Calgary

821-06-06-015

DIGITAL SEISMIC SURVEY
TIEDA LOON AREA, N.W.T.

for

CanDel Oil Ltd.
Calgary, Alberta

by

Geophysical Service Incorporated
Calgary, Alberta

during

November and December, 1972

over

Permit 6446

Report by

McGee Exploration Ltd.

April, 1973

Project No.821-6-6-72-5

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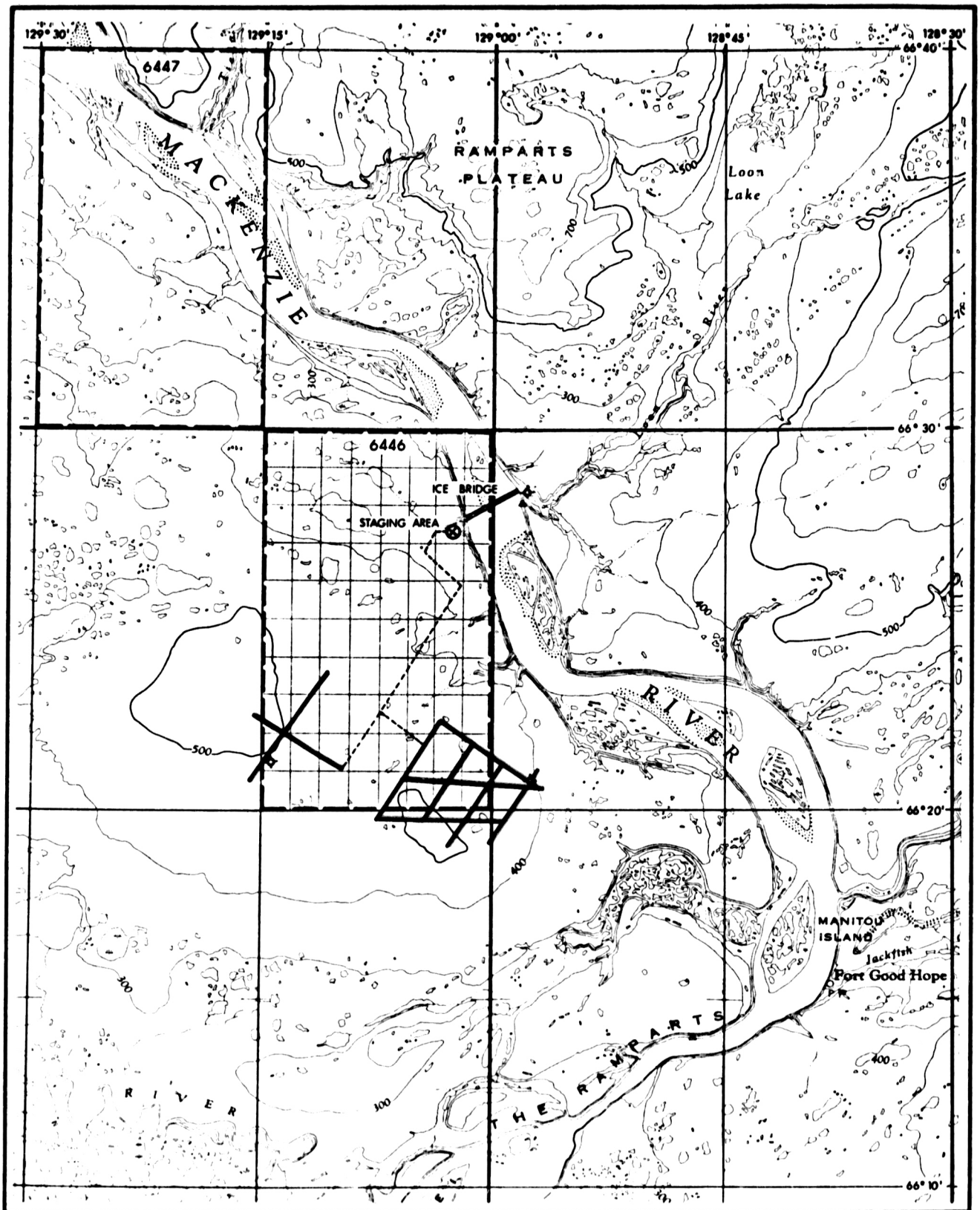
INTRODUCTION

A small seismic survey consisting of 32.8 miles of 800% common depth point profiling was carried out for CanDel Oil Ltd. by Geophysical Service Incorporated during the months of November and December, 1972, in the Tieda-Loon Area.

The survey area is located in NTS 106-I-SW just a few miles west of the Mackenzie River and about 15 miles northwest of the village of Fort Good Hope. A location map of the area is attached as Figure 1.

The purpose of the survey was to look for anomalous conditions around the Atlantic SW Airport Creek #1 and the Atlantic Col. Car. Manitou Lake L-61 dry holes. To effect this, seven lines of closely spaced lines were programmed west of and tying to the L-61 test, and two lines of seismic profiling were positioned north of and tying to the Airport Creek #1 dry hole.



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DRAWN BY C B JAMES	DATE MAY 29/73	
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SCALE MILES 4 3 2 1 0 4		

TIEDA - LOON AREA

(NORTHWEST TERRITORIES)

SEISMIC LOCATION MAP

FIGURE 1

STATISTICAL DATA

Dates of Operation

September	Barge equipment from Grandview to Airport Creek staging area on the Mackenzie River
November 25	First of crew arrive at Airport Creek
November 27	Prepare camp for move into Tieda Loon
November 28	Move camp to Tieda Loon Area and start shot-hole drilling
November 30	Recording crew begins shooting
December 11	Drills finish shothole drilling
December 16	Recording crew finishes shooting
December 17	Crew shuts down and personnel leaves by air

Production Statistics

Profiles Shot	385
Miles shot	32 8
Recording time including moving	190 25 hours
Recording time lost by breakdown	6 days
Holes drilled	389
Drill hours	614
Dynamite used	3880 lbs.
Caps used	392
Normal charge size	10 lbs
Normal hole depth	50 feet
Rock Bits used	10
Insert Bits used	44
Starter Bits used	21
Total bulldozing hours	1307 hours

Equipment

1. Camp (all sleigh mounted)

   3 - 10' x 32' - Twelve man sleeper trailers
   1 - 10' x 30' - Utility trailer
   1 - 10' x 32' - Kitchen-Diner

Camp (cont'd)

1 - 10' x 30' - Workshop with 30 KW Light Plant
1 - 10' x 40' - Flat Deck sleigh with 3 - 500 gallon fuel tanks
1 - 10' x 40' - Flat Deck sleigh with 5 - 500 gallon fuel tanks

2. Basic Party

1 - S-200 Foremost Recorder with Instrument Doghouse
1 - S-100 Foremost Shooting Unit
2 - 6T Foremost Flat Deck Cable Units
1 - 6T Foremost Flat Deck Camp Unit
1 - S-100 Foremost Survey Unit
1 - 1973 Bombardier Halftrack Party Manager Unit

3. Drills

1 - GSI owned 6T Foremost mounted Carey Auger Drill
3 - Seisform Drilling Mayhew 1000 Air Drills mounted on Nodwells

4. Caterpillar Tractors (L. I. Adams Construction)

2 - D6C Cats
1 - D7E Cat
1 - D7F Cat
1 - Kitchen, Diner, Sleeper Trailer mounted on sleigh
1 - Sleeper Trailer mounted on sleigh
1 - Office and Workshop on sleigh
1 - Power Plant and fuel sleigh with 3000 gallon storage

5. Recording Equipment

1 - DFS III, 21 track, 1 inch, Binary gain 48 Channel Recording system with spare parts, radios, tone boxes and 48 trace drywrite camera
17- Sections of cable (110' group intervals, 12 groups per section)
108- Strings of Geophones (9 per string, 8 cycle phones)

Personnel

1 Party Chief
1 Party Manager
1 Instrument Engineer
1 Shooter
1 Surveyor
1 Rodman
1 Cat Foreman
1 Cat Camp cook
1 Mechanic
2 Cooks
1 Camp Attendant
4 Drillers
4 Drill helpers
8 Helpers
4 Catskinners

FIELD PROCEDURES

Instrumentation

The recording instruments were a 48 trace, 21 track Tl Series DFS III digital field system with binary gain amplifiers. The instruments were mounted in a doghouse on an S-200 Foremost. Field recordings were displayed on drywrite paper with the use of a 50 trace camera. The records were displayed either as direct Playbacks, or as read after write monitors. Instrument tests to check dynamic range, amplifier noise, DFS noise, and AGC circuitry were run daily before commencing production shooting

The recording parameters were: sample rate, 2 ms.; record length, 4 seconds; recording filters, 124 - 18/36 slope; gain mode, operate; gain constant, 30 db; initial gain, varied; final gain, 90 db; upper set limit, 75%; lower set limit, 25%; galvo level, 15 db; 60 Hz notch filters, out

The shooting and spread details were as follows: type of coverage, 800% common depth point profiling; spread layout, split 3450'-75'-0-75'-3450'; number of geophone groups, 48; geophone group interval, 150 feet; geophone group length, 9 over 150 feet; geophone group pattern, inline; geophones, type 20D, 9 in series parallel; shotpoint spacing, 450 feet; shot pattern, single holes; shot depth, 50 feet; charge size, 10 pounds.

Drilling

All drilling in the Tieda-Loon area was with air. In general, clay with rocks was encountered to a depth of approximately 20 feet. Below this was mainly hard shale with intermittent sandstone layers. Gravel was found in some holes.

Line Cleaning and Land Use

The D6C cats were used for most of the work since the ground was still soft in some places. Line cutting was no problem since the trees were small and sparse and since much of the shooting was on existing seismic lines The cats windrowed what debris there was and tramped it flat on the ground. No line slashing was required

All creek crossings were removed after the crew had passed through to the satisfaction of the ranger Garbage was incinerated and tin cans were buried in twelve inch holes dug several feet deep

About six inches of snow was left on the surface of cut lines to ensure no damage was done to the surface Cats were equipped with mushroom shoes on the dozer blades.

Survey

Surveying was done by transit and T2 Theodolite. Two wellsites in the area, the Atlantic SW Airport Creek #1 and the Atlantic Col Carb Manitou Lake L-61, were used for

horizontal and vertical control.

Several lines were existing from previous seismic work. Because of the short daylight hours, chaining was done in the dark. Linecutting and surveying was restricted to the afternoon daylight.

DATA PROCESSING

Production Processing Parameters

1. Record Split

48 trace field record split into two 24 trace records (#1-24; #25-48) for subsequent processing.

2. Binary Gain True Amplitude Recovery

B	=	-10 db
α	=	18 db/sec
To	=	0 secs
Tmax	=	2.0 secs

3. Deconvolution

Number of Gates (i.e. filters)	=	4
Gate Lengths	=	1280 ms
Operator Length	=	60 ms
To	=	200 ms
Tmax	=	3400 ms

4. Time Variant Scaling

Applied to 100% records after deconvolution to bring each trace to the same average modulation level

Start time	=	100 ms
No. of Gates	=	13
Gate Length	=	200 ms (1 st gate)
	=	300 ms (remaining 12 gates)

5. C.D.P. Gathers

Two sets of 4 fold common depth point gathers were produced, one containing traces 1-24 only, and the other containing traces 25-48 only. These gather records were used for all subsequent processing.

Trace 25 of each gather record contains annotated data for the individual traces on that record, e.g. trace distance, original field trace number, source and receiver location numbers, structure statics.

6. Normal Moveout

Typical Function:

Time (secs)	Velocity (ft/sec)
0	10,000
170	10,800
400	14,150
800	17,500
4000	20,680

Functions compiled initially from Constant Velocity Stacks, and modified later in the autostatics - RNM routine (see section 9)

7. Structure Statics

Computed by uphole-elevation method using reference plane of 500 ft. and replacement velocity of 10,000 ft./sec.

8. Brute Stacks

Produced using preliminary velocity functions and basic structure statics in order to pick gates for automated static routine.

9. Automated Residual Statics

No. of gates	=	2
Gate length	=	100 ms per gate
Digital Filter	=	30 - 55 Hz
No. of rounds of computations	=	5

After each round of static computations, residual normal moveout was calculated within the selected gates.

10. First Break Suppression

Offset dependant:

Offset =	375 ft.	Time	0 secs.
	525 ft.		.260 secs.
	1275 ft.		.420 secs.
	3525 ft.		.560 secs.

11. Stack

2 sets of 4 fold common depth point gathers combined to give 800% C.D.P. Stack.

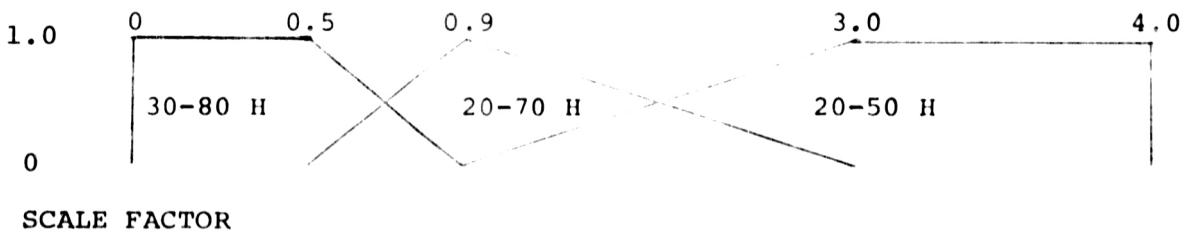
12. Digital Filter

Number of Filters	=	3
Length of Filters	=	200 ms

Filter Application: See diagram below.

13. Time Variant Scaling

Applied to stack records so as to give same modulation level on data traces as would be seen on a synthetic seismogram.



Experimental Processing

Prior to starting the production processing, analyses were run to determine the various parameters.

(a) 10 typical records from Line 2 were used to determine the True Amplitude Recovery parameters.

(b) Deconvolution and digital filtering parameters were determined from analyses run on Line 2, Shotpoint 21.

Additional Processing

Six lines were reprocessed into 400% common depth form using only the near 12 traces on each side of the shotpoint. This was done to eliminate large differences in travel times for common depth points which were caused by the wave path for some shotpoint-geophone configurations passing through a reef and for other shotpoint-geophone configurations the wave path passing through shale surrounding the reef. When this situation occurred, the static routine in processing caused cycle skipping and resulting mis-correlations of the data when all of the 800% common depth points were used By using the shorter spread distances and a 400% composite, the problem of cycle skipping was removed.

INTERPRETATION AND RESULTS

Reflections

Identification of the reflections is based on the two well ties and sonic logs made in the wells. The L-61 test was drilled to -5225 and was bottomed in the Cambrian Salt;

the Airport Creek test bottomed in the Ordovician at a total depth of -1895'.

This information has provided good means of identification of the reflections which originate from the Ramparts, the Hume, and the Cambrian Salt. In addition, a reflection has been identified as Base of the Cambrian Salt, but this identification is speculative.

The Ramparts reflection originates from very shallow in the section; at the Airport Creek test it is contacted at 363 feet below KB and at the L-61 dry hole it is found 320 feet below KB. The Ramparts outcrops along the west bank of the Mackenzie River about two miles northeast of the L-61 test. The Ramparts reflection quality is generally poor, but the reflection can be followed over more than 50% of the area.

The reflection from the Hume is generally of very good quality. The reflection does disappear locally, but this is believed to be caused by reef growth within the Hare Indian shale section.

The reflections from the Cambrian Salt and the Base of the Cambrian Salt are generally of fair to good quality.

Map Discussion

Maps are included as follows: A shotpoint location map, (Figure 2), Shotpoint elevation map (Figure 3), Ramparts Structure (Figure 4), Hume Structure (Figure 5), Cambrian Salt

Structure (Figure 6), Base of Cambrian Salt Structure (Figure 7), Interval Ramparts to Hume (Figure 8), Interval Hume to Cambrian Salt (Figure 9), and Interval Top Cambrian Salt to Base of Cambrian Salt (Figure 10).

The shotpoint location map shows the nine lines of seismic control obtained and their position relative to the two dry holes.

The Shotpoint Elevation map shows that the area is quite flat; the range of elevations is from a high point of 524' above sea level at Shotpoint 16 on Line 3 to a low point of 379' above sea level at Shotpoint 2 on Line 1.

The Ramparts structure map shows very little relief. A structural high area may exist in the eastern portion of the area, but the Ramparts is too shallow to map reliably with the methods used in this survey. The Ramparts outcrop along the Mackenzie River has been sketched on this map. This occurs less than two miles from the eastern end of the seismic survey.

The Hume Structure map shows more evidence of anomalous conditions than does the Ramparts. The two lines near the Airport Creek dry hole show the Hume to be quite flat, but the lines around the L-61 test show two high areas. The larger of the two highs surrounds the L-61 dry hole and the second high is located immediately to the west. On both of these high areas, the Hume cannot be picked over the crest of the anomaly. The sides of the anomalous areas may be steeper

than is indicated here by this contouring.

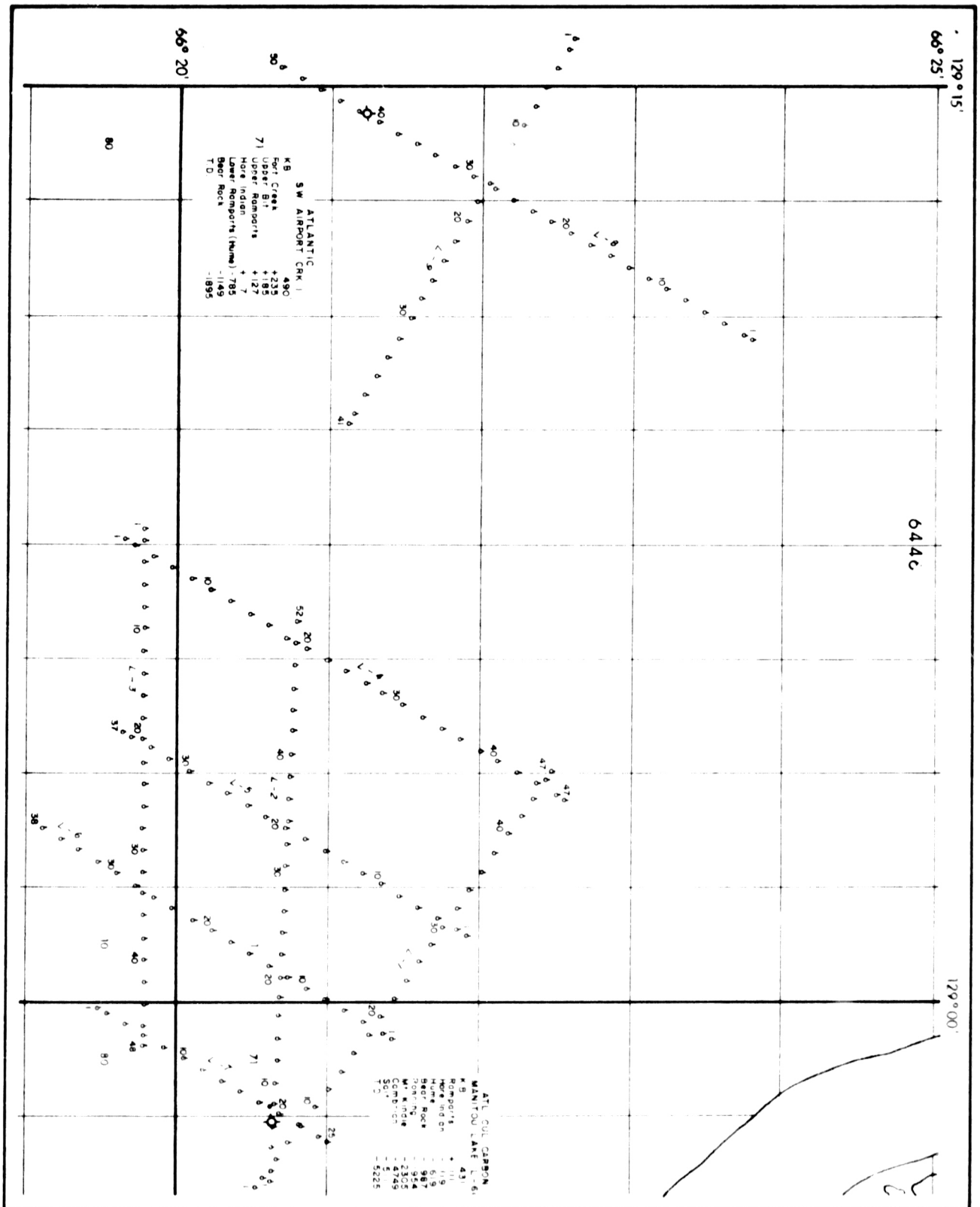
The Top Cambrian Salt structure map also shows two anomalous areas which coincide with those shown on the Hume structure map, but which have less relief than at the Hume level.

The Base of the Cambrian Salt also shows the same two anomalous areas, but with the relief differing somewhat from that shown at both the Hume and Cambrian Salt levels.

The Ramparts to Hume Interval is lacking data on a number of shotpoints because of the problem in mapping the shallow Ramparts reflection, but it does give an indication of two anomalously thin areas that coincide with the two anomalous areas that show on the Hume and Cambrian structure maps. Very little change is shown in the western part of the area near the Airport Creek dry hole.

The Hume to Top of Cambrian Salt Interval shows little change in the western part of the area and two anomalous areas of thickening in the eastern part of the area; these coincide with the anomalous areas shown by the other maps, and it confirms that the anomalous condition, although present on both reflections, is stronger at the Hume level.

The Interval from the Cambrian Salt to the Base of the Cambrian Salt does not show the two anomalous areas that has been discussed above. Instead, it shows a thick area immediately west and northwest of the L-61 dry hole which is probably indicative of a thick Cambrian Salt which thins both to the east and to the west.



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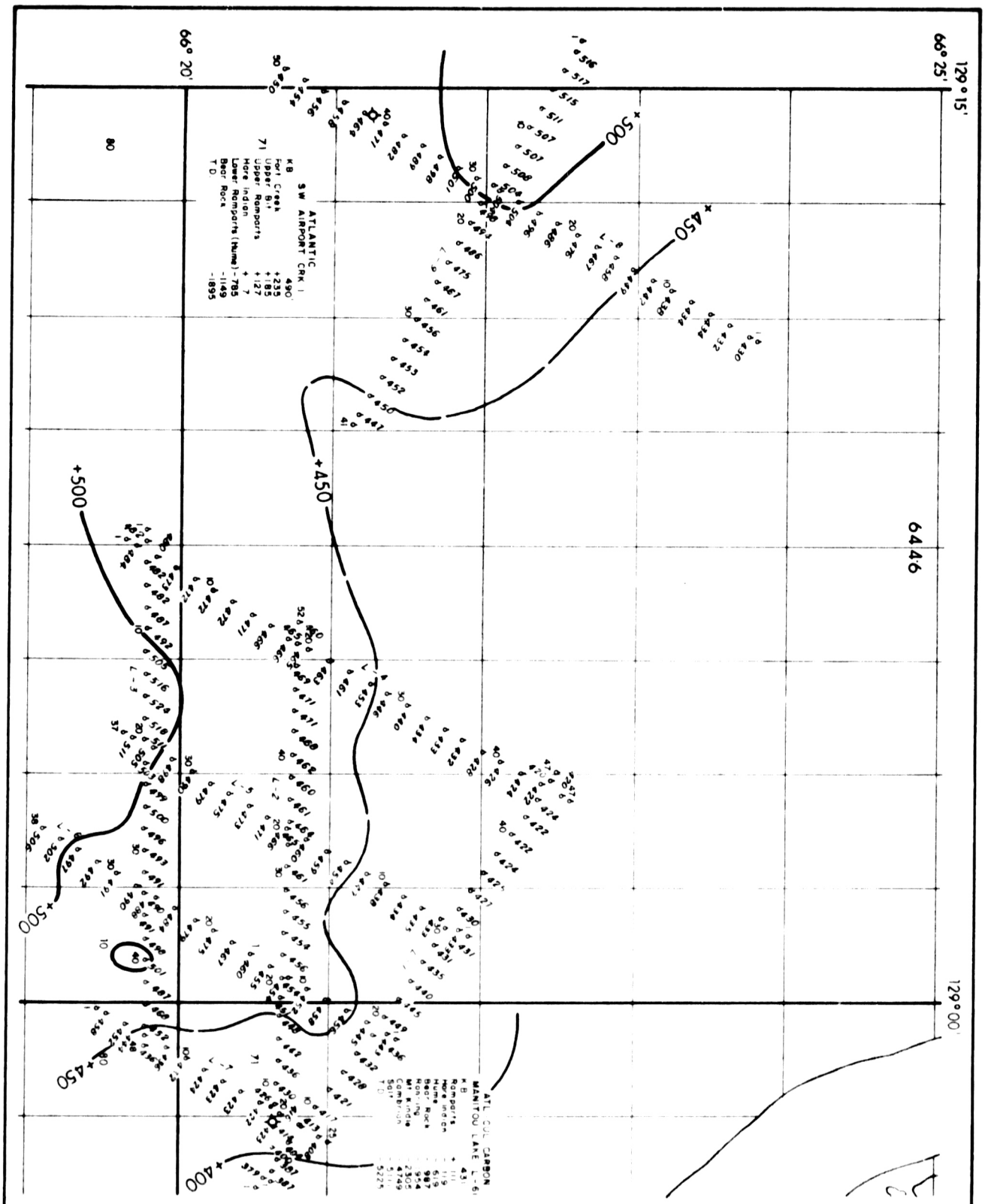
TIEDA - LOON

(NORTHWEST TERRITORIES)

SHOT POINT LOCATION MAP

FIGURE 2



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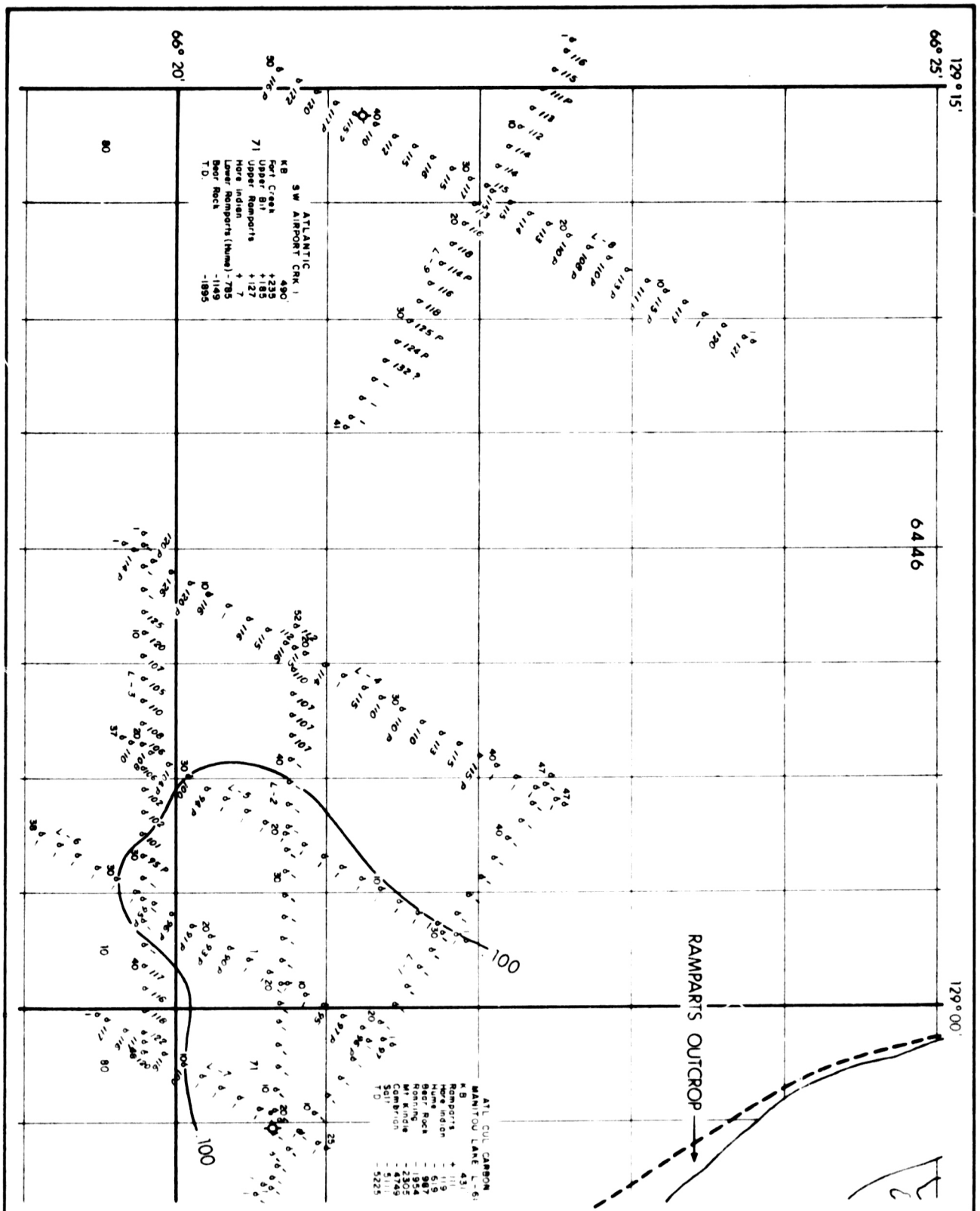
TIEDA - LOON

(NORTHWEST TERRITORIES)

SHOT POINT ELEVATIONS

C.I = 50'

FIGURE 3


66° 20'
66° 25'
129° 15'
129° 00'
64 46
ATLANTIC
SW AIRPORT CRK 1
KB 490'
Fort Creek +235
Upper Bit +185
71 Upper Ramparts +127
Hare Indian + 7
Lower Ramparts (Hume) -785
Bear Rock -1149
T.D. -1895
100
100
RAMPARTS OUTCROP
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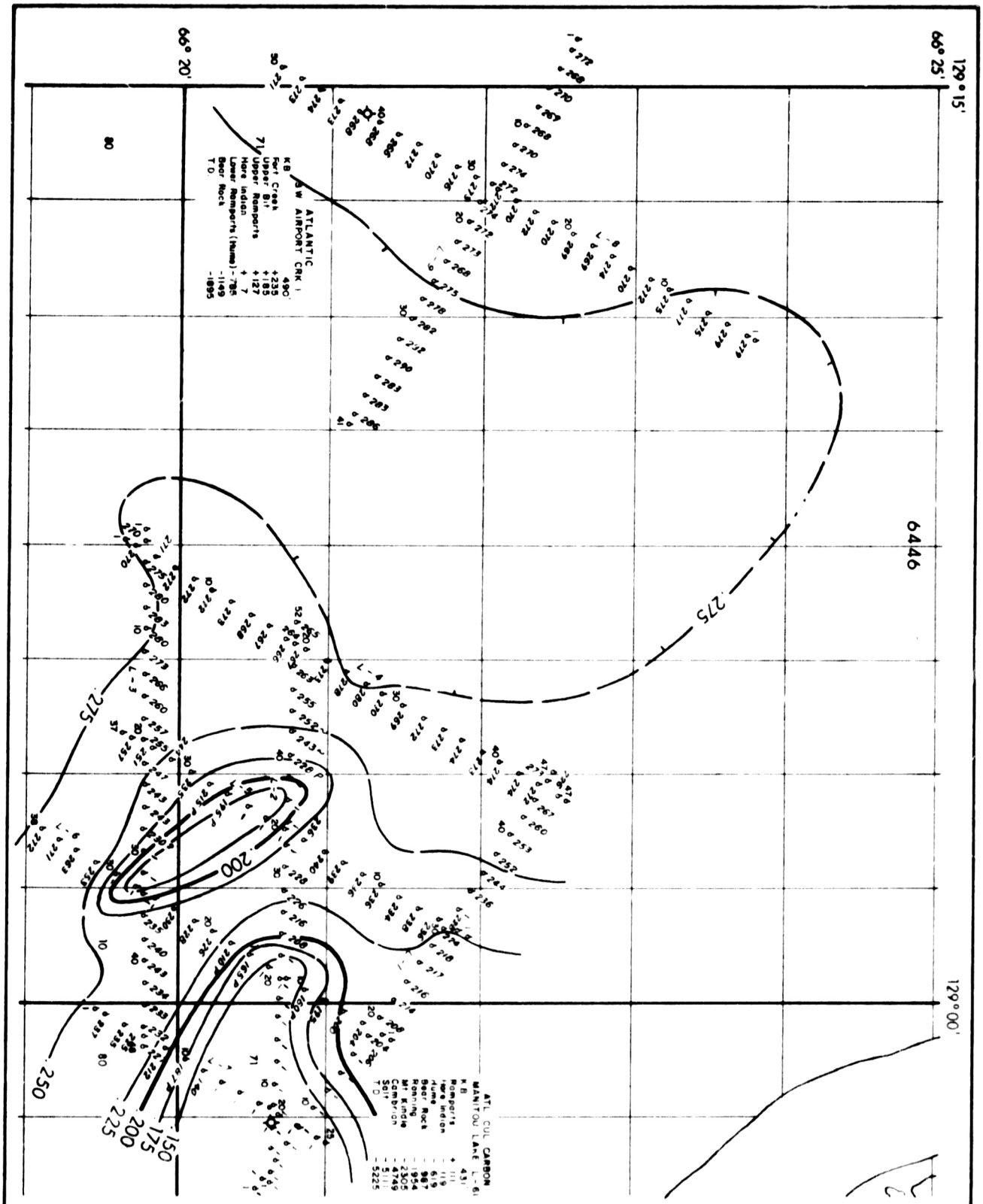
TIEDA - LOON
(NORTHWEST TERRITORIES)
STRUCTURE - RAMPARTS
C.I. = 025 sec
D.P. +500'

FIGURE 4



CANDEL OIL LTD. CALGARY ALBERTA	REVISED	TIEDA - LOON
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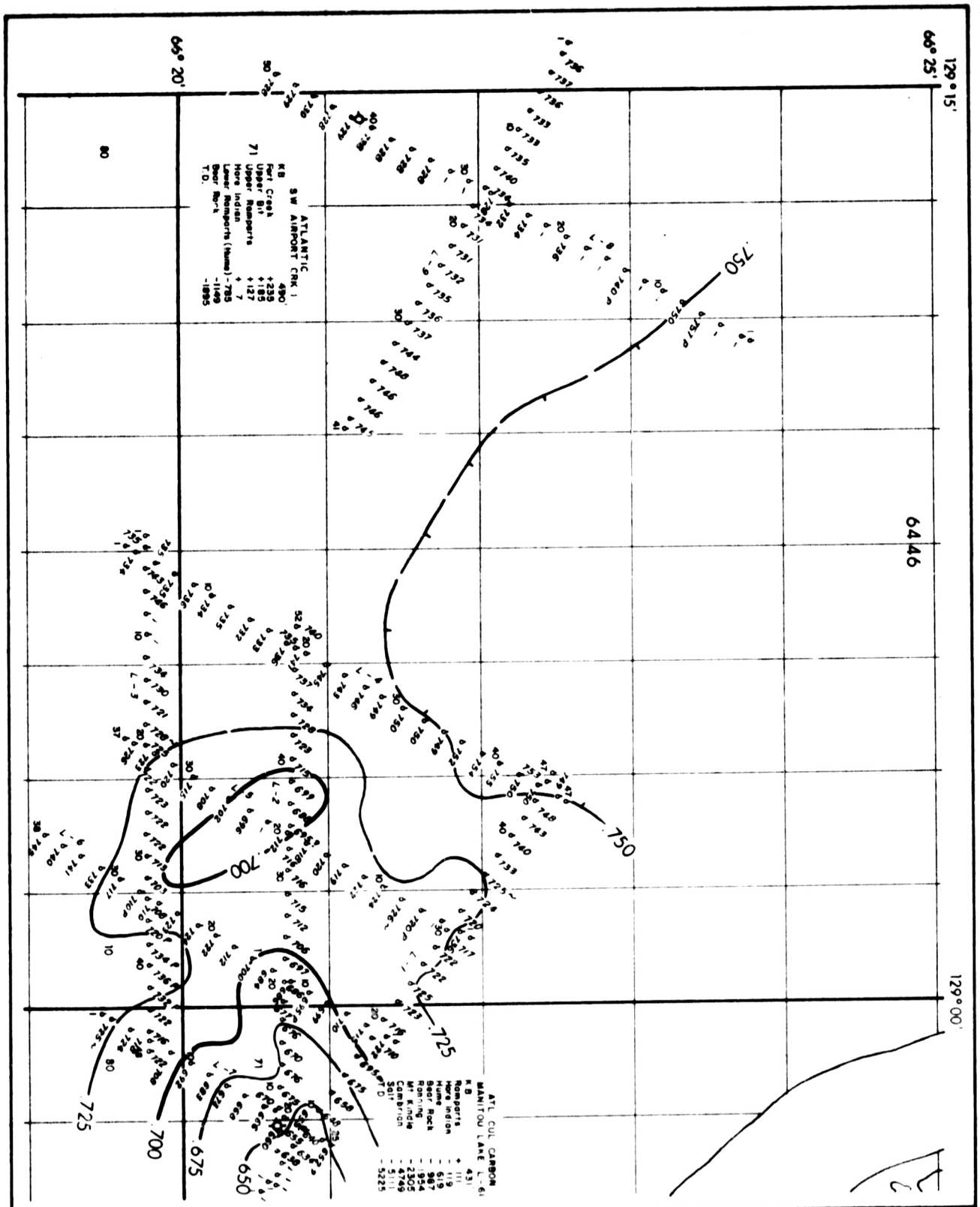
DRAWN BY C B JAMES — DATE MAY 15/73		STRUCTURE - HUME
CHECKED BY — DATE		
SCALE MILES 0		C I = 025 sec — D P +500'

FIGURE 5



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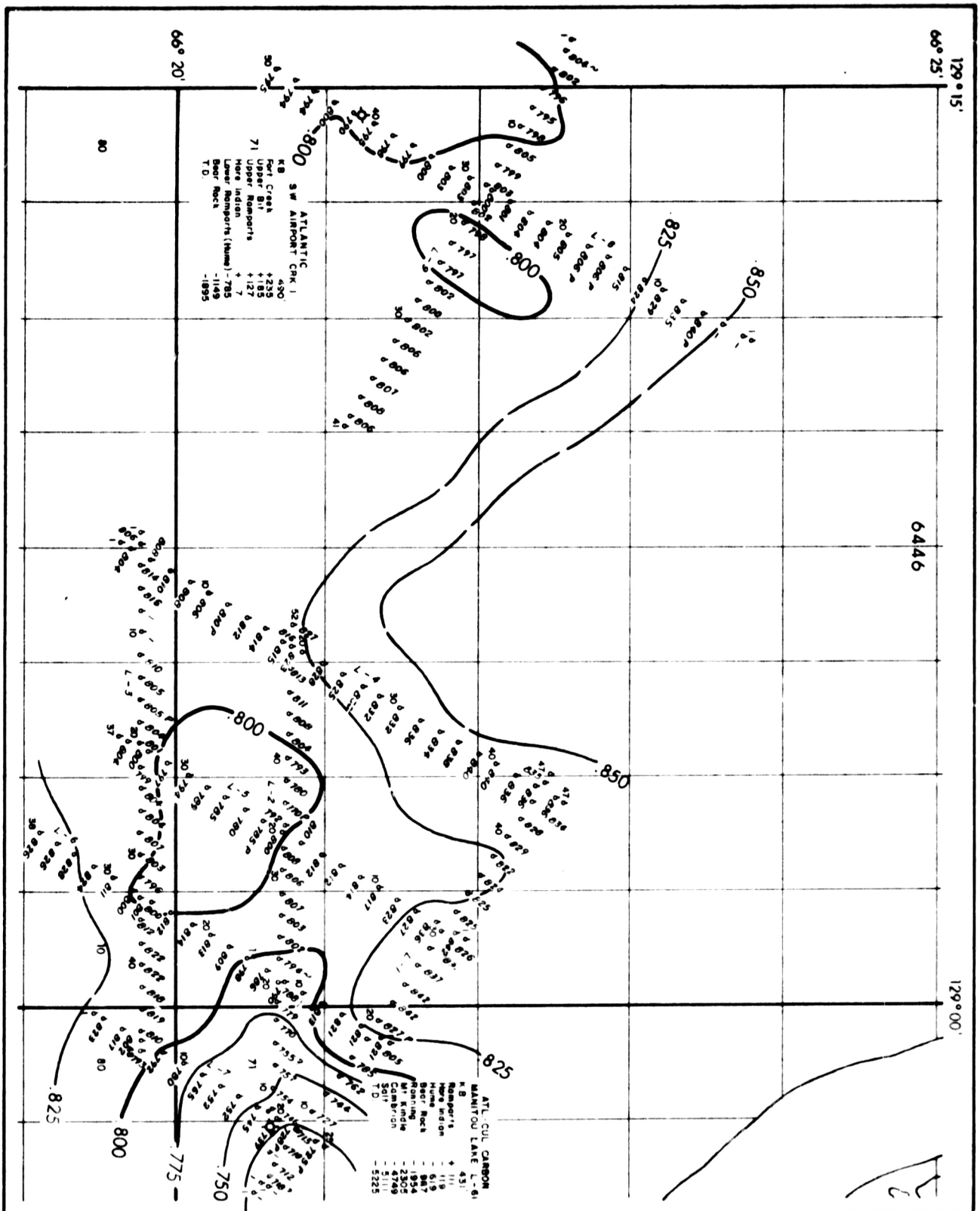
TIEDA - LOON

(NORTHWEST TERRITORIES)

STRUCTURE - TOP OF CAMBRIAN SALT

C.I. = .025 sec D.P. +500'

FIGURE 6



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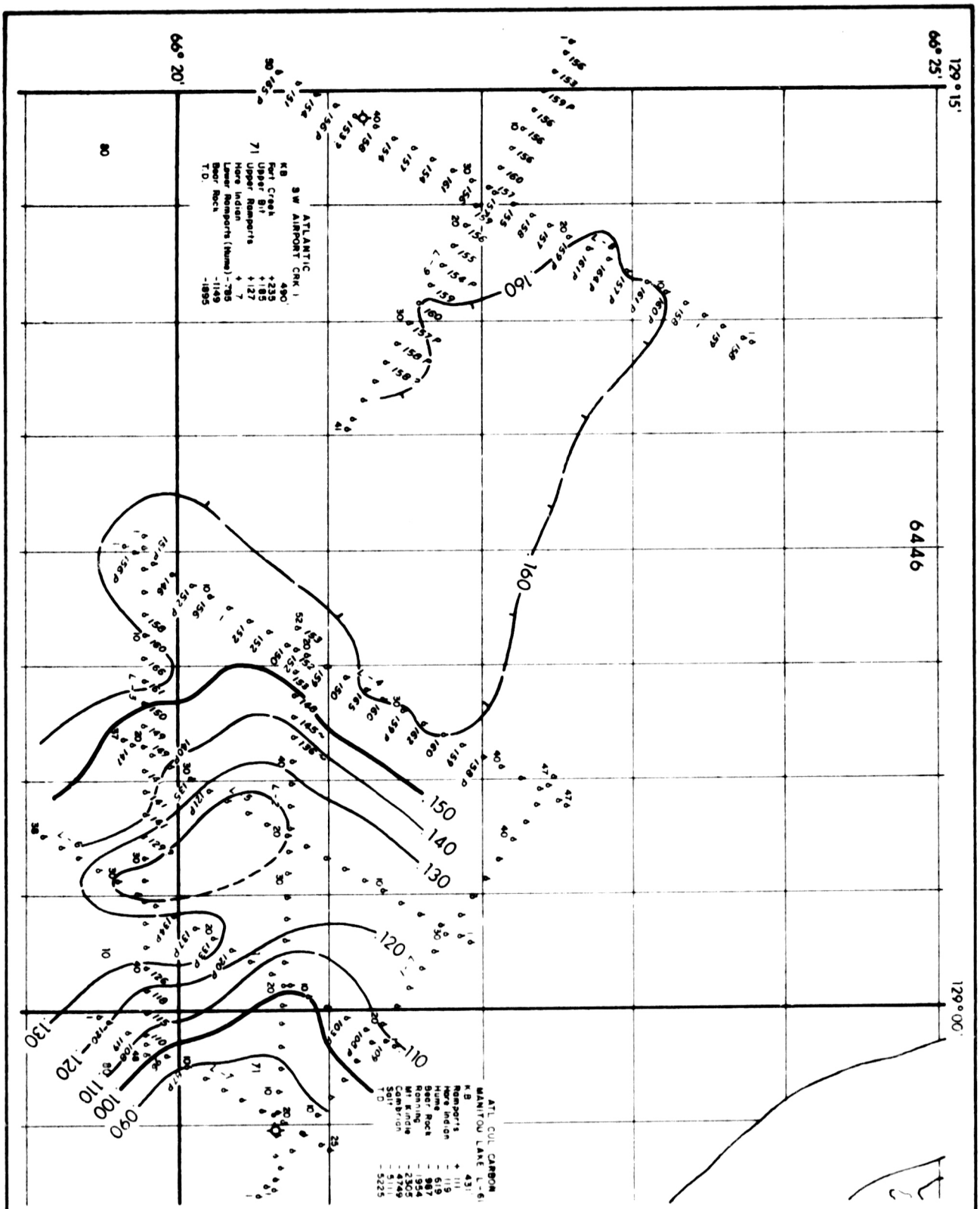
TIEDA - LOON

(NORTHWEST TERRITORIES)

STRUCTURE - BASE OF CAMBRIAN SALT ?

C.I. = .025 sec D.P. +500'

FIGURE 7



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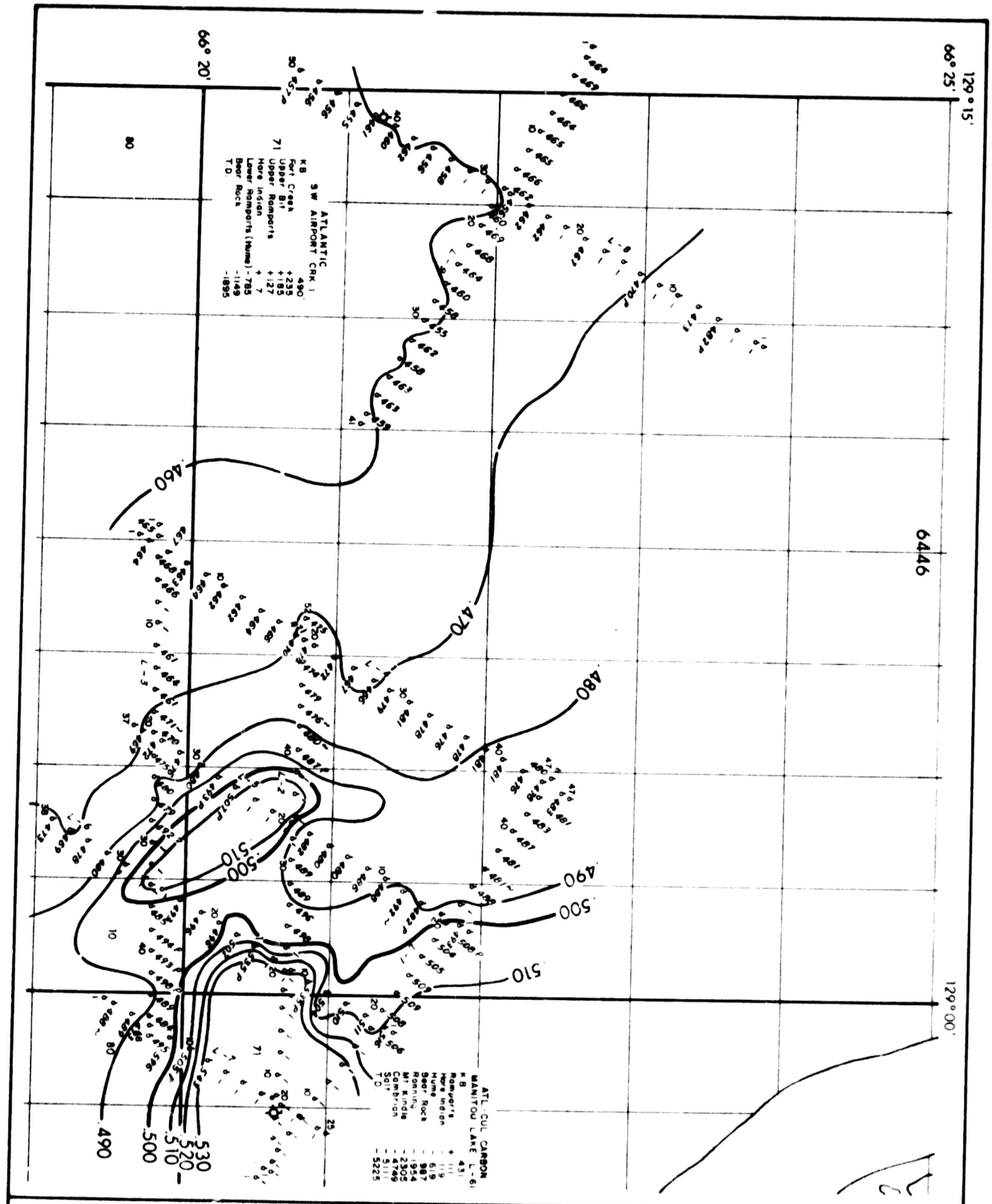
TIEDA - LOON

(NORTHWEST TERRITORIES)

INTERVAL - RAMPARTS TO HUME

C I = .010 sec.

FIGURE 8



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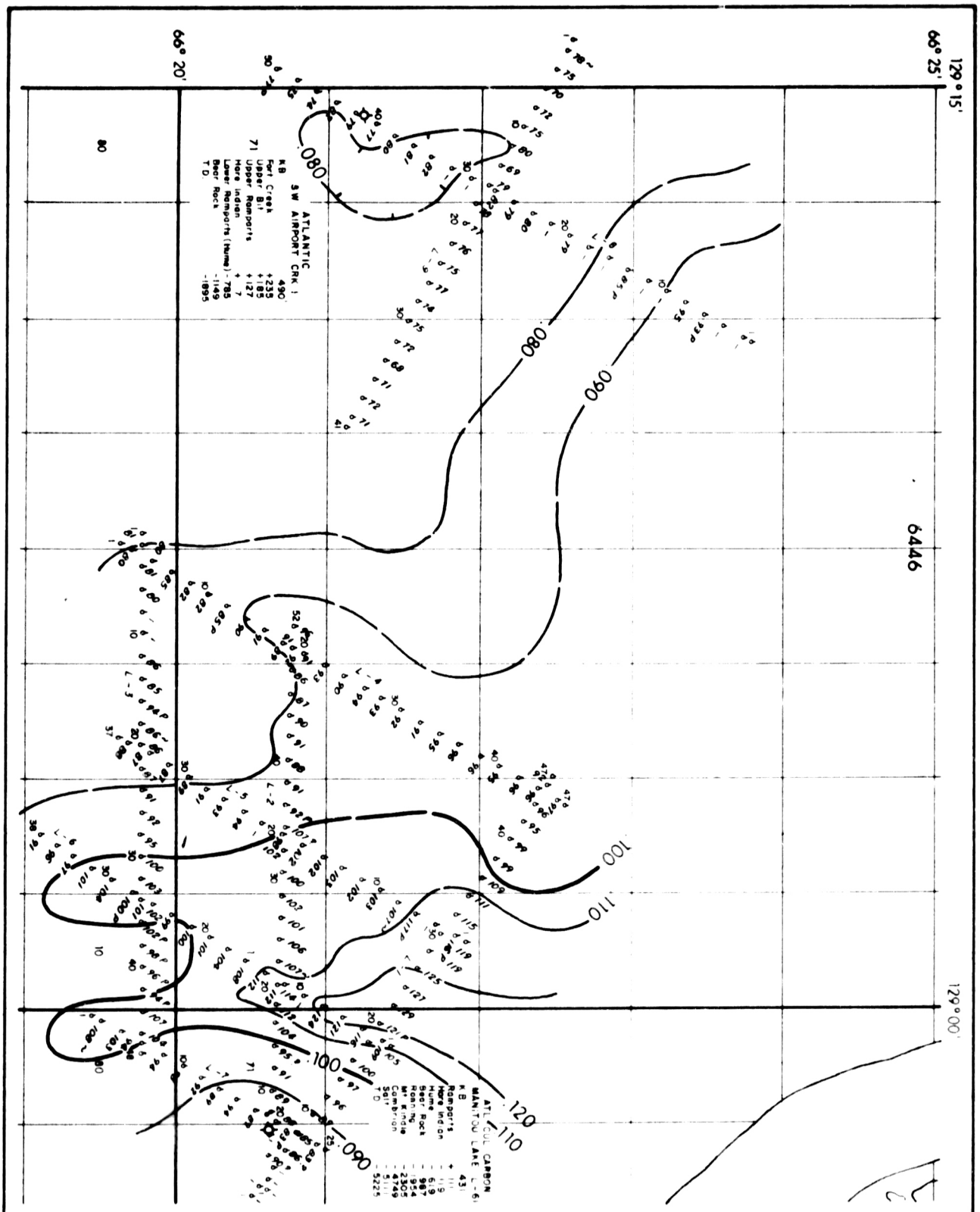
TIEDA - LOON

(NORTHWEST TERRITORIES)

INTERVAL HUME TO TOP OF CAMBRIAN SALT

C I = .010 sec.

FIGURE 9



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TIEDA - LOON

(NORTHWEST TERRITORIES)

INTERVAL

TOP TO BASE OF CAMBRIAN SALT ?

C I = .010 sec

FIGURE 10

CONCLUSIONS AND RECOMMENDATIONS

No anomalous conditions are noted near the SW Airport Creek #1 dry hole.

Two anomalous conditions are present in the eastern part of the area. The larger one surrounds the L-61 dry hole and the second and smaller anomaly is located immediately to the west of the first. These anomalous conditions are believed to be the result of reef growth which began within the Hume, or possibly deeper within the Bear Rock, and carried upwards through the Hare Indian section to the Ramparts.

The Ramparts map shows no evidence of the reef growth. This may be because of the problem in mapping the Ramparts; reef growth may have continued through the Ramparts or it may have stopped at the Ramparts limestone.

The Hume map shows good evidence of the flanks of the Reef, but the top of the Reef cannot be mapped, because it becomes too shallow for the methods used.

The structure maps of the Cambrian Salt and Base of the Cambrian Salt show the two Reef areas as highs which are velocity expressions of the presence of the Reef within the Hare Indian Shale; the sonic log of the L-61 dry hole shows a Hare Indian reefal limestone with a velocity of 17,000 feet per second, and the sonic log of the SW Airport Creek #1 dry hole shows a Hare Indian Shale with a velocity of 12,000 feet per second. Therefore, if the total shale section of 792 feet

as shown by the SW Airport Creek #1 test is replaced with a reef as is suggested by the L-61 dry hole, a pseudo-high will exist on pre-reef reflections of 39 milliseconds. This is approximately the relief that is shown by the Cambrian Salt and Base of Cambrian Salt structure maps; we suggest, however that these maps are also influenced by other changes such as Salt movement and early structure, and by a thinner than normal Hare Indian Shale between the Reefs.

The Interval Ramparts to Hume shows the thinning around the reef as the Hume reflection moves up the flank of the Reef.

The Hume to Cambrian Salt shows a thick interval where the Reef is present because the relief at the Hume level from the flanks of the Reef is greater than the pseudo-high on the Cambrian Salt.

The map of the Hume postulates by the contouring that the Reef at the L-61 dry hole may close off to the east in an area of no seismic control. This is based on outcrop information to the east along the Mackenzie River where the Hare Indian sections appears to be a shale.

The L-61 well drilled through the Reef, but the area may still need further testing to determine its potential. The L-61 test encountered oil staining in Devonian Fort Creek sands at 100 to 160 feet below KB and oil staining in the Ramparts at 350 feet below KB. Surface pipe was set to 499' and no logs or tests were run within the stained area.

The fact that the Reef appears to grow into the Ramparts does not necessarily make for an escape for hydrocarbons since the Ramparts may be impermeable away from the Reef growth.

Since the Reef growth is at such a shallow depth, some Reefs may have been breached by erosion, but others such as the one to the west of the L-61 dry hole may not have been breached and could contain a thick oil or gas column. It appears quite possible to have 800 to 900 feet of Reef growth above the Hume. Also, with evidence from this survey of two Reefs, the possibility exists that many more may be present within the surrounding area.

Therefore, it is suggested that one or more wells be drilled to test these Reefs and that additional area be considered for seismic exploration.