Reykjanes Ridge evolution and the elimination of transform faults in the north Atlantic

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Bernard McKiernan, Robert Koprowski, Robert Hagg

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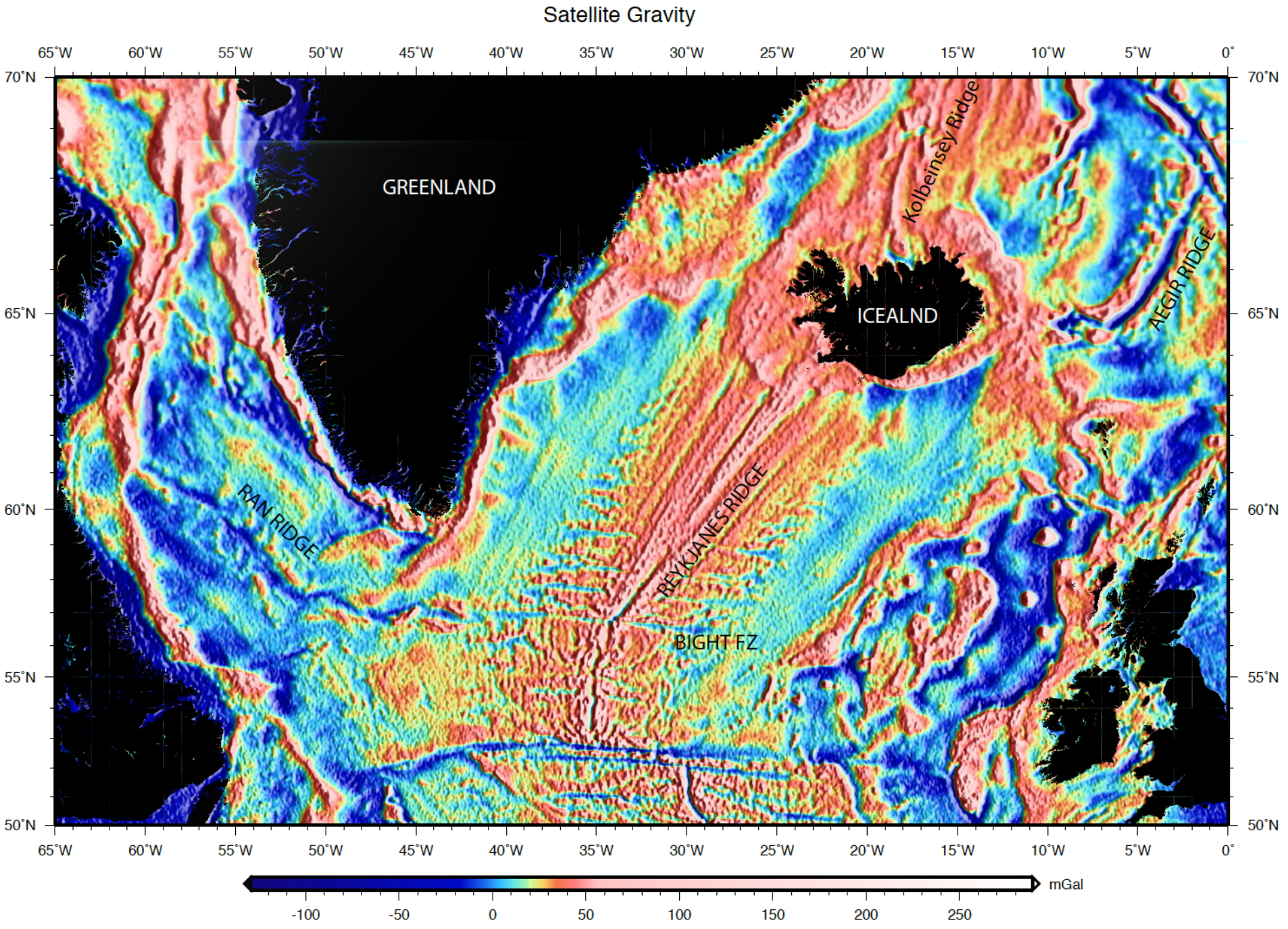
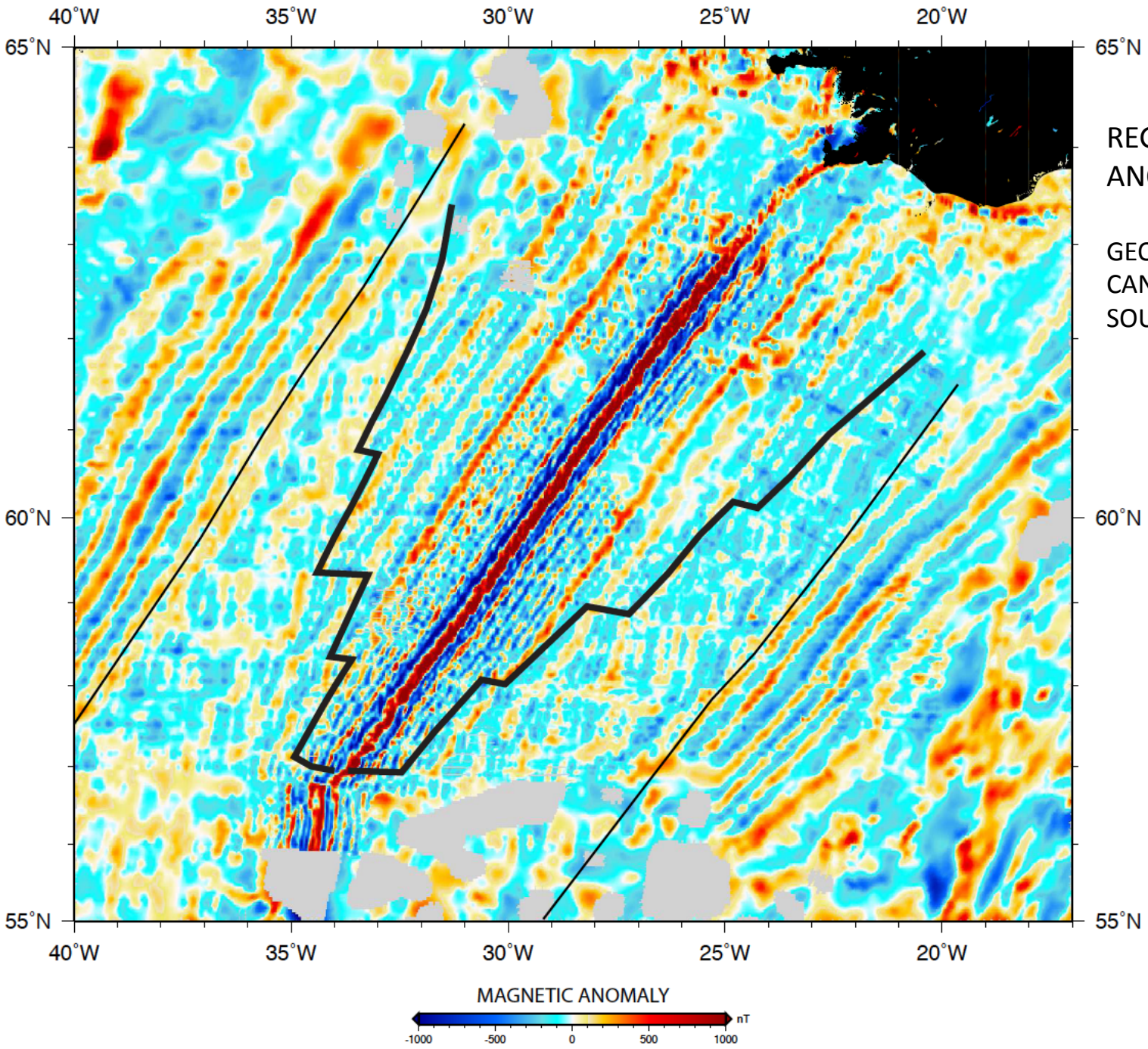
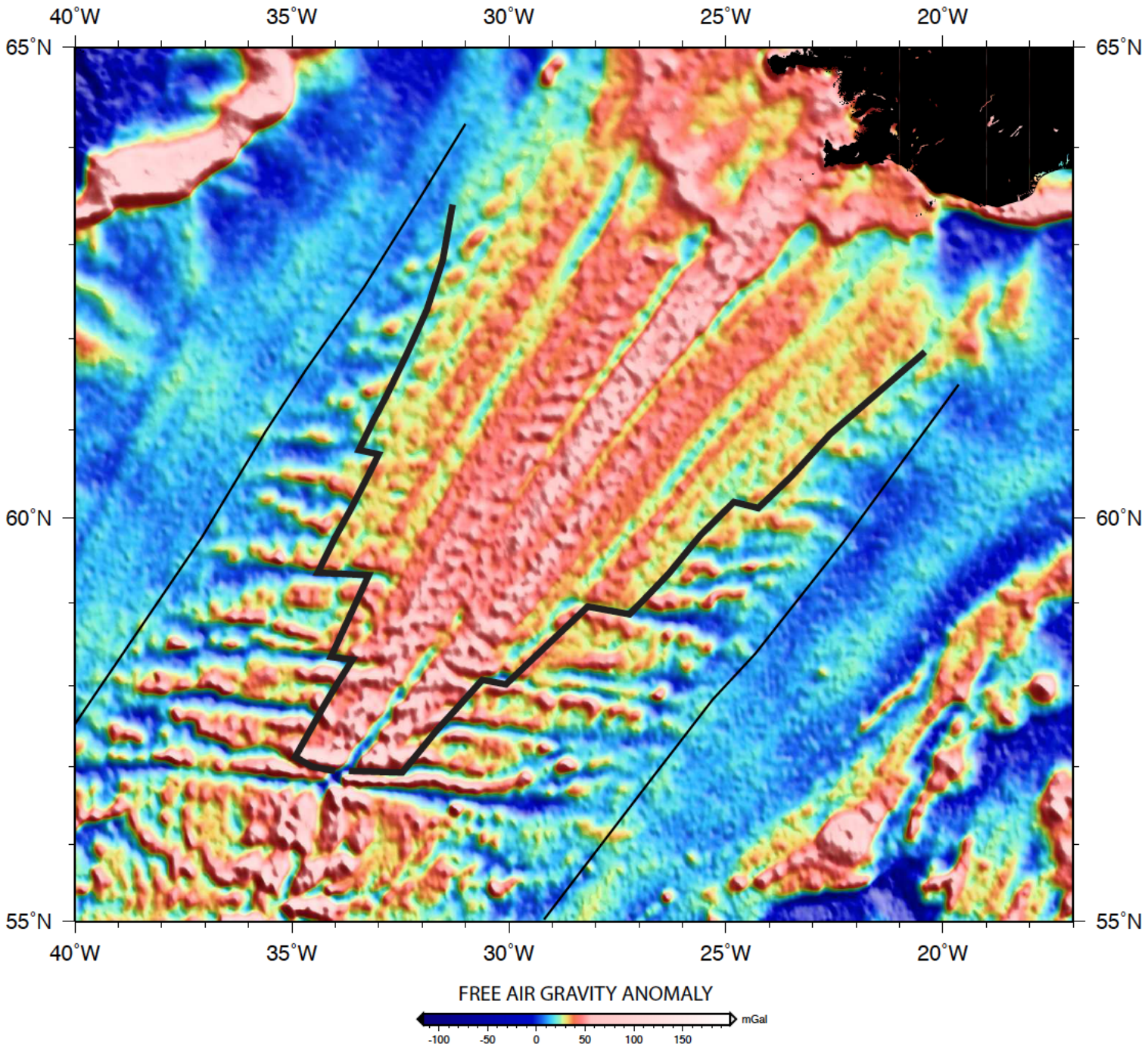
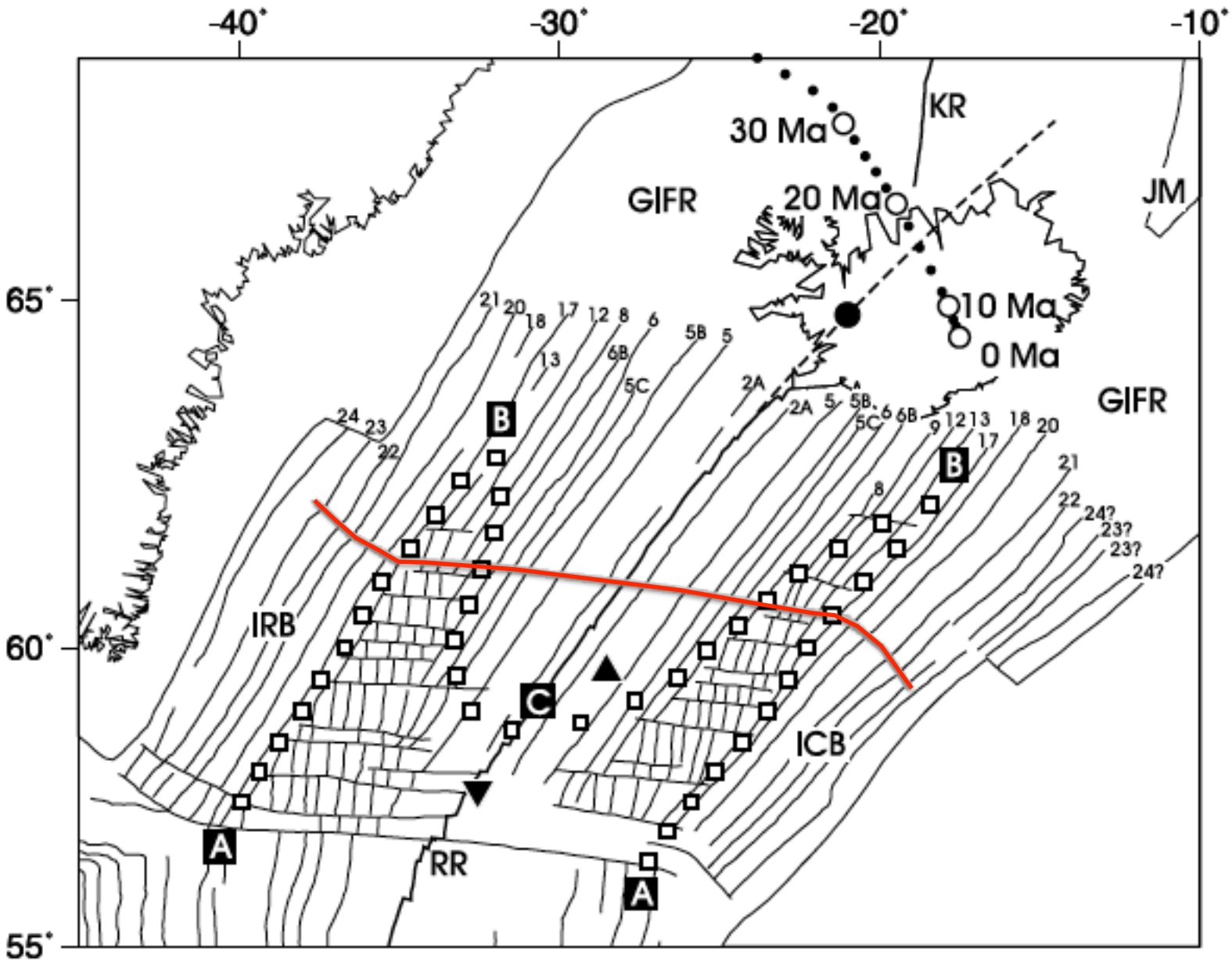

Satellite Gravity
65°W
60°W
55°W
50°W
45°W
40°W
35°W
30°W
25°W
20°W
15°W
10°W
5°W
0°
70°N
65°N
60°N
55°N
50°N
GREENLAND
ICEALND
Kolbeinsey Ridge
AEGIR RIDGE
RAN RIDGE
REYKJANES RIDGE
BIGHT FZ
mGal
-100
-50
0
50
100
150
200
250



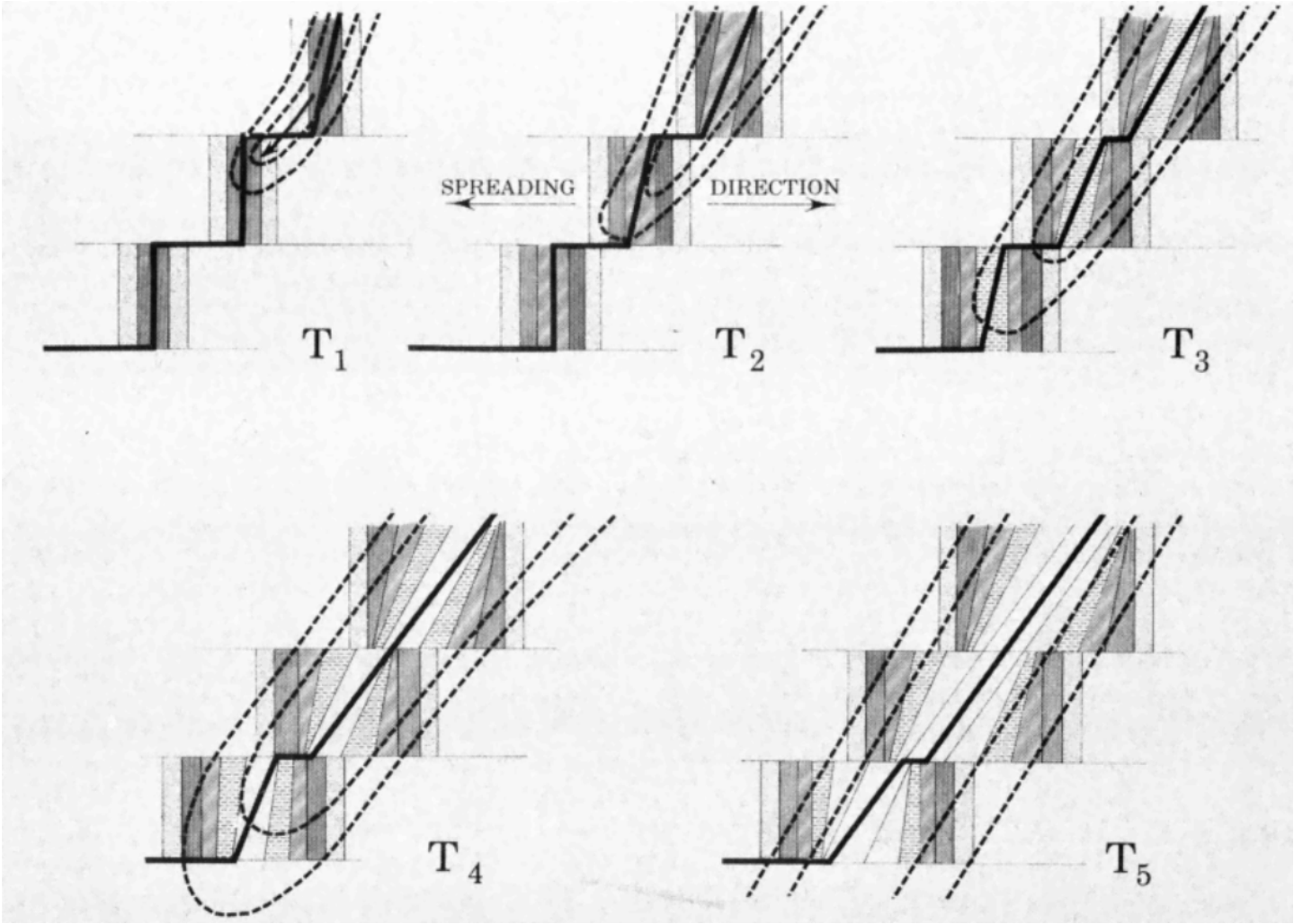
REGIONAL MAGNETIC ANOMALY COMPILATION

GEOLOGICAL SURVEY OF CANADA AND OTHER SOURCES


40°W
35°W
30°W
25°W
20°W
65°N
60°N
55°N
FREE AIR GRAVITY ANOMALY
mGal
-100
-50
0
50
100
150


-40°
-30°
-20°
-10°
65°
60°
55°
30 Ma
20 Ma
10 Ma
0 Ma
KR
JM
GIFR
GIFR
IRB
ICB
RR
A
A
B
B
C
21 20 18 17 13 12 8 6 6B 5C 5B 5
24 23 22
2A 2A 5 5B 5C 6 6B 9 12 13 17 18 20 21 8 22 24? 23? 23? 24?

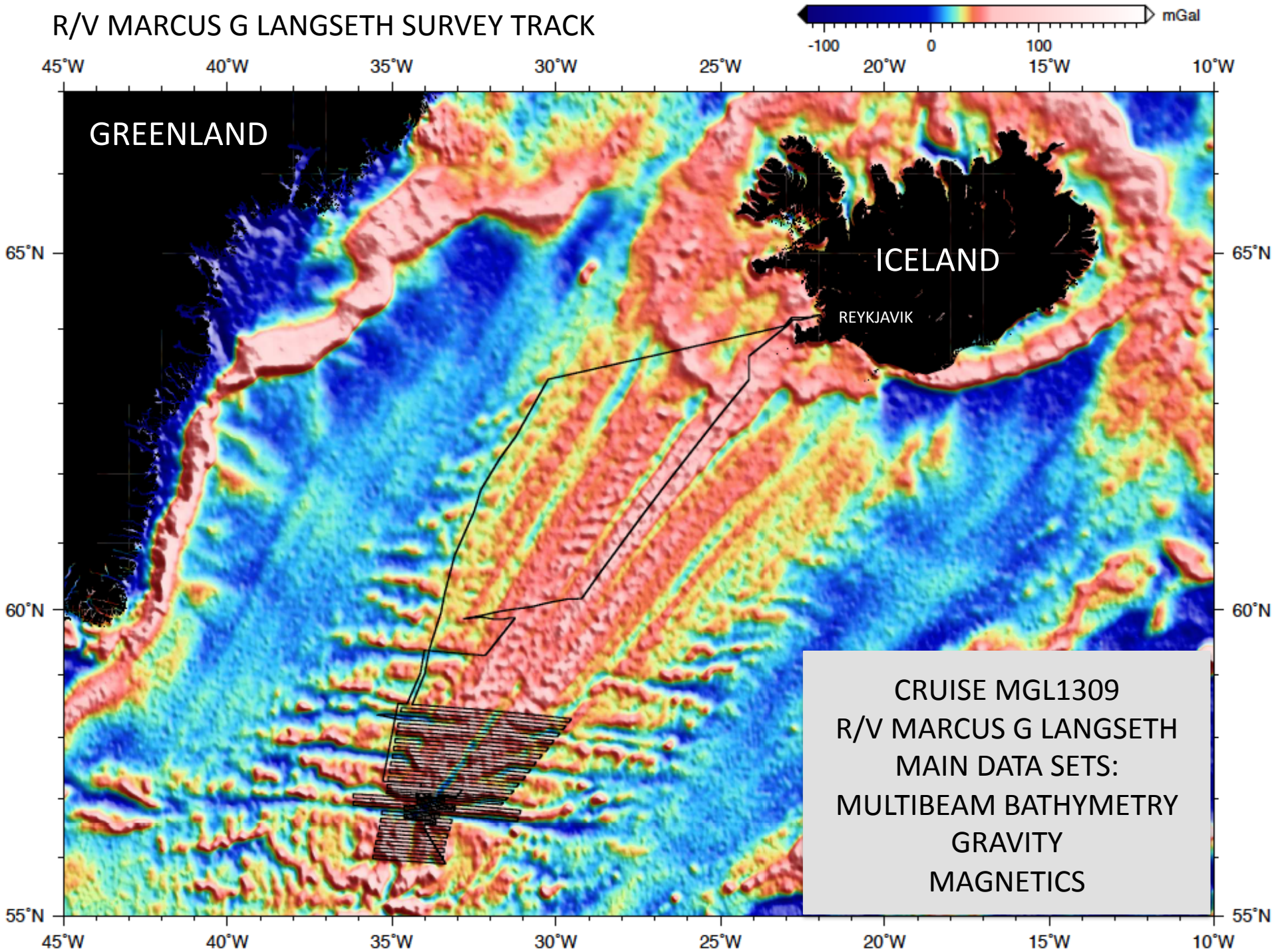
MANTLE PLUME THERMAL WEAKENING OF THE LITHOSPHERE AND RIDGE ROTATION MODEL

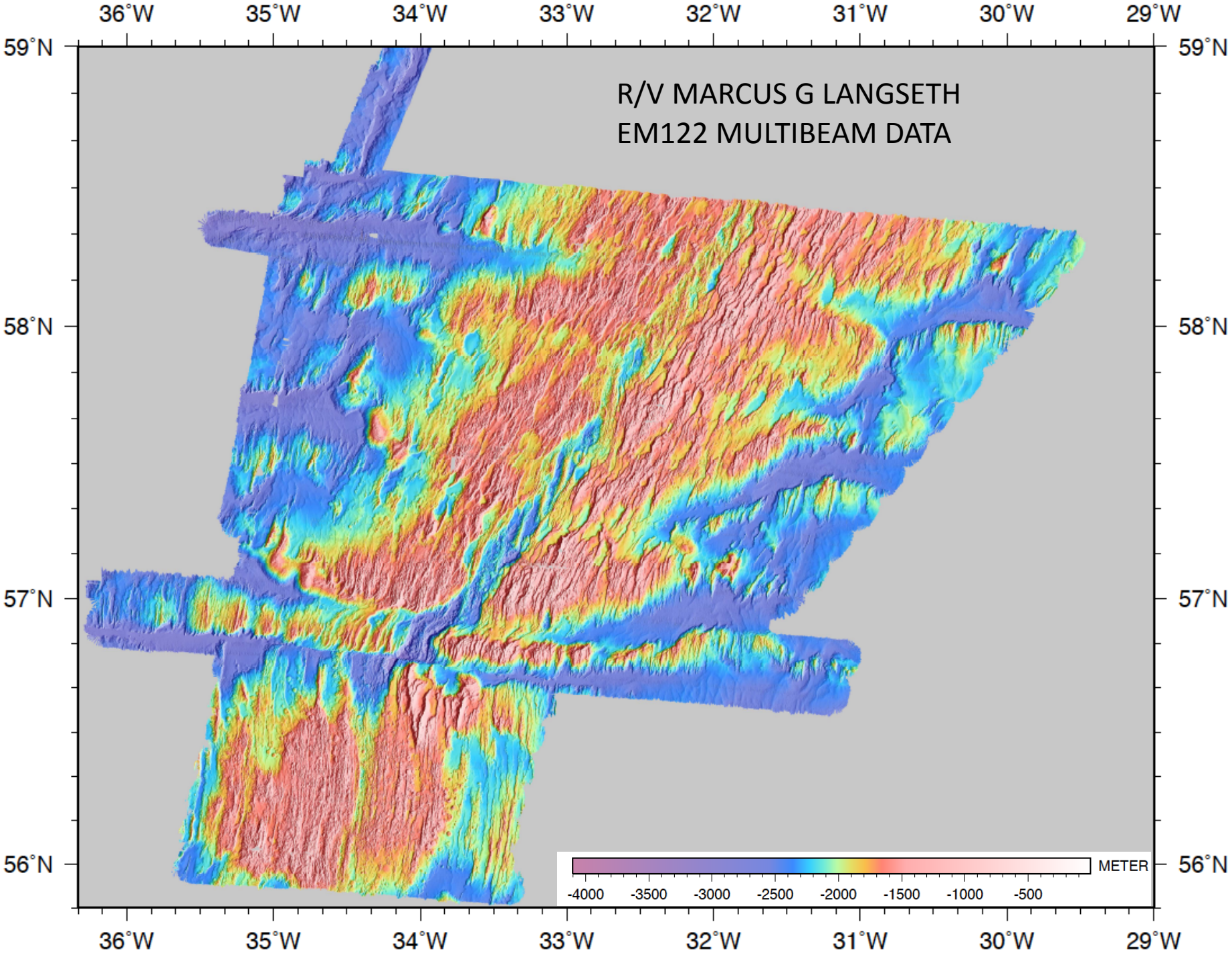


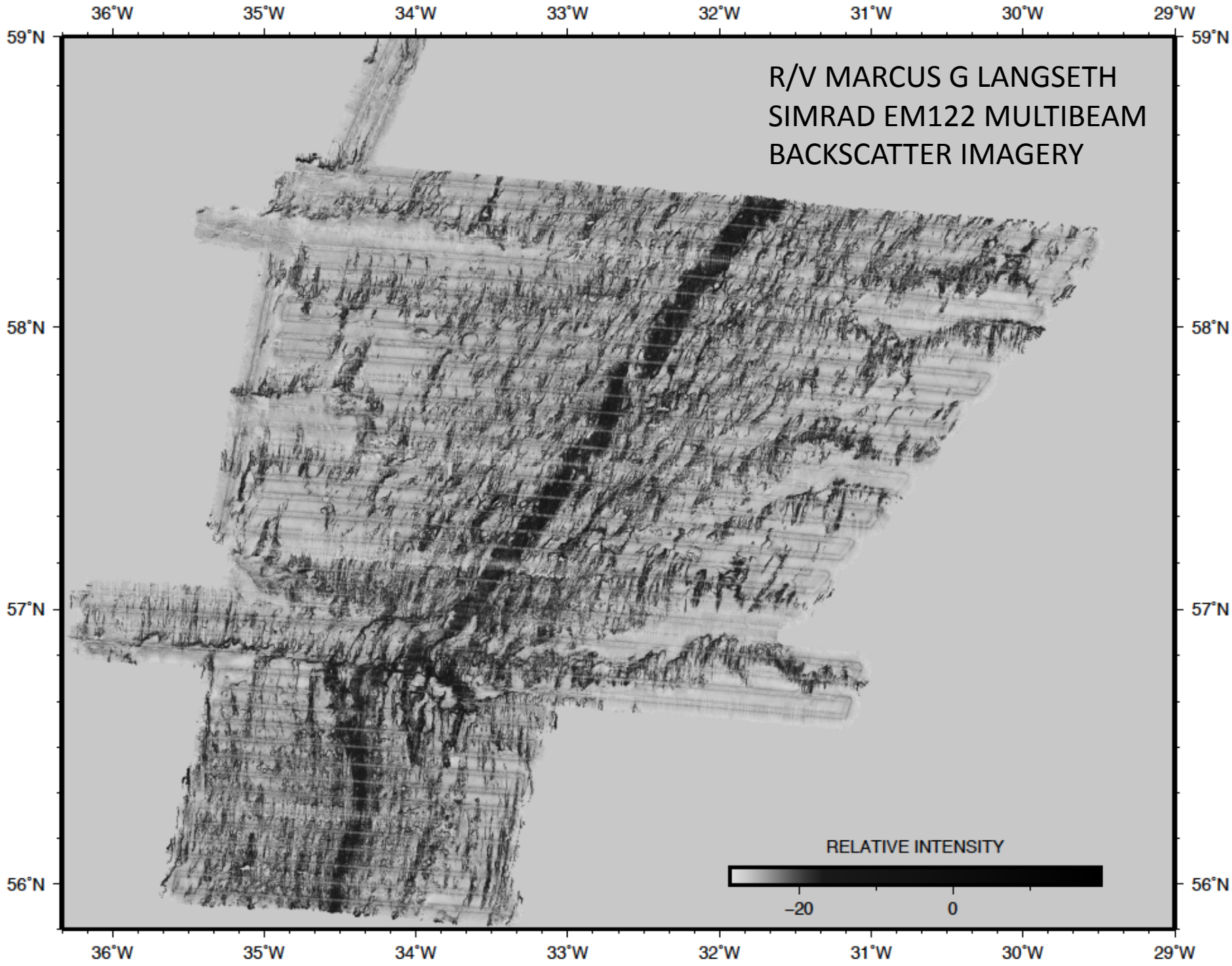
Vogt & Johnson (1975) reorganization model, in which Iceland plume asthenospheric flow (dashed contours) thermally weakens axial lithosphere & progressively rotates each segment by differential asymmetric spreading, creating a sequence of "zed pattern" reorganizations (e.g., Menard & Atwater, 1968).

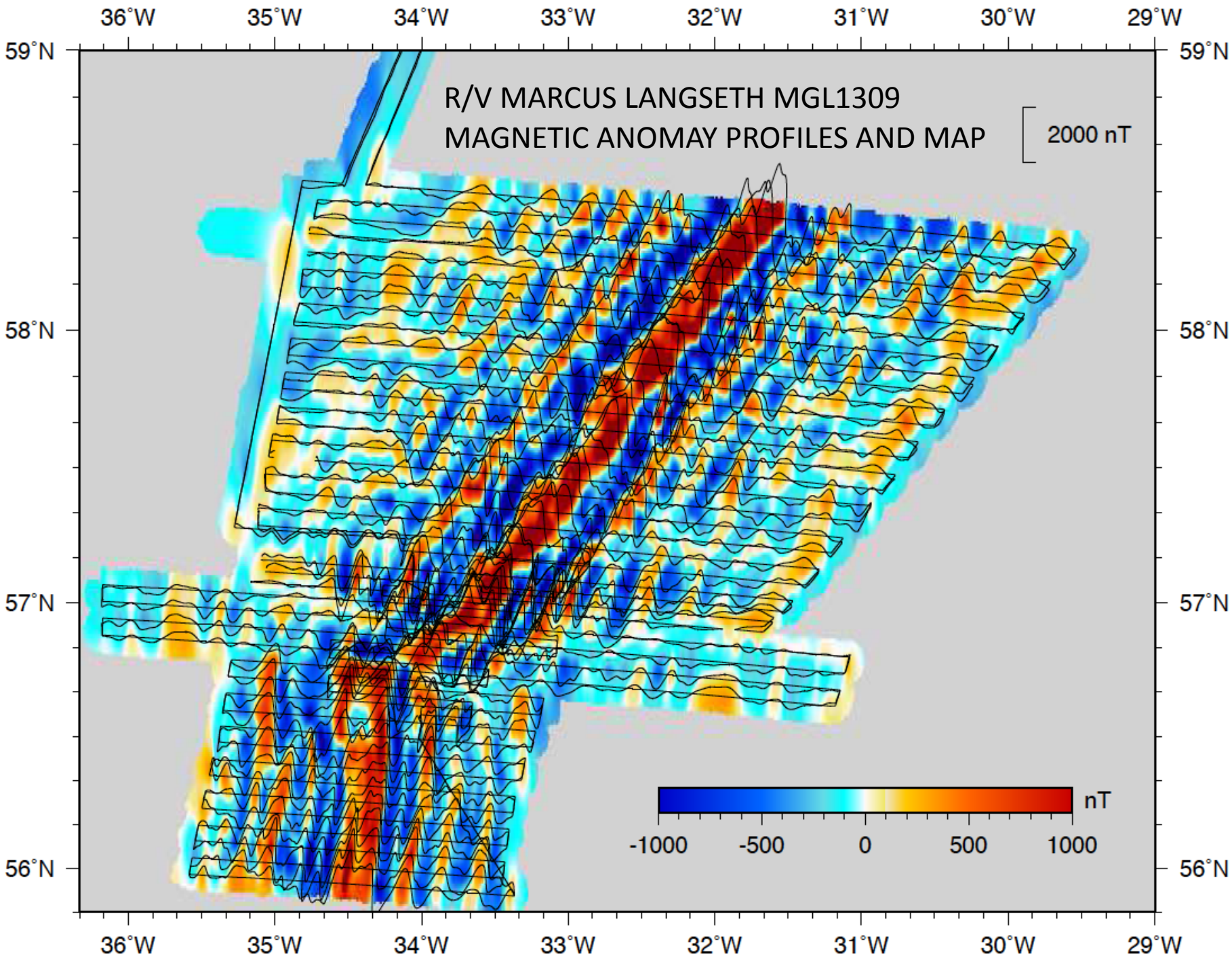
R/V MARCUS G. LANGSETH IN REYKJAVIK, ICELAND

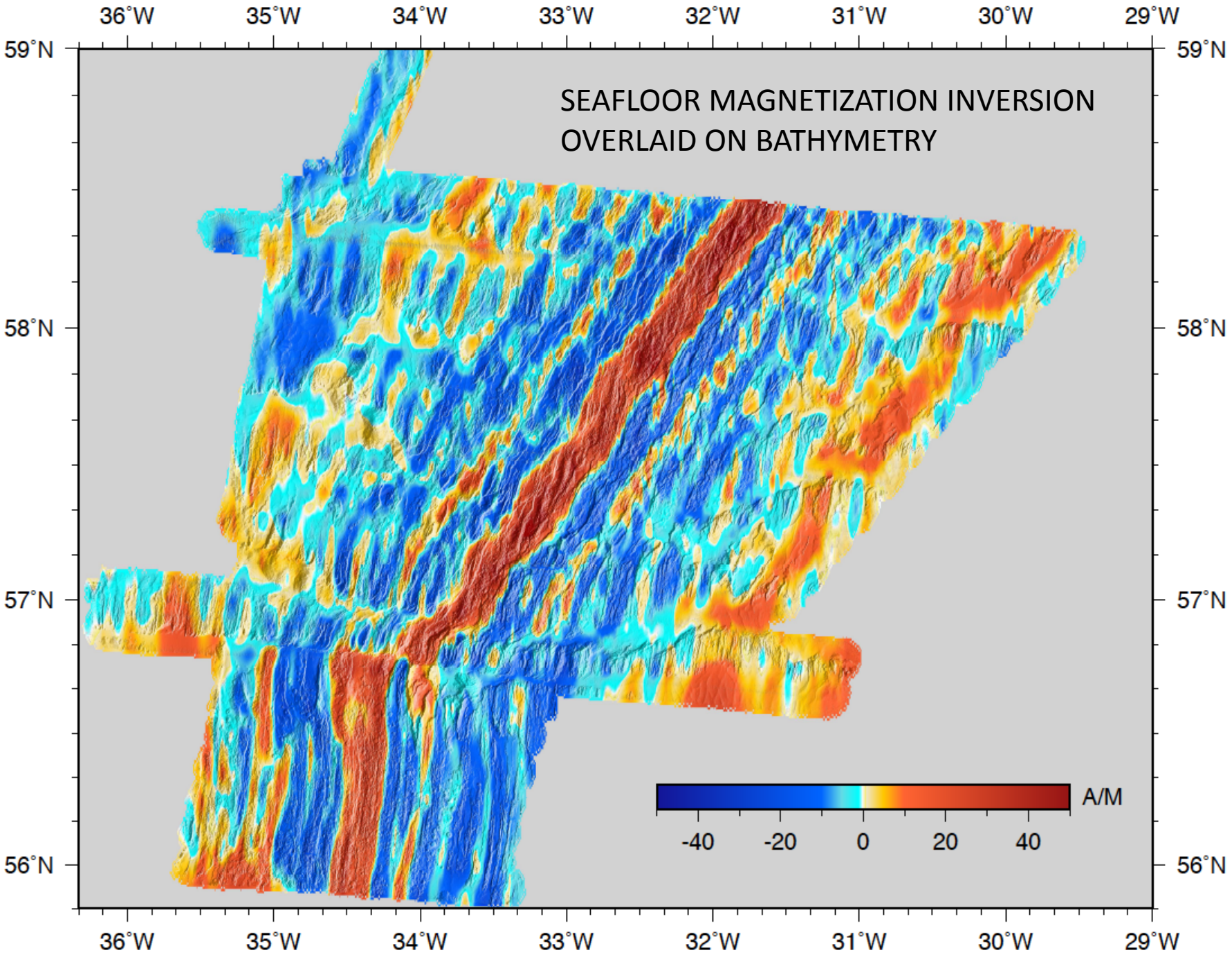
R/V MARCUS G LANGSETH SURVEY TRACK

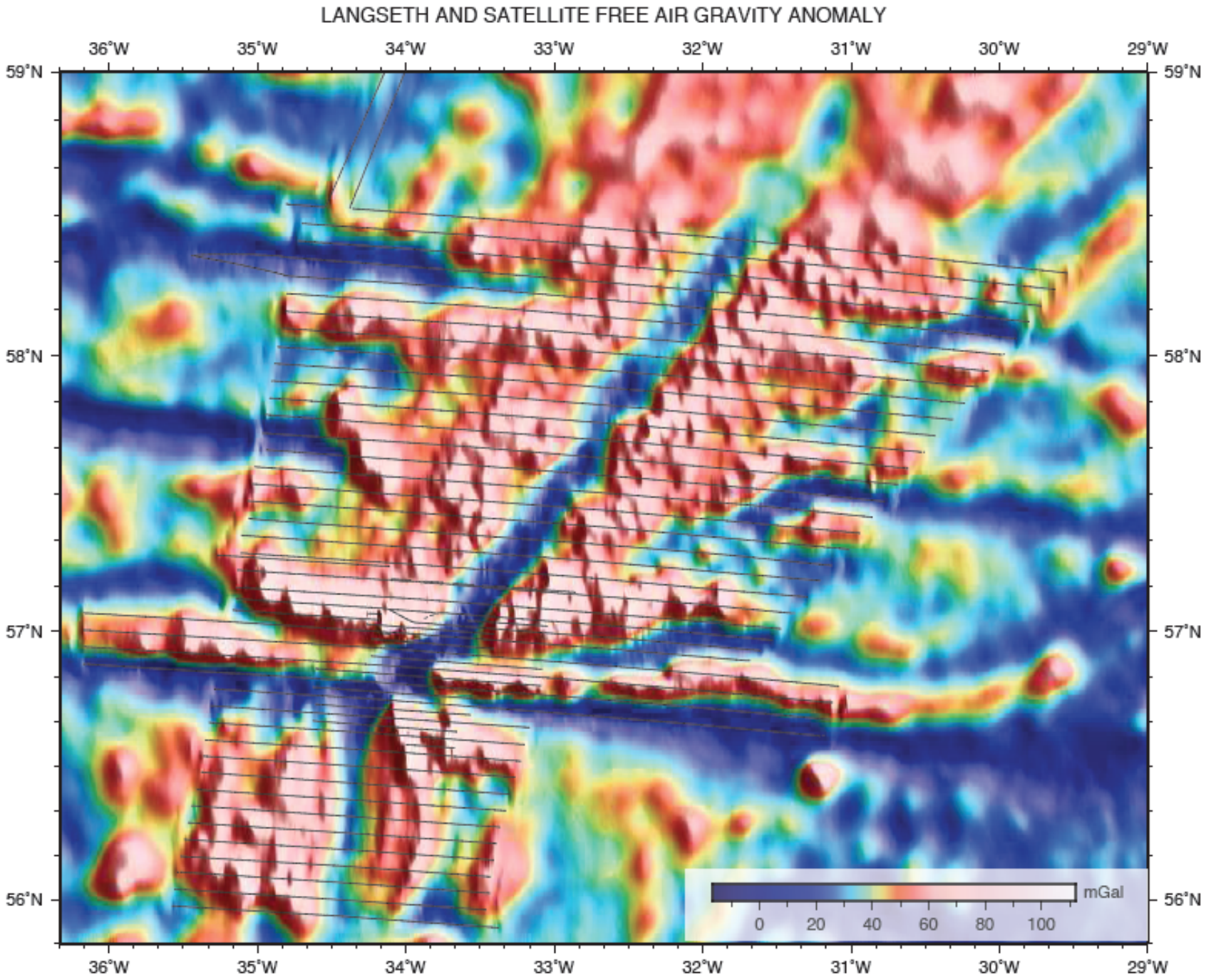


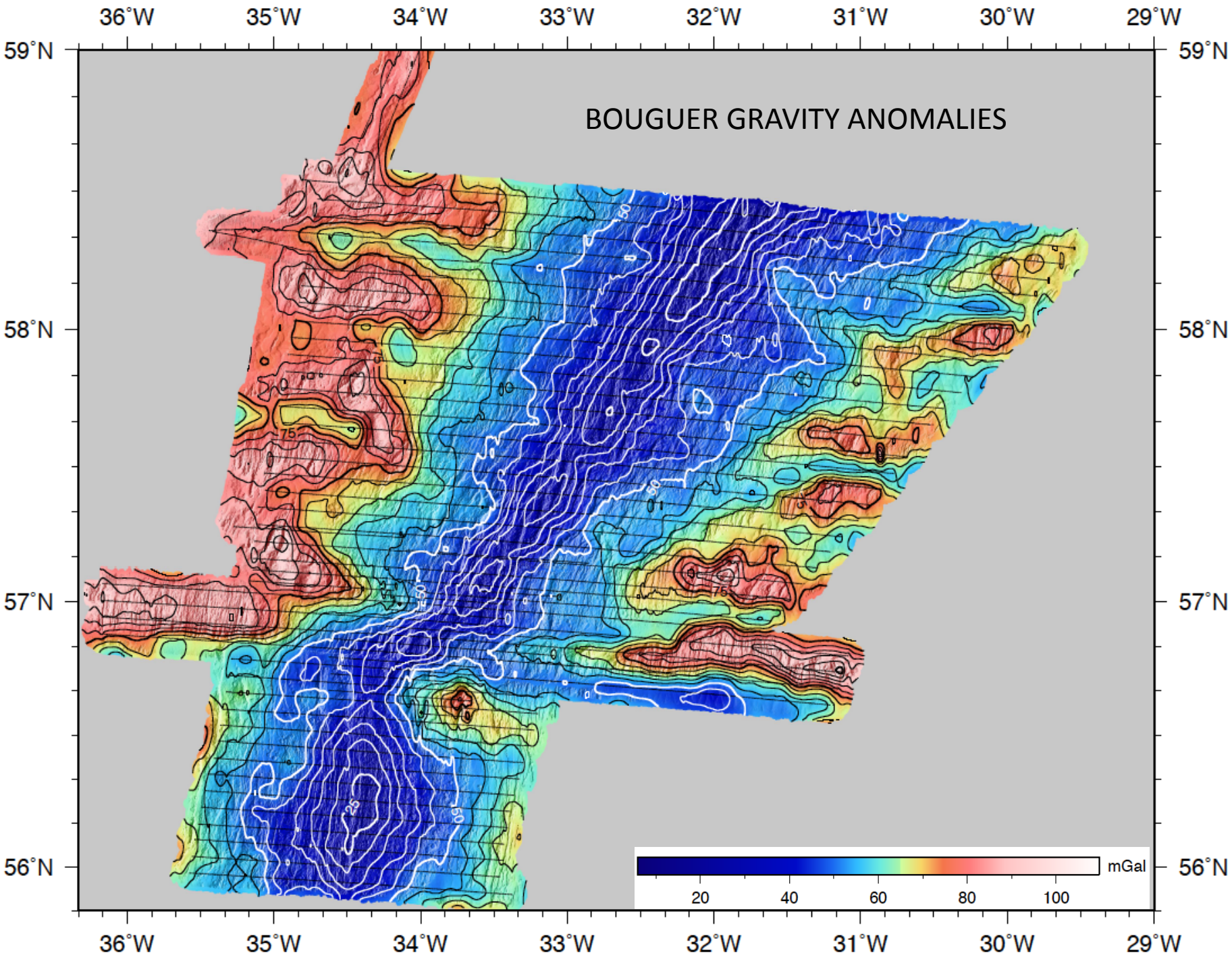

R/V MARCUS G LANGSETH
EM122 MULTIBEAM DATA
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N
METER
-4000
-3500
-3000
-2500
-2000
-1500
-1000
-500


R/V MARCUS G LANGSETH
SIMRAD EM122 MULTIBEAM
BACKSCATTER IMAGERY
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N
RELATIVE INTENSITY
–20
0

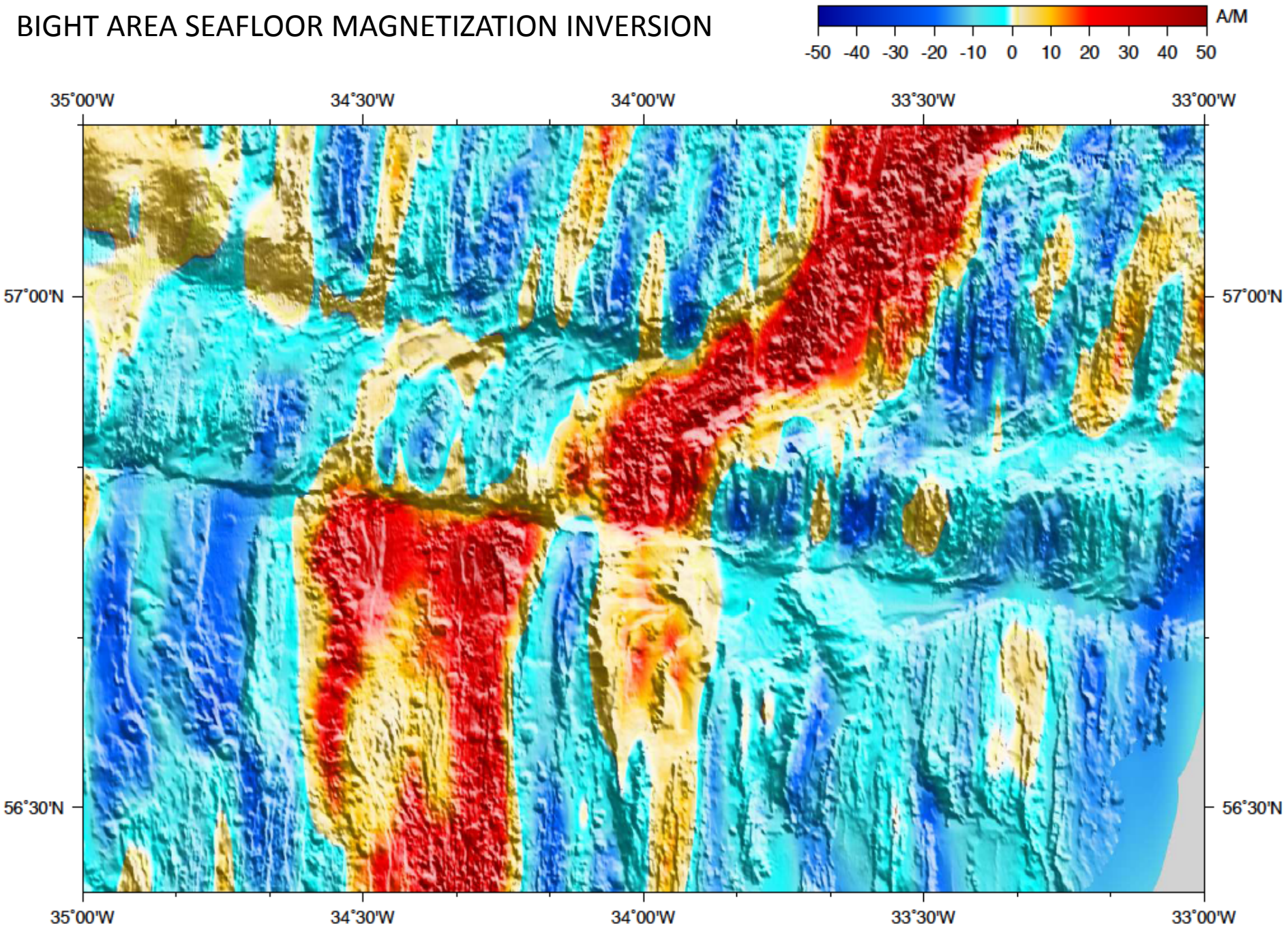

R/V MARCUS LANGSETH MGL1309
MAGNETIC ANOMAY PROFILES AND MAP
2000 nT
nT
-1000
-500
0
500
1000
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N


SEAFLOOR MAGNETIZATION INVERSION
OVERLAID ON BATHYMETRY
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N
-40
-20
0
20
40
A/M

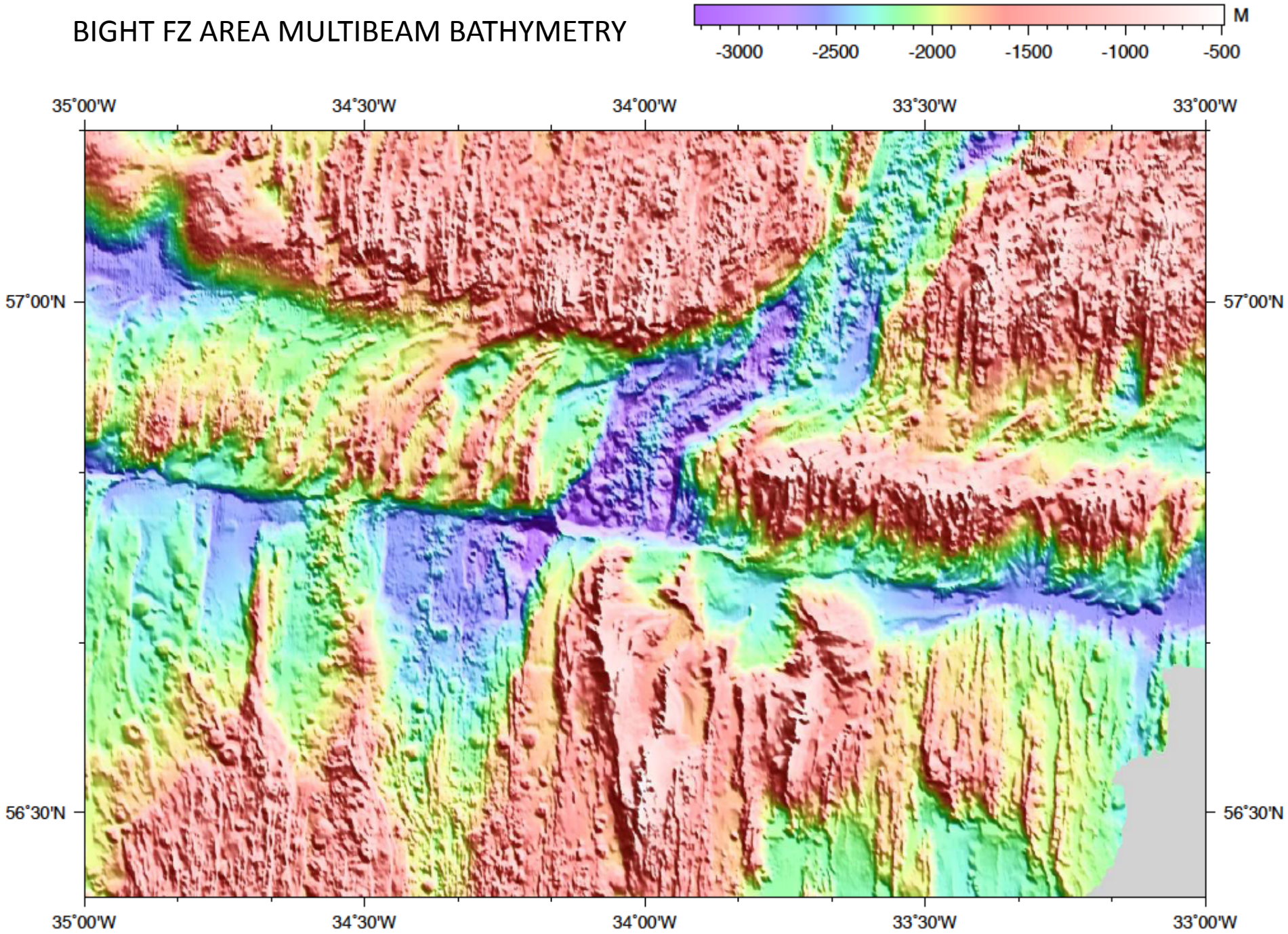

LANGSETH AND SATELLITE FREE AIR GRAVITY ANOMALY
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N
mGal
0
20
40
60
80
100


BOUGUER GRAVITY ANOMALIES
36°W
35°W
34°W
33°W
32°W
31°W
30°W
29°W
59°N
58°N
57°N
56°N
mGal
20
40
60
80
100

BIGHT AREA SEAFLOOR MAGNETIZATION INVERSION



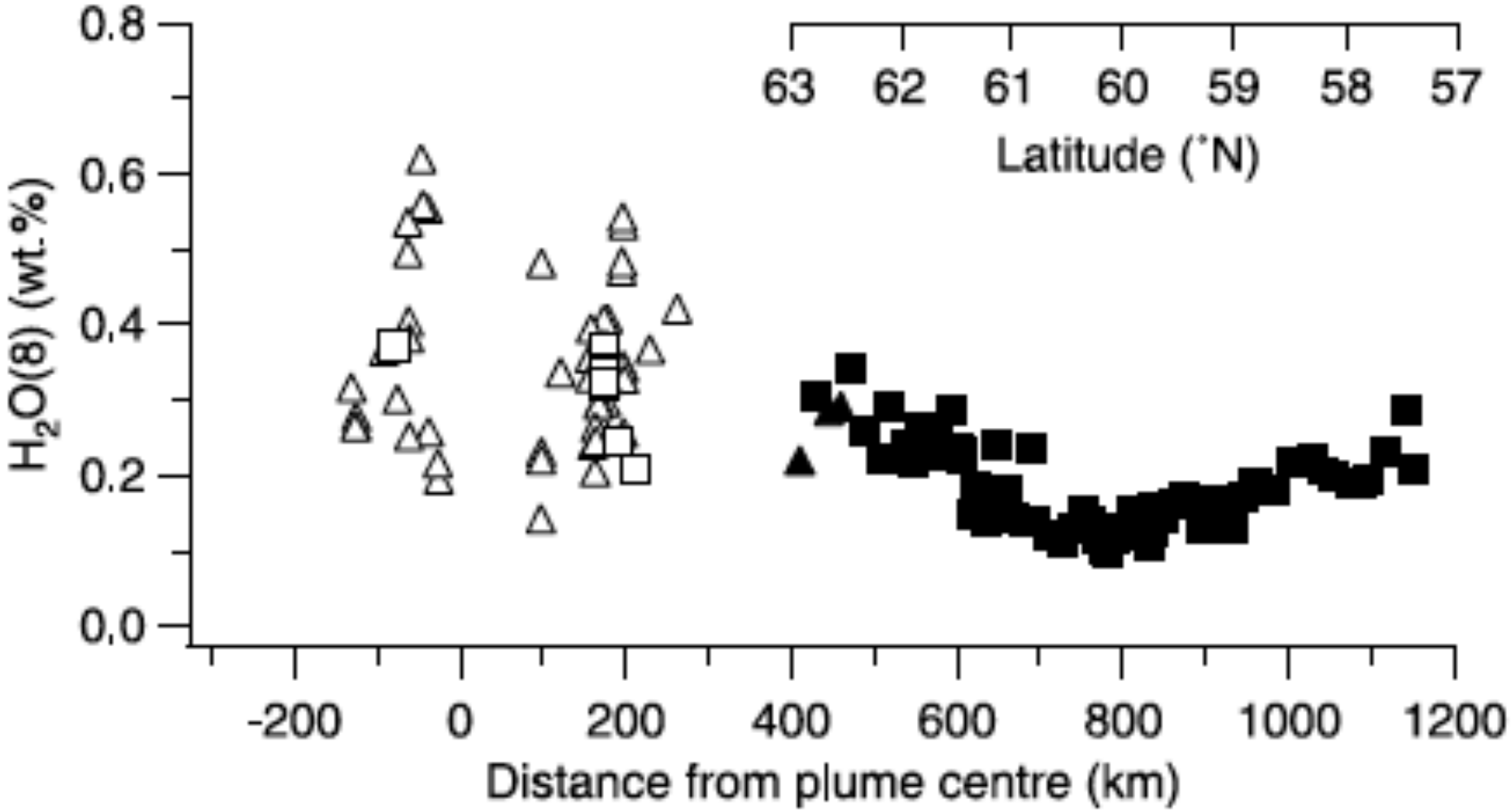
BIGHT FZ AREA MULTIBEAM BATHYMETRY



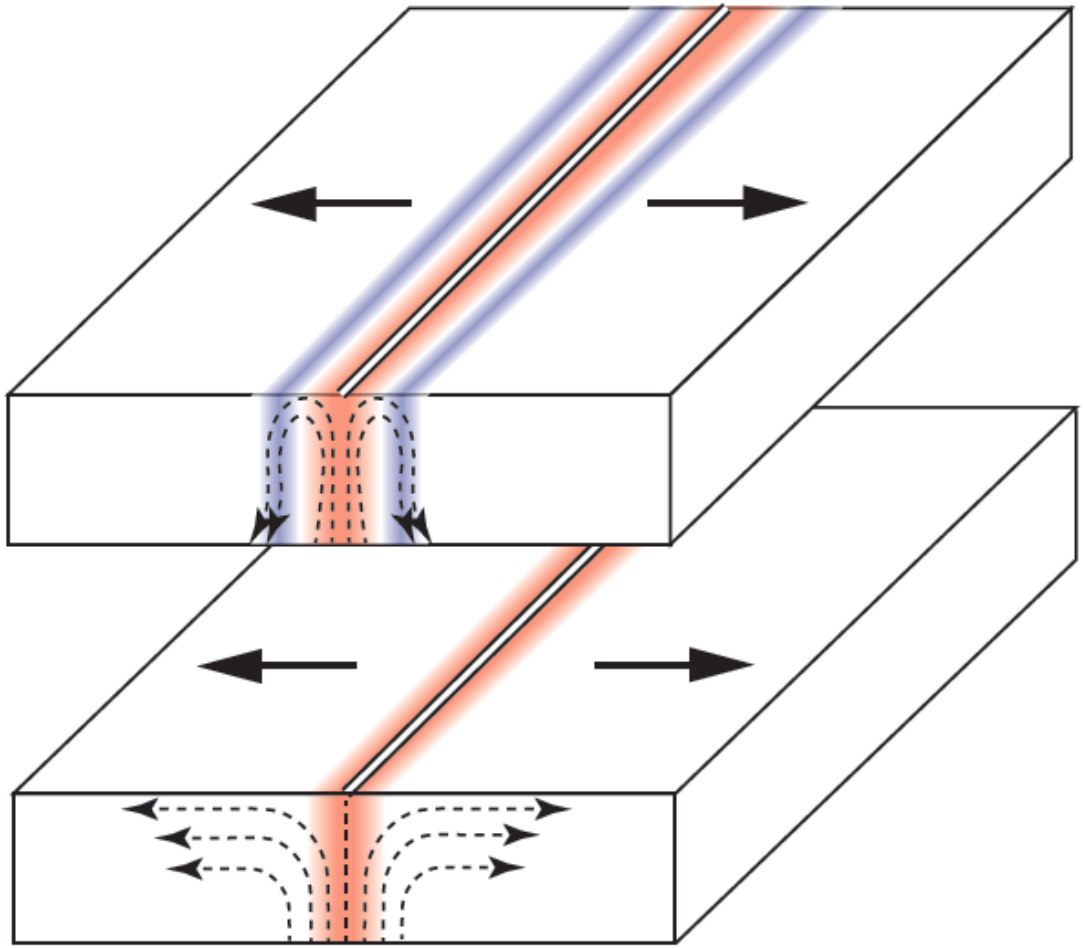
Is the Iceland hot spot also wet? Evidence from the water contents of undegassed submarine and subglacial pillow basalts

A.R.L. Nichols [a,*], M.R. Carroll [a,1], Á. Höskuldsson [b]

Earth and Planetary Science Letters 202 (2002) 77–87



BUOYANT UPWELLING BENEATH A SLOW-SPREADING MID-OCEAN RIDGE

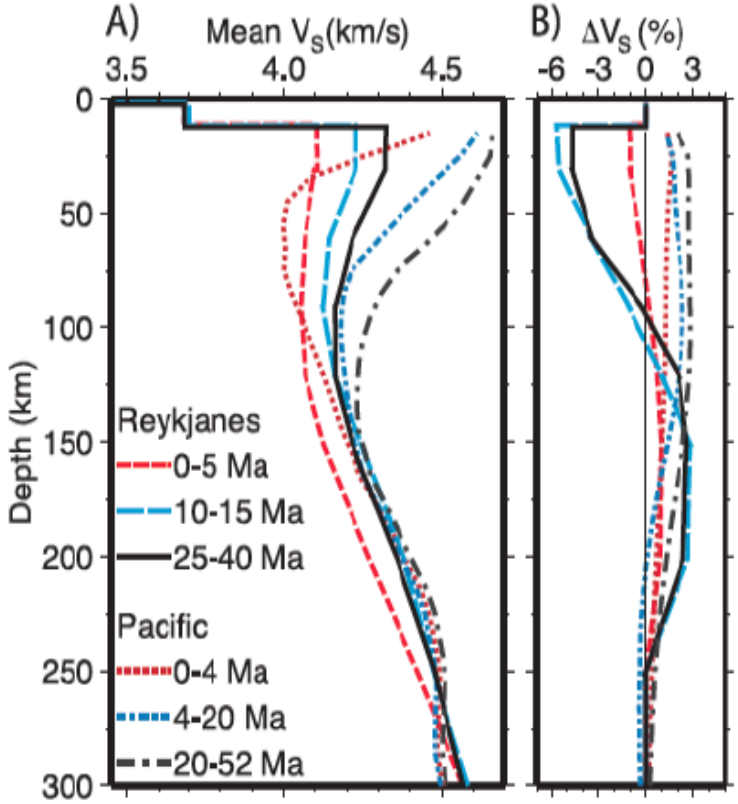


PASSIVE UPWELLING BENEATH A FAST-SPREADING MID-OCEAN RIDGE

James B. Gaherty

Seismic Evidence for Hotspot-Induced Buoyant Flow Beneath the Reykjanes Ridge

SCIENCE VOL 293 31 AUGUST 2001



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A Self-Consistent Model of Melting, Magma Migration and Buoyancy-Driven Circulation Beneath Mid-Ocean Ridges

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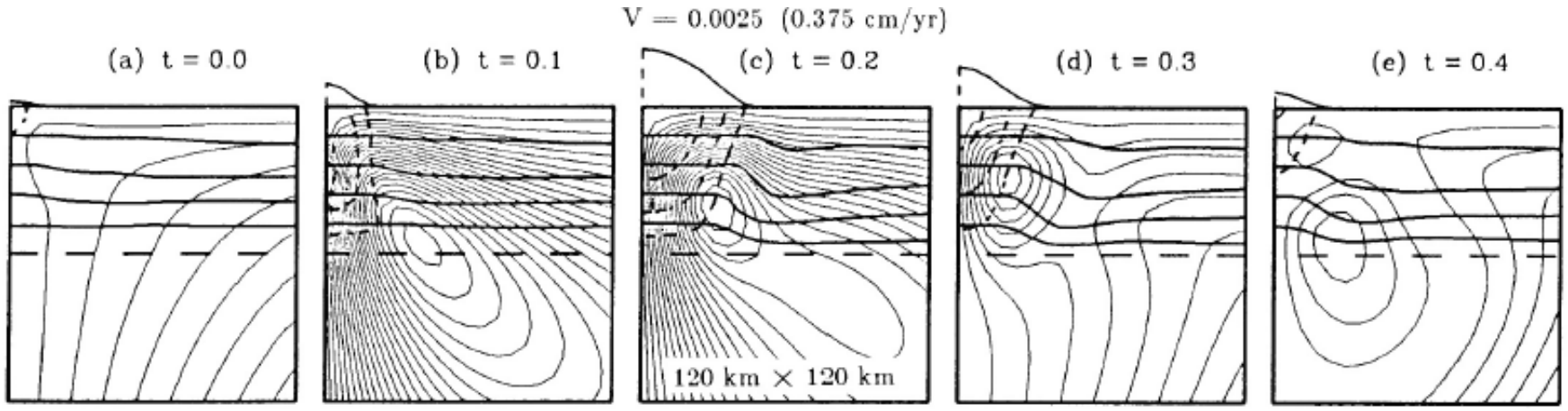
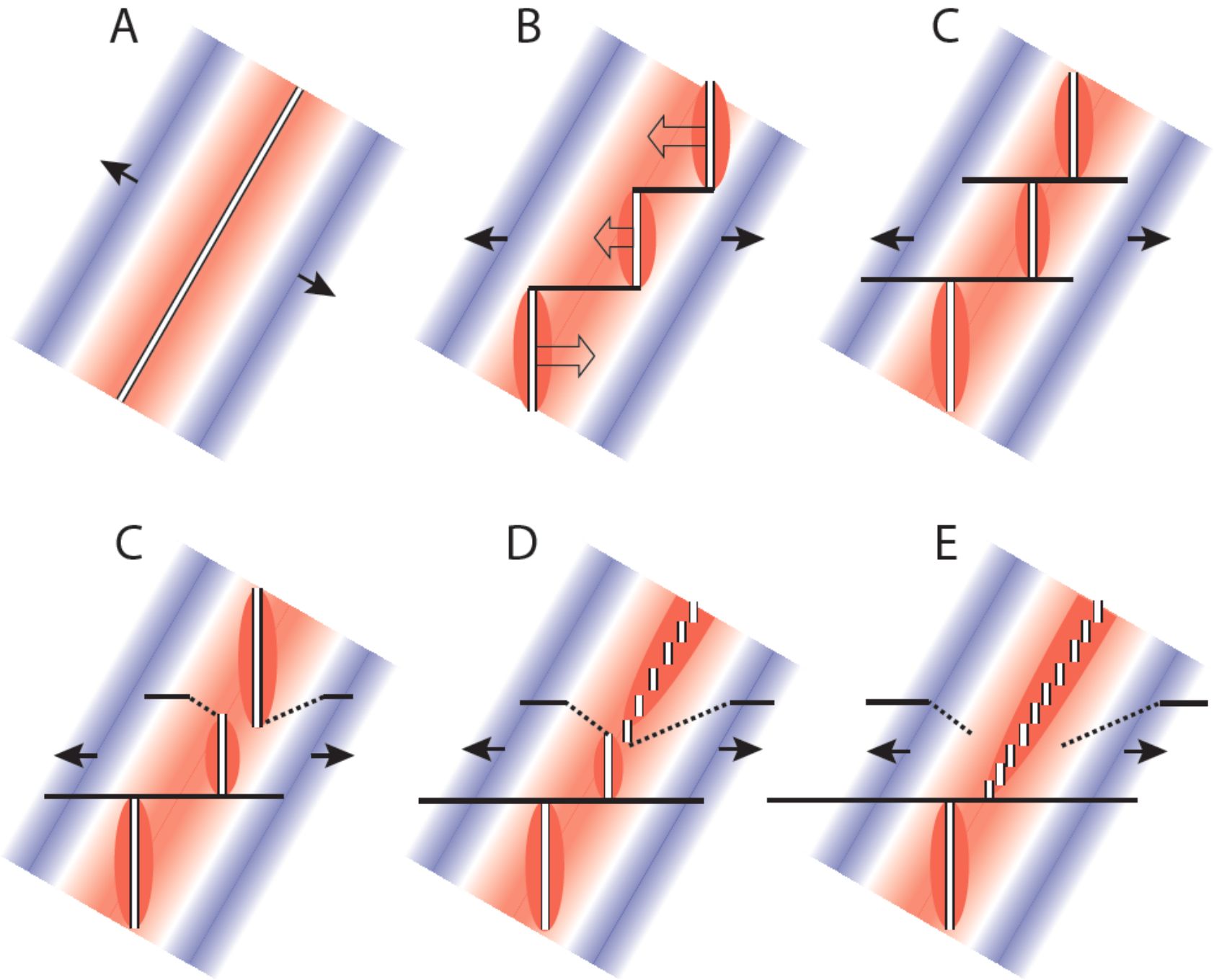


Fig. 6. Time-dependent flow and distribution of liquid and solid, with buoyancy-driven circulation. The spreading rate is slightly smaller than the spreading rate in Figure 4*a*. The times above each frame are in units of z_{sol} / V_s. The episode of unstable upwelling and melting recurs with a period of approximately 0.75 in these units.


A
B
C
C
D
E


R/V MARCUS G LANGSETH
SCIENCE PARTY
THANK YOU