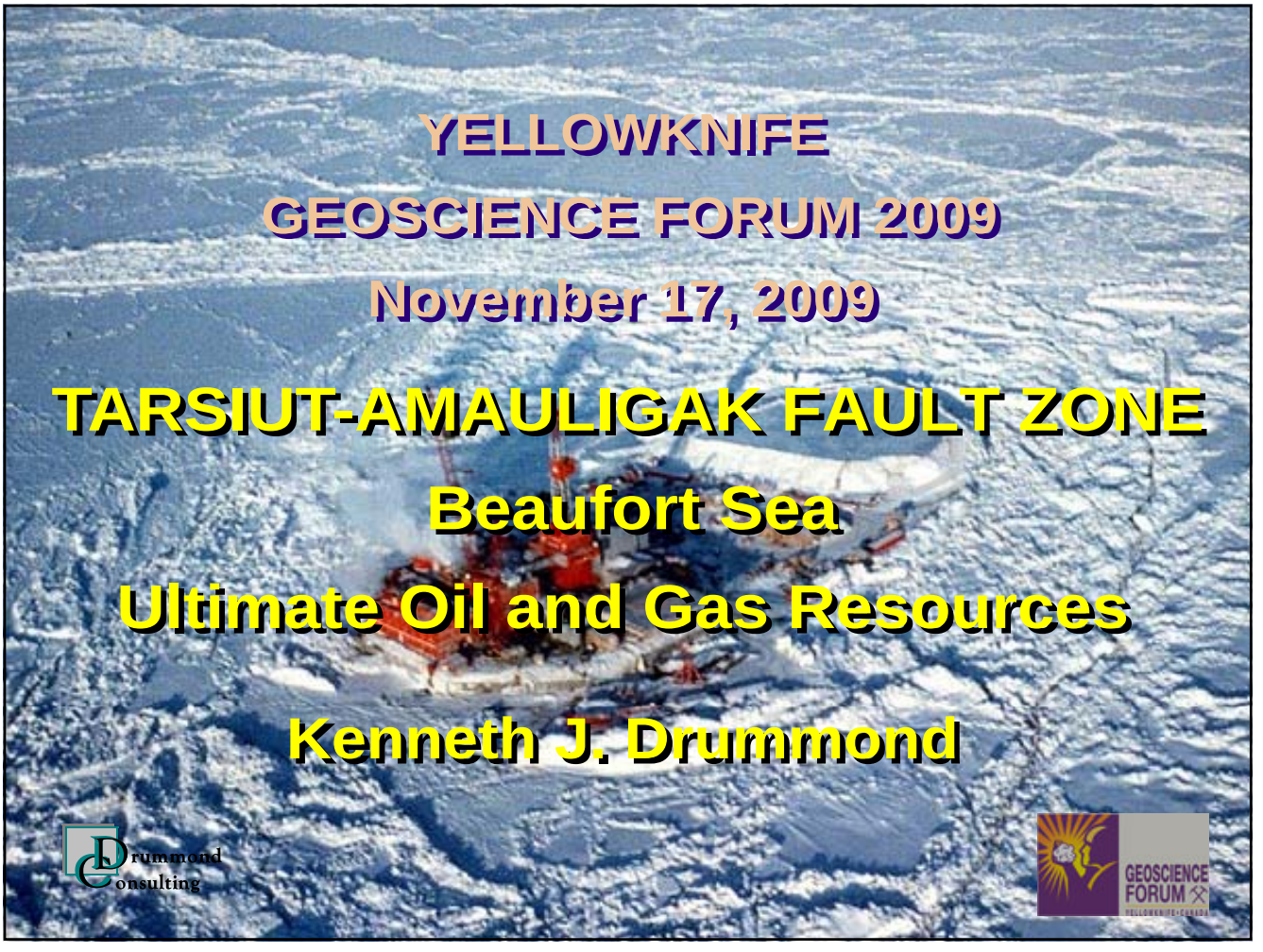
YELLOWKNIFE
GEOSCIENCE FORUM 2009
November 17, 2009
TARSIUT-AMAULIGAK FAULT ZONE
Beaufort Sea
Ultimate Oil and Gas Resources
Kenneth J. Drummond
Drummond Consulting
GEOSCIENCE FORUM

TARSIUT-AMAULIGAK FAULT ZONE, BEAUFORT SEA
ULTIMATE OIL AND GAS RESOURCES

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The Beaufort Sea has a large resource of discovered oil and gas and a very significant potential for future undiscovered oil and gas. The Tarsiut-Amauligak Fault Zone play is one of the more important plays in the Beaufort Sea, with discovered resources of 378 MMB of recoverable oil and 3,298 BCF of recoverable gas. The undiscovered potential is estimated to be 846 MMB of recoverable oil and 6,785 BCF of recoverable gas.

The Tarsiut-Amauligak Fault Zone play includes all pools and prospects within delta front sandstones of the Kugmallit sequence. The reservoirs at Amauligak are proximal delta front sandstones which become more distal to the west towards Tarsiut. The play is bounded to the south by the facies boundary with the delta plain facies of the Kugmallit sequence (Netserk play), and to the east and west by the disappearance of a potential reservoir at the fringes of the delta. To the north the play is bounded by the Kugmallit shelf edge and the deeper water sandstones of the Kopanoar play.

The play area is entirely offshore in water depths between 12 and 35 metres. The delta front facies of the Kugmallit sequence is characterized by upward-coarsening sandstones, with overall net sand content between 20 and 30 per cent. Reservoir sandstones are between 5 and 15 meters thick, with an average porosity of 22 per cent. The larger fields contain numerous stacked pools. Thick interbedded shales and the overlying Mackenzie Bay shale succession provide a good seal.

The majority of traps in the play are structural, created by major post-depositional movement on long, sinuous east-northeast trending faults of the Tarsiut-Amauligak Fault Zone. Major post-depositional movements on faults of the Tarsiut-Amauligak Fault Zone have resulted in the development of large rotated fault blocks. Pinchout of the sandstone/siltstone packages adds a stratigraphic component to trapping.

Exploration began with the spudding of Dome et al Tingmiark K-91 in the summer of 1976. During the years 1976 to 1989 a total of 32 wells were drilled on 18 structures in the play, resulting in the issue of 11 Significant Discovery Licences, for a success rate of 61%. The last well drilled was the gas discovery Gulf et al Amauligak O-86.

The only production is from Gulf et al Amauligak I-65B, which was production tested in the summer of 1986. Combined drill stem tests and extended flow tests produced a total of 422 thousand barrels of oil, of which 302 thousand barrels was shipped via tanker through the Bering Sea. The well flowed at a maximum rate of 18,060 barrels per day.

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TARSIUT-AMAULIGAK FAULT ZONE

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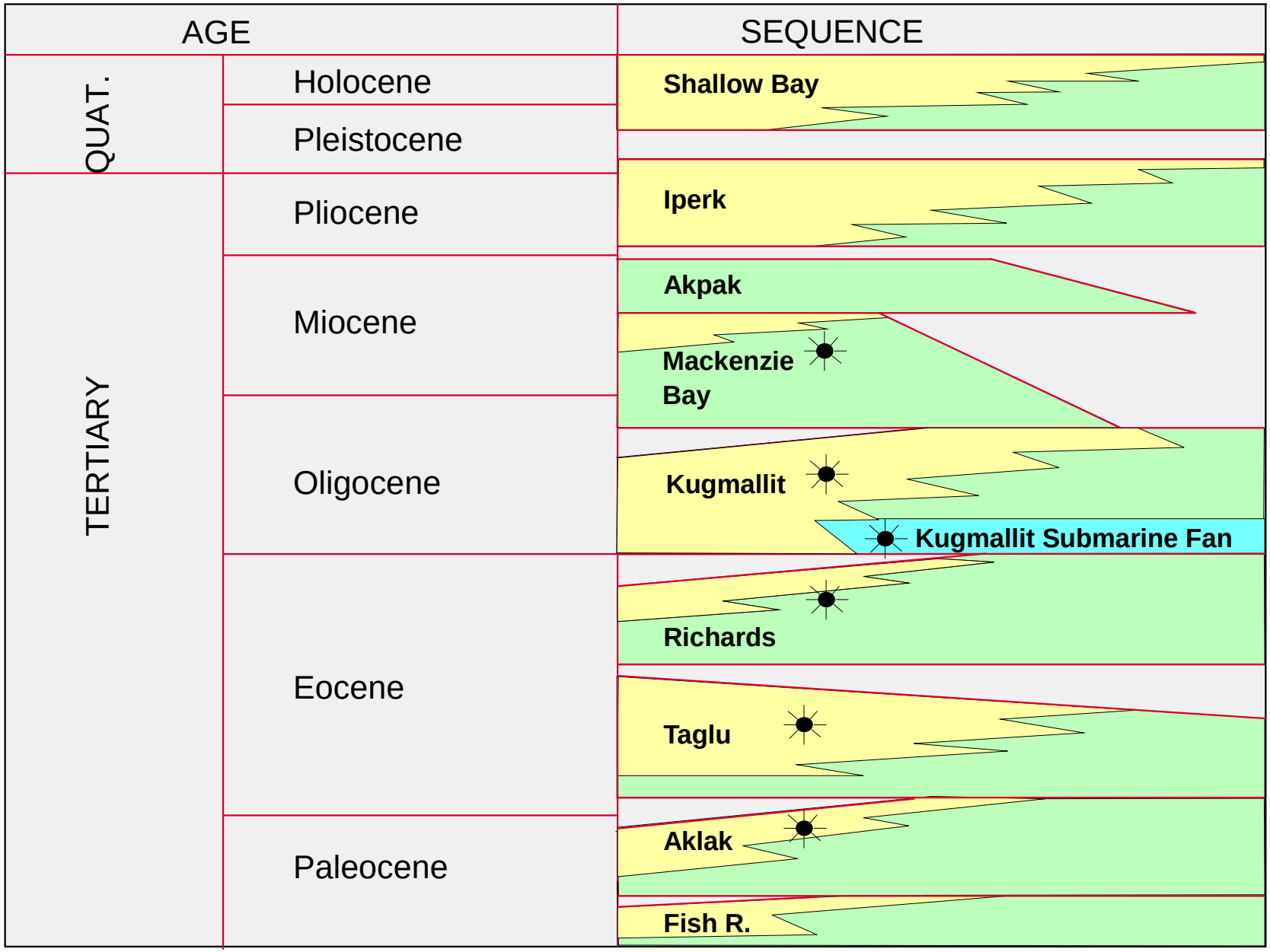
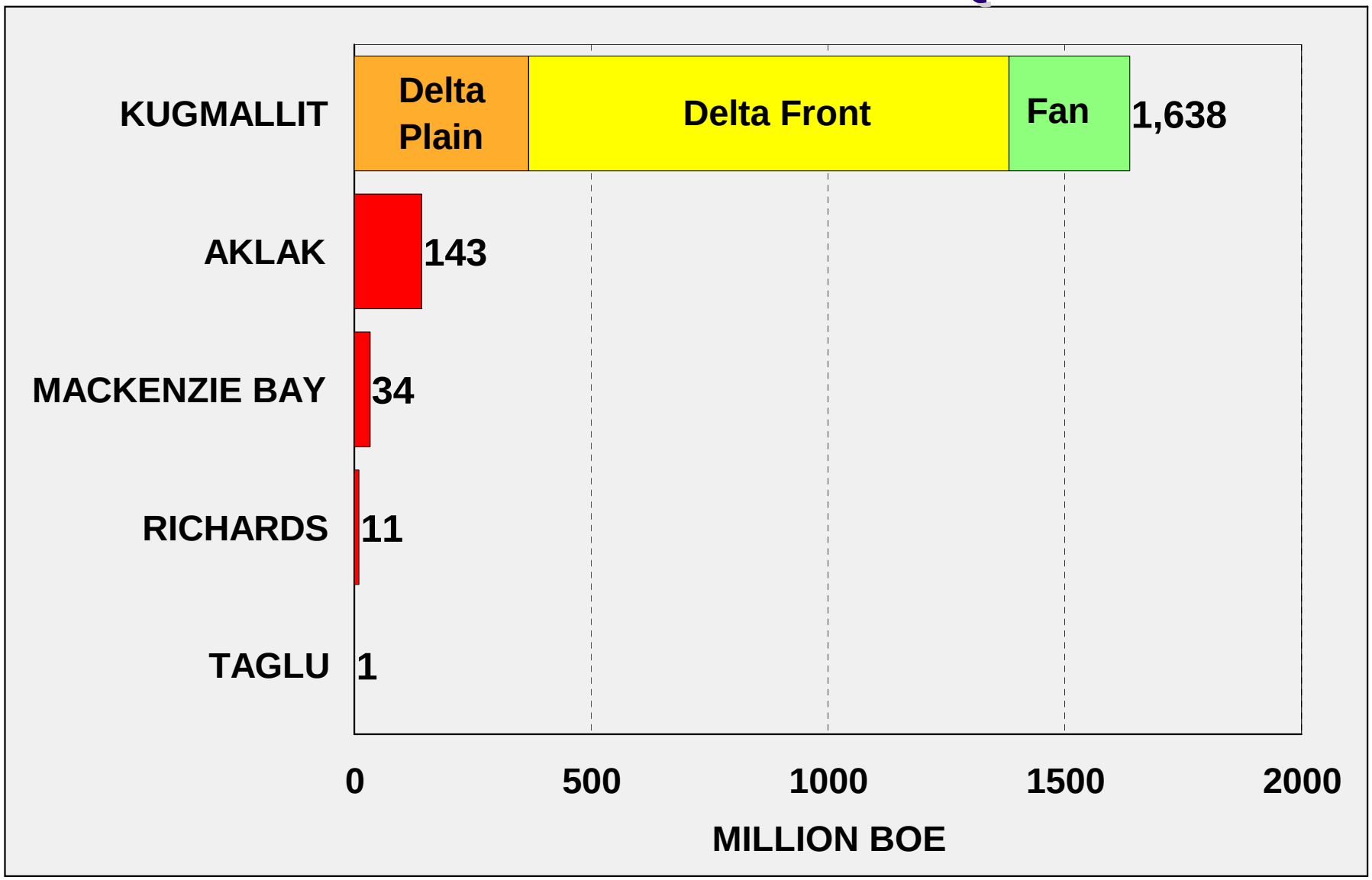
GEOSCIENCE FORUM



BEAUFORT SEA STRATIGRAPHIC SECTION

BEAUFORT SEA - STRATIGRAPHIC DISTRIBUTION
DISCOVERED RECOVERABLE OIL EQUIVALENT

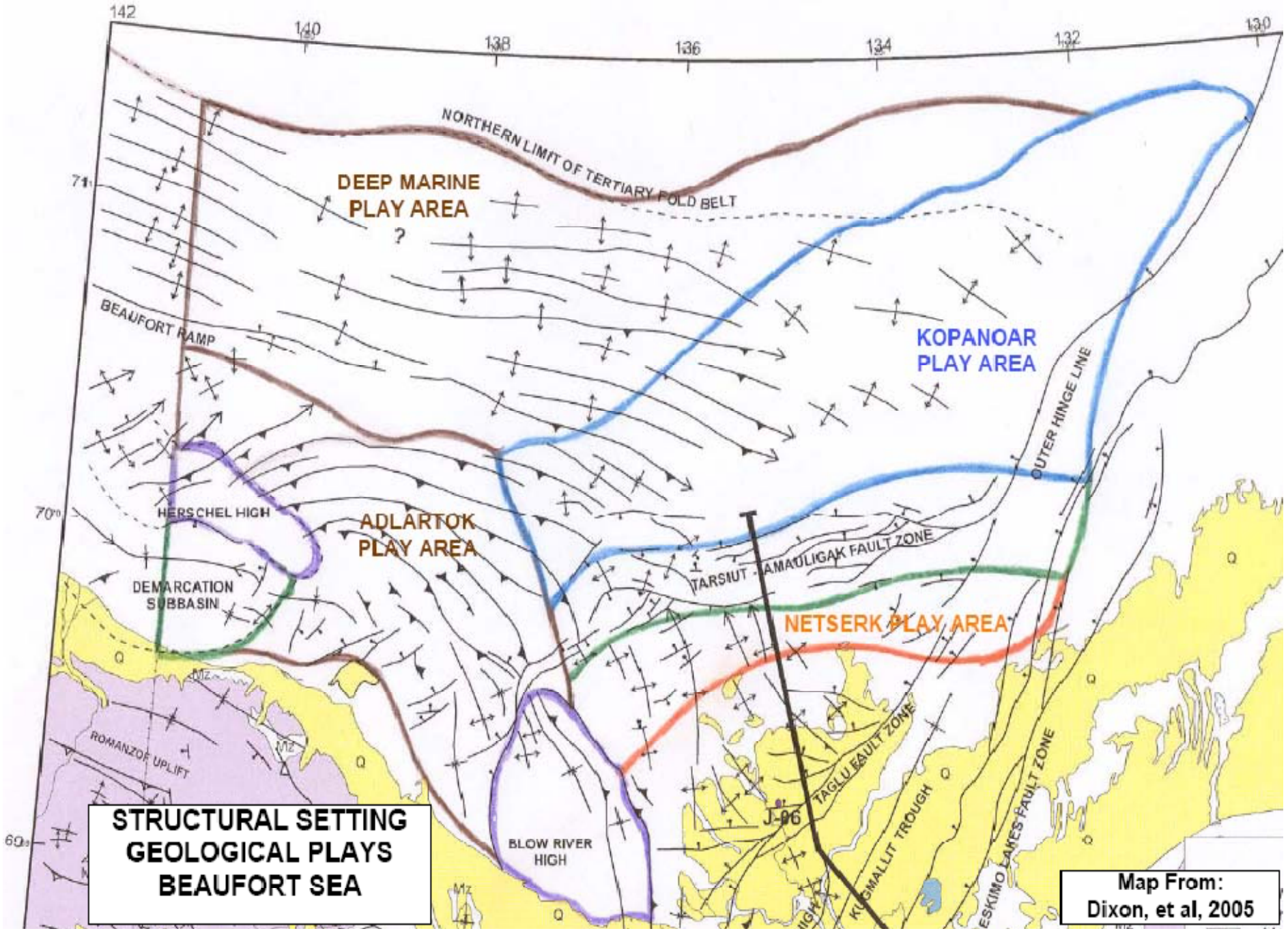


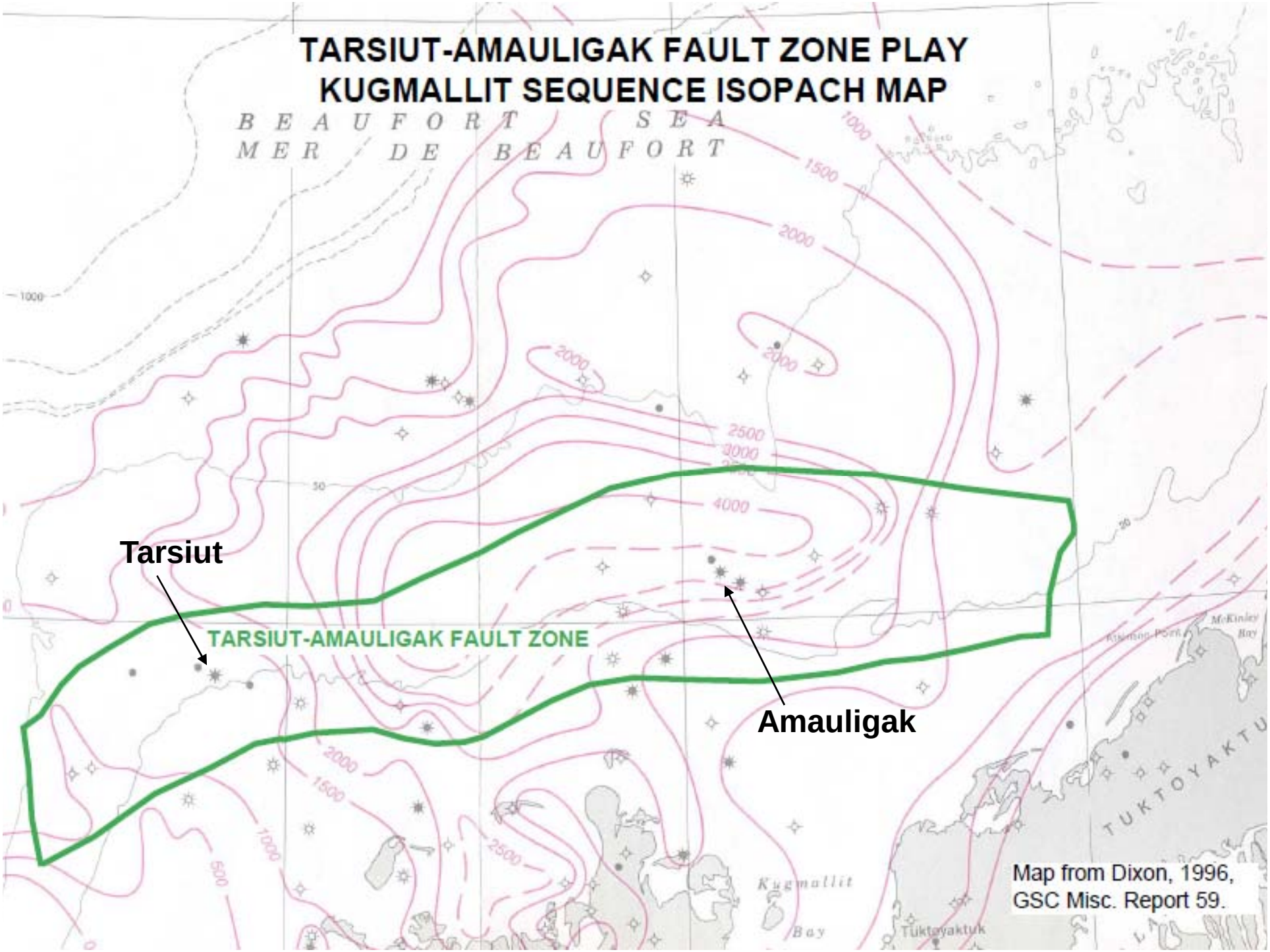
Tarsiut-Amauligak Fault Zone Play

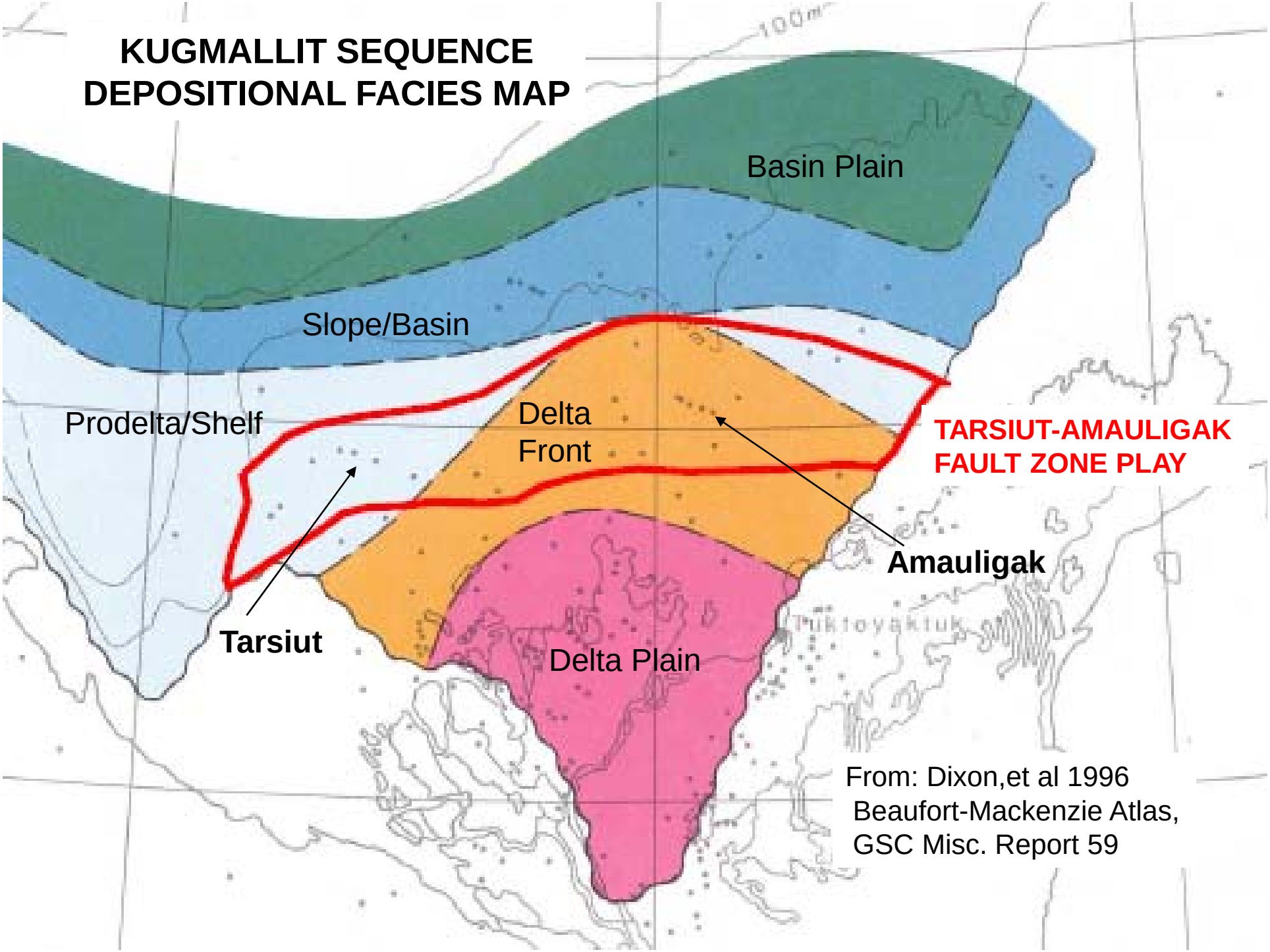
Mainly Kugmallit Delta Front sandstones, proximal at Amauligak, becoming more distal towards Tarsiut.

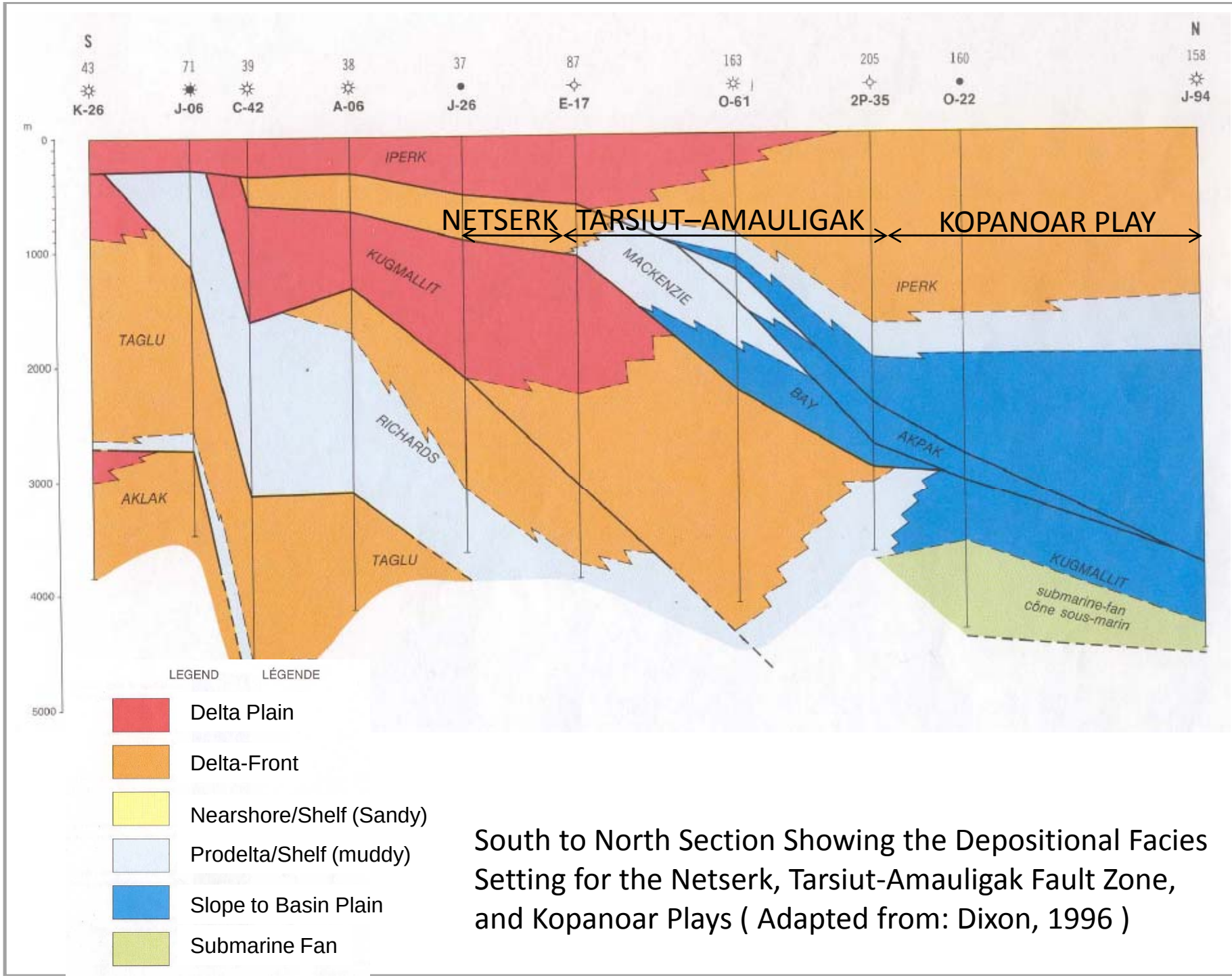
Also may include clastics of the Mackenzie Bay, Richards and Taglu sequences.

East-West trending listric growth faulted, rotated anticlinal structures.


142
140
138
136
134
132
130
NORTHERN LIMIT OF TERTIARY FOLD BELT
DEEP MARINE
PLAY AREA
?
BEAUFORT RAMP
KOPANOAR
PLAY AREA
OUTER HINGE LINE
HERSCHEL HIGH
ADLARTOK
PLAY AREA
DEMARCATION
SUBBASIN
TARSIUT - AMAULIGAK FAULT ZONE
NETSERK PLAY AREA
ROMANZOF UPLIFT
TAGLU FAULT ZONE
J-96
BLOW RIVER
HIGH
KUGMALLIT TROUGH
ESKIMO LAKES FAULT ZONE
Q
Mz
STRUCTURAL SETTING
GEOLOGICAL PLAYS
BEAUFORT SEA
Map From:
Dixon, et al, 2005

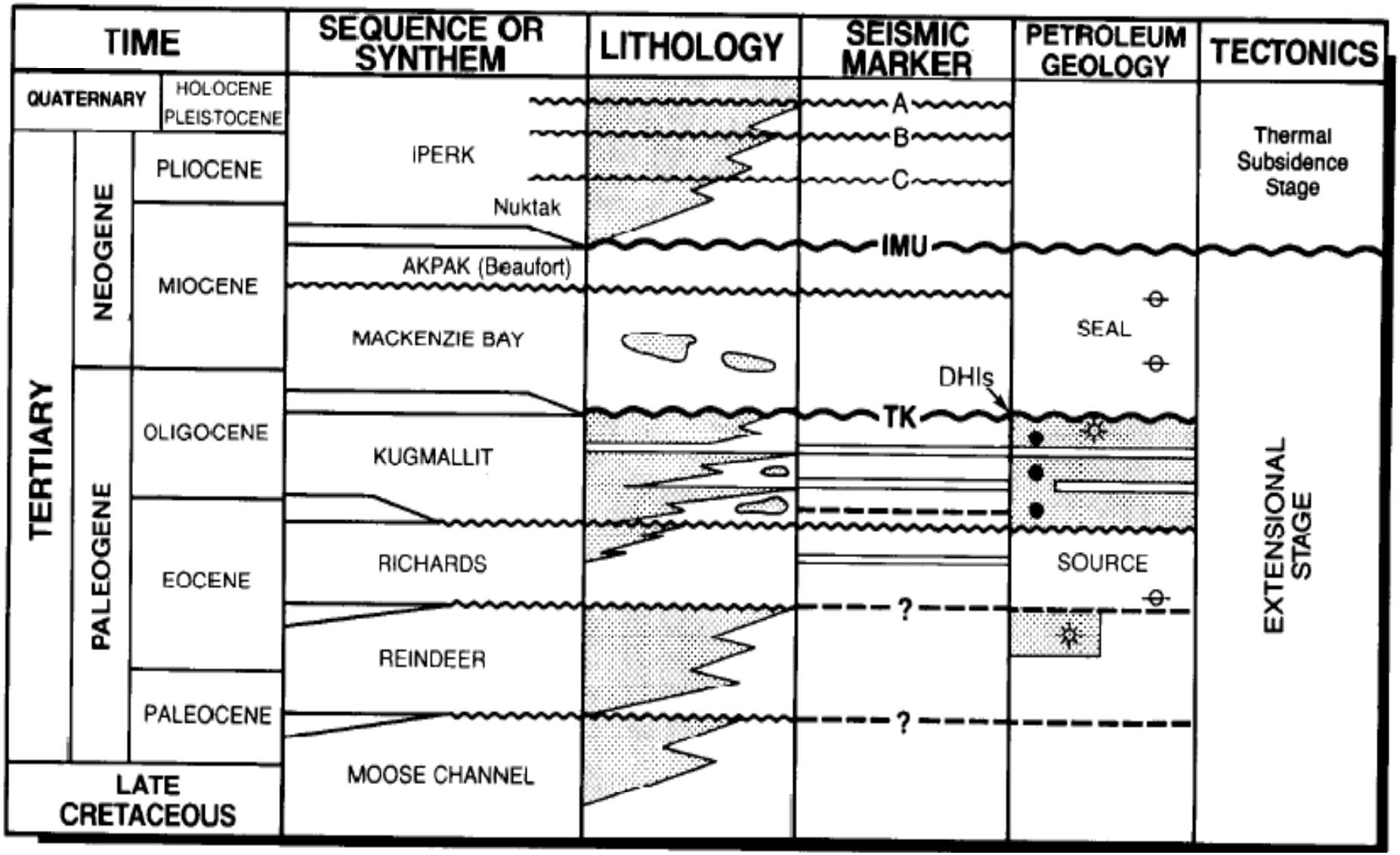

TARSIUT-AMAULIGAK FAULT ZONE PLAY
KUGMALLIT SEQUENCE ISOPACH MAP
BEAUFORT SEA
MER DE BEAUFORT
1000
1500
2000
2500
3000
4000
Tarsiut
TARSIUT-AMAULIGAK FAULT ZONE
Amauligak
Kugmallit Bay
Tuktoyaktuk
TUKTOYAKTU
McKinley Bay
Map from Dixon, 1996,
GSC Misc. Report 59.


KUGMALLIT SEQUENCE
DEPOSITIONAL FACIES MAP
Basin Plain
Slope/Basin
Prodelta/Shelf
Delta
Front
Delta Plain
TARSIUT-AMAULIGAK
FAULT ZONE PLAY
Amauligak
Tarsiut
From: Dixon,et al 1996
Beaufort-Mackenzie Atlas,
GSC Misc. Report 59

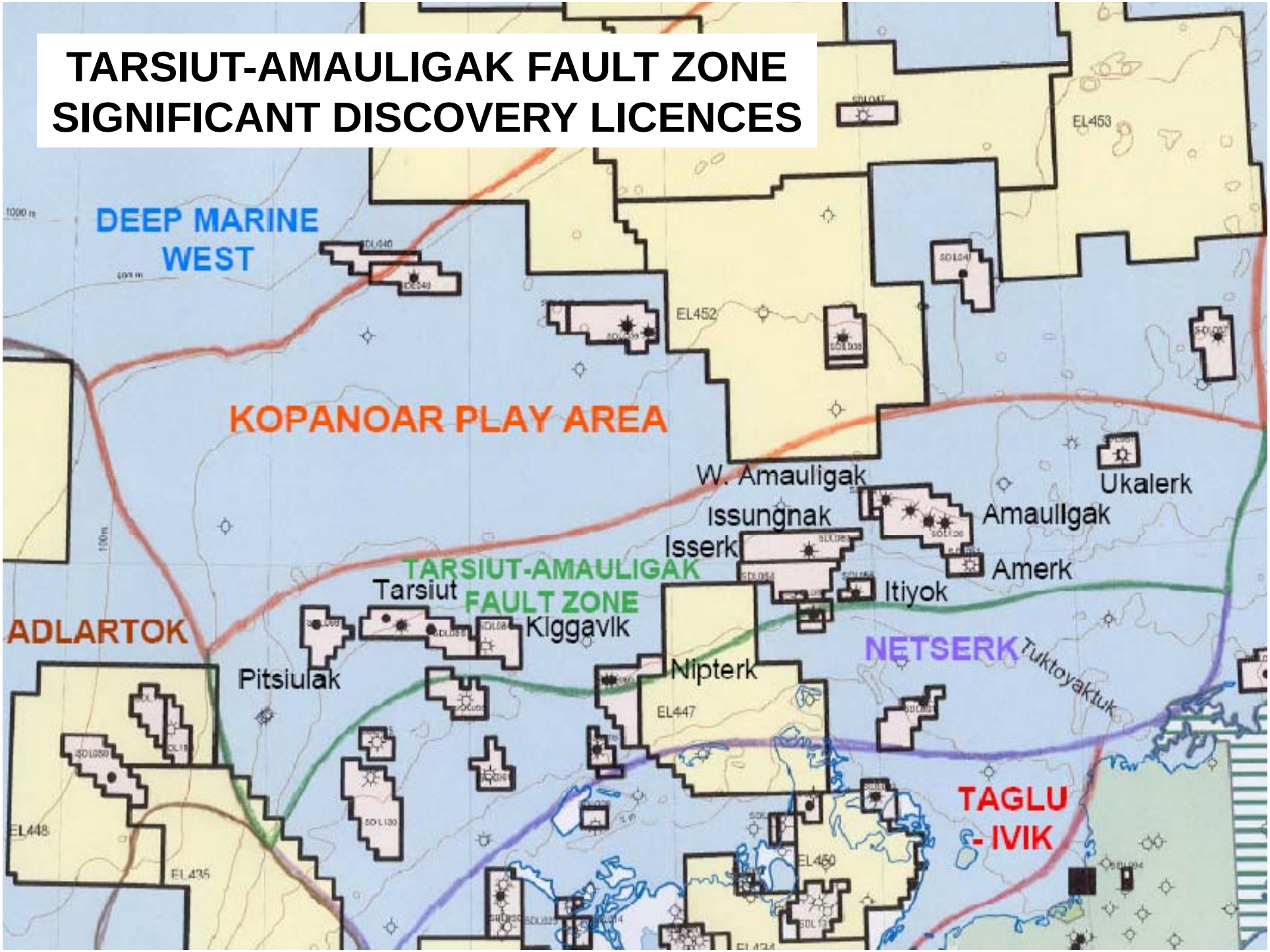


South to North Section Showing the Depositional Facies Setting for the Netserk, Tarsiut-Amauligak Fault Zone, and Kopanoar Plays (Adapted from: Dixon, 1996)

TARSIUT-AMAULIGAK FAULT ZONE PETROLEUM GEOLOGY

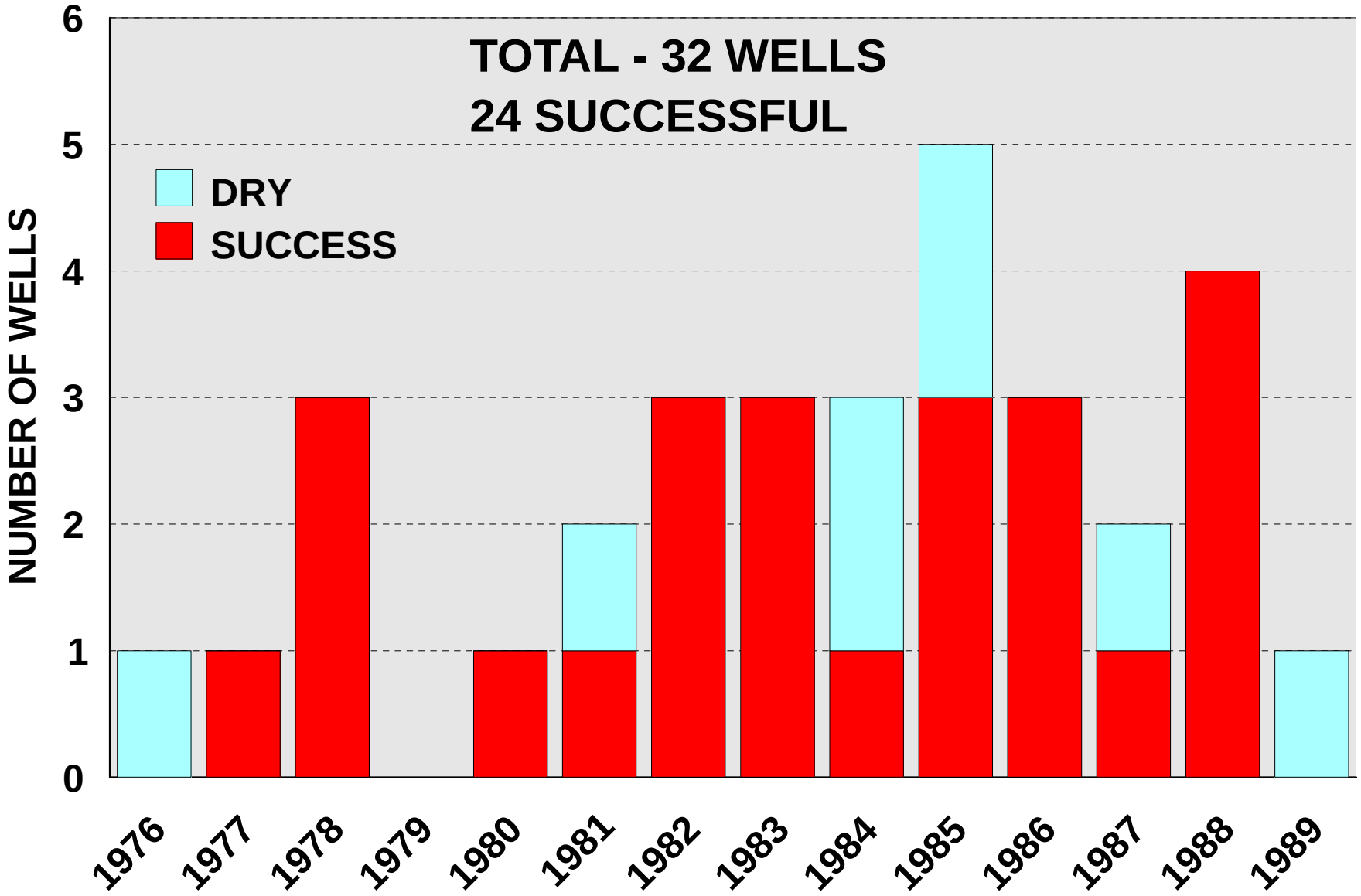


From: Enachescu, M.E, 1990


TARSIUT-AMAULIGAK FAULT ZONE
SIGNIFICANT DISCOVERY LICENCES
DEEP MARINE
WEST
KOPANOAR PLAY AREA
ADLARTOK
TARSIUT-AMAULIGAK
FAULT ZONE
Tarsiut
Kiggavik
Pitsiulak
W. Amauligak
Issungnak
Isserk
Amauligak
Ukalerk
Amerk
Itiyok
NETSERK
Tuktoyaktuk
Nipterk
TAGLU
- IVIK
EL452
EL453
EL447
EL448
EL435
EL450

TARSIUT-AMAULIGAK FAULT ZONE

WELLS DRILLED BY RIG RELEASE



TARSIUT-AMAULIGAK FAULT ZONE
HIGH SUCCESS RATE

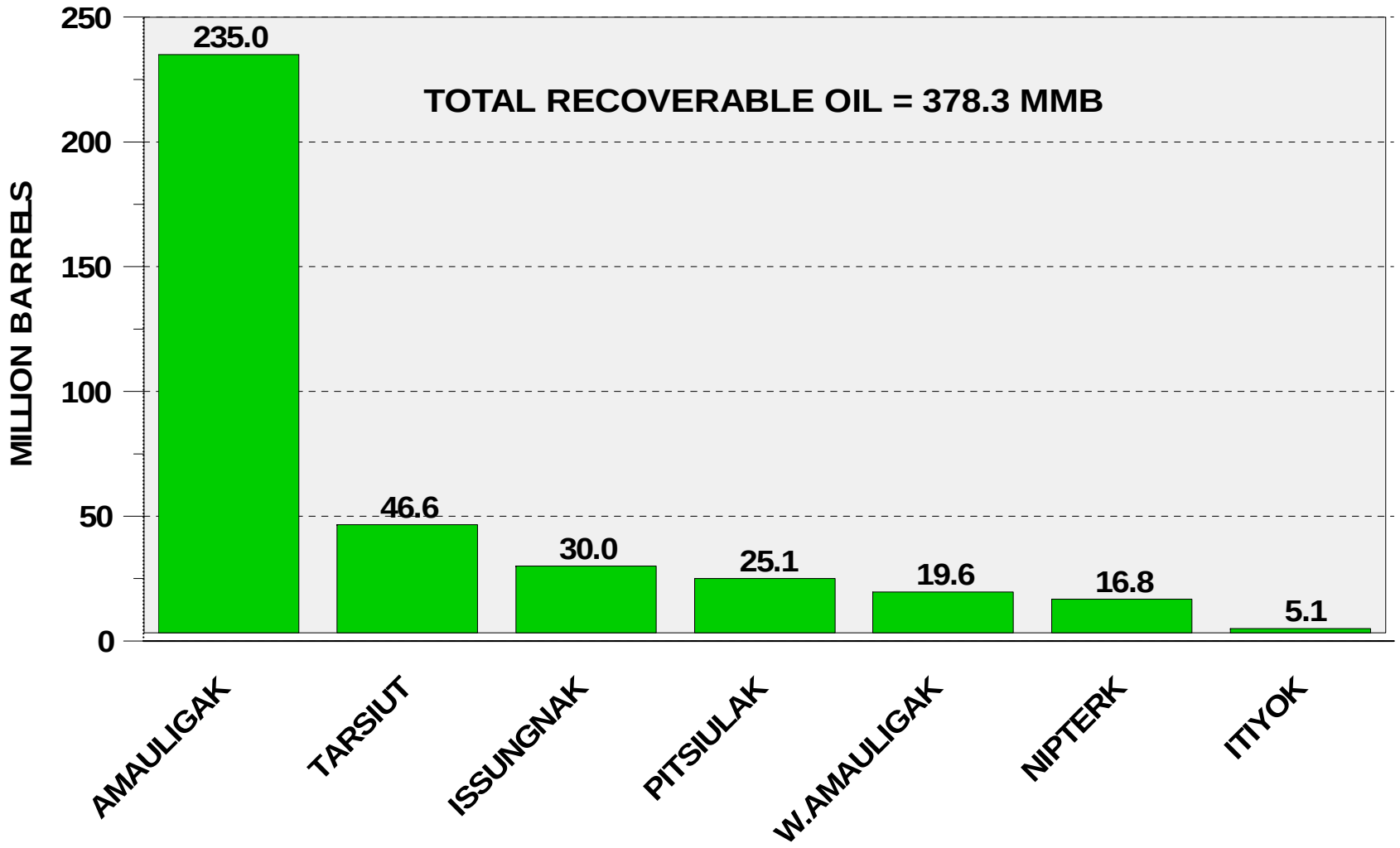
	DRILLED	SUCCESSFUL	SUCCESS %
TOTAL WELLS	32	24	75%
STRUCTURES DRILLED	18	11	61%
STRUCTURES DRILLED SDL's + SHOWS	18	12	67%

TARSIUT - AMAULIGAK FAULT ZONE DISCOVERED OIL & GAS FIELDS RECOVERABLE RESOURCES

FIELD	OIL (MMB)	GAS (BCF)	MMBOE
AMAULIGAK	235.0	1,567.4	496.2
ISSUNGNAK	30.0	1,223.7	235.3
TARSIUT	45.6	41.6	53.5
WEST AMAULIGAK	19.6	75.2	32.3
PITSIULAK	25.1	0.0	25.1
ITIYOK	5.1	118.5	24.8
KIGGAVIK	0.0	127.1	21.2
NIPTERK L-19	127.1	14.9	19.3
UKALERK	0.0	104.4	17.4
AMERK	0.0	21.4	4.0
ISSERK E-27	0.0	3.6	0.6
TOTAL	378.3	3,297.7	929.8

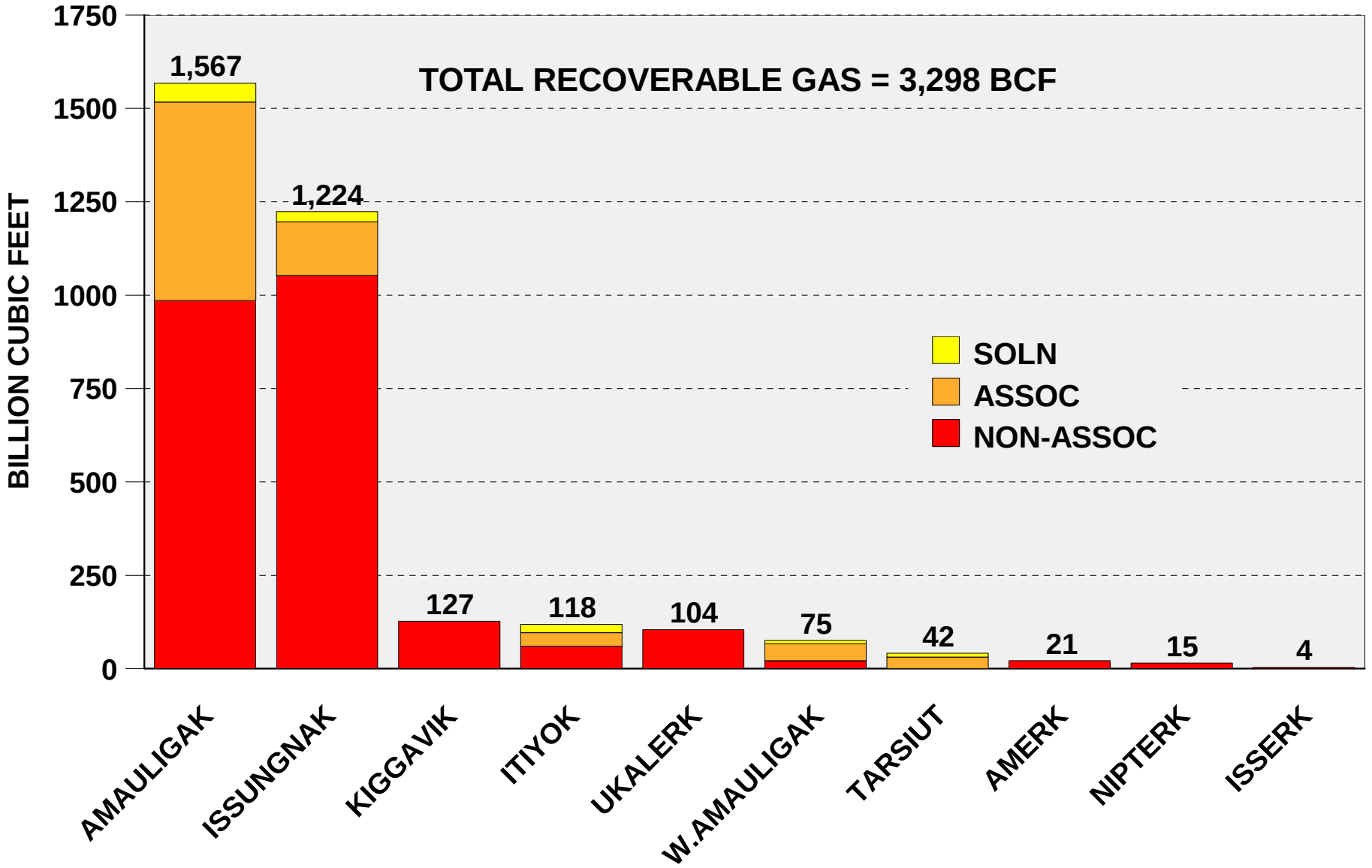
TARSIUT - AMAULIGAK FAULT ZONE

DISCOVERED OIL FIELD SIZE DISTRIBTUTION



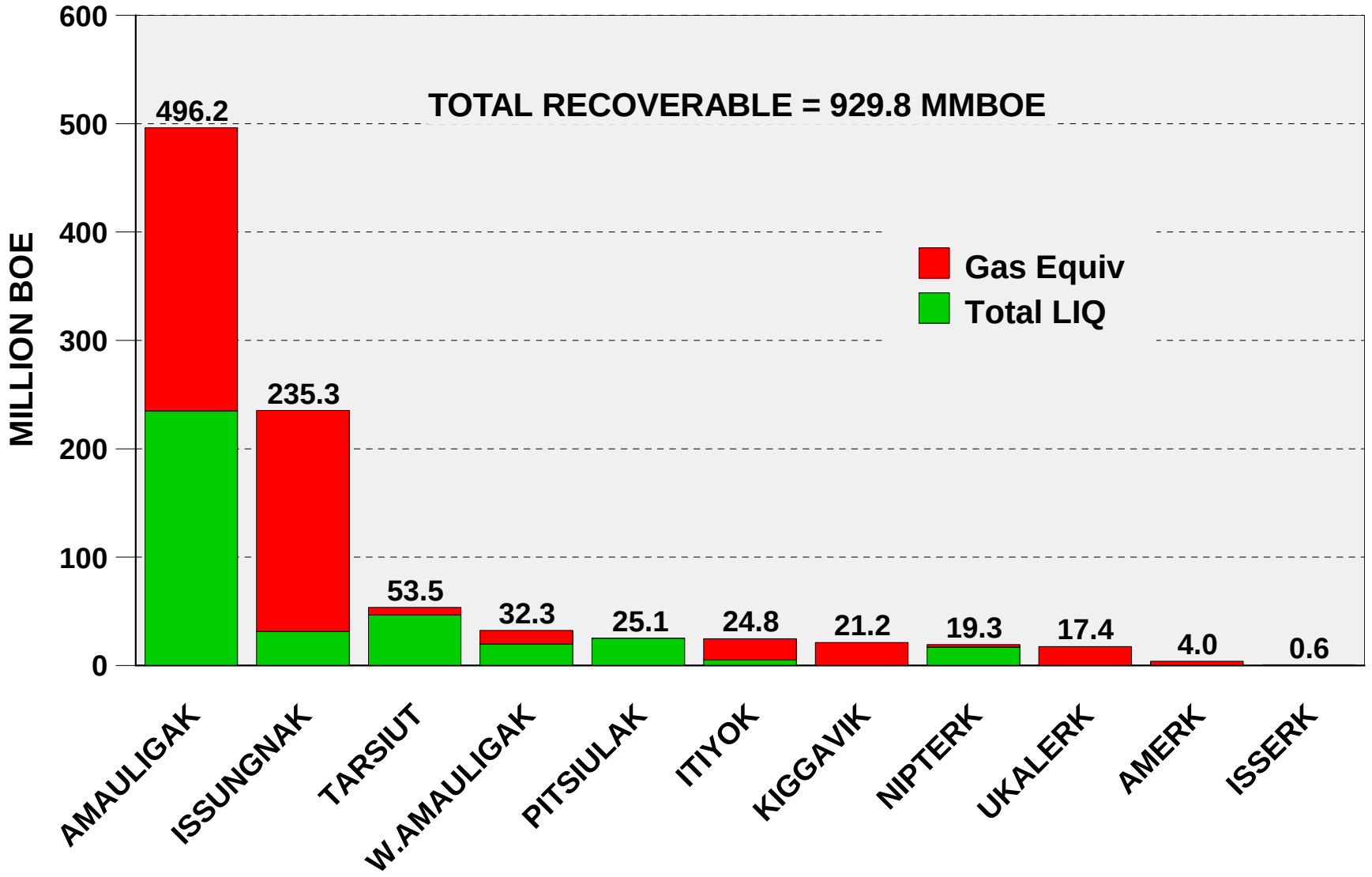
TARSIUT - AMAULIGAK FAULT ZONE

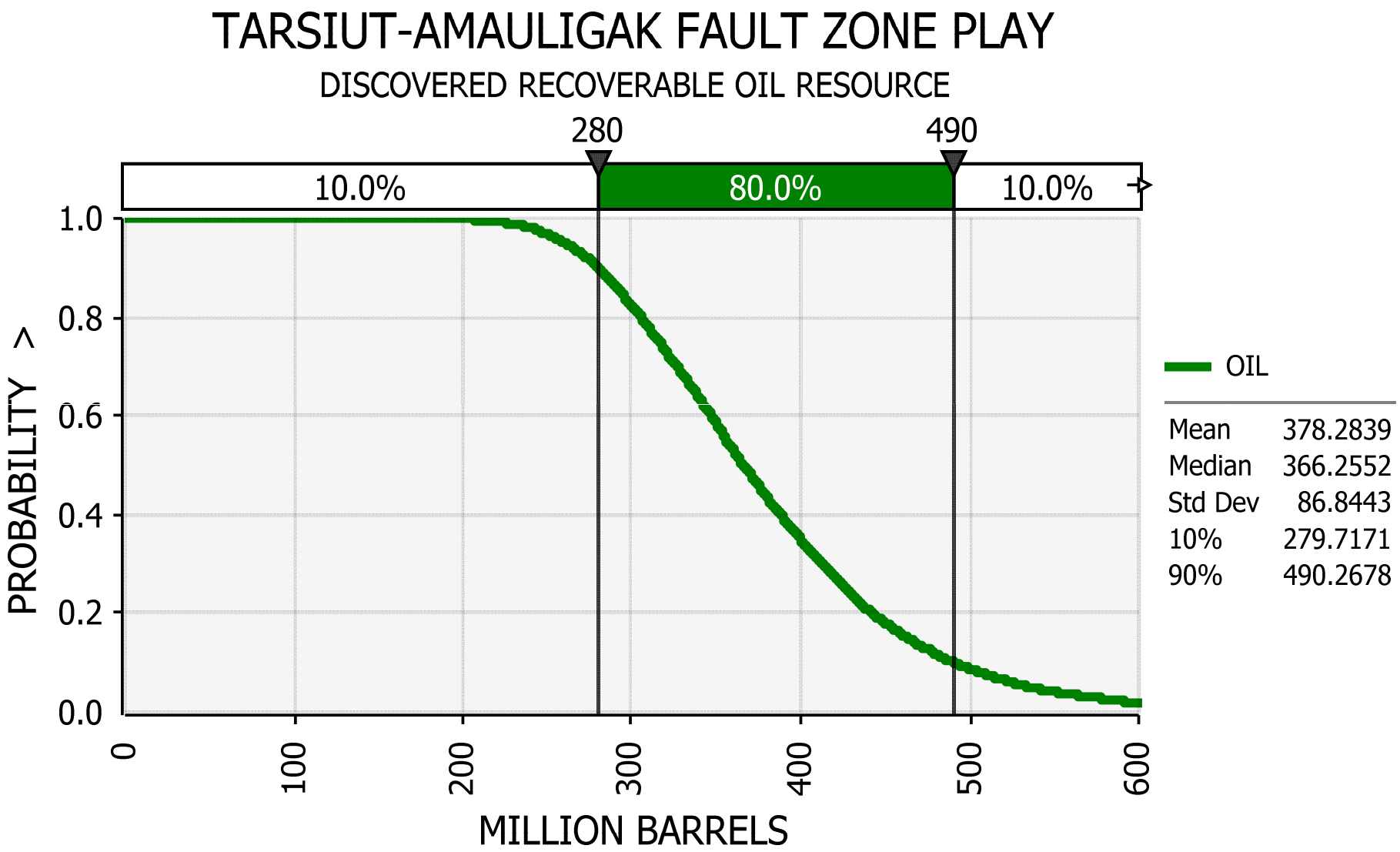
DISCOVERED GAS FIELD SIZE DISTRIBTUTION

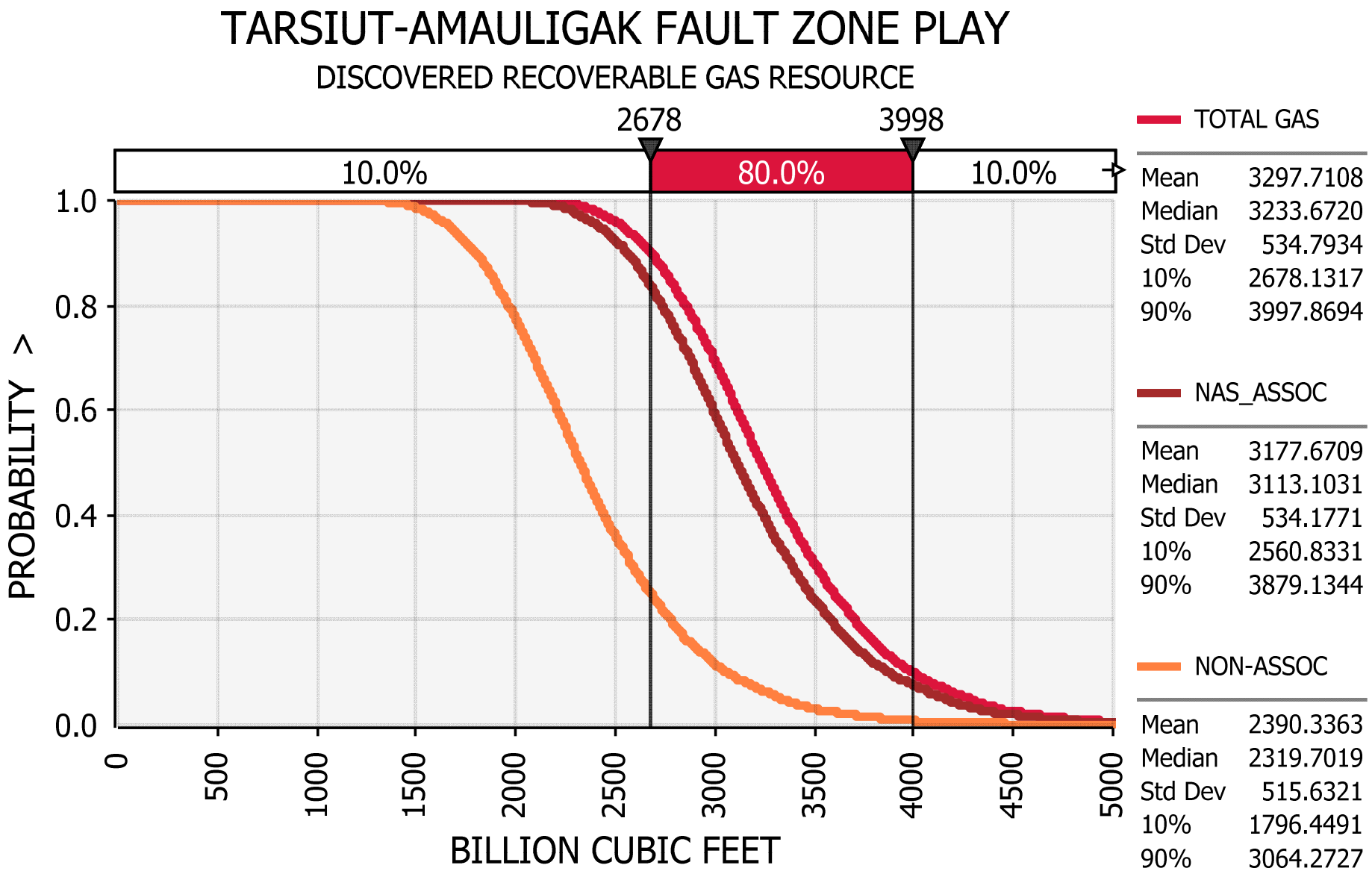


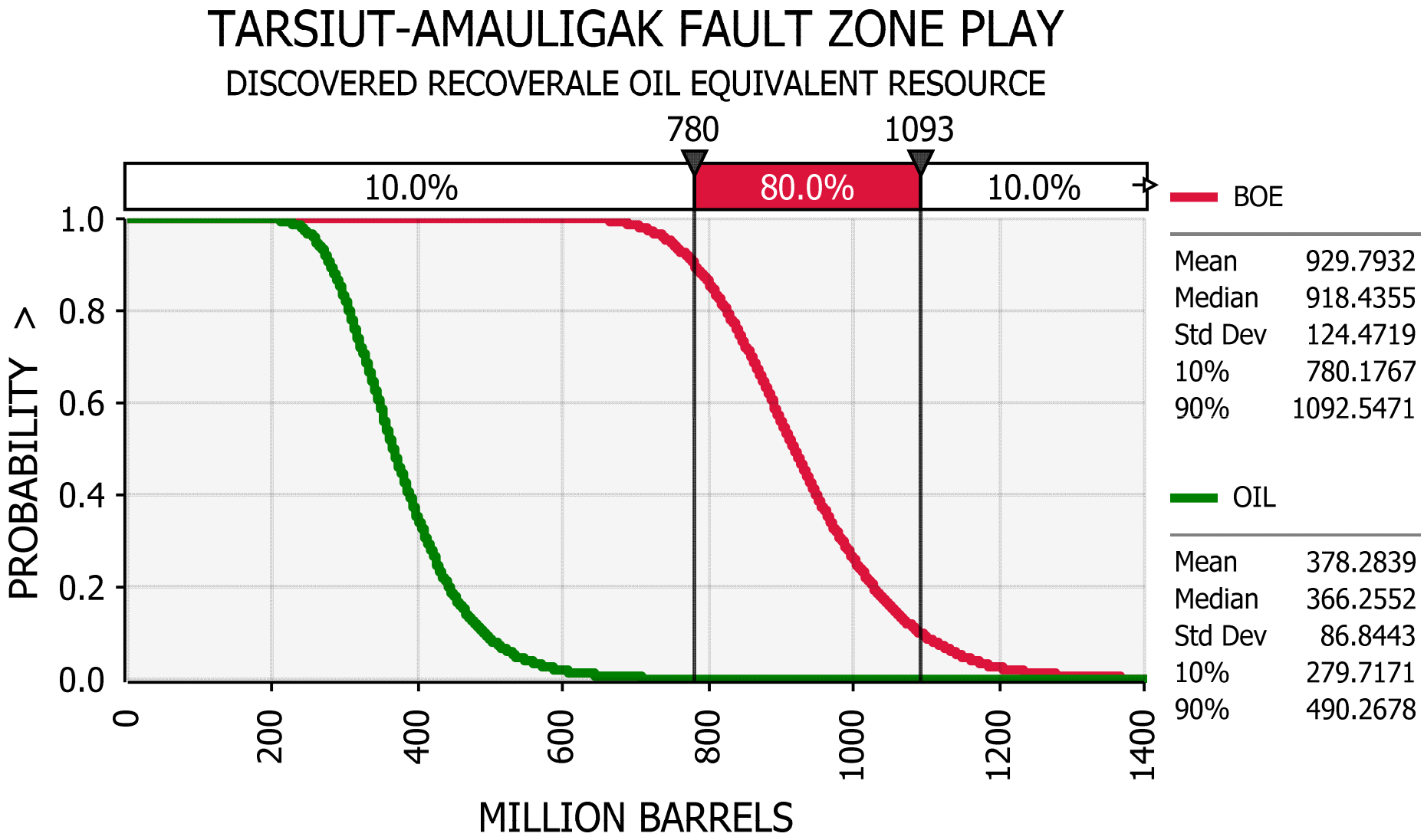
TARSIUT - AMAULIGAK FAULT ZONE

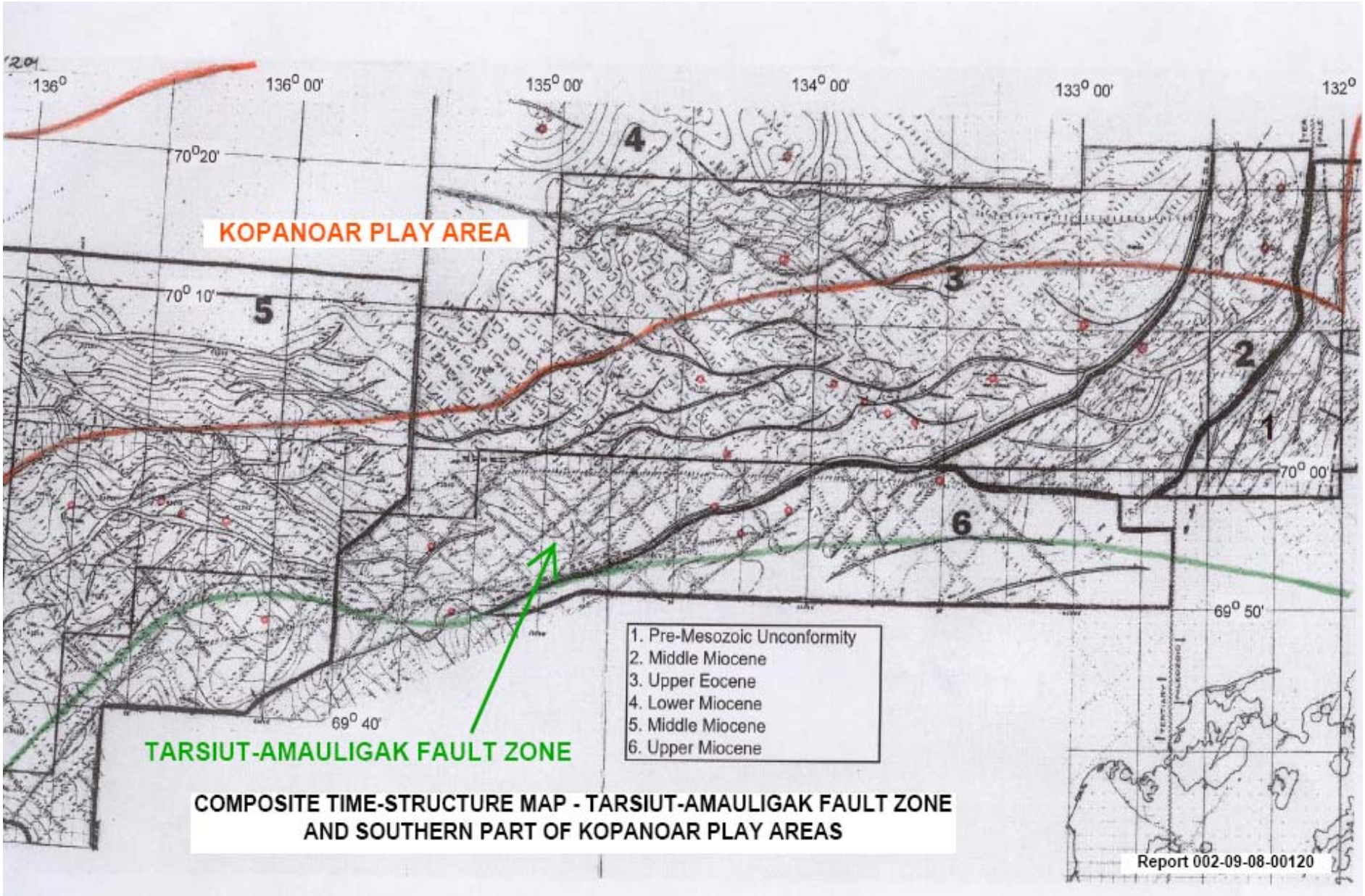
DISCOVERED BOE FIELD SIZE DISTRIBTUTION



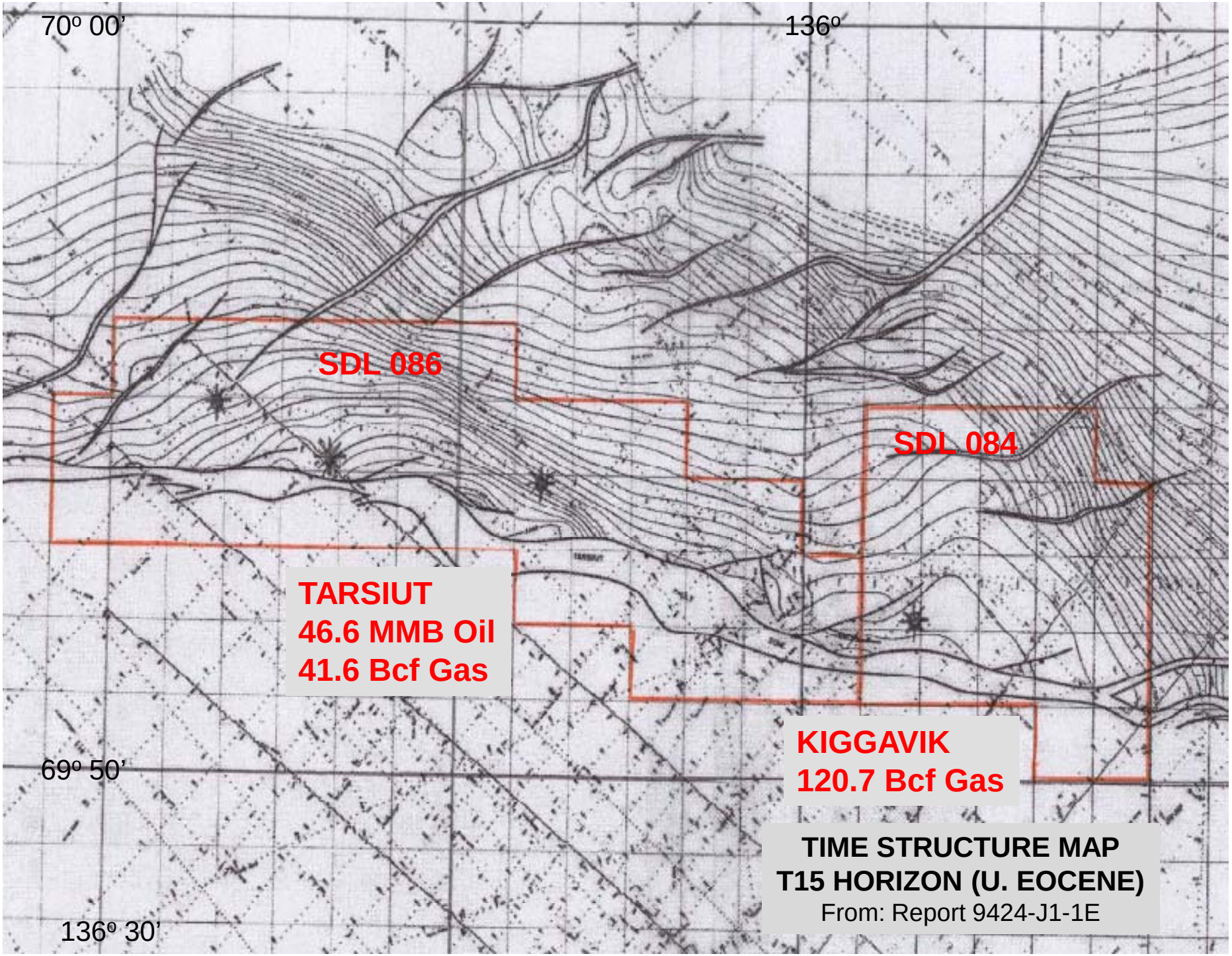

TARSIUT-AMAULIGAK FAULT ZONE PLAY
DISCOVERED RECOVERABLE OIL RESOURCE
280
490
10.0%
80.0%
10.0%
1.0
0.8
0.6
0.4
0.2
0.0
PROBABILITY >
0
100
200
300
400
500
600
MILLION BARRELS
OIL
Mean 378.2839
Median 366.2552
Std Dev 86.8443
10% 279.7171
90% 490.2678


TARSIUT-AMAULIGAK FAULT ZONE PLAY
DISCOVERED RECOVERABLE GAS RESOURCE
2678
3998
10.0%
80.0%
10.0%
PROBABILITY >
1.0
0.8
0.6
0.4
0.2
0.0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
BILLION CUBIC FEET
TOTAL GAS
Mean 3297.7108
Median 3233.6720
Std Dev 534.7934
10% 2678.1317
90% 3997.8694
NAS_ASSOC
Mean 3177.6709
Median 3113.1031
Std Dev 534.1771
10% 2560.8331
90% 3879.1344
NON-ASSOC
Mean 2390.3363
Median 2319.7019
Std Dev 515.6321
10% 1796.4491
90% 3064.2727


TARSIUT-AMAULIGAK FAULT ZONE PLAY
DISCOVERED RECOVERALE OIL EQUIVALENT RESOURCE
780
1093
10.0%
80.0%
10.0%
PROBABILITY >
1.0
0.8
0.6
0.4
0.2
0.0
0
200
400
600
800
1000
1200
1400
MILLION BARRELS
BOE
Mean 929.7932
Median 918.4355
Std Dev 124.4719
10% 780.1767
90% 1092.5471
OIL
Mean 378.2839
Median 366.2552
Std Dev 86.8443
10% 279.7171
90% 490.2678

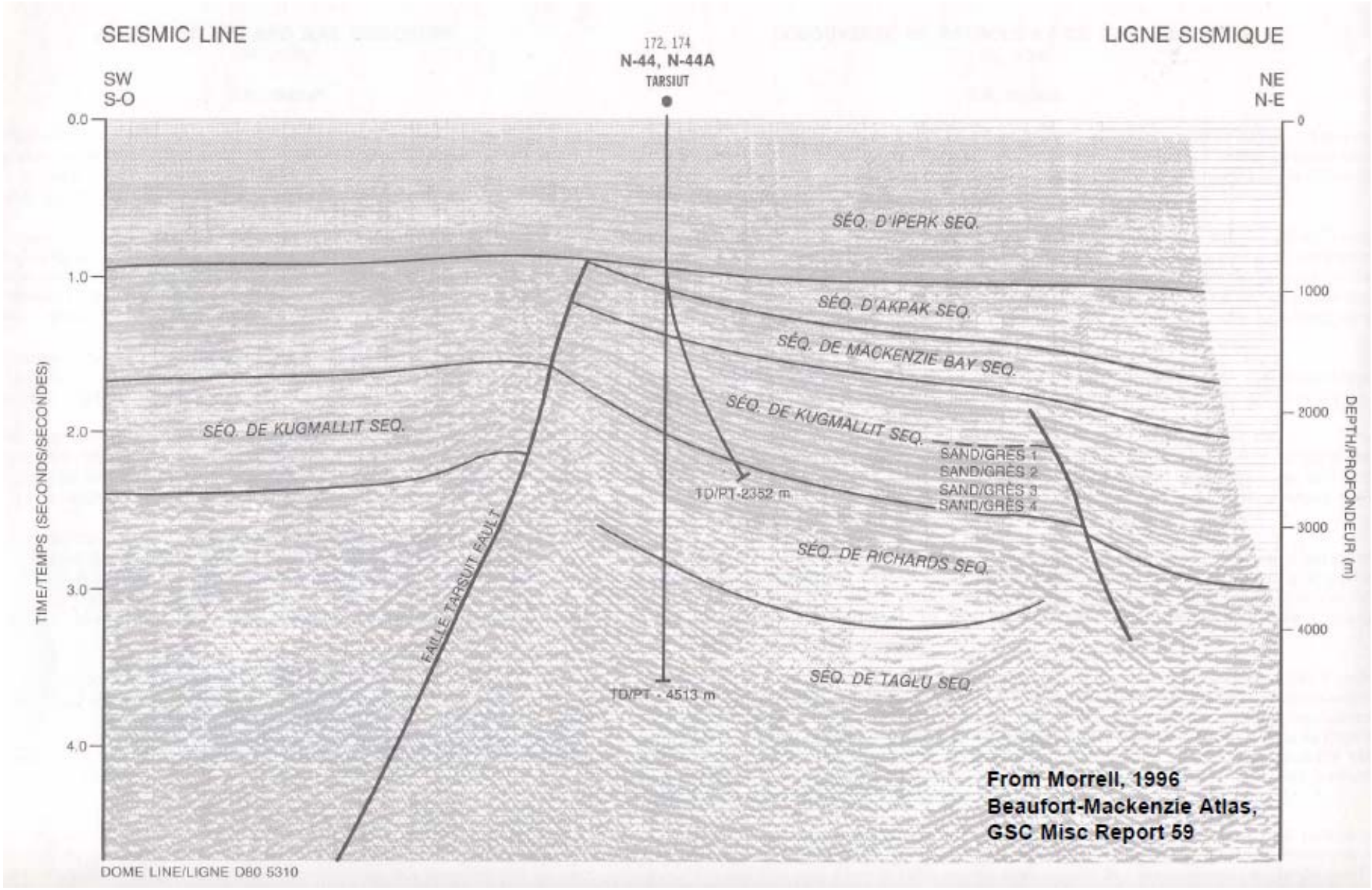


COMPOSITE TIME-STRUCTURE MAP - TARSIUT-AMAULIGAK FAULT ZONE AND SOUTHERN PART OF KOPANOAR PLAY AREAS

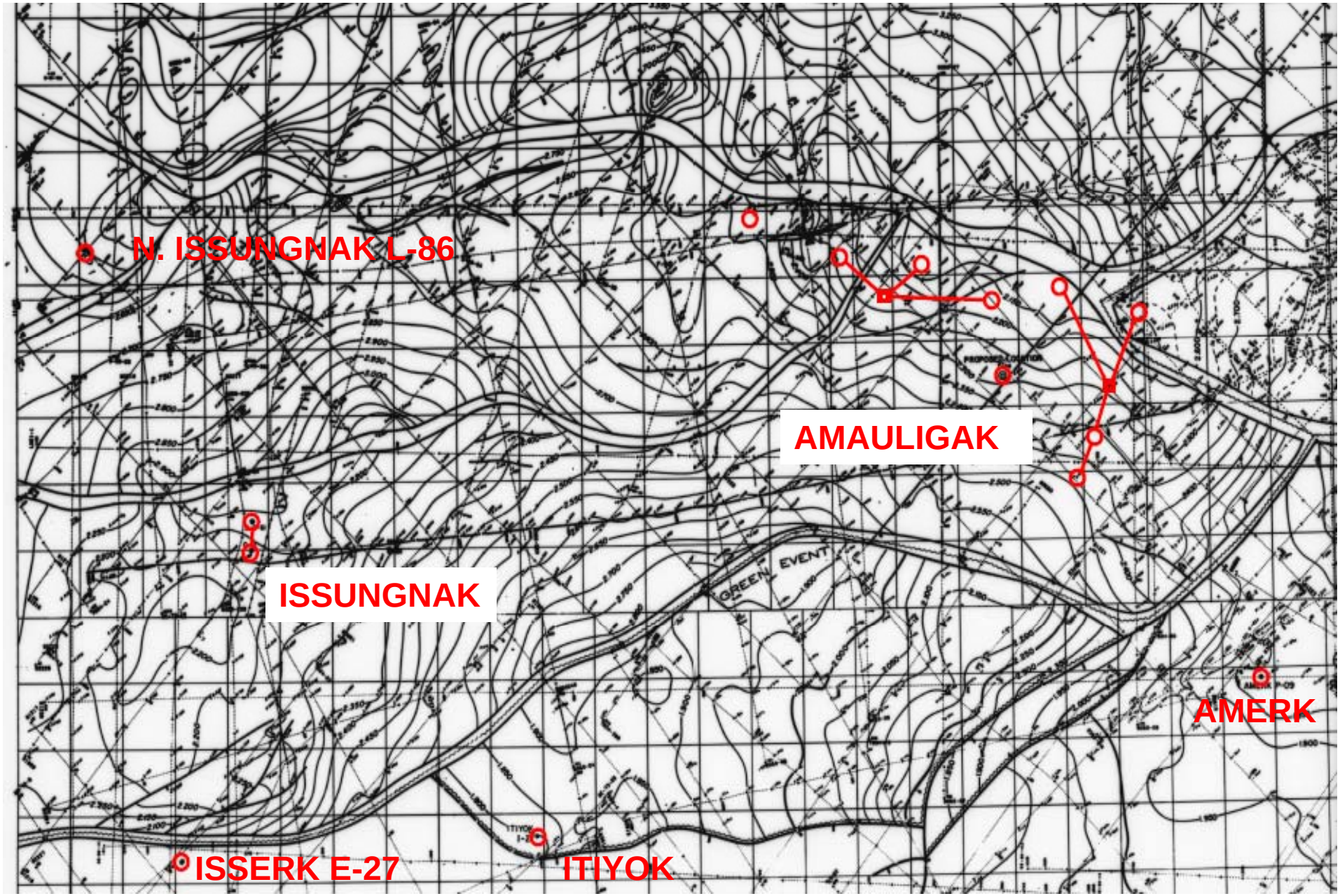


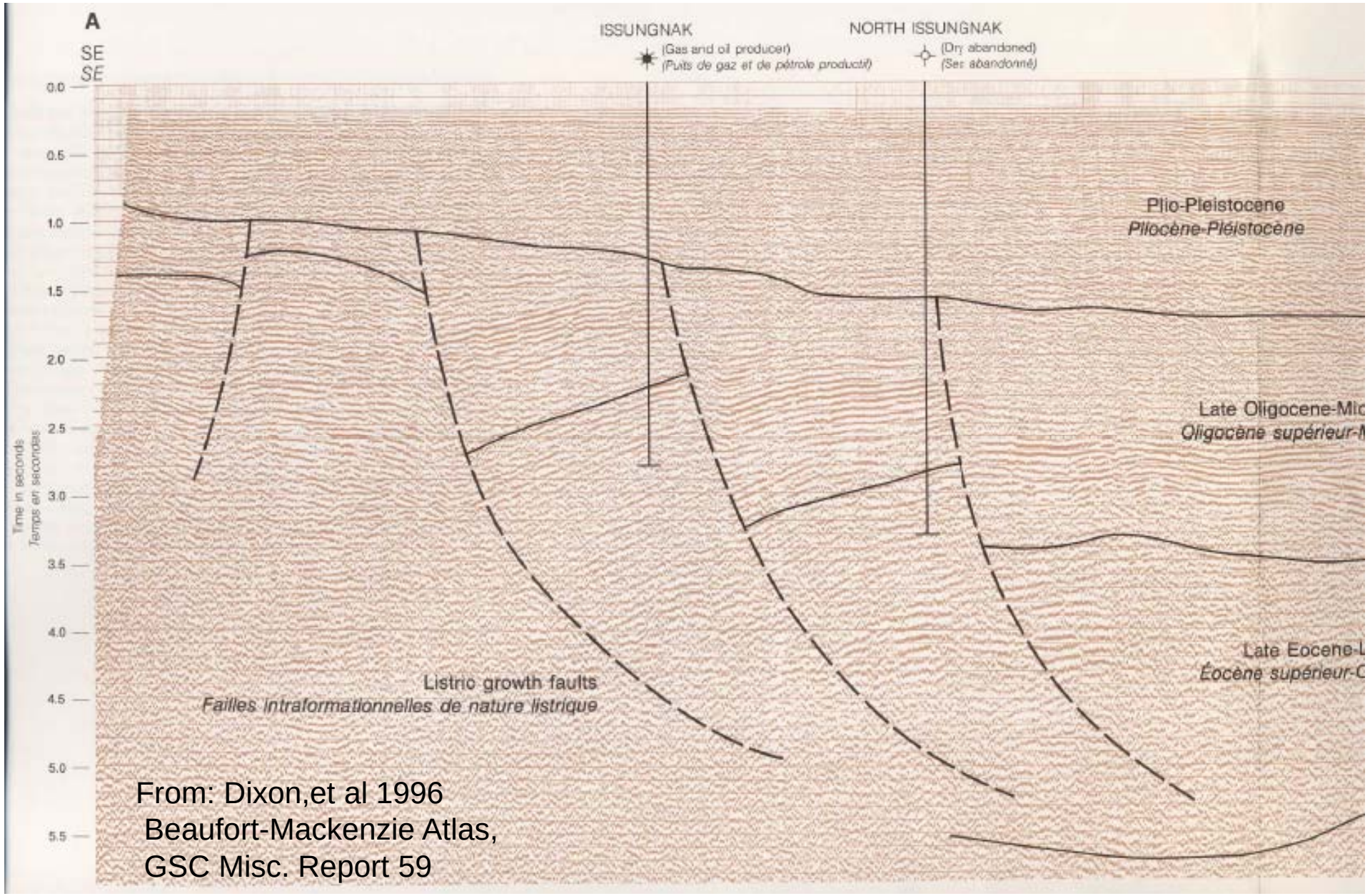
TIME STRUCTURE MAP
T15 HORIZON (U. EOCENE)
From: Report 9424-J1-1E

TARSIUT OIL DISCOVERY

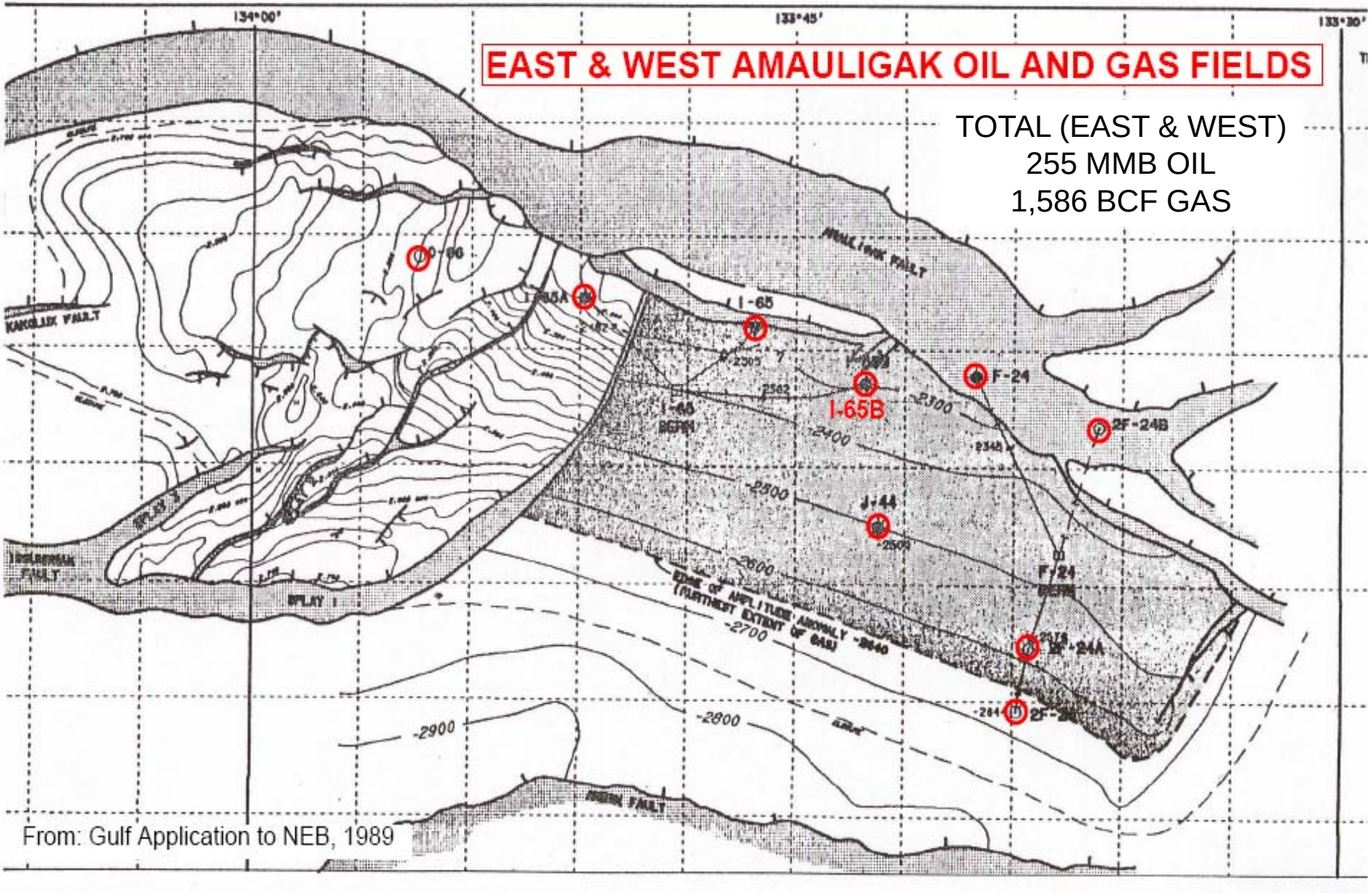


ISSUNGNAK-AMAULIGAK – TOP OF KUGMALLIT

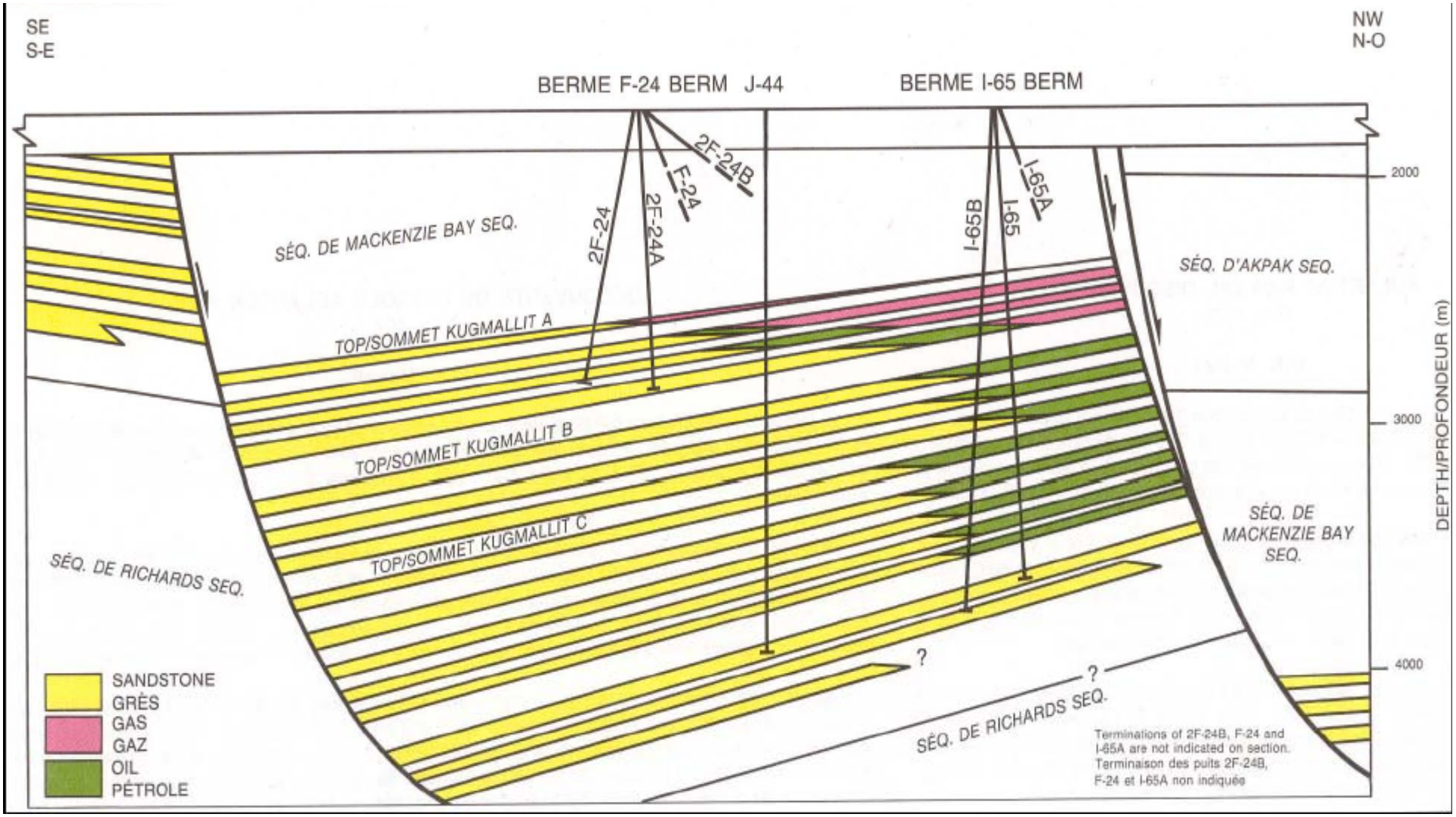


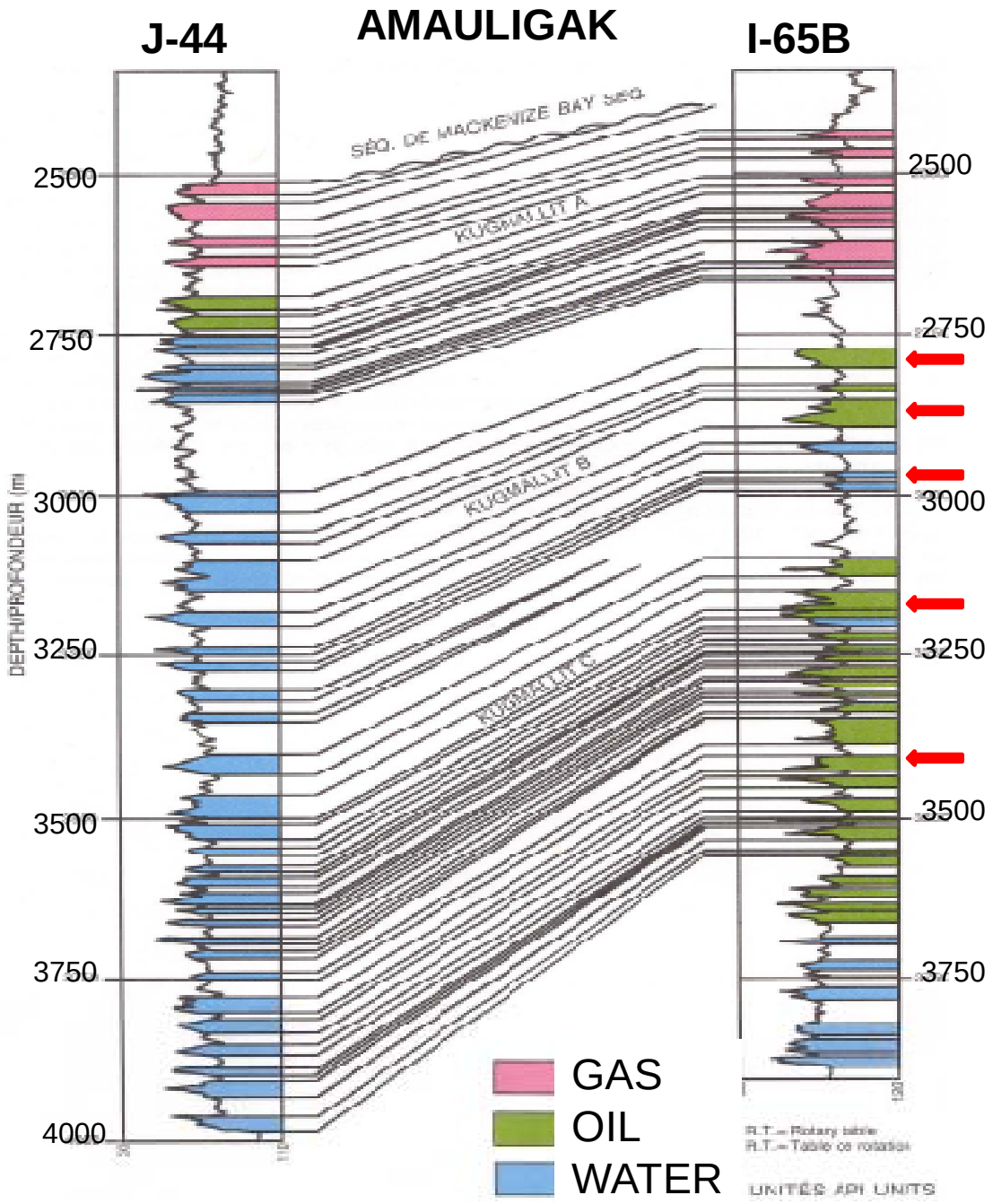


From: Dixon,et al 1996
Beaufort-Mackenzie Atlas,
GSC Misc. Report 59


EAST & WEST AMAULIGAK OIL AND GAS FIELDS
TOTAL (EAST & WEST)
255 MMB OIL
1,586 BCF GAS
134°00'
133°45'
I-65
I-65B
F-24
2F-24B
J-44
2F-24A
-2300
-2400
-2500
-2600
-2700
-2800
-2900
From: Gulf Application to NEB, 1989

AMAULIGAK OIL AND GAS DISCOVERY





TEST ZONES AMAULIGAK I-65B

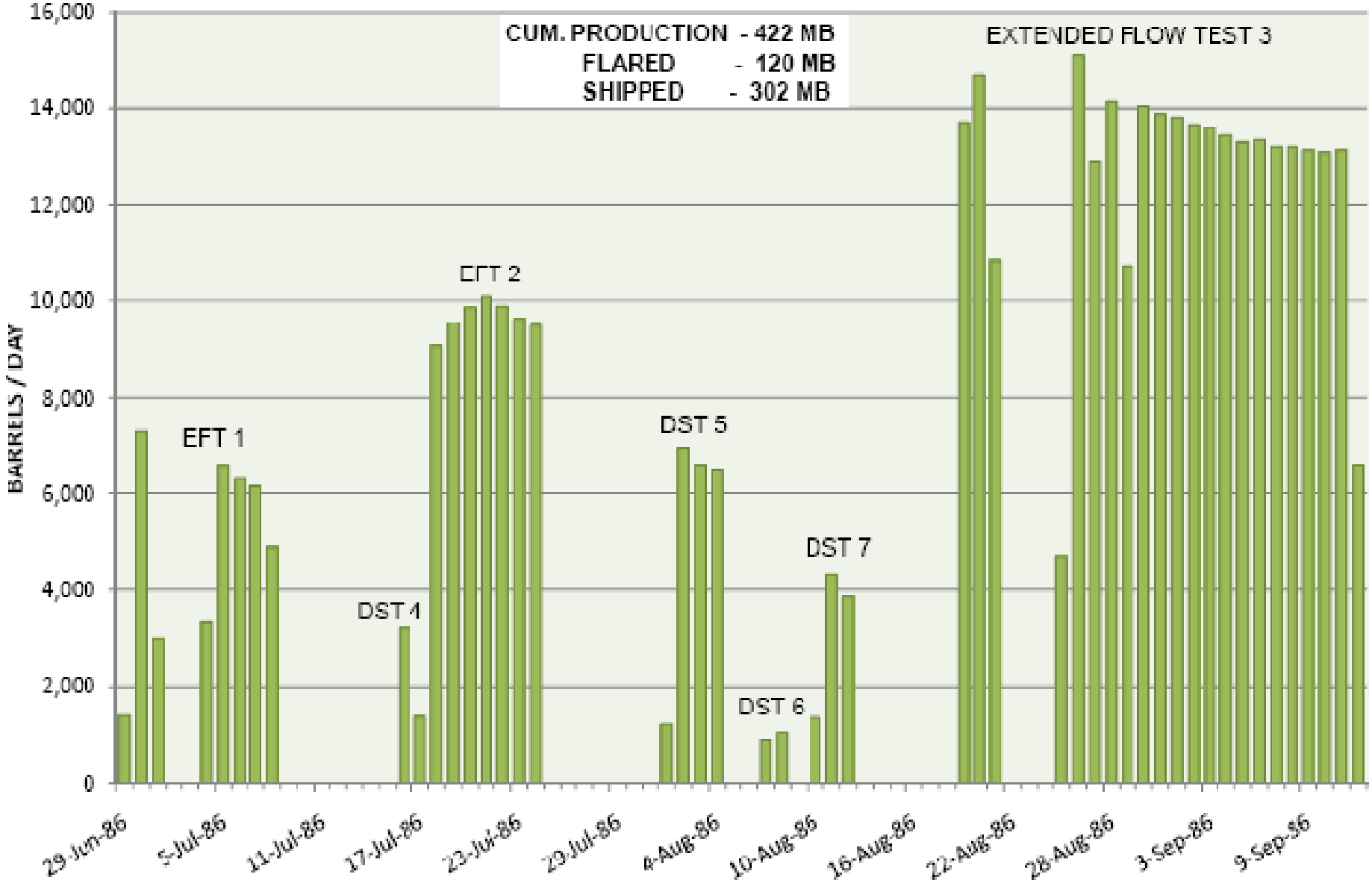
- DST#7
- DST#6
- DST#5

EFT#3

- DST#4 , EFT #2
- DST#3 , EFT#1

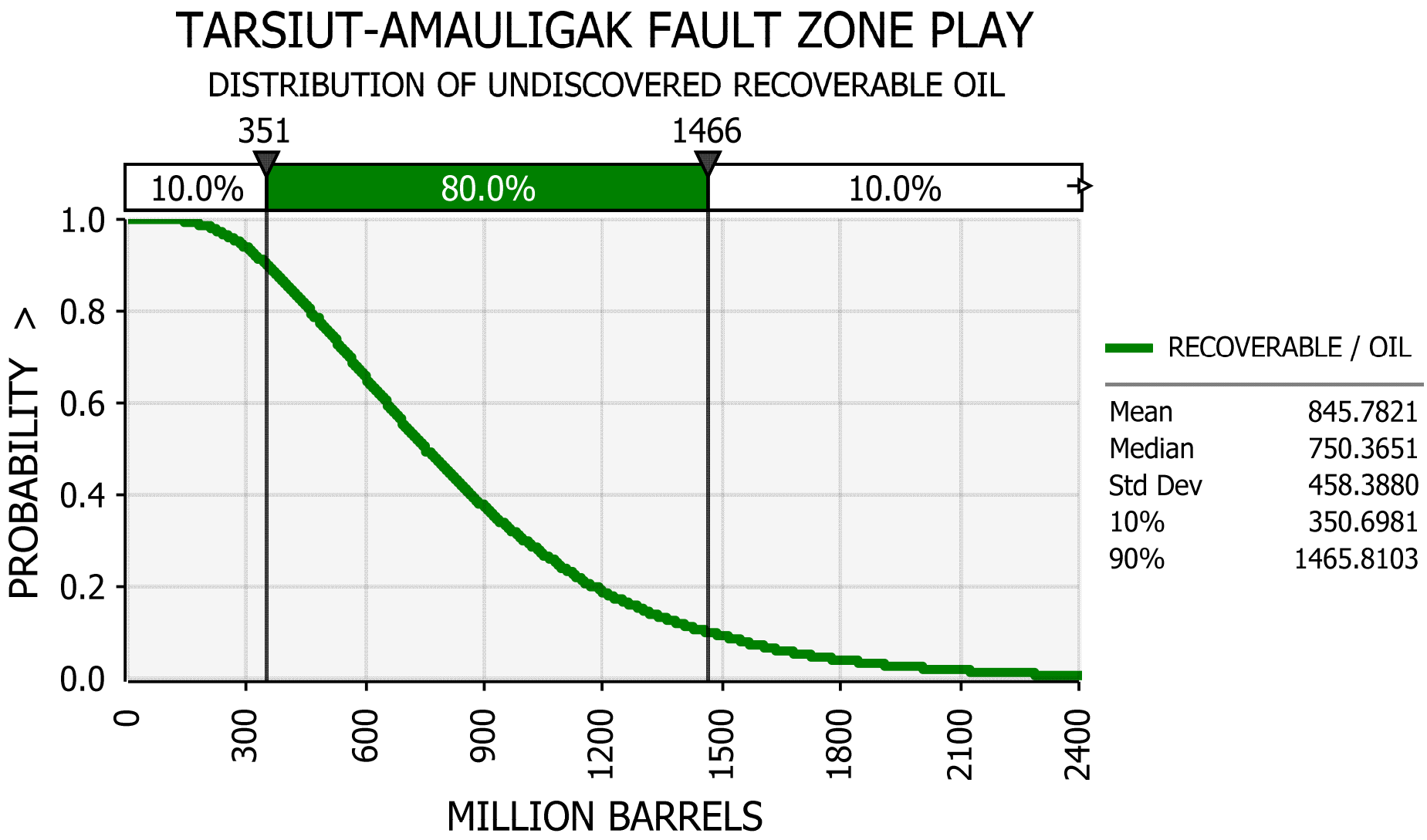
Adapted from: Morrell, 1996
GSC Misc. Report 59

GULF et al AMAULIGAK I-65B
OIL PRODUCTION - DST AND EXTENDED FLOW TEST



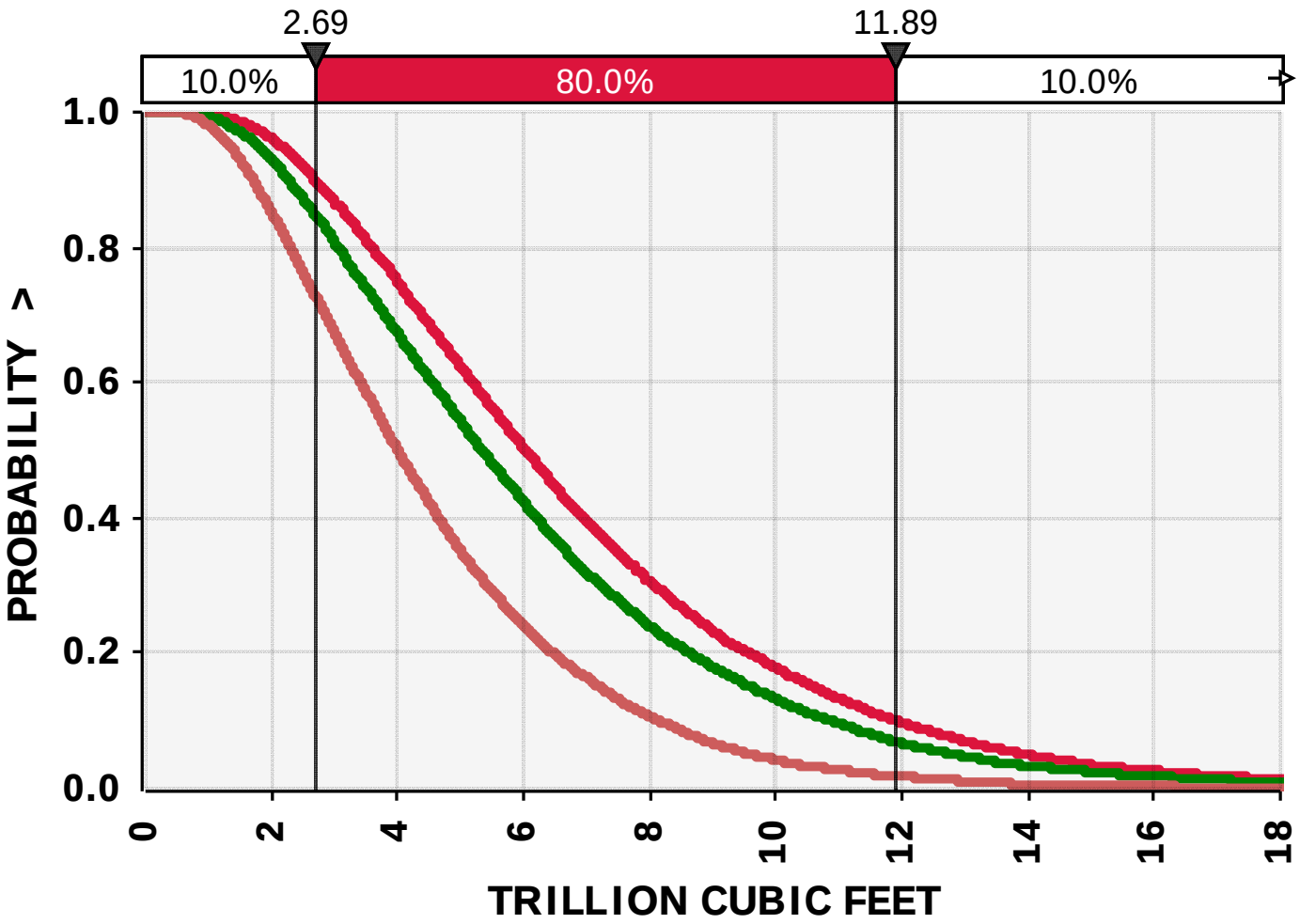
ULTIMATE RECOVERABLE RESOURCES OF THE BEAUFORT SEA

	DISCOVERED RESOURCES		UNDISCOVERED RESOURCES		ULTIMATE RESOURCES	
PLAY	OIL (MMB)	GAS (BCF)	OIL (MMB)	GAS (BCF)	OIL (MMB)	GAS (BCF)
NETSERK	269	659	599	5,046	868	5,705
TARSIUT-AMAULIGAK	378	3,298	846	6,785	1,224	10,083
KOPANOAR	234	822	1,866	7,044	2,100	7,866
ADLARTOK	129	88	1,605	6,435	1,734	6,523
DEEP WATER WEST			793	7,113	793	7,113
HERSCHEL			172	692	172	692
DEMARCATION			93	446	93	446
TOTAL	1,010	4,867	5,974	33,561	6,984	38,428


TARSIUT-AMAULIGAK FAULT ZONE PLAY
DISTRIBUTION OF UNDISCOVERED RECOVERABLE OIL
351
1466
10.0%
80.0%
10.0%
PROBABILITY >
1.0
0.8
0.6
0.4
0.2
0.0
0
300
600
900
1200
1500
1800
2100
2400
MILLION BARRELS
RECOVERABLE / OIL
Mean 845.7821
Median 750.3651
Std Dev 458.3880
10% 350.6981
90% 1465.8103

TARSIUT-AMAULIGAK FAULT ZONE PLAY

DISTRIBUTION OF UNDISCOVERED TOTAL RECOVERABLE GAS



RECOVERABLE / TOTGAS

Mean	6785.2483
Median	6038.2086
Std Dev	3777.8549
10%	2686.7990
90%	11888.5081

RECOVERABLE / NAS-ASSOC

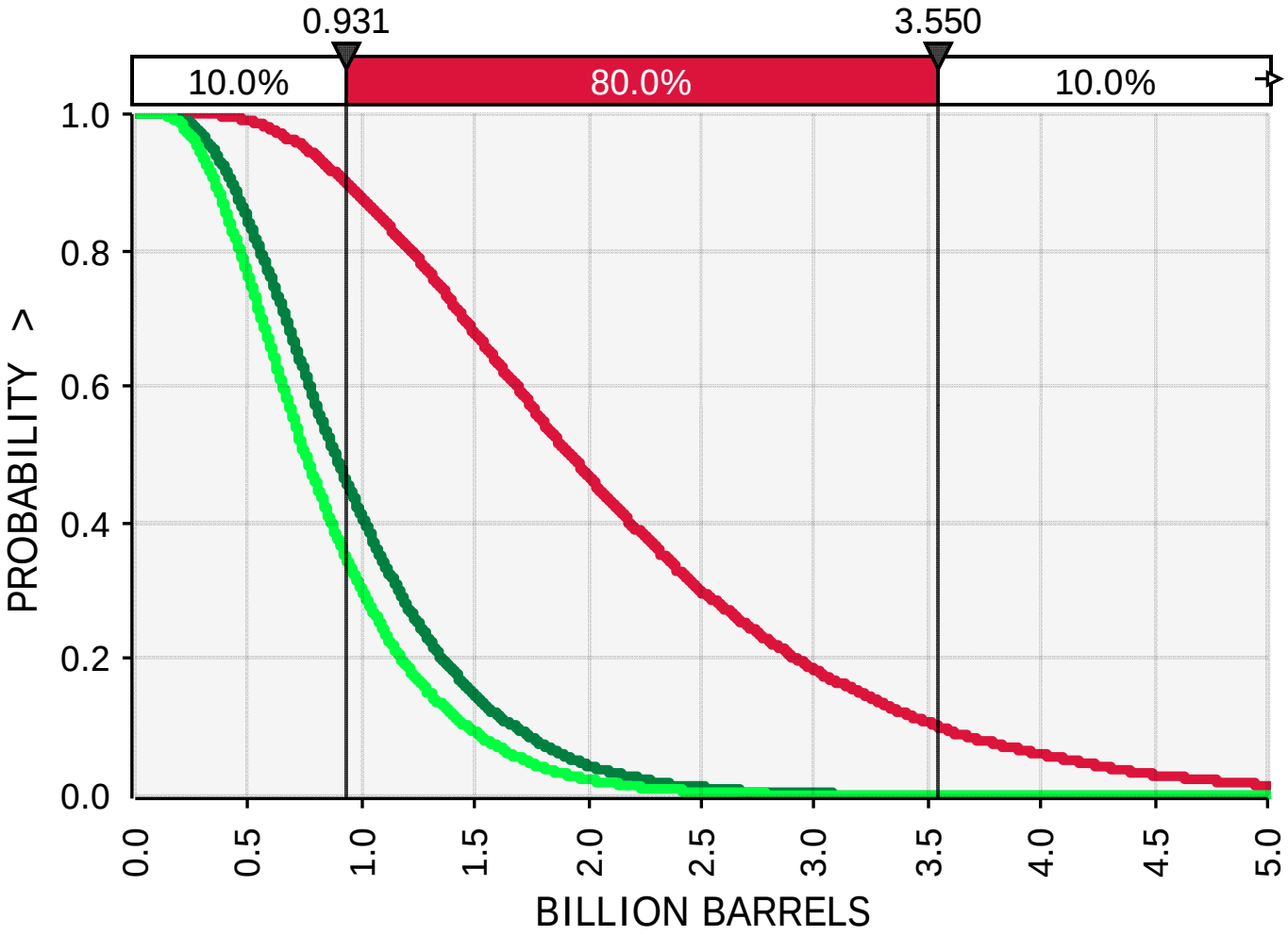
Mean	6060.8650
Median	5340.3613
Std Dev	3548.4767
10%	2269.5381
90%	10866.1079

RECOVERABLE / NON-ASSOC

Mean	4545.6487
Median	4005.2710
Std Dev	2661.3575
10%	1702.1536
90%	8149.5809

TARSIUT-AMAULIGAK FAULT ZONE PLAY

DISTRIBUTION OF UNDISCOVERED RECOVERABLE BOE RESOURCE



RECOVERABLE / BOE

Mean	2112.2935
Median	1918.5811
Std Dev	1053.8463
10%	931.1304
90%	3549.5172

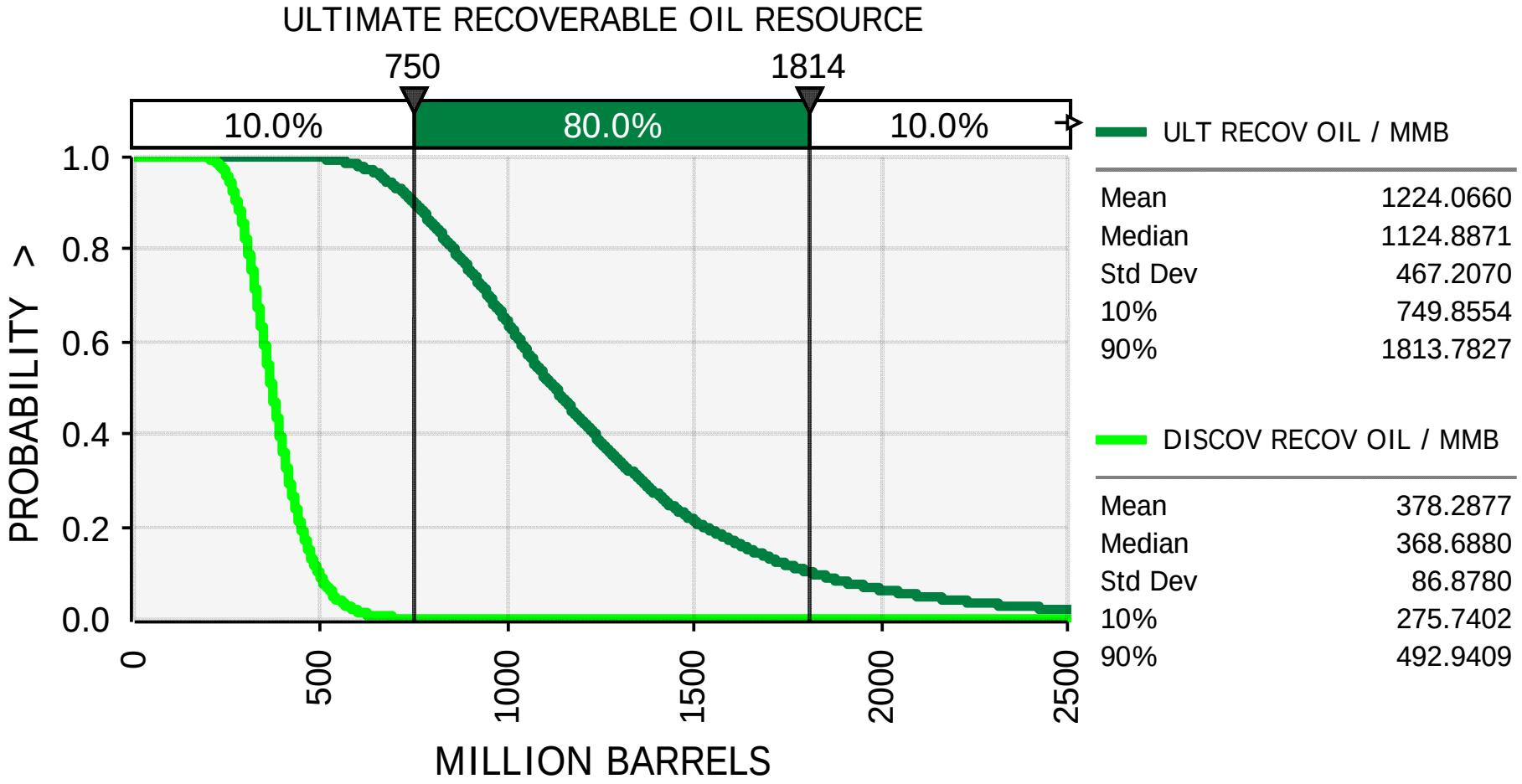
RECOVERABLE / TOTLIQ

Mean	981.4188
Median	883.6725
Std Dev	507.6763
10%	423.1520
90%	1681.6821

RECOVERABLE / OIL

Mean	845.7821
Median	750.3651
Std Dev	458.3880
10%	350.6981
90%	1465.8103

TARSIUT-AMAULIGAK FAULT ZONE PLAY

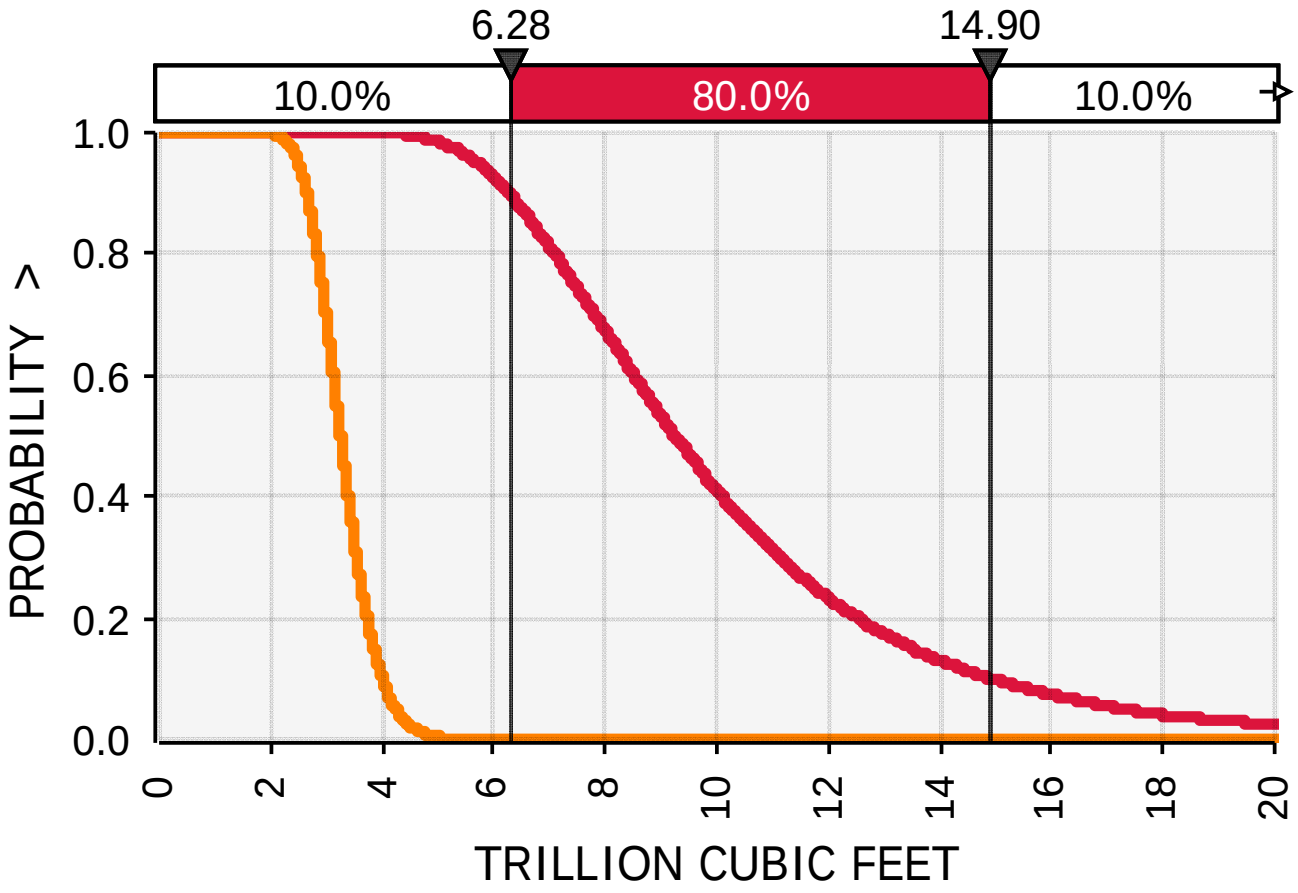


ULT RECOV OIL / MMB	
Mean	1224.0660
Median	1124.8871
Std Dev	467.2070
10%	749.8554
90%	1813.7827

DISCOV RECOV OIL / MMB	
Mean	378.2877
Median	368.6880
Std Dev	86.8780
10%	275.7402
90%	492.9409

TARSIUT-AMAULIGAK FAULT ZONE PLAY

ULTIMATE RECOVERABLE GAS RESOURCE



ULT RECOV GAS / BCF

Mean	10082.9590
Median	9245.9445
Std Dev	3811.5106
10%	6275.3581
90%	14901.6805

DISCOV RECOV GAS / BCF

Mean	3297.7121
Median	3255.1320
Std Dev	534.7998
10%	2647.8264
90%	4001.7364

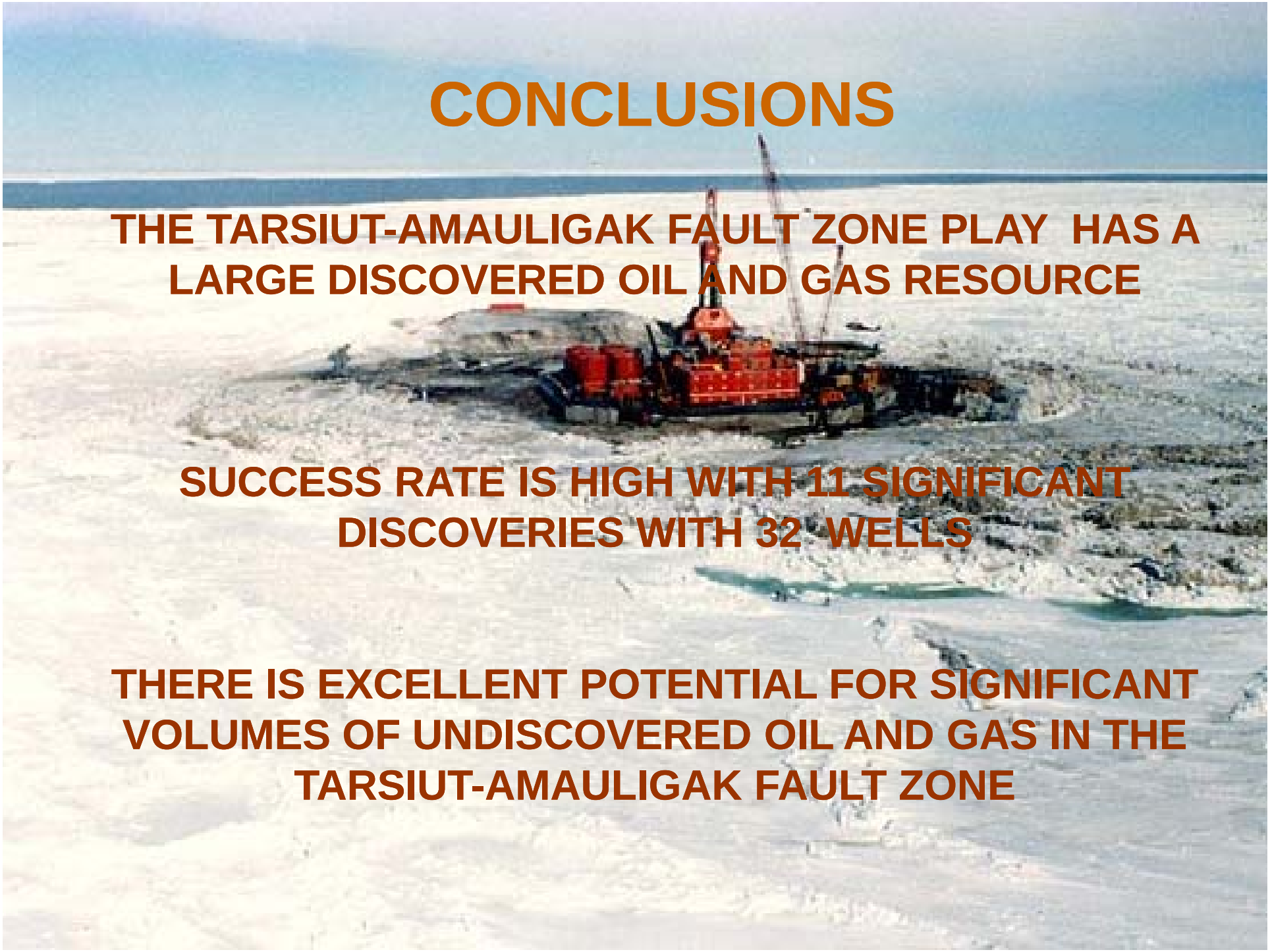
TARSIUT-AMAULIGAK FAULT ZONE

ULTIMATE RECOVERABLE RESOURCE

1.2 BILLION BARRELS OF OIL
- **0.4 DISCOVERED**
- **0.8 UNDISCOVERED**

10.1 TRILLION CUBIC FEET OF GAS
- **3.3 DISCOVERED**
- **6.8 UNDISCOVERED**

3.0 BILLION BOE
- **0.9 DISCOVERED**
- **2.1 UNDISCOVERED**



CONCLUSIONS

THE TARSIUT-AMAULIGAK FAULT ZONE PLAY HAS A LARGE DISCOVERED OIL AND GAS RESOURCE

SUCCESS RATE IS HIGH WITH 11 SIGNIFICANT DISCOVERIES WITH 32 WELLS

THERE IS EXCELLENT POTENTIAL FOR SIGNIFICANT VOLUMES OF UNDISCOVERED OIL AND GAS IN THE TARSIUT-AMAULIGAK FAULT ZONE