PROJECT NAME: RINGAROOMA JOINT VENTURE

TITLE: PALAEOGEOMORPHOLOGICAL STUDY OF NORTHEAST TASMANIA PHASE 1 LANDSAT ANALYSIS

AREA NAME/S, STATE 1:250,000 SHEET NO/S & COORDINATES: TAS, K55-4

COMMODITY/IES:

TEXT PAGES NO: 6

PLAN NOS: See attached list

TABLE NOS:

APPENDICES:

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DATE: 1 March 1982

AUSTRALIAN ANGLO AMERICAN LIMITED

Incorporated in the State of Victoria

760002

C O N T E N T S

760003

LIST OF PLANS

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TAS-10-69	Palaeodrainage System	1:250 000
TAS-10-62	Lineaments	1:250 000
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TAS-10-58	Rose Diagram - Lineaments -10° Interval	
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TAS-10-67	Directional Lineaments 129 - 161°	1:250 000

RINGAROOMA JOINT VENTURE

PALAEOGEOMORPHOLOGICAL STUDY OF NORTHEAST TASMANIA

PHASE 1 LANDSAT ANALYSIS

1. INTRODUCTION

The area investigated in this study covers the eastern half of the Launceston map sheet No K55-4. This study was based on the Landsat image produced by the Australian Landsat Station (No C060881/2238823055 Path 96 Row 89). In addition to Landsat imagery examination, profiles across the area were produced from the 1:100 000 topographic maps, and a drainage map of the area was produced from 1:250 000 scale topocadastral map. The area investigated is bounded on the west by the Tamar Valley and consists of a dissected highland which abuts onto the east coast and is bounded by the coastal plains in the north and valley of the river Esk in the south.

Vegetation cover is uniform outside of the valley floors, which are cultivated. A structural analysis based on fractures interpreted from the Landsat imagery has been carried out. Examination of the imagery in detail using the interactive image processing system assisted in the detection of fractures which were incorporated in the fracture interpretation map.

2. GEOLOGY

Geologically the area consists of two major batholiths i.e. the Blue Tier granite in the east and Roses Tier granodiorite in the centre of the area. These batholiths are intruded into lower Devonian Mathinna sediments which strike at approximately 140^{o} *. The western and southern margins of the area investigated are underlain by Permo-Carboniferous sediments which are capped by Jurassic dolerite and related rocks. Terrestrial Tertiary sediments are confined to the coastal plain and river valleys. Tertiary basalts also infill some of the valleys. Recent (Quaternary) sediments, alluvium and talus, blanket the coastal plain and cover the floors of valleys throughout the area.

Overlaying the geological survey map of the area onto the Landsat image demonstrates that lithological boundaries can be detected on the imagery. No major discrepancies are indicated though the boundaries are not easily discernable on the Landsat imagery. Several areas within the Blue Tier batholith have a distinctly different Landsat signature compared with the surrounding areas which suggests lithological variation within the batholith, which is not indicated from the geological survey map. (See TAS-10-69)

* All bearings in this report refer to AMG grid north.

...2

3. STRUCTURAL ANALYSIS

3.1. Folding

No fold axes or closures can be detected from the Landsat imagery.

3.2. Fracturing (TAS-10-62)

Fractures have been delineated from the Landsat imagery and analysed using the Linal programmes run on the EDB system

3.2.1. Rose Diagram Analysis (TAS-10-60, 58, 61 & 59)

The Rose diagrams produced from the Landsat fracture data show the following:

a. Major fracture trends at 20^{o}, 80^{o}, 120^{o} and 140^{o}

b. Using Huntingtons[2] parallelogram method for Rose diagram analysis the regional strike has been determined at 135^{o}. This is close to the measured strike from the geological map of 140^{o}.

3.2.2. Fracture Density Analysis (TAS-10-54, 53, 57, 68, 55, 56 & 60)

Fracture density maps have been plotted for fracture intersections and fracture length per unit (10 km cell). The contour pattern for both intersections and total number of fractures is similar. A northwest trend to the contour is apparent and highs appear to be associated with the outcrop of granodiorite and to a lesser extent the Jurassic dolerite. This is probably a reflection of the outcrop characteristics of these rocks rather than on their response to deformation. The directional density plots indicate that fracture trends are uniformly distributed throughout the area with the exception of $4\text{-}26^{o}$ fracture trend which is concentrated in the central, north and eastern part of the region.

A comparison of the lineament density plots with the Bouger anomaly map of the area did not indicate any correlation between gravity highs or lows and intersection highs or lows.

...3

4. GEOMORPHOLOGICAL INTERPRETATION

4.1. Structural Control (TAS-10-69)

There is a strong coincidence of structural lineaments/ fractures with river and stream valleys. The prominent trend of drainage throughout the area is northwest. In several locations it is apparent from the Landsat imagery that palaeoriver courses trending northwest have been captured by drainage controlled by east-west fractures. Windgaps located on the Landsat imagery and topographic maps also indicate changes in drainage patterns. Obvious examples of captures are indicated on TAS-10-69.

The pattern of northwest trending rivers captured by later east-west trending drainage supports and is supported by the fracture analysis, which indicates that northwest to northeast trending fractures pre-date later east-west trending fractures. As indicated on TAS-10-69 the pre-Tertiary (?) drainage pattern for the area may have consisted of a number of consequent rivers draining northwest across the present northern coastal plain and from the palaeo divide southeast into what is now the Esk River valley, which then discharged to the east.

4.2. Warping (TAS-10-70 & 71)

No evidence for major upwarps has been detected from Landsat imagery covering this area. However, examination of geological profiles drawn across the area has been made in an attempt to determine the existence and location of palaeo warps.

Probable palaeosurfaces were extrapolated from the surface geology and topography (TAS-10-70 & 71). The fracture interpretation map was also used to examine the relationship of faulting to palaeosurfaces. Four surfaces have been suggested:

- the pre-Carboniferous surface;
- the pre-Jurassic (dolerite) surface;
- the pre-Tertiary surface; and
- the Tertiary to Recent surface.

The pre-Carboniferous surface, (Mathinna Beds, Upper Devonian adamellites and granodiorites) appears to be sub horizontal in the centre of the area with a maximum height of 1050m. To the east, this surface has been downfaulted towards the coast. Subsequent erosion has planed this surface and it now appears to dip gently eastwards. To the west this surface is overlain by Permo-Carboniferous sediments and Jurassic dolerite and appears from the profiles to dip at 10^{o} to the west. To the south this surface dips gradually southwards away from the centre. North of the Blue Tier Batholith there appears to be a graben and north of this graben the surface dips gently into the Bass Basin.

...4

The major fault trends which initially affected this surface are at 10 - 20°. This is made evident by the distribution of fractures on this trend in the area, which appear to be masked by Jurassic and later rocks and displaced by all other fracture trends.

The pre-Jurassic surface in the west and south of the area appears to be dipping west into the Tamar graben and south into the South Esk Valley, as does the pre-Tertiary surface. The two surfaces appear to be parallel.

Where surfaces dip to the west this is probably the result of movement on the major faults trending at 145°. Cross faulting at 80° has developed a series of uplifted blocks (the highest of these being the Ben Lomond area at 1 500m) raising the pre-Jurassic and pre-Tertiary palaeosurfaces well above their general levels in the area.

The post Tertiary surface has been infilled in places by Recent alluvium.

There is little or no evidence for major warping, either up or down, and any change in palaeosurface levels and slope is the result of a fault controlled northwest trending divide in the west of the area.

From the data available from this phase of the survey it has not been possible to delineate precisely the post Tertiary surfaces, which are near horizontal.

4.3. Evolution of Geomorphology (TAS-10-69)

Two stages can be determined in the evolution of geomorphology of the area:

a. Pre-Tertiary to Early Tertiary (±) north-south consequent rivers controlled by an early fracture system, i.e. a trellis drainage system.

b. Tertiary/Quaternary River System: This is the present drainage which can be subdivided into four provinces:

   i. Drains north into the Bass Strait.

   ii. Drains west into the Tamar Valley.

   iii. Drains south into the South Esk.

   iv. Drains east into the Tasman Sea.

From this survey it has not been possible to determine the order in which river capture have occurred, to arrive at an evolutionary scheme for the development of the drainage system in this area.

However, the general development history may be summarised as follows:

Preliminary development of northerly and southerly trending rivers from a northeast-southwest trending palaeodivide in pre to early Tertiary times.

This drainage was controlled by strong northwest and northeast trending fractures and the regional strike. Subsequently during the Tertiary the development of east-west fractures, (related to stress fields that produced the Bass Basin), resulted in headward erosion of subsequent streams along these fractures and therefore capture of the northerly and southerly trending streams. The temporal pattern was determined by changes in sea level during the Tertiary, (which controlled the rejuvenation throughout the area), and the fault controlled uplift to the east of the Tamar graben, along the pre Tertiary palaeodivide. This accentuated the headward erosion of eastward flowing consequent streams resulting in captures.

J Newton-Smith[1] has proposed at least three stages of capture to account for the evolution of the Ringarooma system. No evidence has been obtained to contradict or verify this hypothesis. It does appear, however, that the Ringarooma River may flow west-east along a graben in the Endurance area.

4.4. Drainage Anomalies

On the northern coastal plains there are a number of possible courses which the Ringarooma River may have previously followed. These may be target areas for the location of alluvial tin deposits, the source of which would have been the Blue Tier Batholith. Other palaeo-drainage channels in the centre of the area were probably never connected to the streams draining the Blue Tier Batholith. Furthermore, high level remnants of these valleys do not appear, from the Landsat imagery, to have any extensive alluvial infill.

5. RECOMMENDATIONS

From the evidence available it is apparent that the evolution of drainage geomorphology in this area has been influenced and controlled by structural lineaments. The general pattern of spatial changes in the drainage pattern has been determined. Evidence for the more specific locations of palaeoriver

channels and the order of evolution cannot be determined reliably by using Landsat imagery and topographic maps alone. To achieve this, aerial photographs should be examined in stereo. This should permit the location of palaeo terraces and other high level drainage features which can then be plotted onto base maps at their correct altitude, hopefully permitting the development of a temporal as well as spatial view of the regional drainage development.

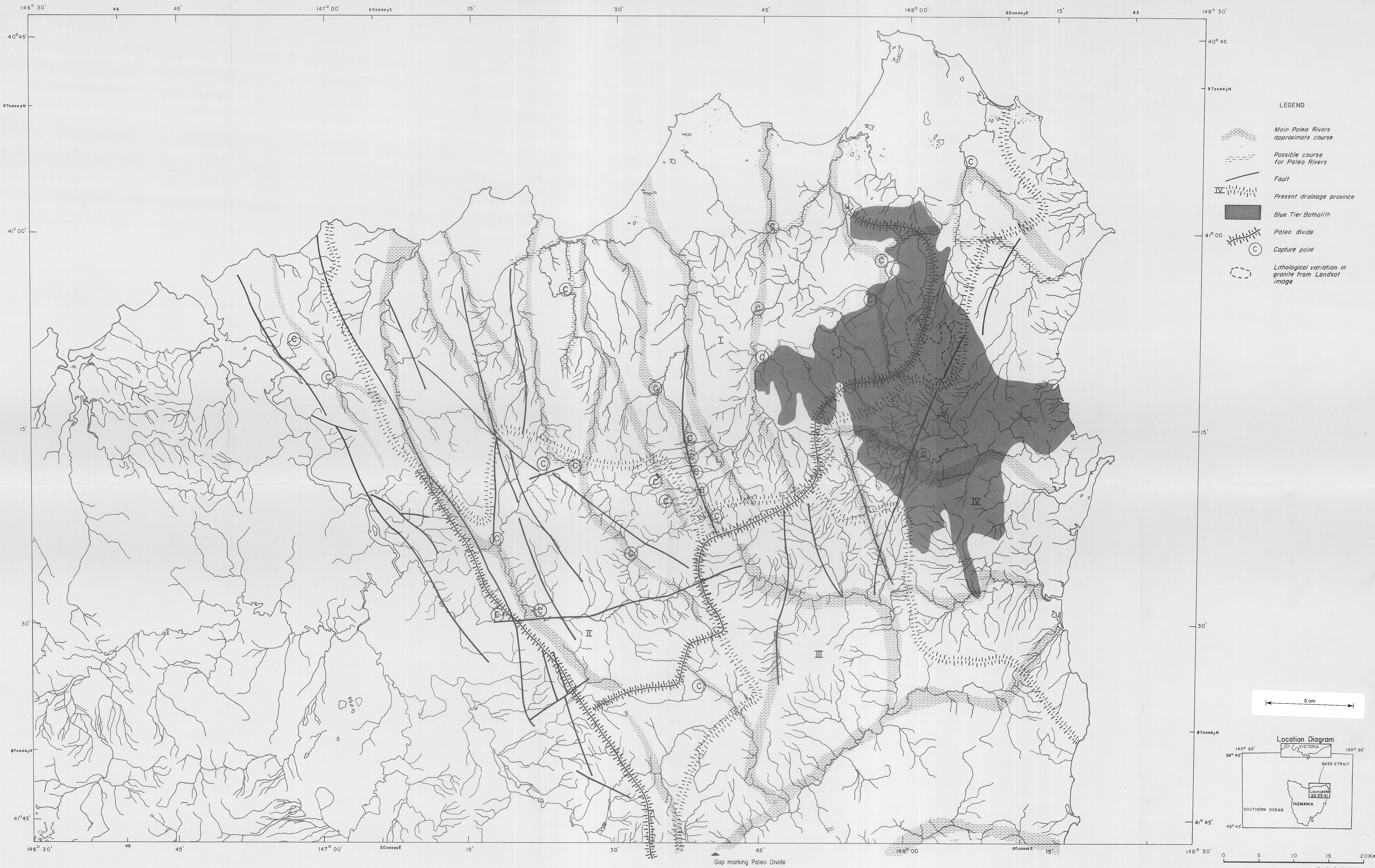
M C Hussey

1 March 1982

REFERENCES

1. J Newton-Smith 1981. A preliminary review of the alluvial tin potential of the Ringarooma Valley (IC Doc 10469)

2. J F Huntington 1969. Methods and application of fracture trace analysis in the quantification of structral geology. Geo. Mag. Vol 106. No 5



82-1778. 760011

AUSTRALIAN ANGLO AMERICAN LTD			
PROJECT	RINGAROOMA JOINT VENTURE		
AREA	NORTH EAST TASMANIA		
DATA	RESEARCH & TECHNICAL SERVICES DIVISION PALEO DRAINAGE SYSTEMS		
COMPILED	M.C.Hussey	SCALE	1:250 000
DRAWN	February 1982	REF No	TAS-10-69
AMENDED			

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40 45 0

5480000.
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82-1778.

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

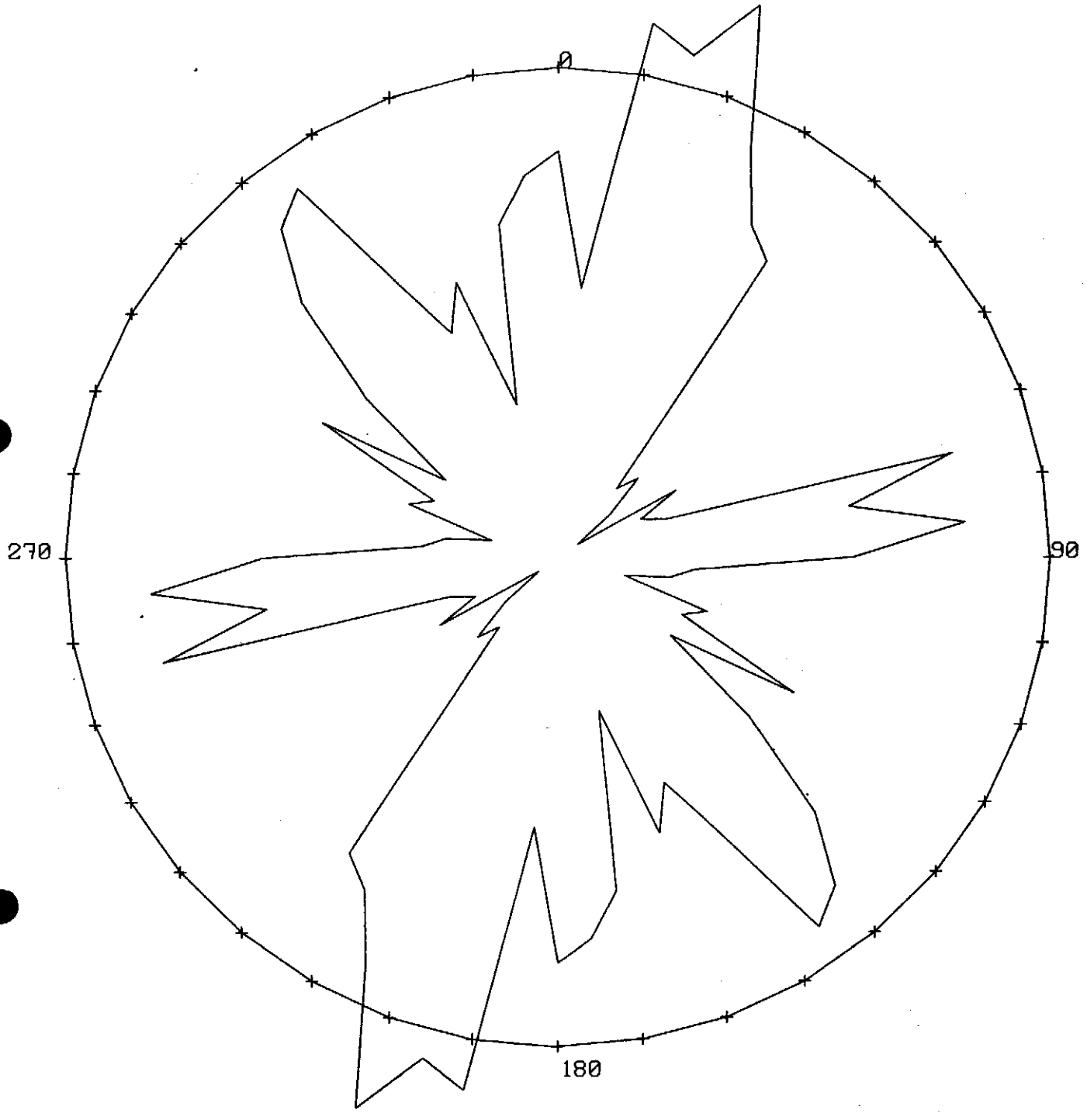
TAS-10-62 760012

5 cm

LINAMENTS

LINAMENT INTERSECTIONS

760013



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CIRCLE RADIUS = 5 PERCENT
BASED ON AZIMUTH/NUMBER
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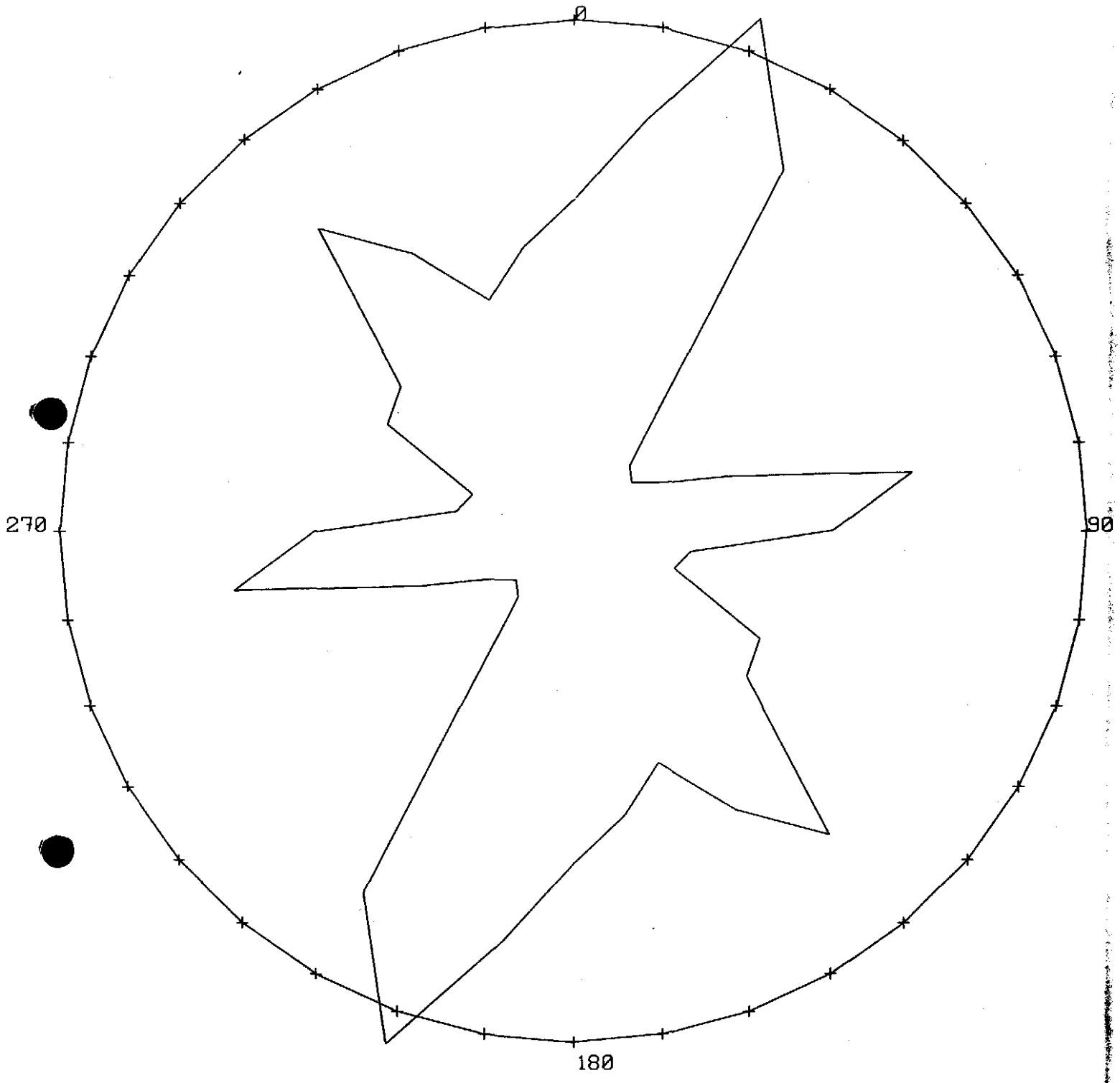
PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82



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CIRCLE RADIUS = 11 PERCENT
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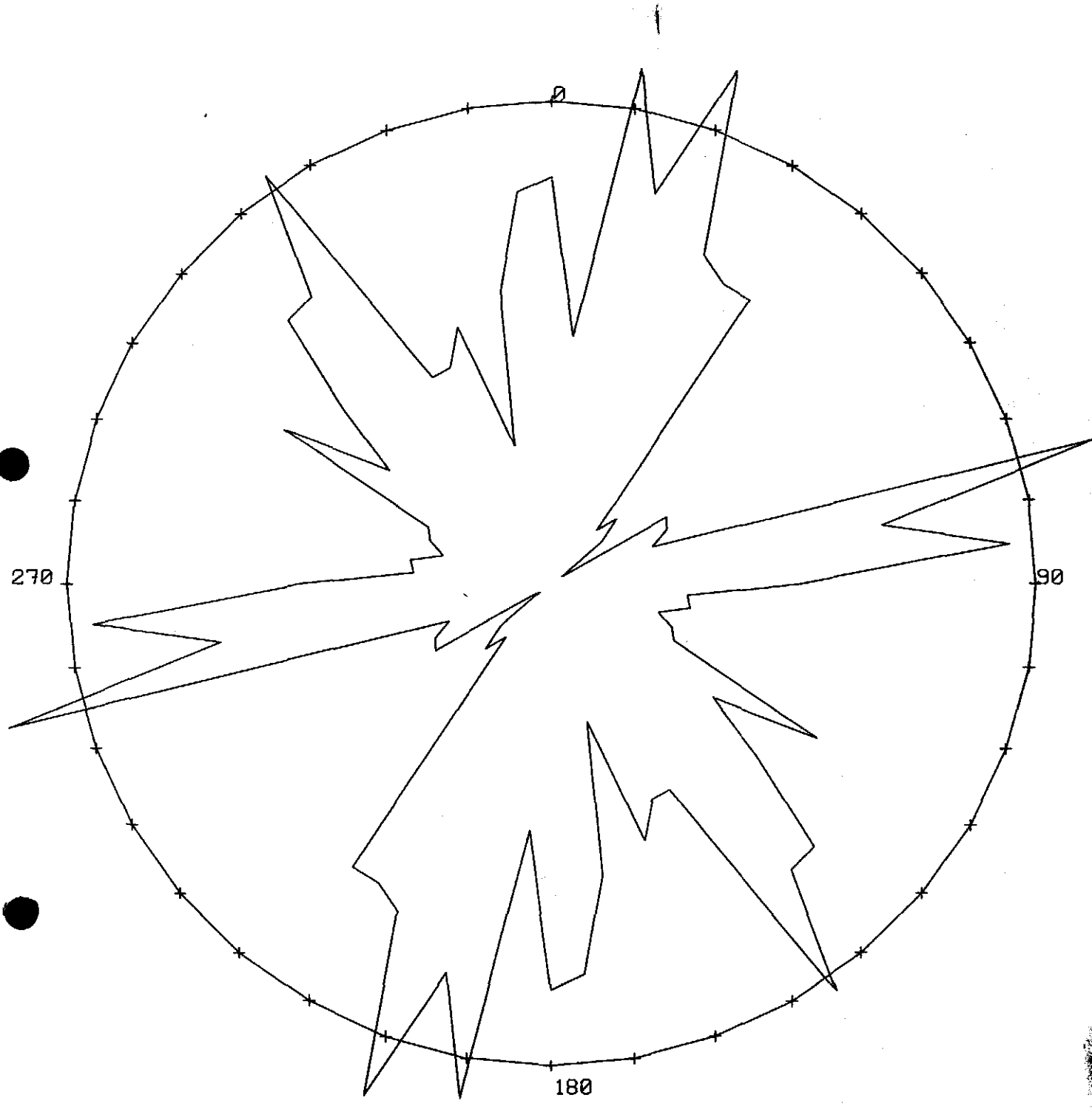

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BASED ON AZIMUTH/LENGTH
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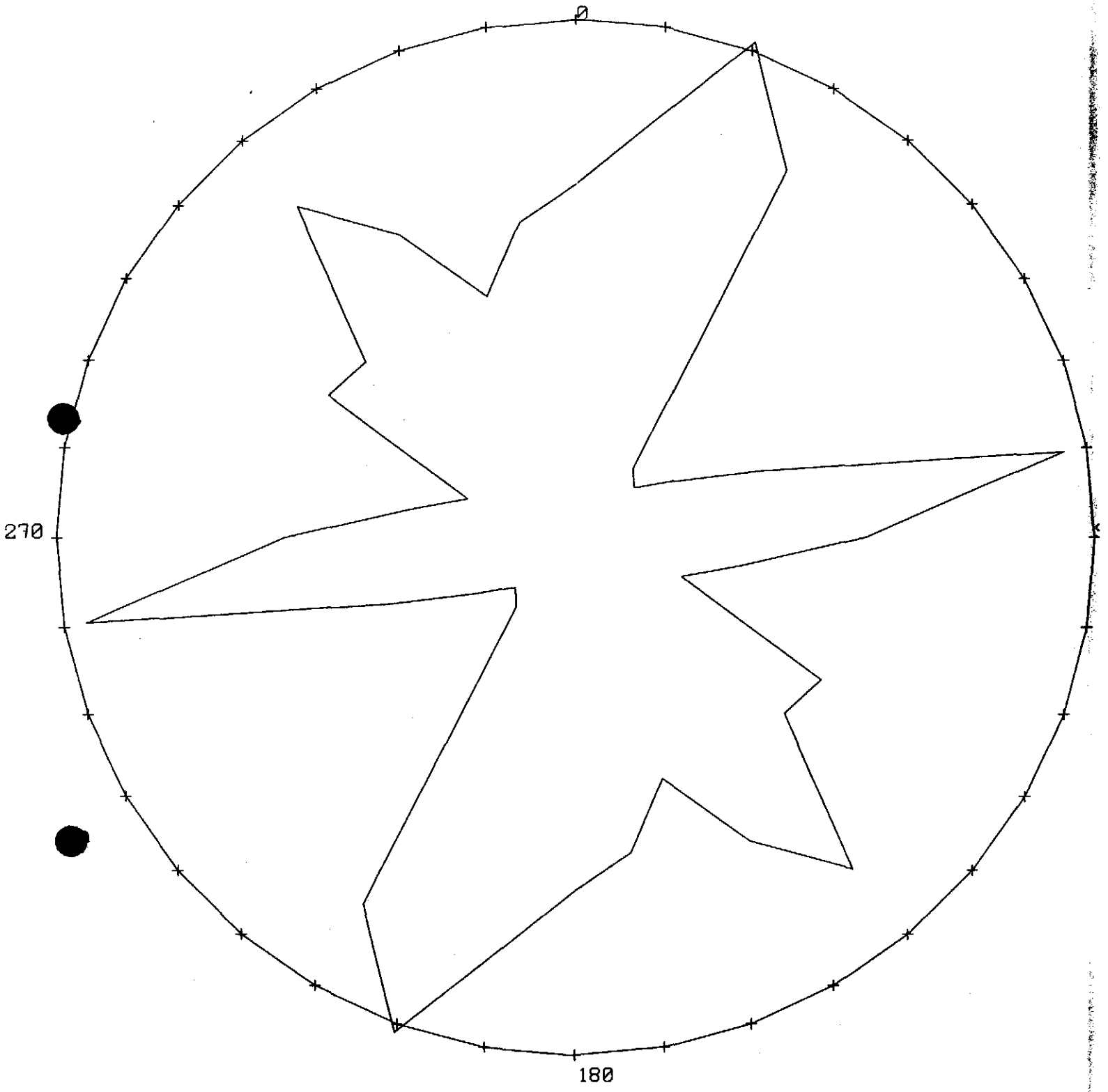

AREA ID. : BLUELN
INTERVAL=10 DEGREES
CIRCLE RADIUS = 10 PERCENT
BASED ON AZIMUTH/LENGTH
TOTAL LENGTH OF LINAMENTS = 135. KMS.

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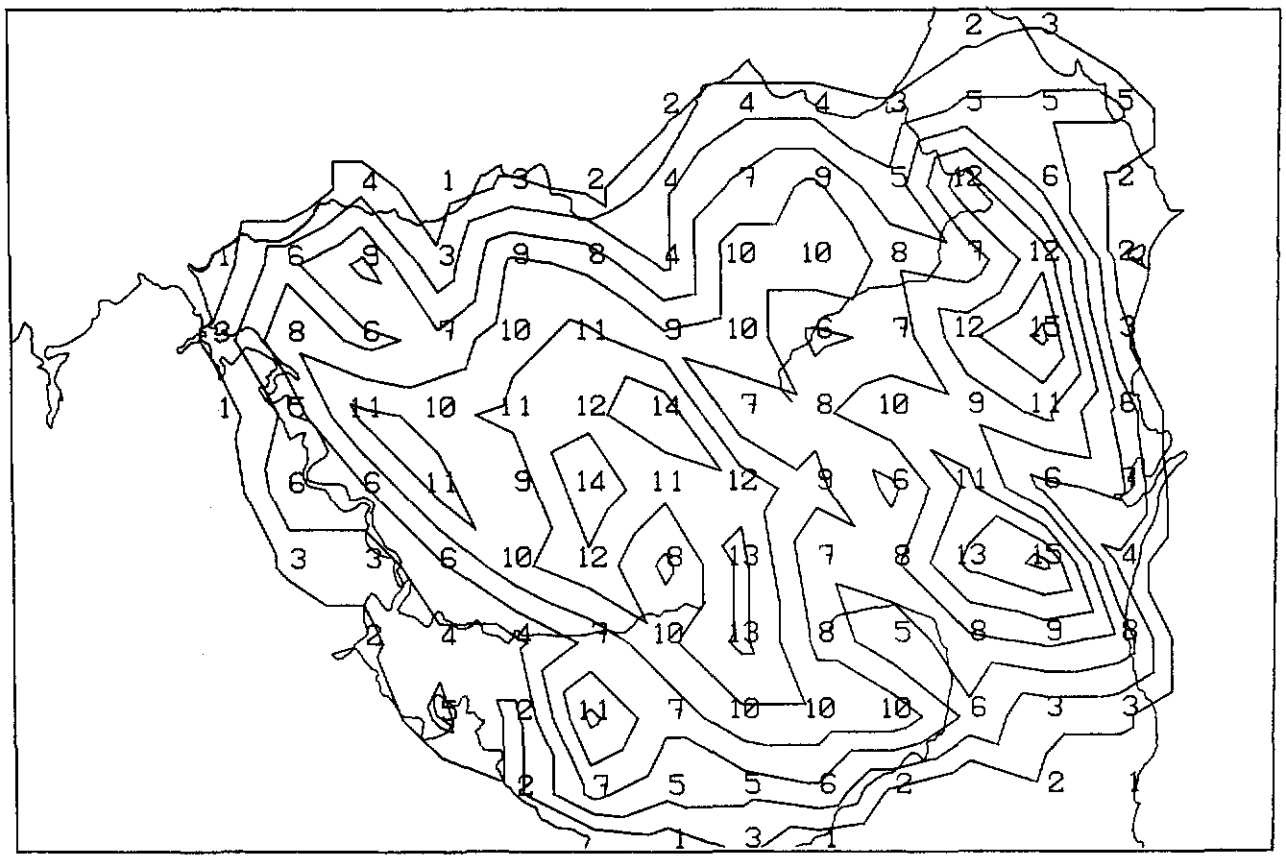
148 30 0

40 45 0



41 45 0

146 30 0

148 30 0

5 cm

760017

LINAMENT DENSITY

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE (N/E TASMANIA 11-FEB-82

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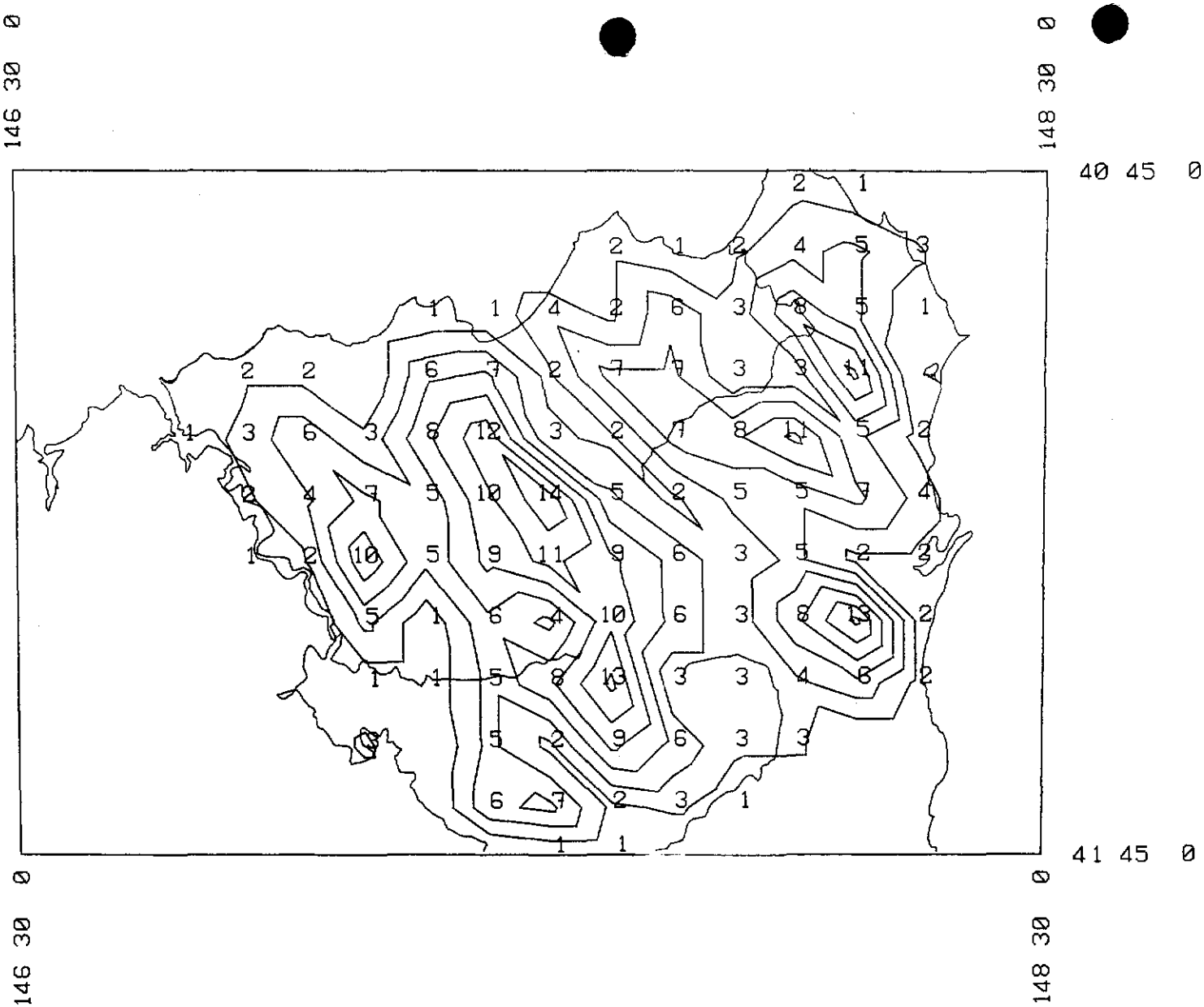
TAS-10-54



760018

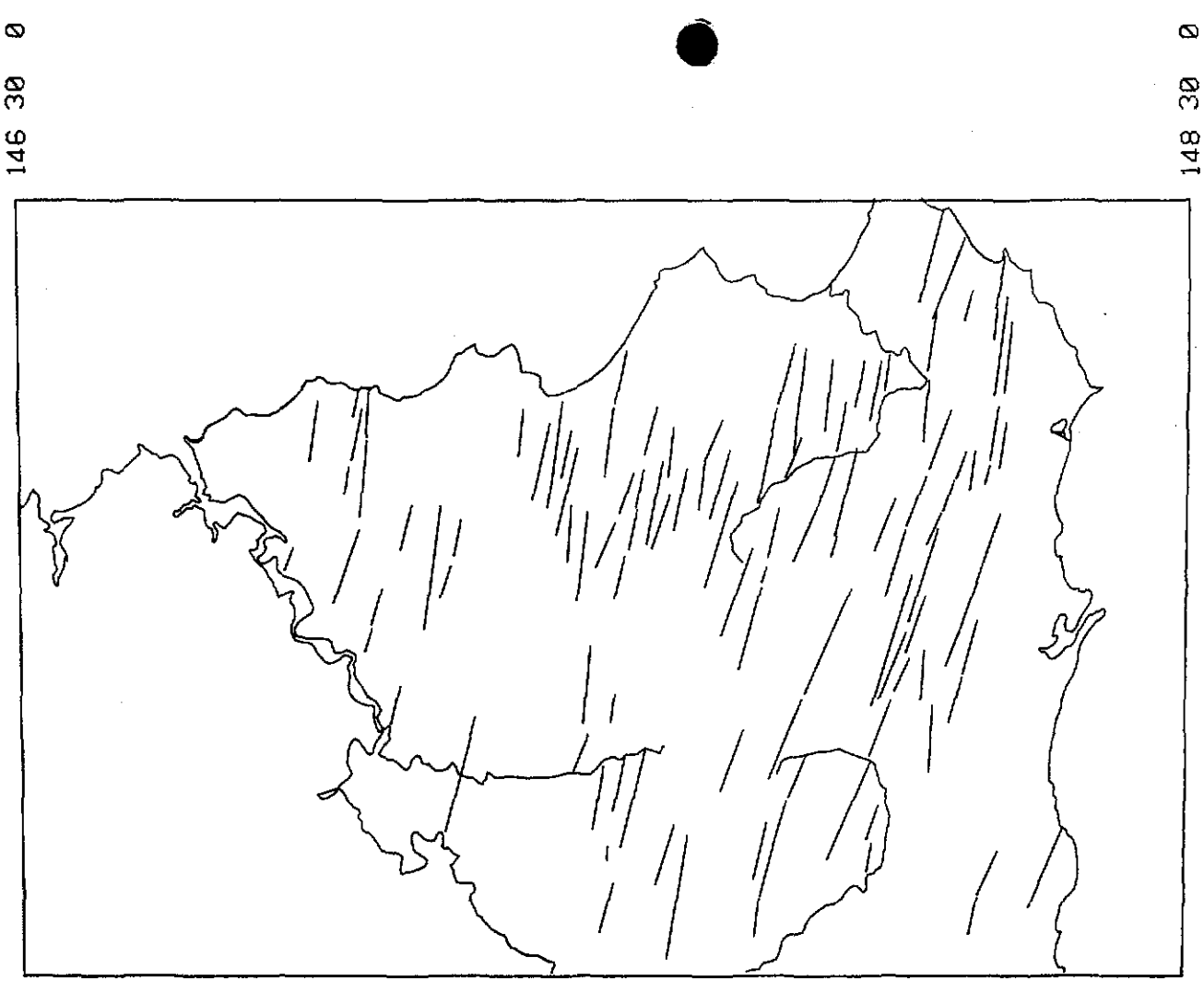
5 cm

INTERSECTION DENSITY

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE (N/E TASMANIA 11-FEB-82

SCALE 1 TO 1000000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-53



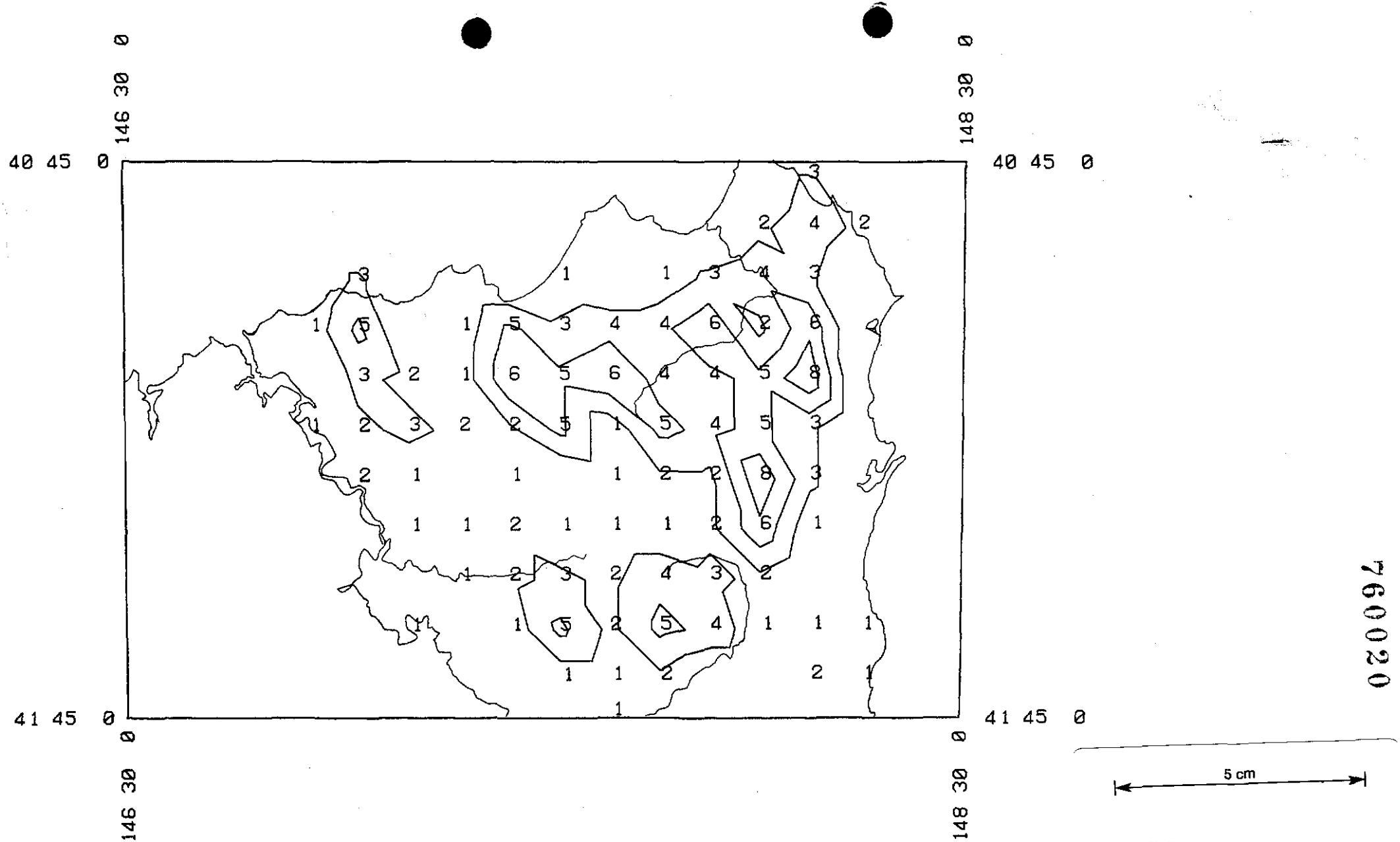
5 cm

DIRECTIONAL LINAMENT BETWEEN 4. AND 26. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE (N/E TASMANIA 11-FEB-82

SCALE 1 TO 1000000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-57

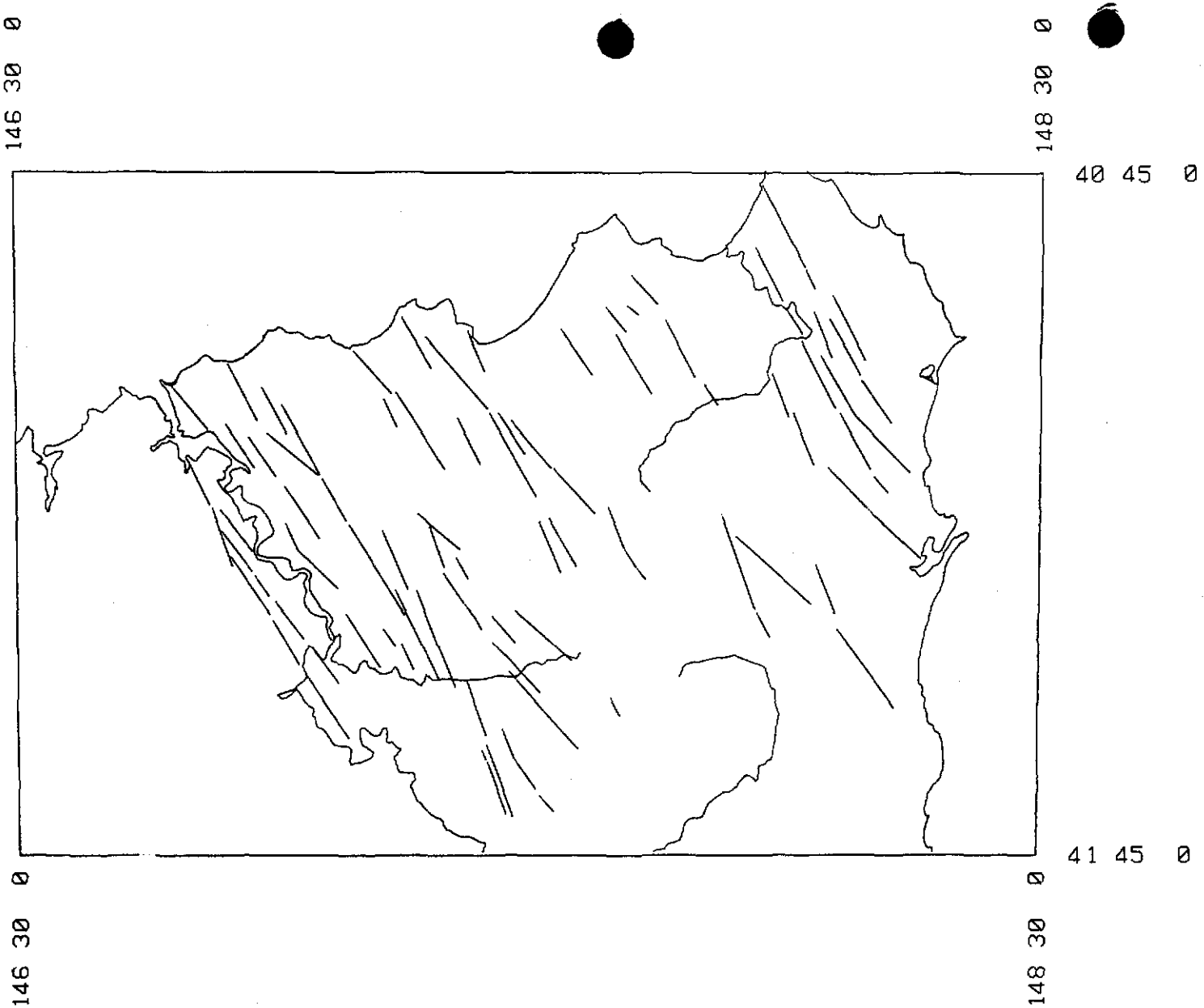


DIRECTIONAL LINAMENT BETWEEN 3. AND 27. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE

SCALE 1 TO 1000000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-JO-68



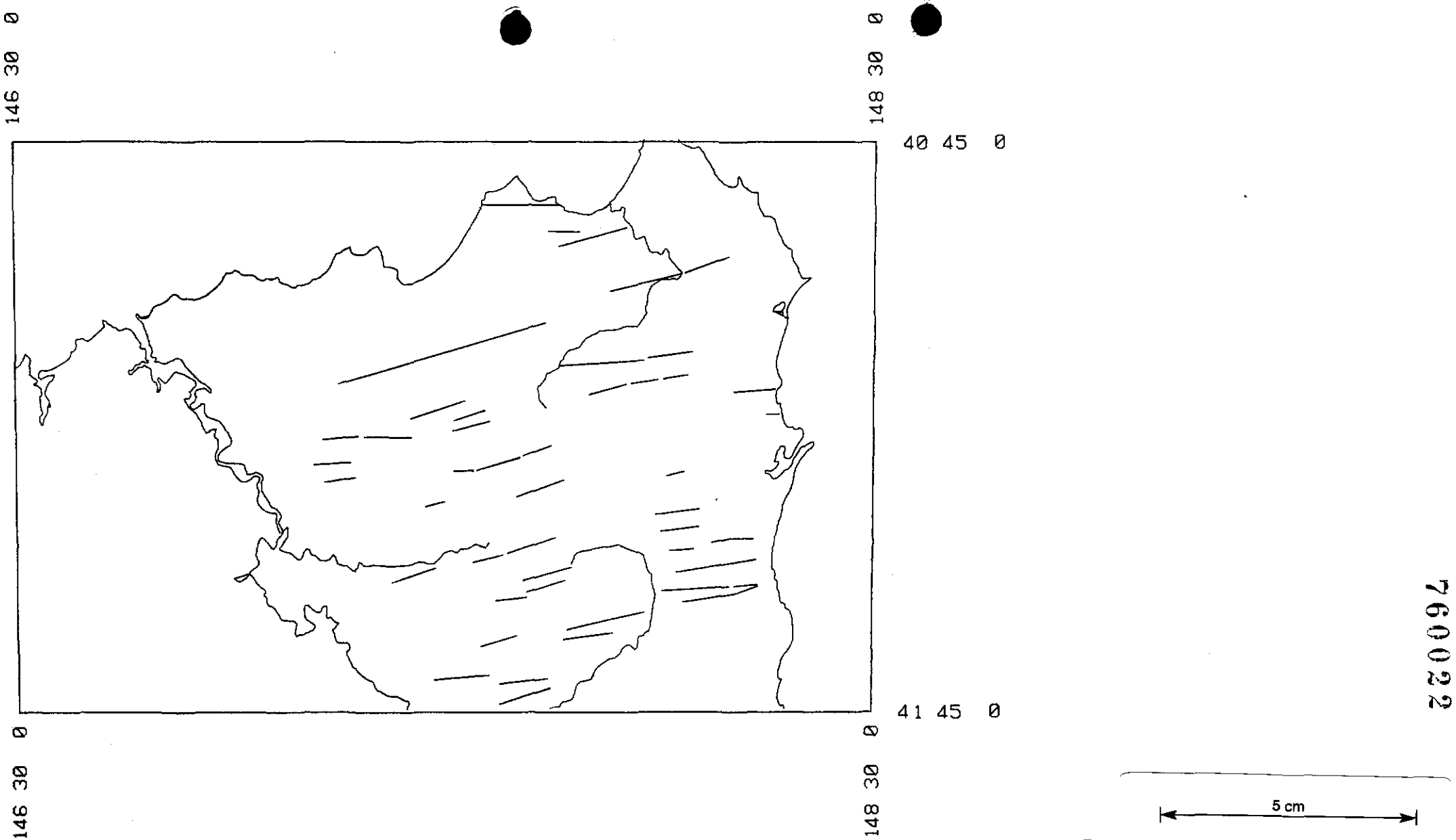
760021

DIRECTIONAL LINAMENT BETWEEN 129. AND 161. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE (N/E TASMANIA 11-FEB-82

SCALE 1 TO 1000000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-55



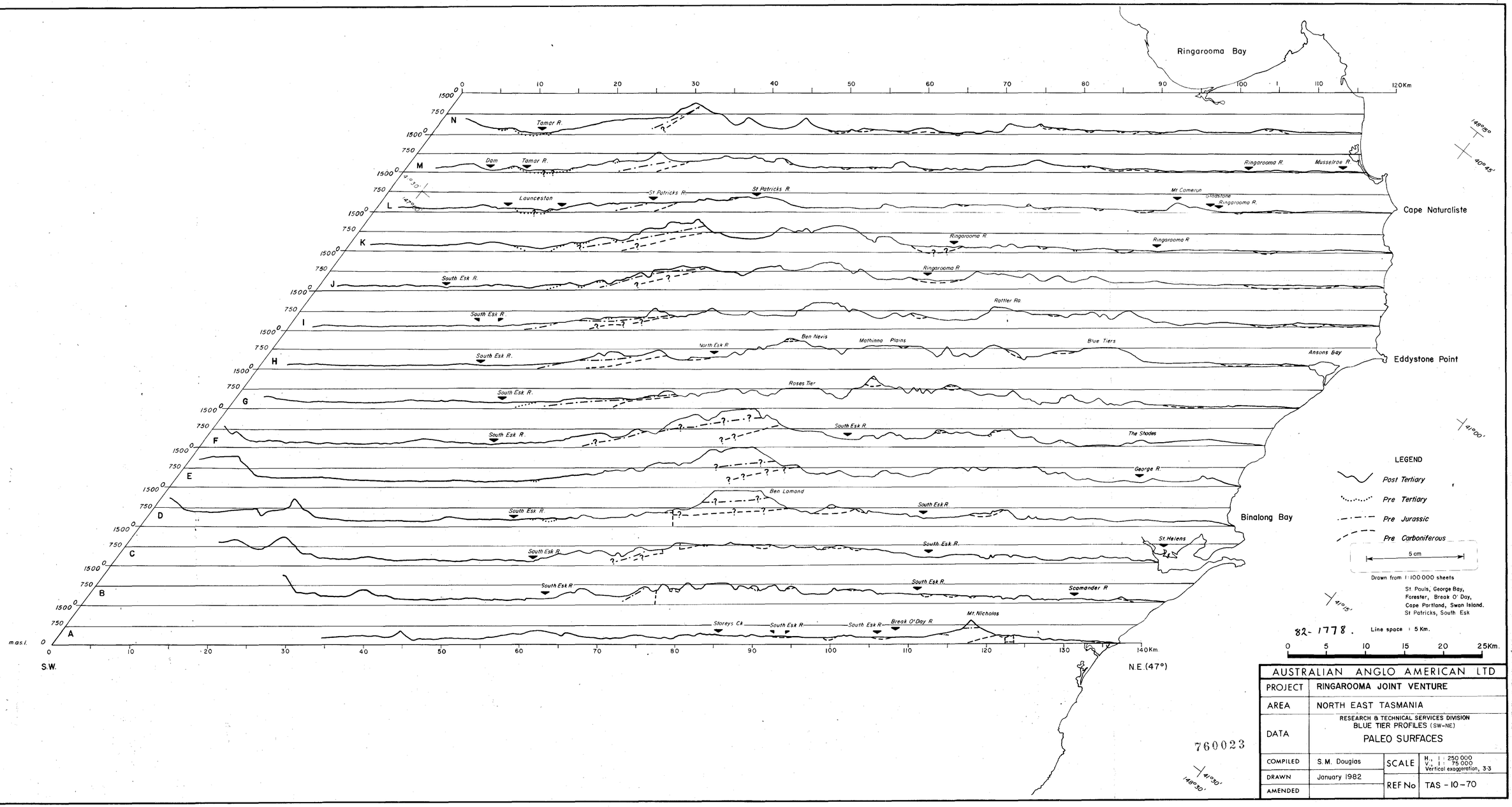
760022

DIRECTIONAL LINAMENT BETWEEN 69. AND 91. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE (N/E TASMANIA 11-FEB-82

SCALE 1 TO 1000000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

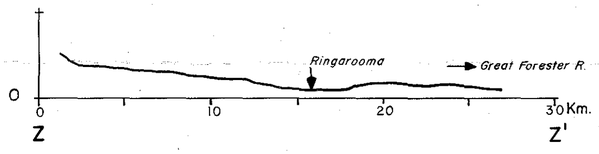
TAS-10-56



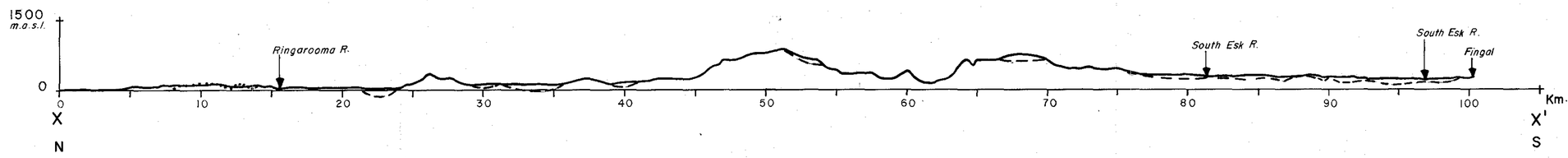
82-1778.

760023

AUSTRALIAN ANGLO AMERICAN LTD			
PROJECT	RINGAROOMA JOINT VENTURE		
AREA	NORTH EAST TASMANIA		
DATA	RESEARCH & TECHNICAL SERVICES DIVISION BLUE TIER PROFILES (SW-NE) PALEO SURFACES		
COMPILED	S.M. Douglas	SCALE	H.: 1 : 250 000 V.: 1 : 75 000 Vertical exaggeration, 3·3
DRAWN	January 1982	REF No	TAS - 10 - 70
AMENDED			



PROFILE OF CASCADE RIVER. (JNS.-TAS-100-9)



LEGEND

Pre Tertiary

Pre Carboniferous

0 5 10 15 20 25 Km.

82-1778.

760024

5 cm

AUSTRALIAN ANGLO AMERICAN LTD			
PROJECT	RINGAROOMA JOINT VENTURE		
AREA	NORTH EAST TASMANIA		
DATA	RESEARCH & TECHNICAL SERVICES DIVISION BLUE TIER PROFILES (N-S) PALEO SURFACES		
COMPILED	S. M. Douglas	SCALE	H., 1 : 250 000 V., 1 : 75 000 Vertical exaggeration 3·3
DRAWN	February 1982	REF No	TAS-10-71
AMENDED			

146 30 0

40 45 0

148 30 0

40 45 0

41 45 0

146 30 0

148 30 0

41 45 0

760025

LINAMENT DENSITY

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-63

82-1778.

5 cm

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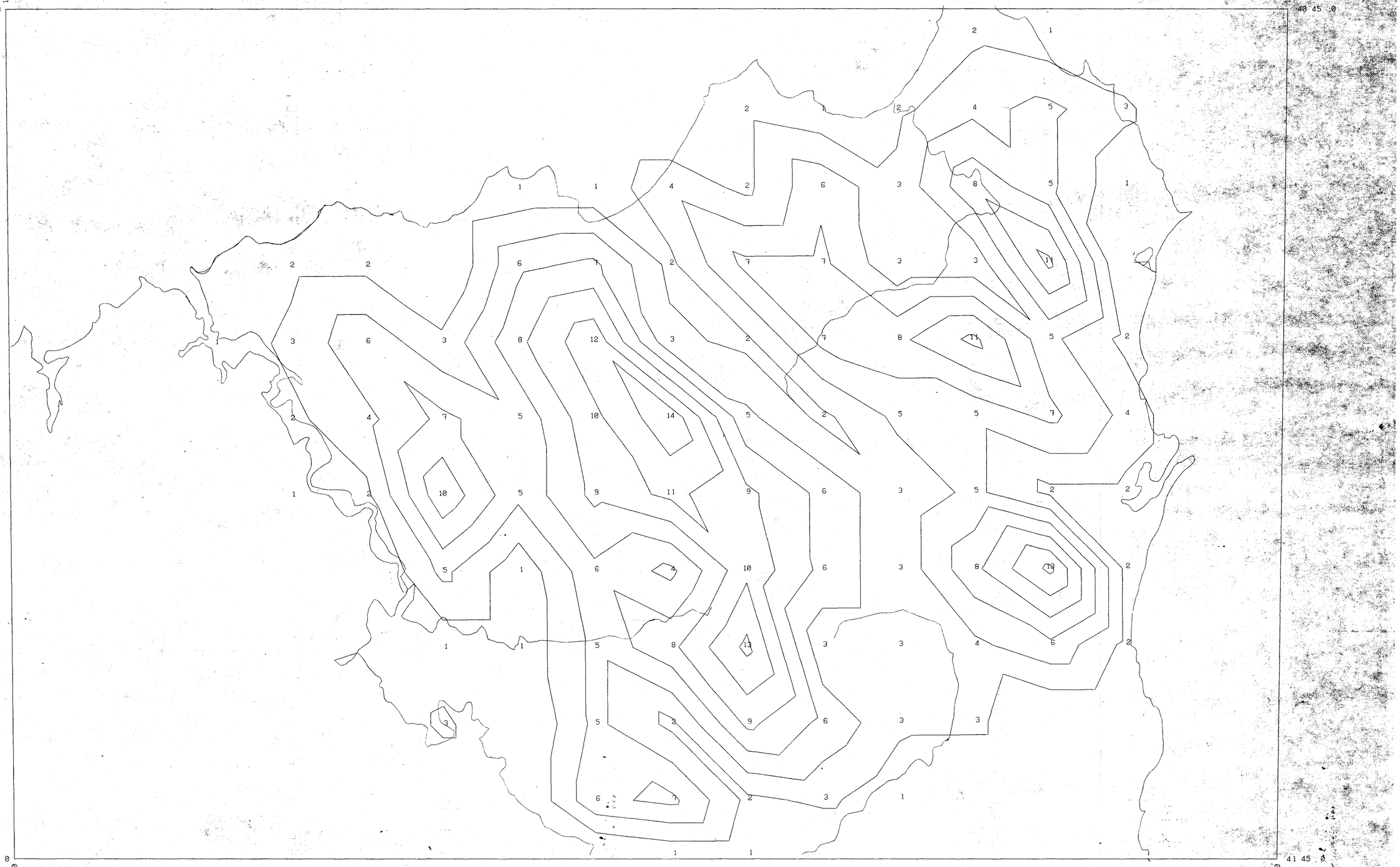
40 45 0

148 30 0

40 45 0



41 45 0

146 30 0

760026

148 30 0

41 45 0

INTERSECTION DENSITY

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-64

82-1778.

5 cm

40 45 0

146 30 0

148 30 0

40 45 0

41 45 0

146 30 0

148 30 0

41 45 0

760027

DIRECTIONAL LINAMENT BETWEEN 4. AND 26. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-65

82-1778.

5 cm

40 45 0

148 30 0

148 30 0

40 45 0

41 45 0

146 30 0

148 30 0

41 45 0

760028

DIRECTIONAL LINAMENT BETWEEN 69. AND 91. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-66

82-1778

5 cm

40 45 0

146 30 0

148 30 0

41 45 0

760029

DIRECTIONAL LINAMENT BETWEEN 129. AND 161. DEGREES

PALEO GEOMORPHOLOGICAL STUDY RINGAROOMA JOINT VENTURE N/E TASMANIA 11-FEB-82

SCALE 1 TO 250000. GRID SIZE = 10000.METRES (A.M.G. PROJECTION)

TAS-10-67

82-1778.

5 cm