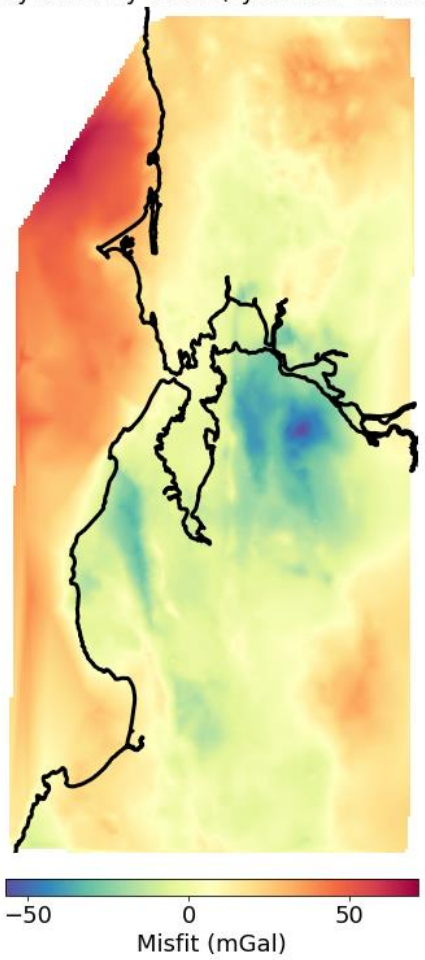
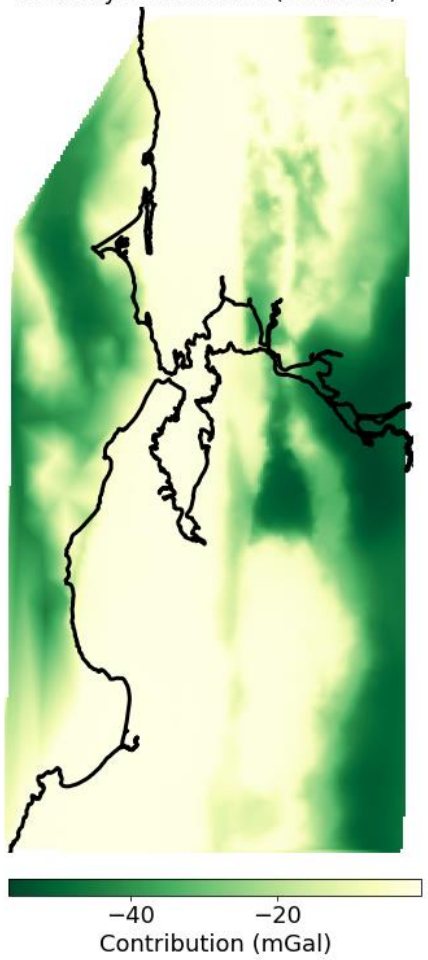
Forward modeling the gravity anomaly in the San Francisco Bay Region Seismic Velocity Model: A tool for validation

Collin Cronkite-Ratcliff, U.S. Geological Survey, ccronkite-ratcliff@usgs.gov

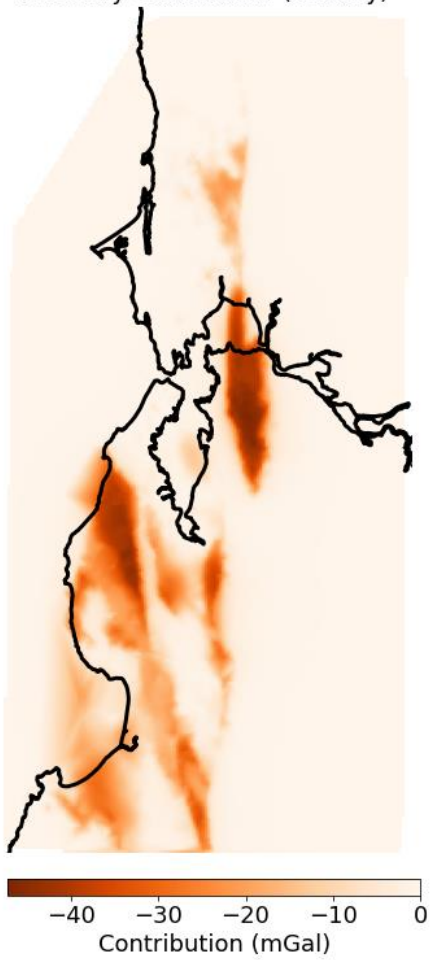
Gravity anomaly misfit (synthetic - observed)



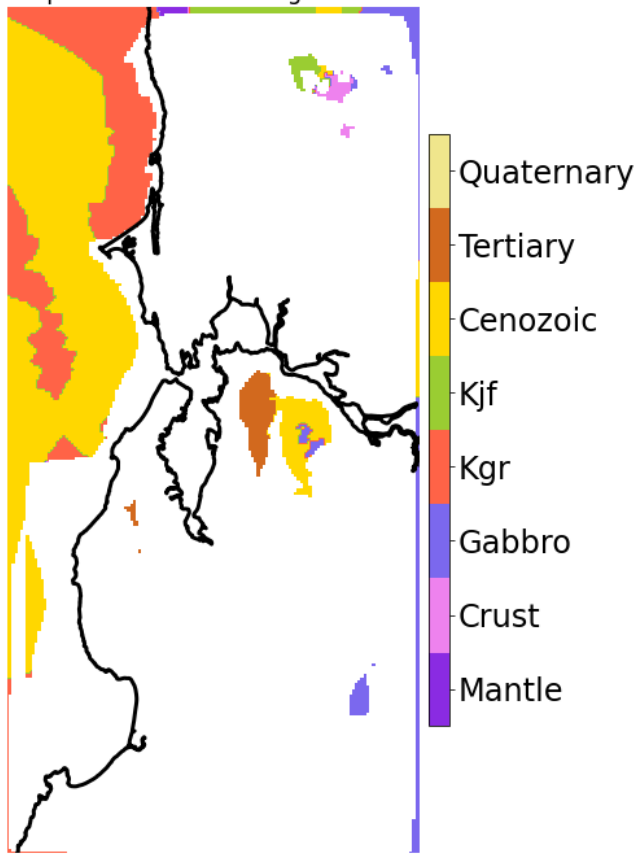
Anomaly contribution (Cenozoic)



Anomaly contribution (Tertiary)



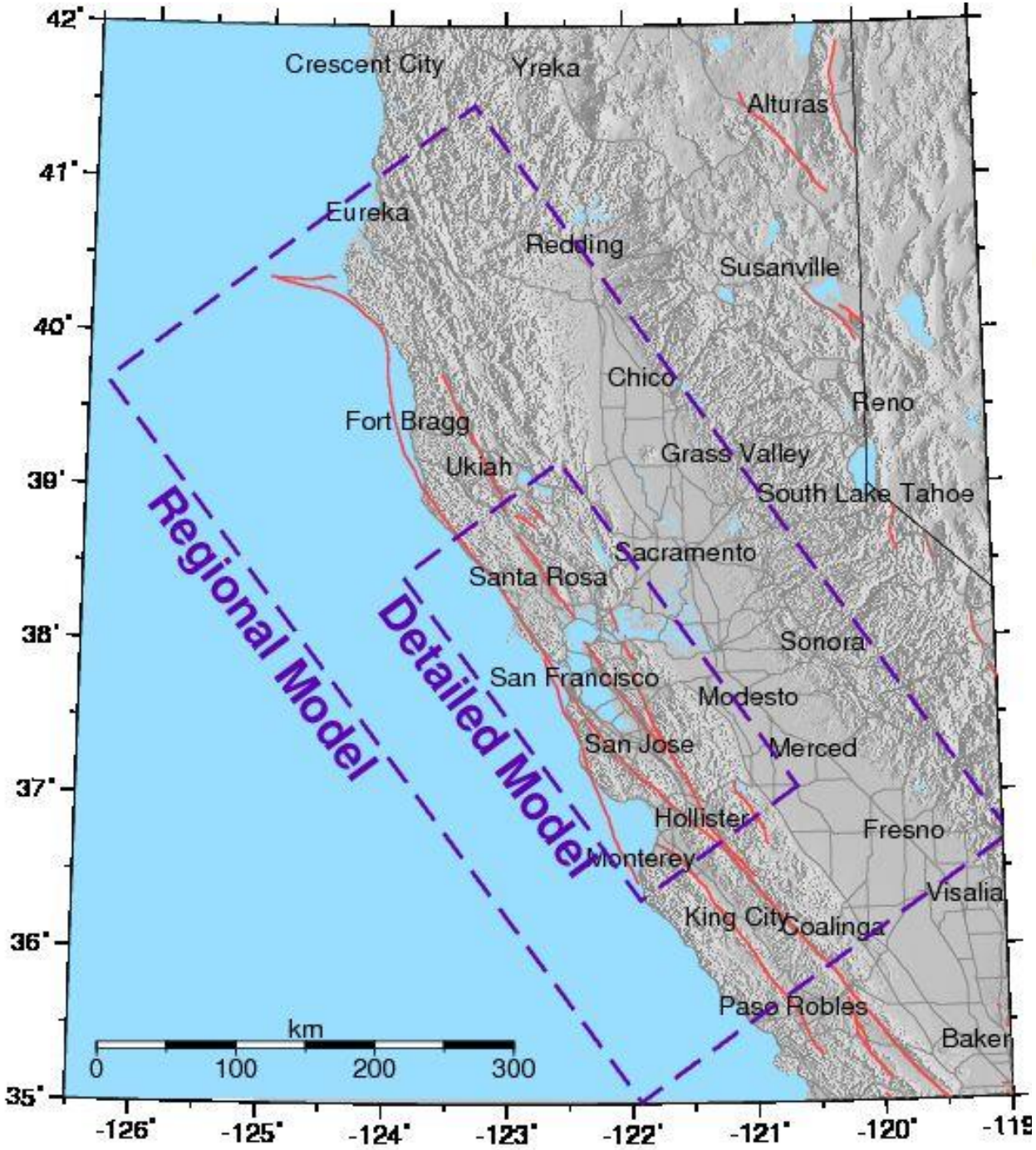
Overrepresented units in high misfit areas

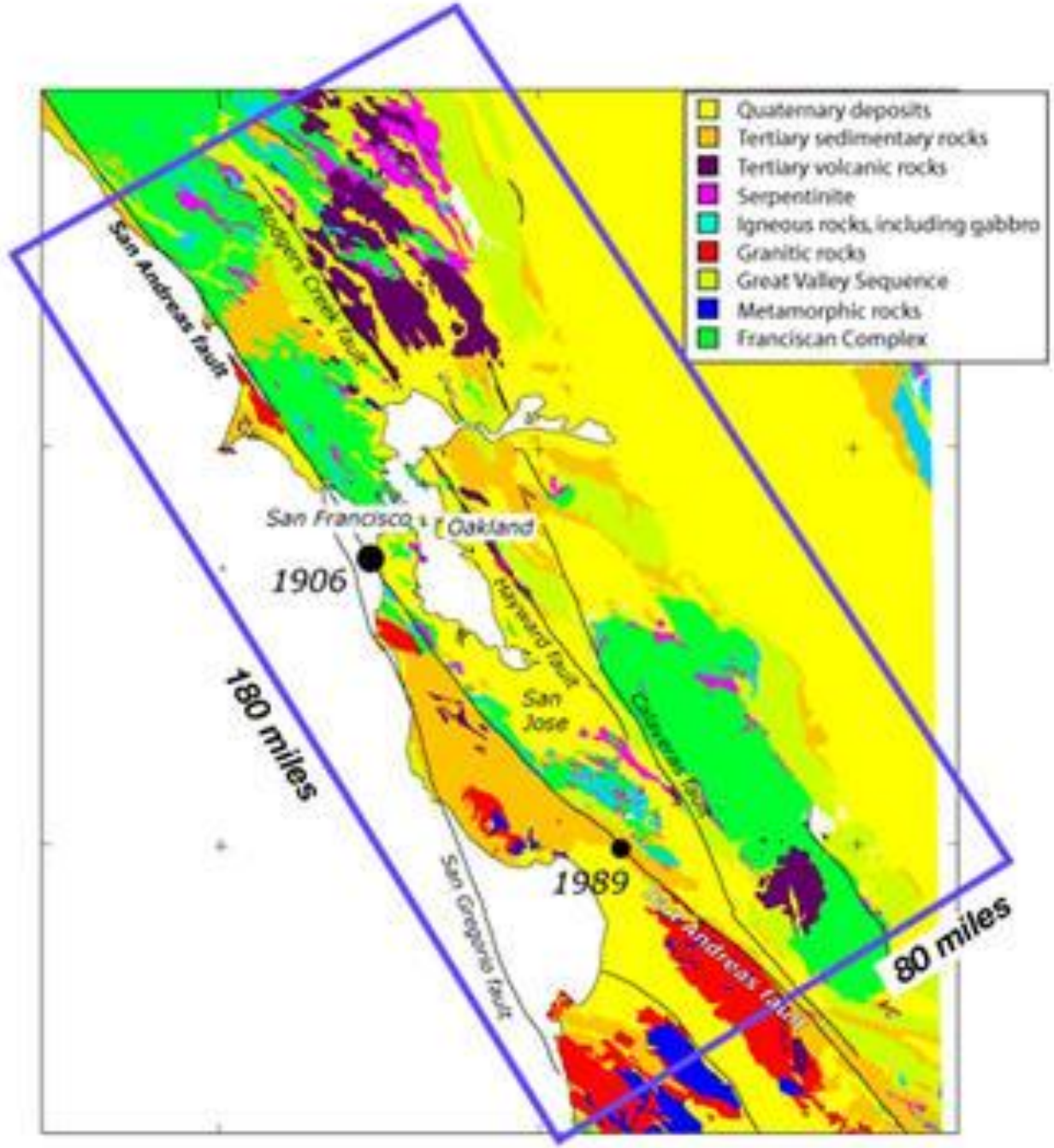


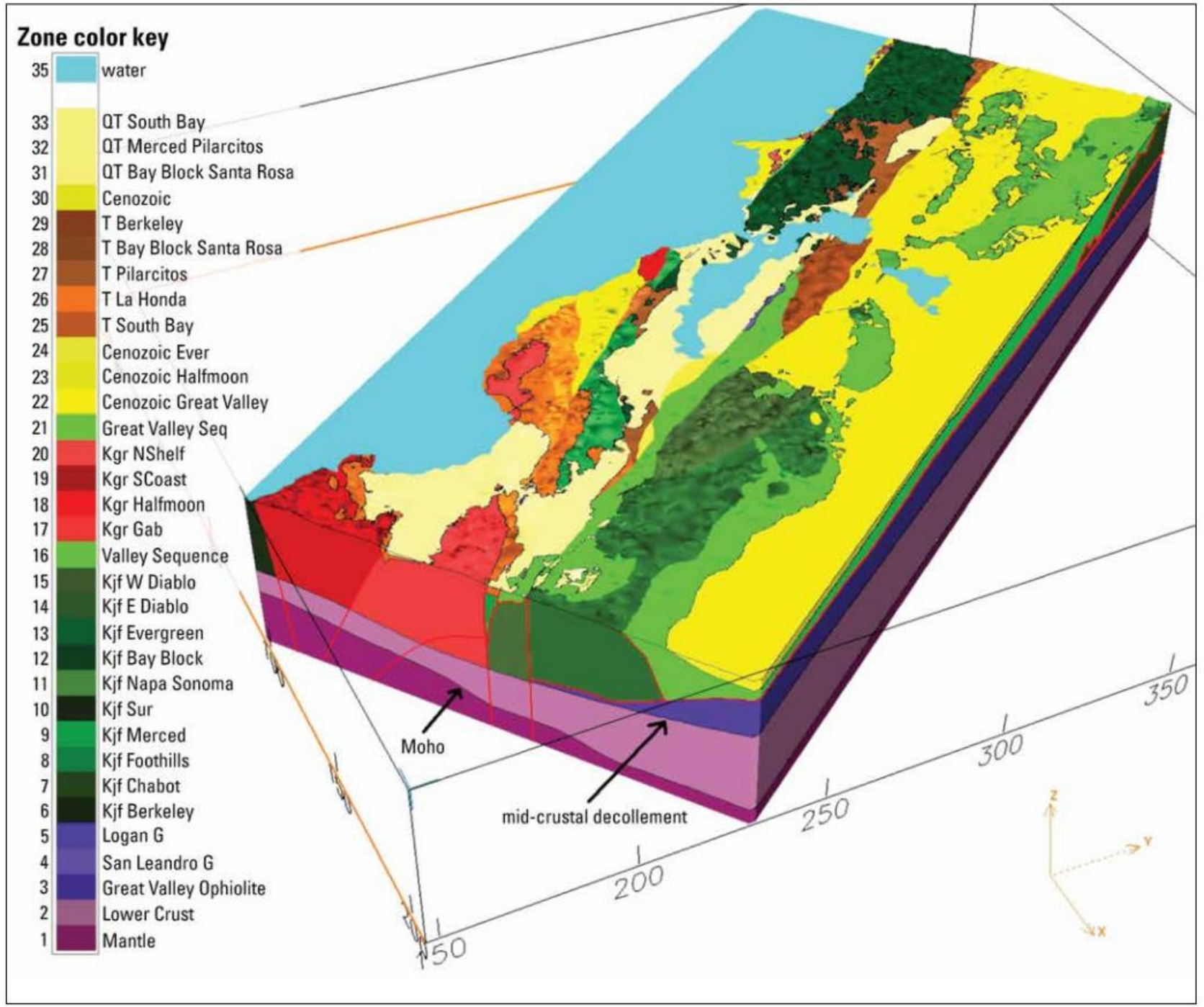
1. Forward modeling → Calculate misfit

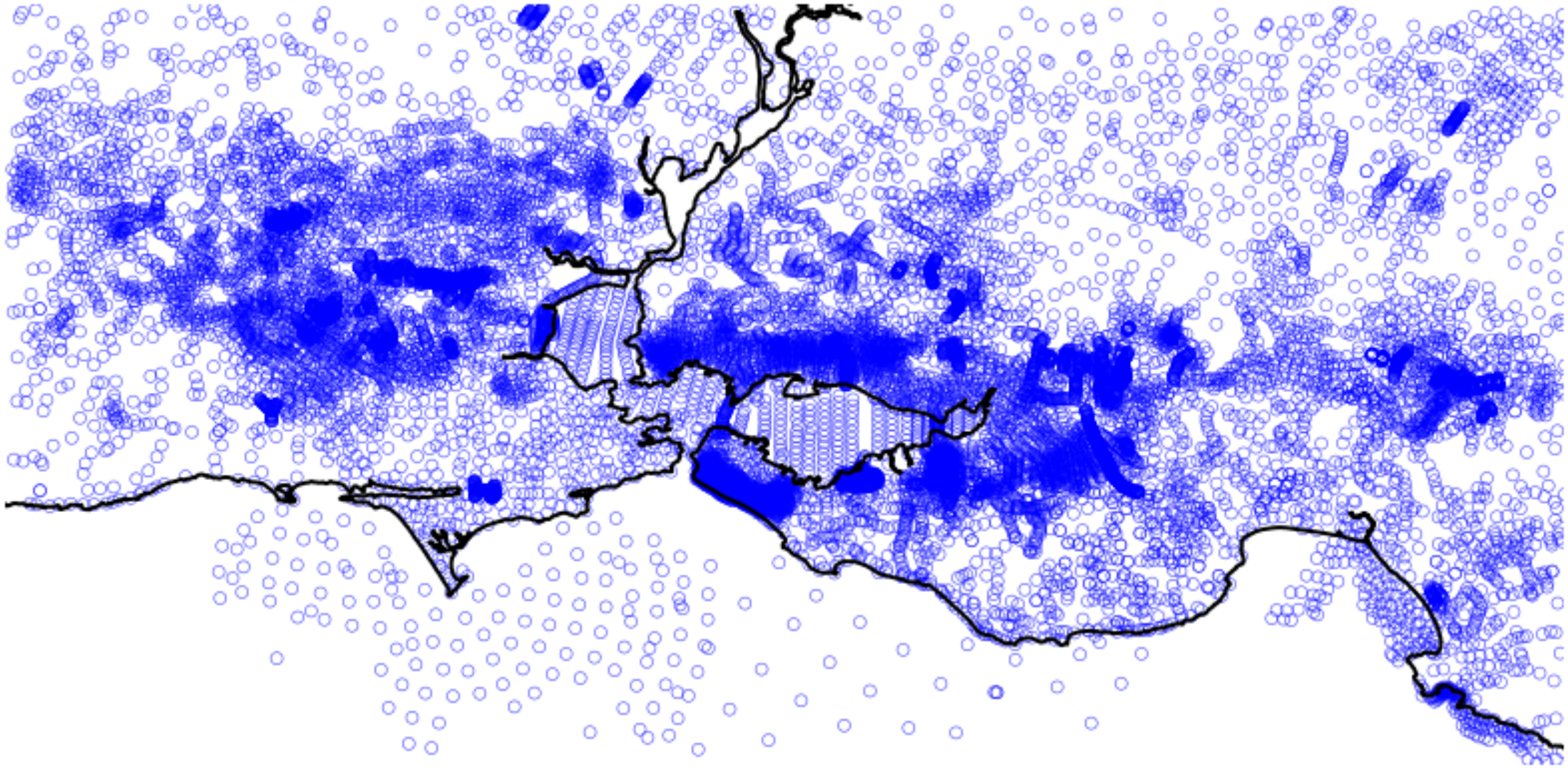
2. How much does each geologic unit contribute to the (synthetic) anomaly?

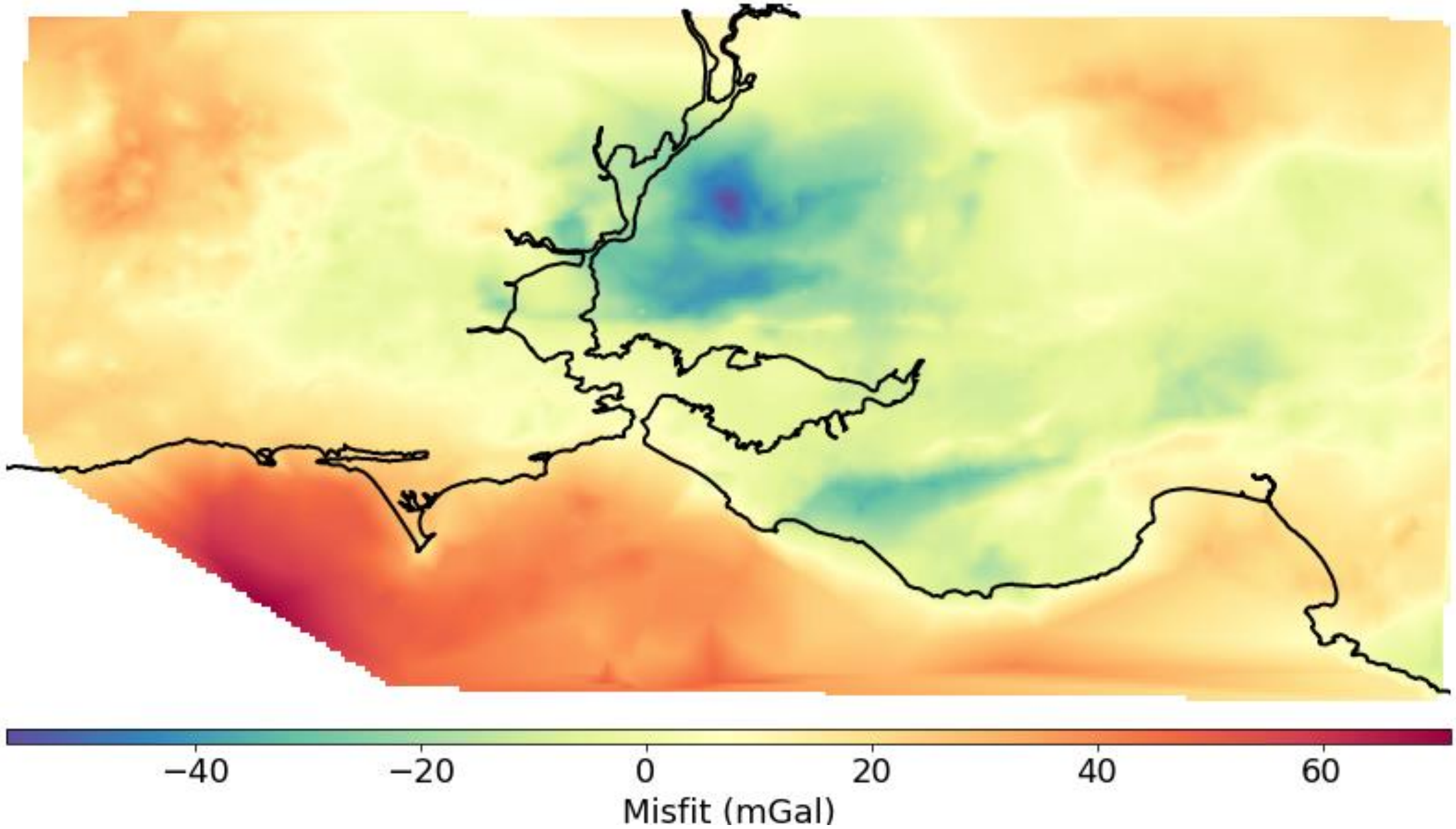
3. Which units are dominant in high misfit areas?

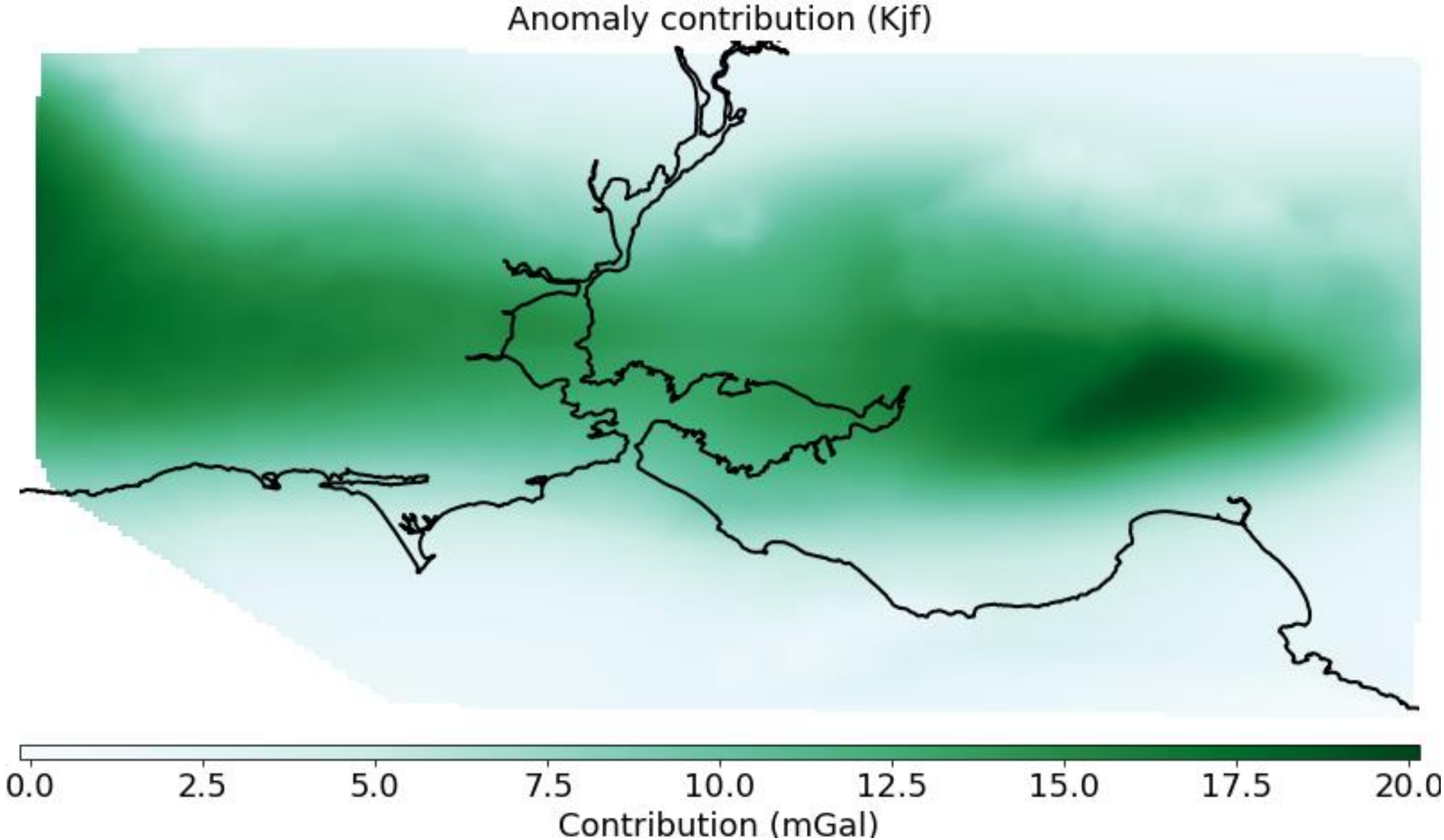

Crescent City
Yreka
Alturas
Eureka
Redding
Susanville
Chico
Reno
Fort Bragg
Grass Valley
Ukiah
South Lake Tahoe
Sacramento
Santa Rosa
Sonora
San Francisco
Modesto
San Jose
Merced
Hollister
Fresno
Monterey
Visalia
King City
Coalinga
Paso Robles
Baker
Regional Model
Detailed Model
km
0
100
200
300
42°
41°
40°
39°
38°
37°
36°
35°
-126°
-125°
-124°
-123°
-122°
-121°
-120°
-119

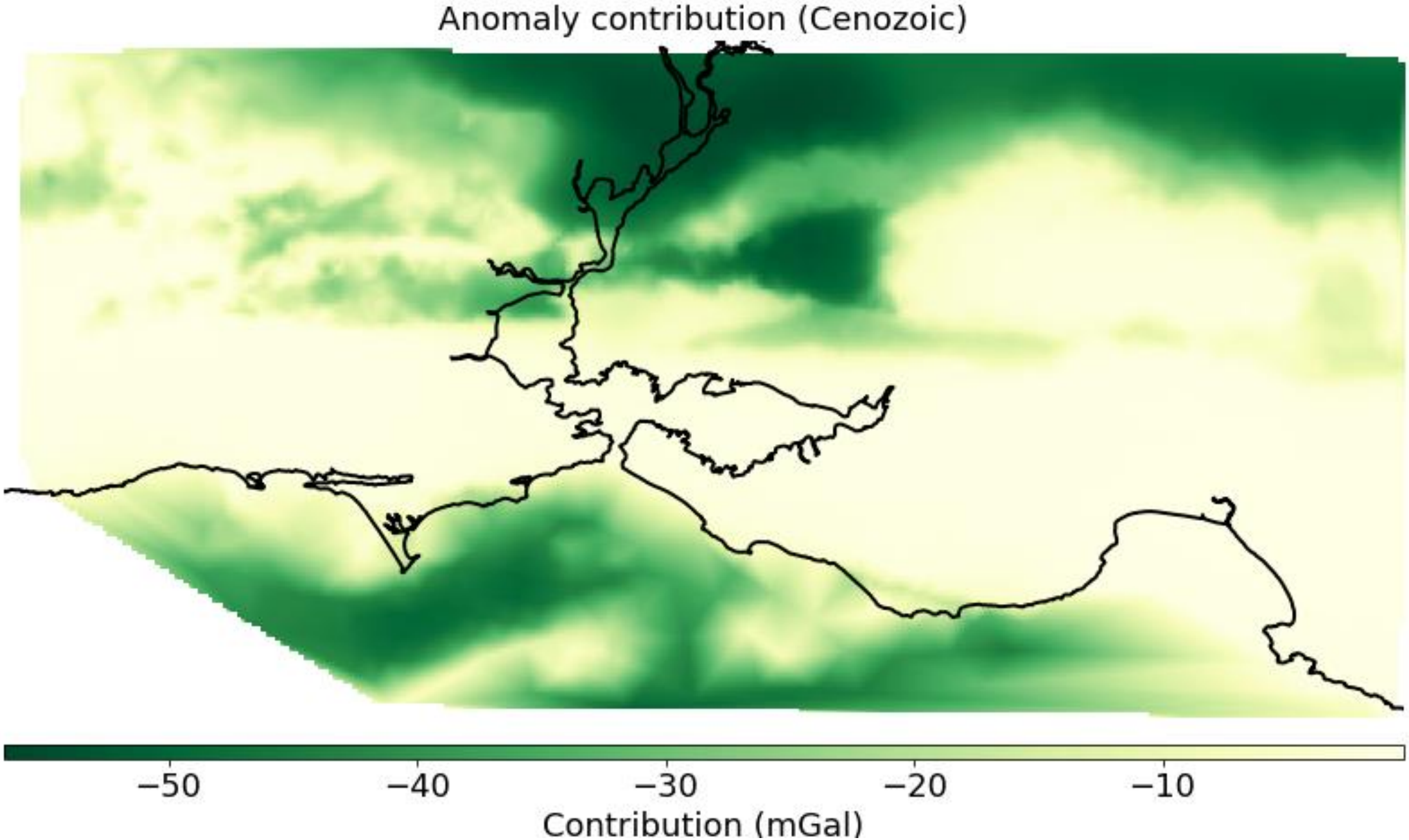

Quaternary deposits
Tertiary sedimentary rocks
Tertiary volcanic rocks
Serpentinite
Igneous rocks, including gabbro
Granitic rocks
Great Valley Sequence
Metamorphic rocks
Franciscan Complex
San Andreas fault
Rodgers Creek fault
San Francisco
Oakland
1906
Hayward fault
San Jose
Calaveras fault
1989
San Gregorio fault
San Andreas fault
180 miles
80 miles

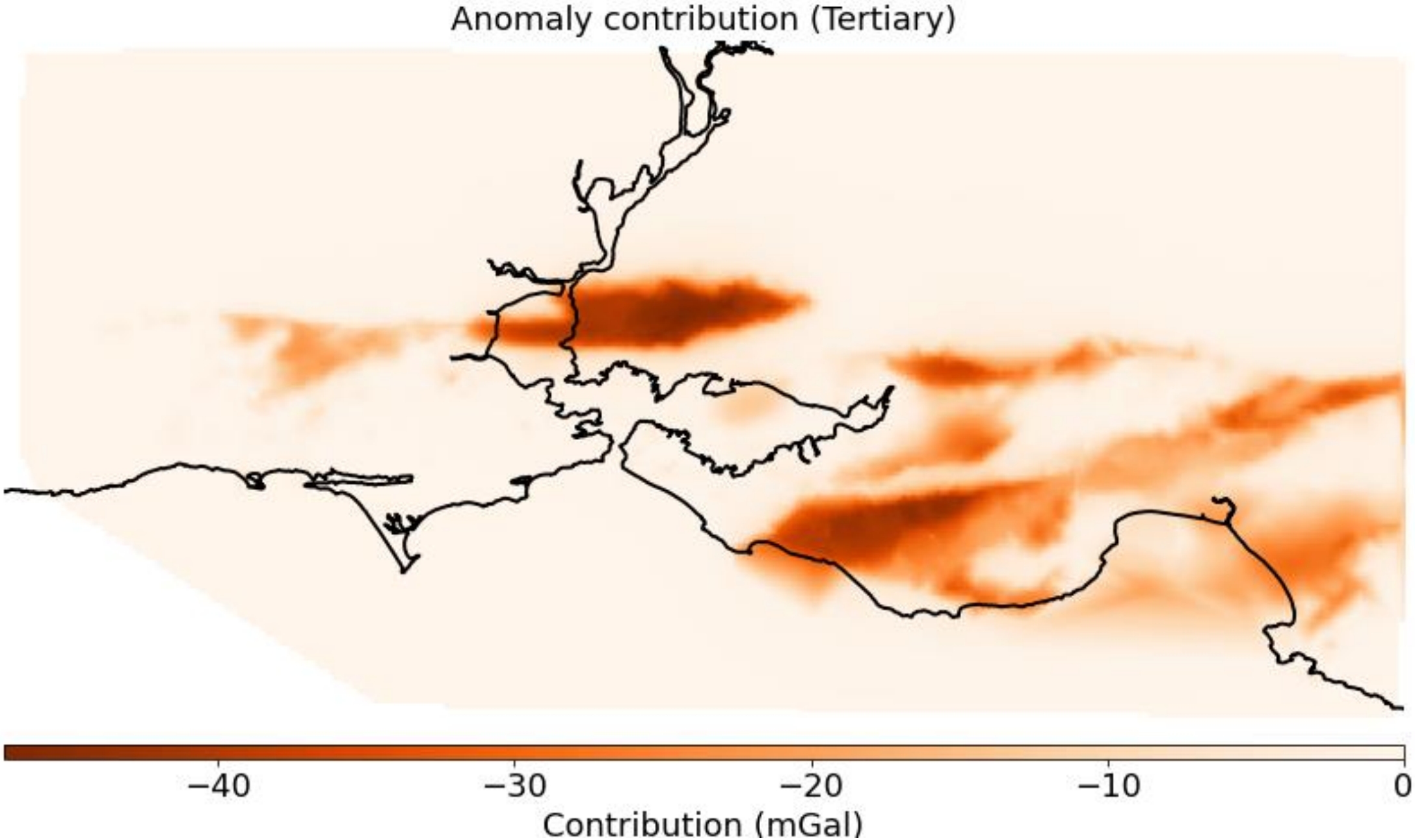

Zone color key
35 water
33 QT South Bay
32 QT Merced Pilarcitos
31 QT Bay Block Santa Rosa
30 Cenozoic
29 T Berkeley
28 T Bay Block Santa Rosa
27 T Pilarcitos
26 T La Honda
25 T South Bay
24 Cenozoic Ever
23 Cenozoic Halfmoon
22 Cenozoic Great Valley
21 Great Valley Seq
20 Kgr NShelf
19 Kgr SCoast
18 Kgr Halfmoon
17 Kgr Gab
16 Valley Sequence
15 Kjf W Diablo
14 Kjf E Diablo
13 Kjf Evergreen
12 Kjf Bay Block
11 Kjf Napa Sonoma
10 Kjf Sur
9 Kjf Merced
8 Kjf Foothills
7 Kjf Chabot
6 Kjf Berkeley
5 Logan G
4 San Leandro G
3 Great Valley Ophiolite
2 Lower Crust
1 Mantle
Moho
mid-crustal decollement
50
200
250
300
350
Z
Y
X

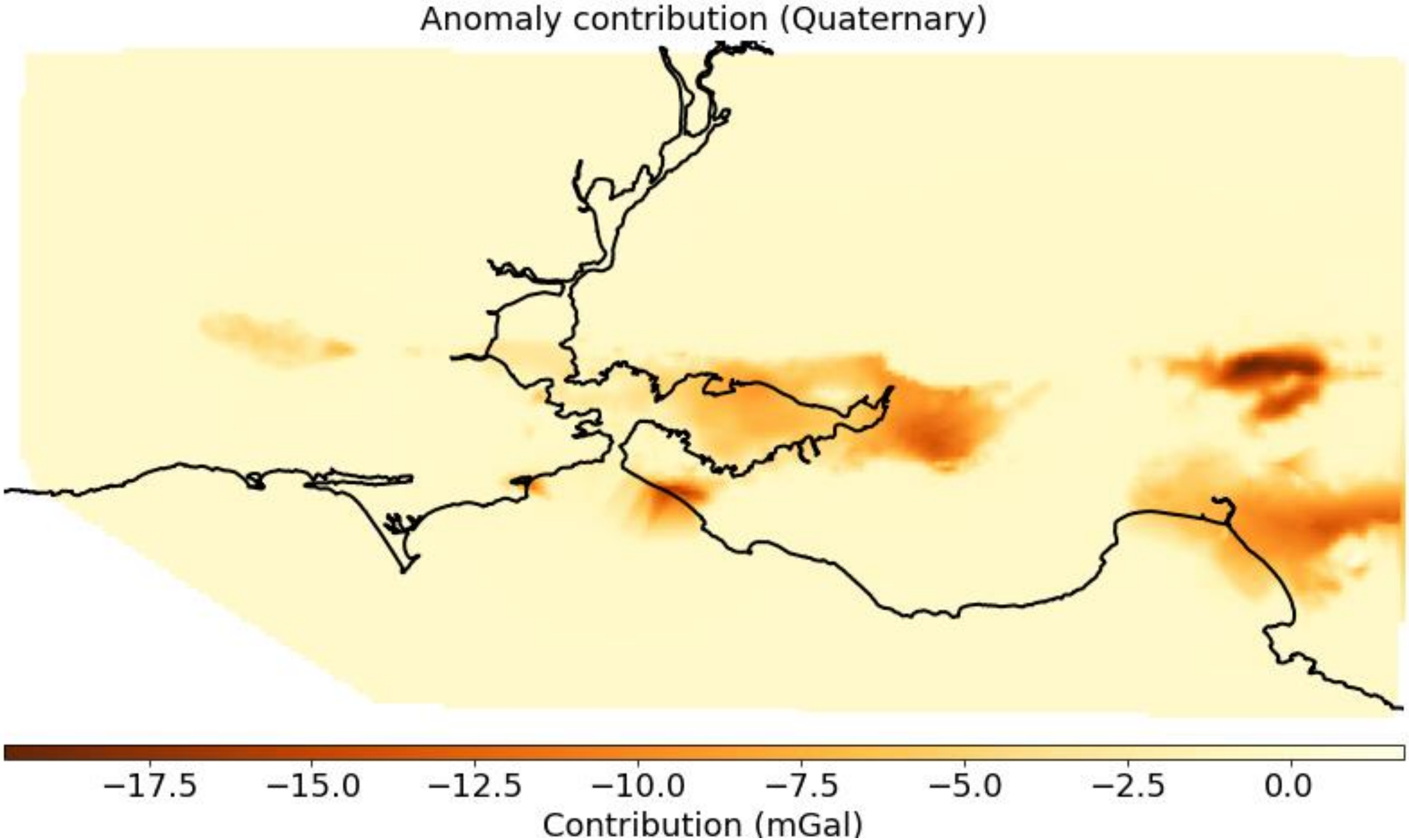


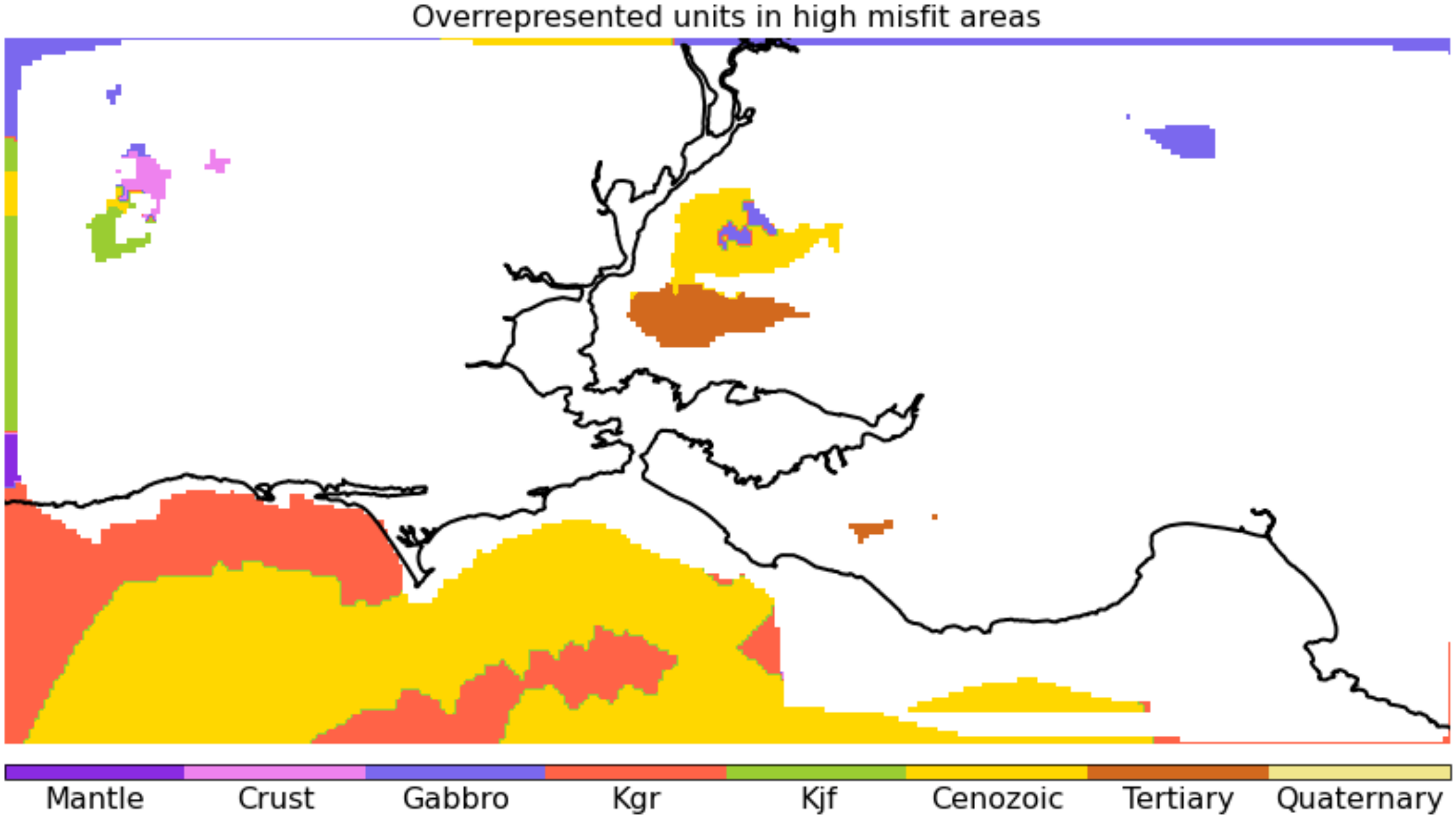

−40
−20
0
20
40
60
Misfit (mGal)


Anomaly contribution (Kjf)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Contribution (mGal)


Anomaly contribution (Cenozoic)
−50
−40
−30
−20
−10
Contribution (mGal)


Anomaly contribution (Tertiary)
−40
−30
−20
−10
0
Contribution (mGal)


Anomaly contribution (Quaternary)
−17.5
−15.0
−12.5
−10.0
−7.5
−5.0
−2.5
0.0
Contribution (mGal)


Overrepresented units in high misfit areas
Mantle
Crust
Gabbro
Kgr
Kjf
Cenozoic
Tertiary
Quaternary