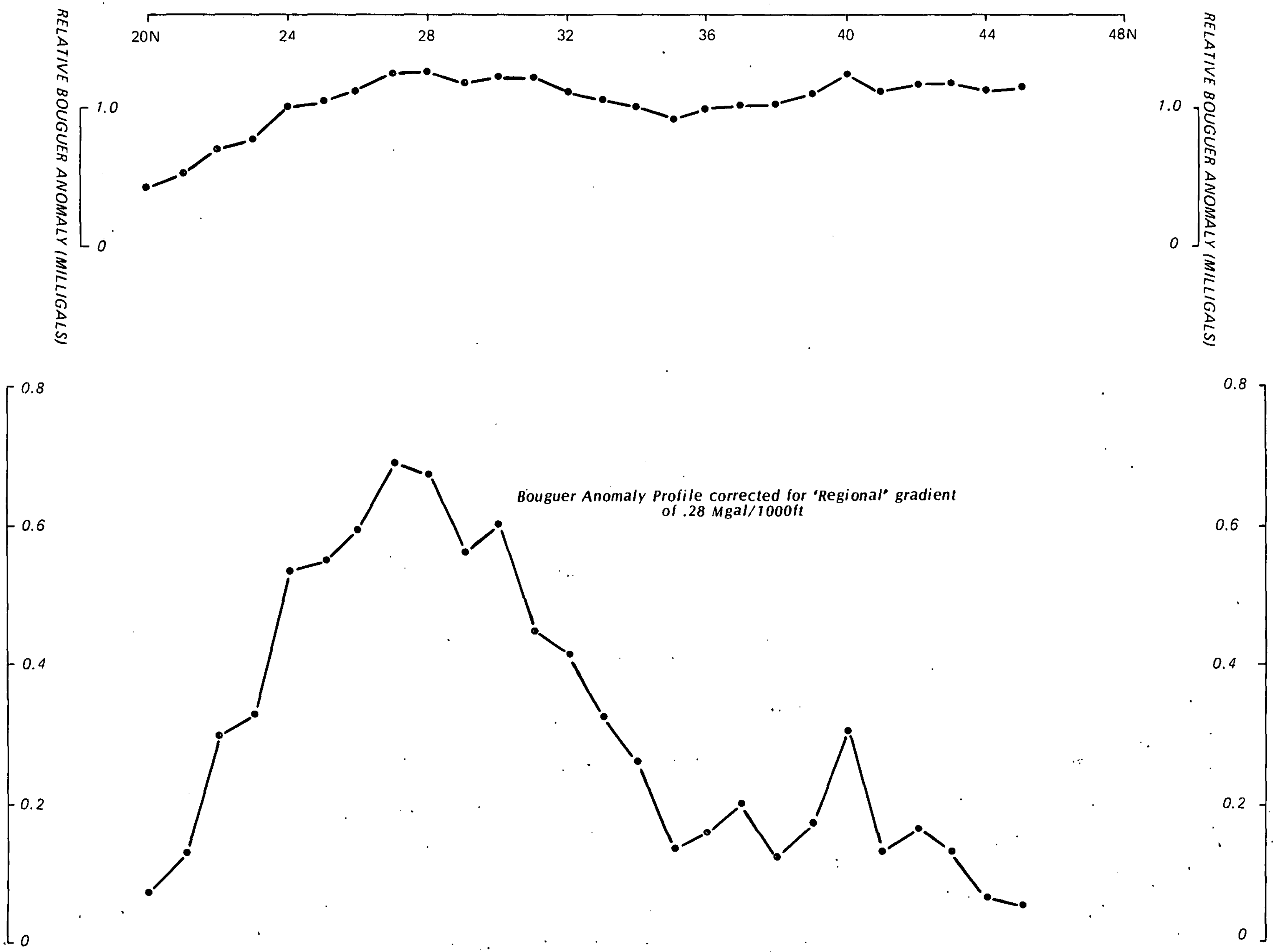
To accompany Record No. 1969/87

E53/B7-83

To accompany Record No.1969/87

TENNANT CREEK AREA C11 – TRAVERSE 8400E

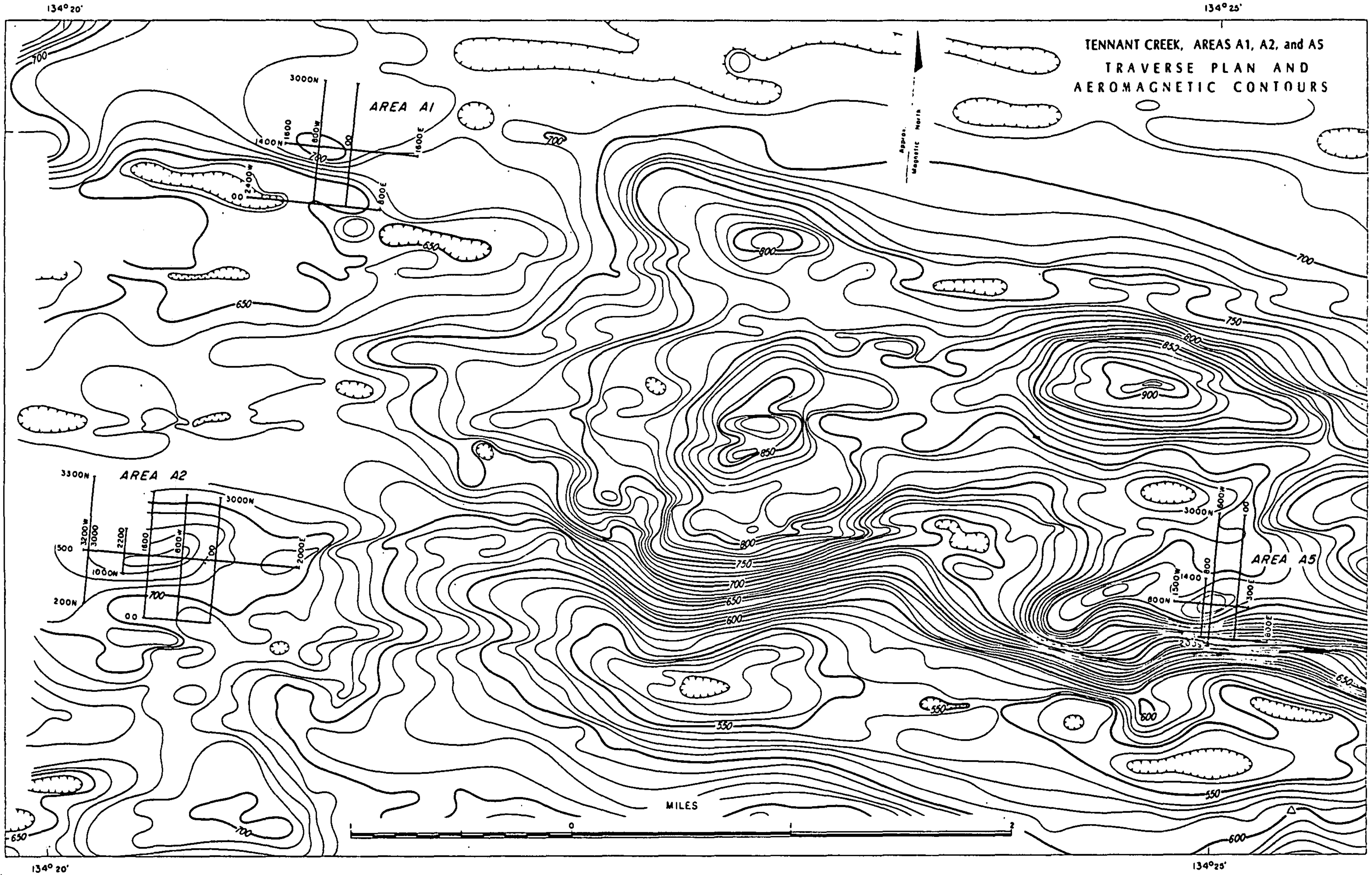
GRAVITY PROFILES



E53/B7–86

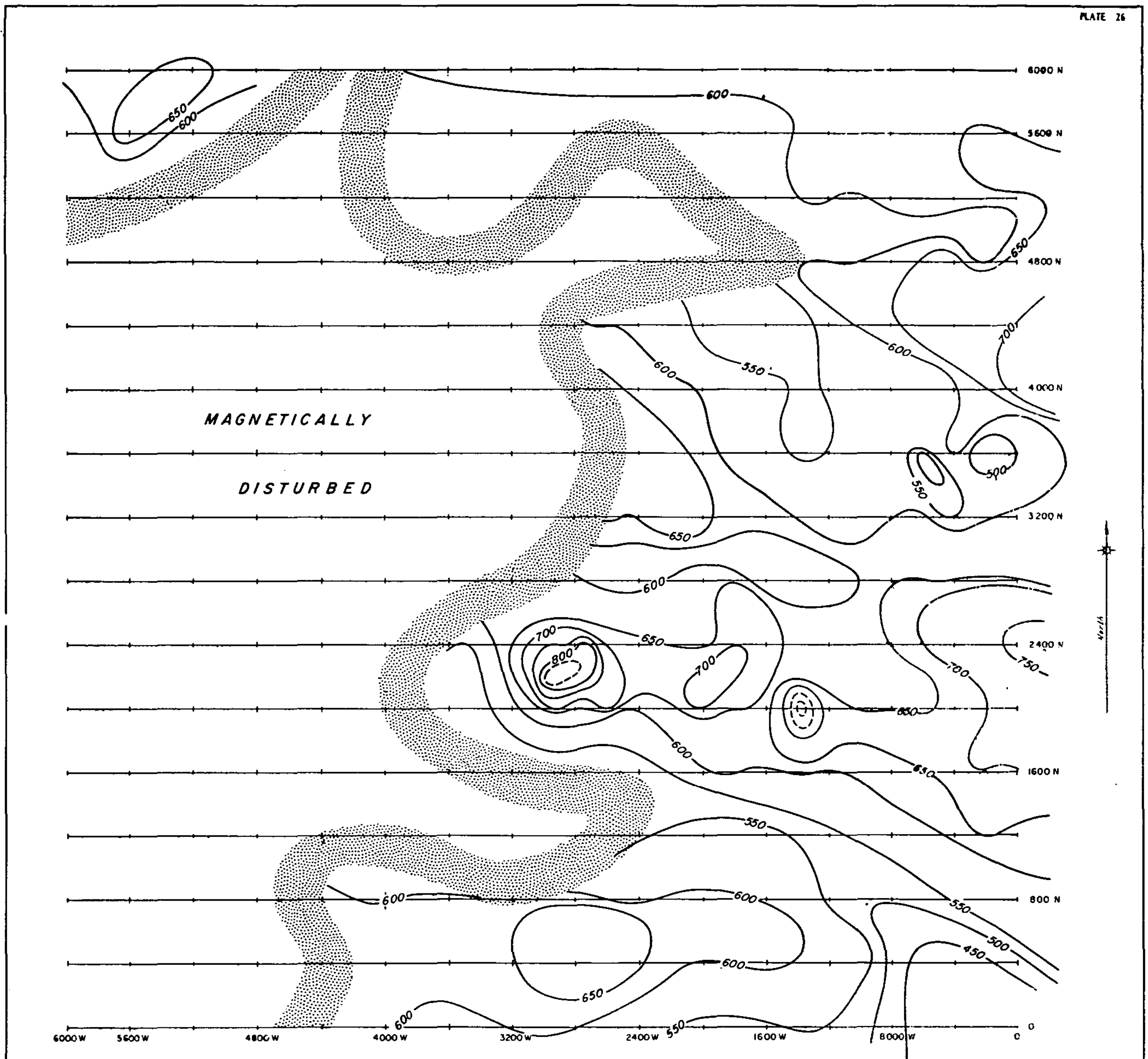
PLATE 24

PLATE 25



To accompany Record No.1969 87

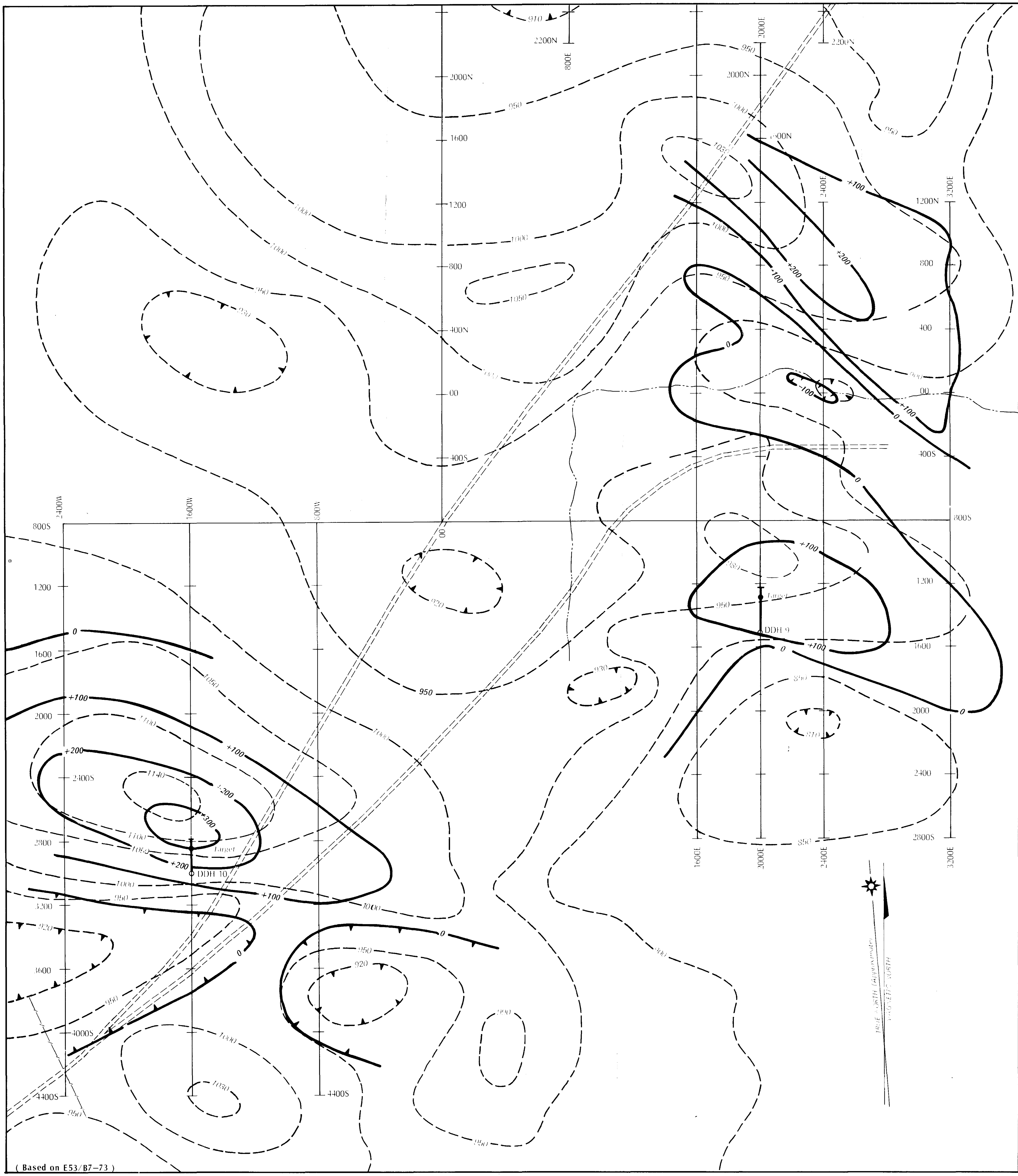
E53/B7-104



TENNANT CREEK N.T.
GREAT WESTERN GEOCHEMICAL RESERVE
CONTOURS OF VERTICAL MAGNETIC INTENSITY
CONTOUR INTERVAL 50 GAMMA

E53/87-72

PLATE 27



LEGEND

Track

Creek

Fence line

Ground traverse

Aeromagnetic contours

Aeromagnetic contours taken from BMR map E53 B1-39. (position approximate)

Ground magnetic contours

Ground magnetic contours are based on arbitrary datum which is not necessarily the same for other parts of Area 4

Magnetic 'low'

FEET

400 0 400 800

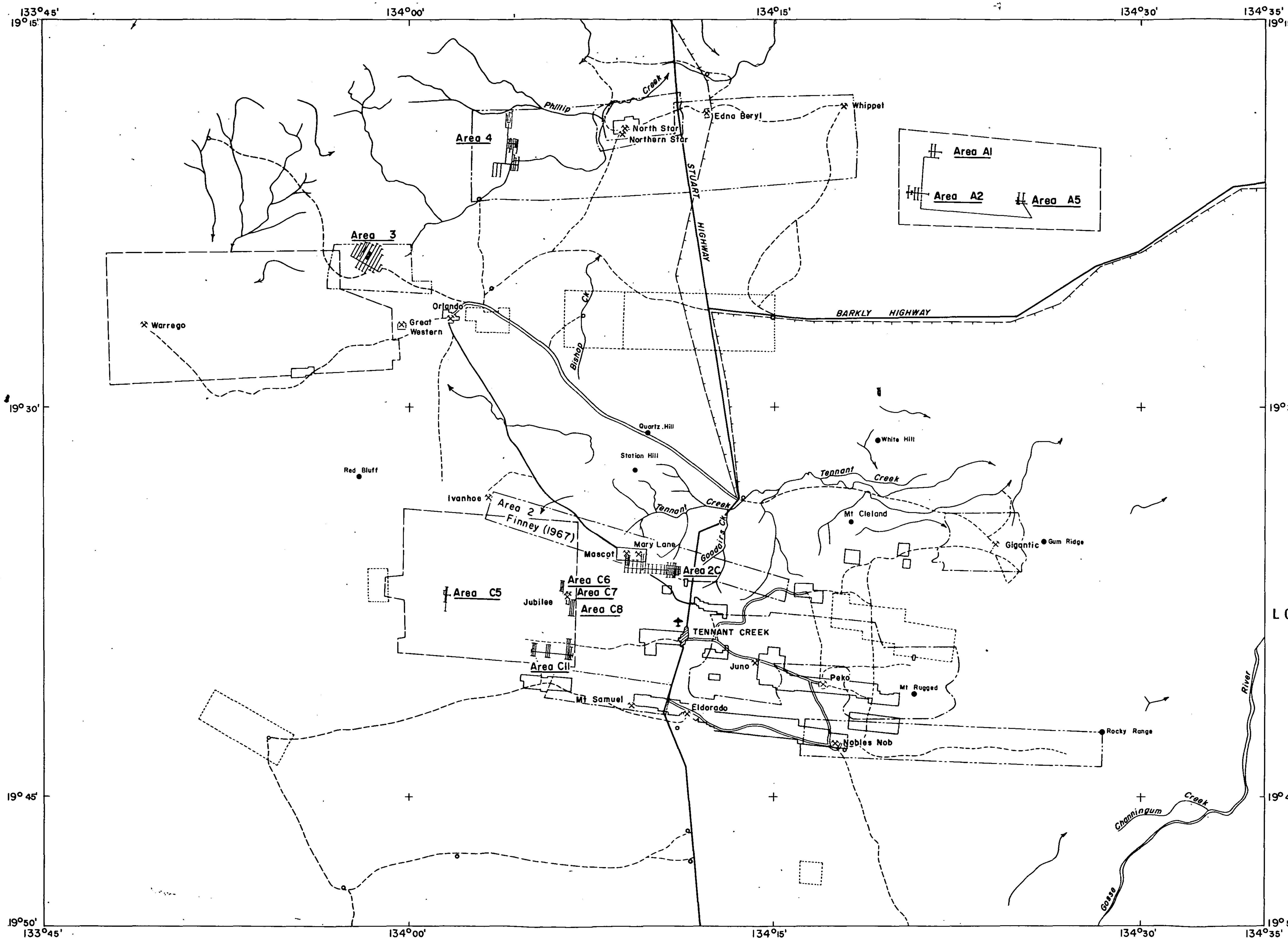
TENNANT CREEK NT AREA 4, SOUTHERN PART

TRAVERSES SHOWING AEROMAGNETIC AND GROUND MAGNETIC CONTOURS

To accompany Record No.1969/87

E53/B7-74

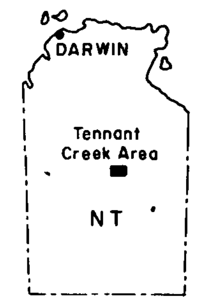
PLATE 28



LEGEND

River or creek
Highway or main road
Secondary road
Road or track
Bore
Mine
Aerodrome or landing ground
Boundary of 1964 BMR airborne survey
" " 1966 " " "
" " 1967 " " "
" " AGGSNA ground magnetic survey
" " BMR " " "
1967 BMR traverse layouts
Telephone line
Builtup area

LOCATION DIAGRAM



TENNANT CREEK MAGNETIC SURVEY, 1967

LOCALITY MAP SHOWING SURVEY AREAS IN RELATION TO PREVIOUS SURVEYS

MILES

4 2 0 4 8

To accompany Record No. 1969/87

E53/B7-77