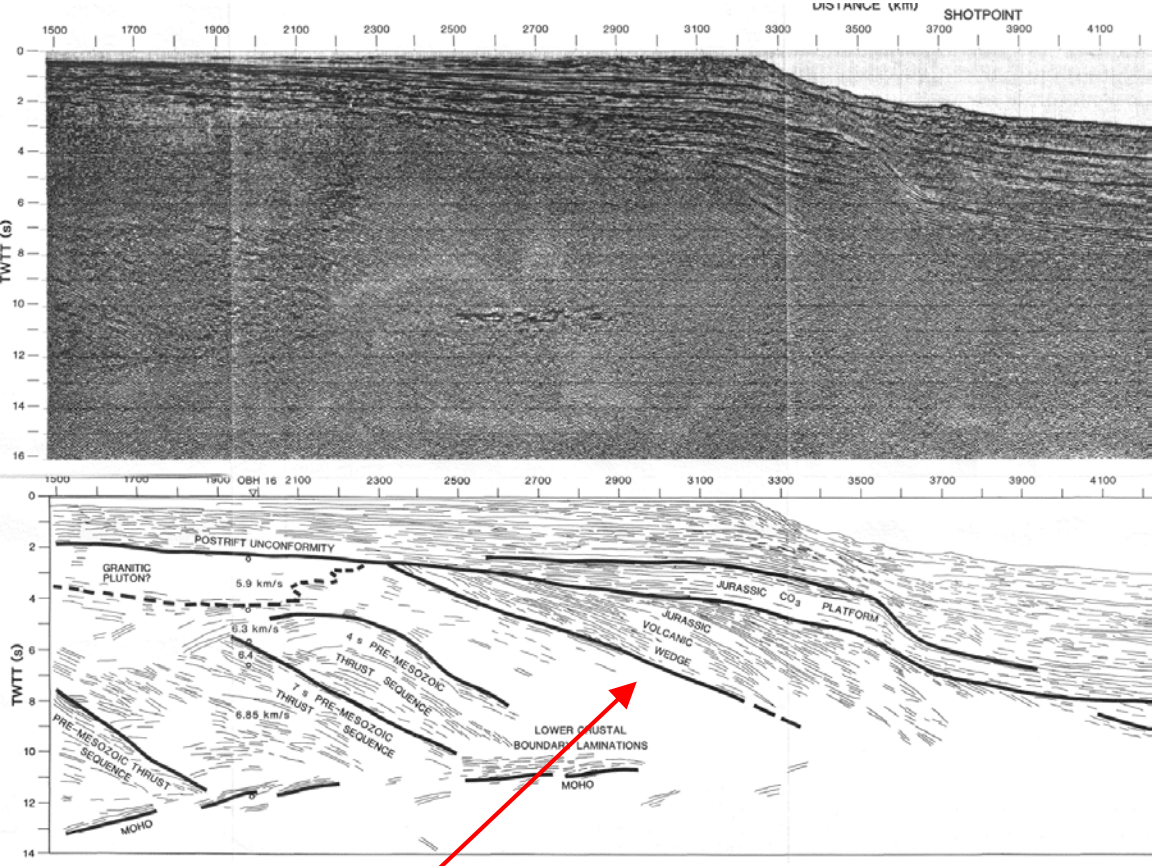
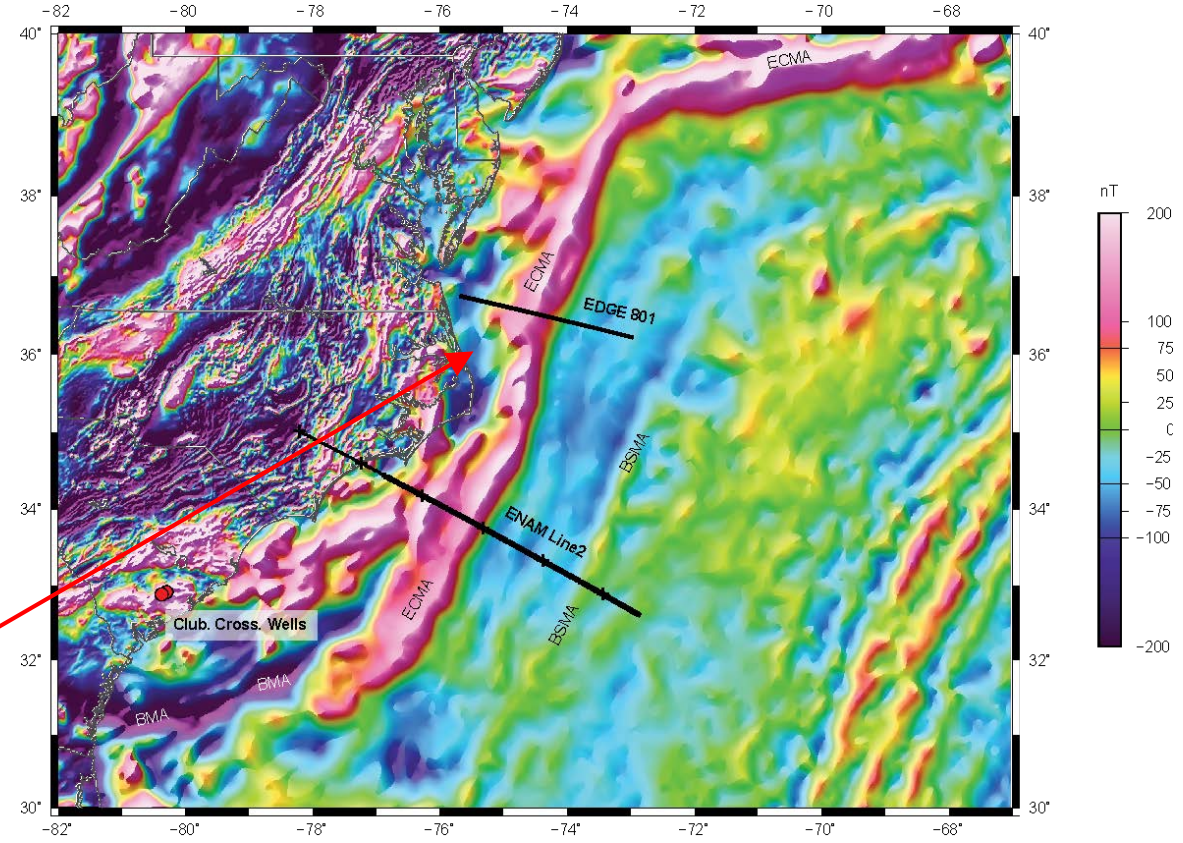
How fast were the ECMA SDRs emplaced?

...The band of thick igneous crust may have a volume of as much as 2.7 x 10^6 km^3, classifying it among the world's large igneous provinces.
(Kelemen & Holbrook, 1995; Deccan 1.6 x 10^6 km^3)



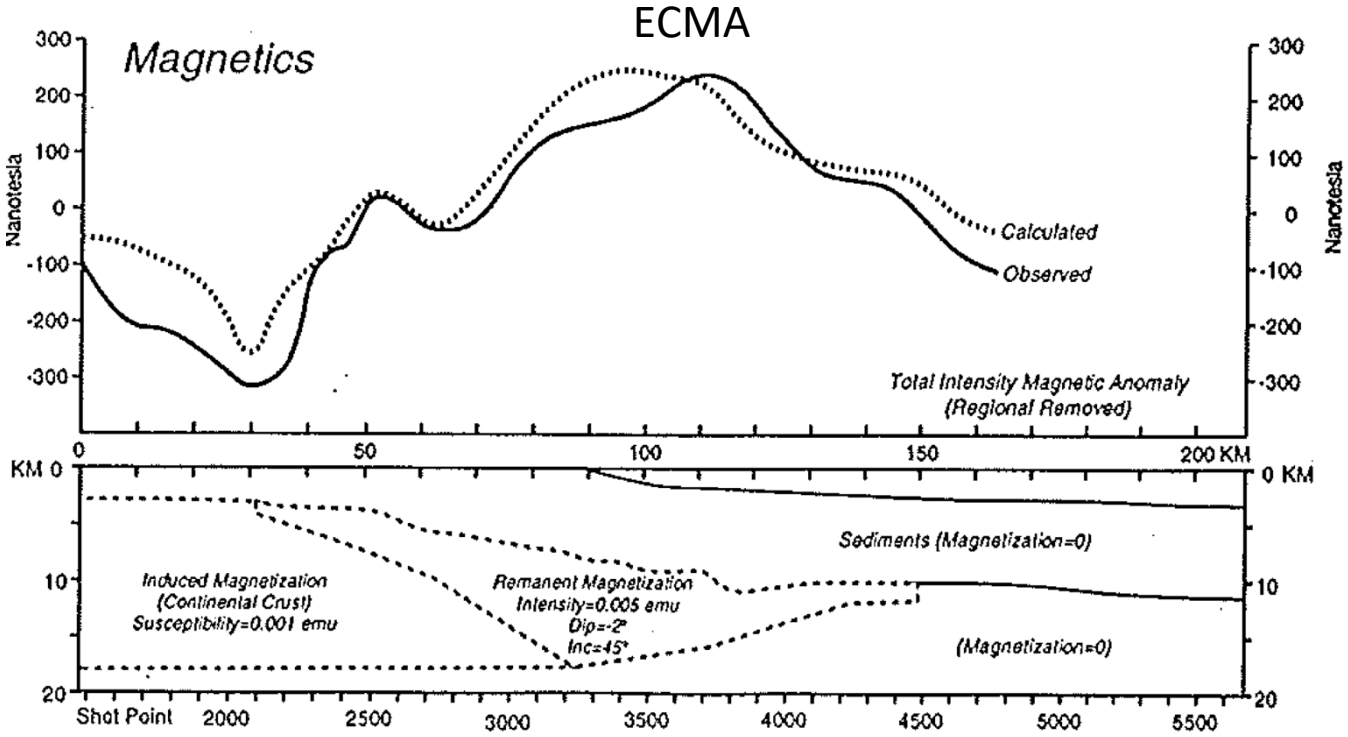
SDRs (Sheridan et al., 1993)

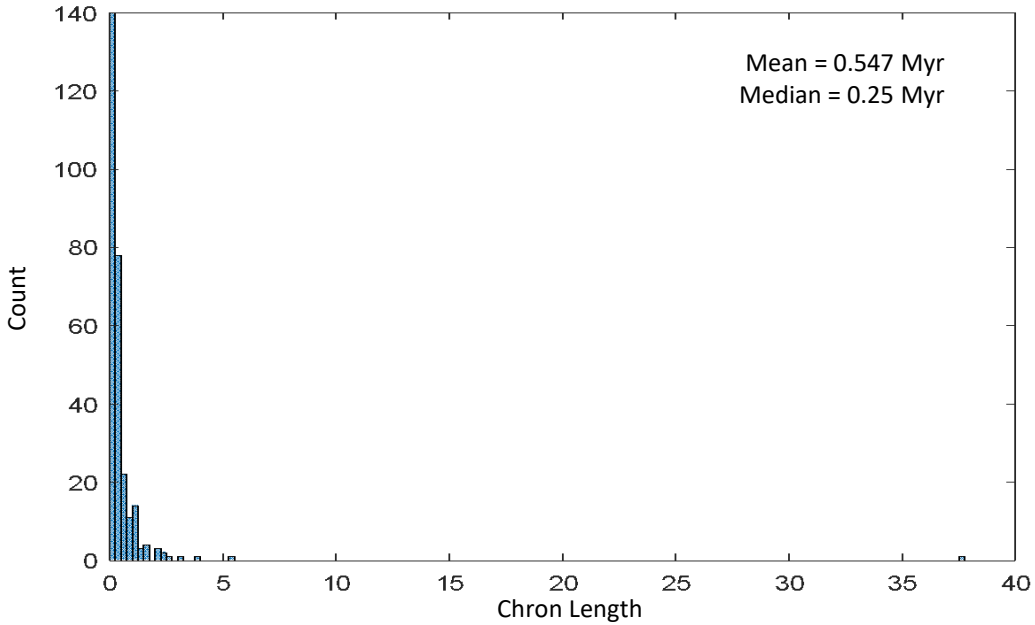


ECMA

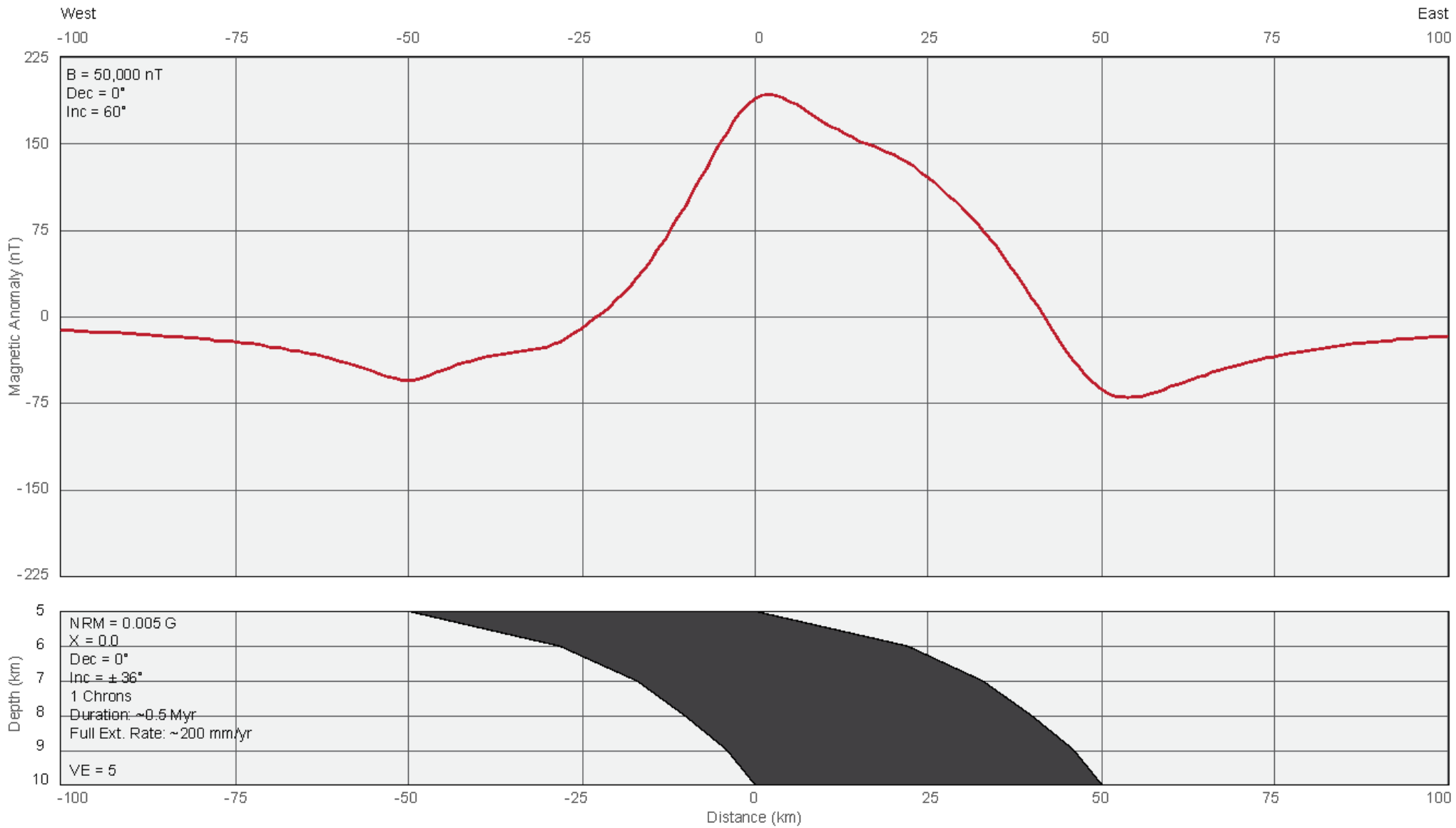
Talwani et al., (1995)

- "To produce the ECMA it is necessary that [the SDRs] possess a single magnetic polarity"
- The average reversal frequency of the GMT is ~0.5 Myr
- Is this a reasonable assumption?
- What type of magnetic anomalies do SDRs produce as reasonable extension rates?
- Globally, why don't we observe any high amplitude <u>negative</u> anomalies above SDRs?

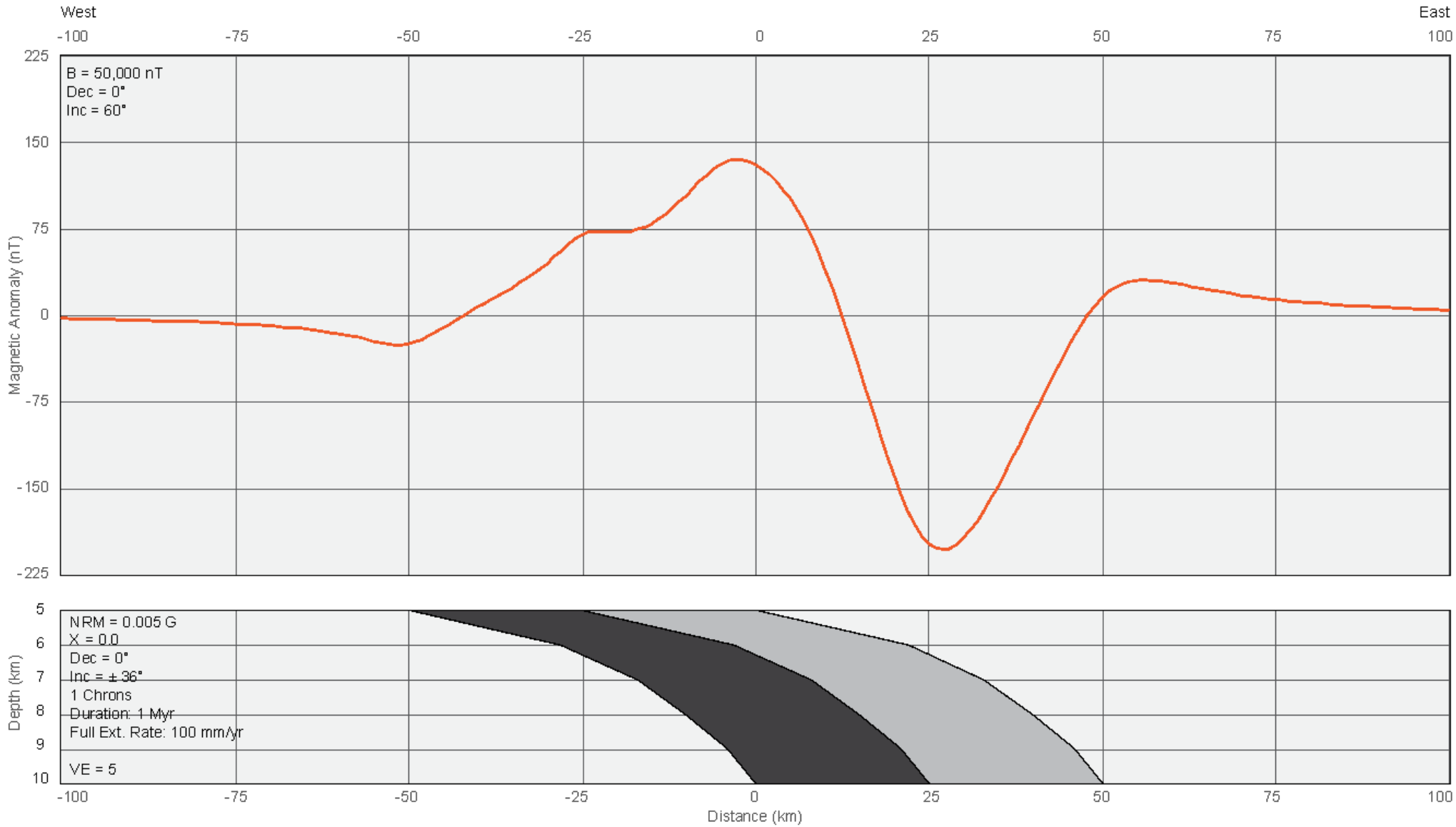




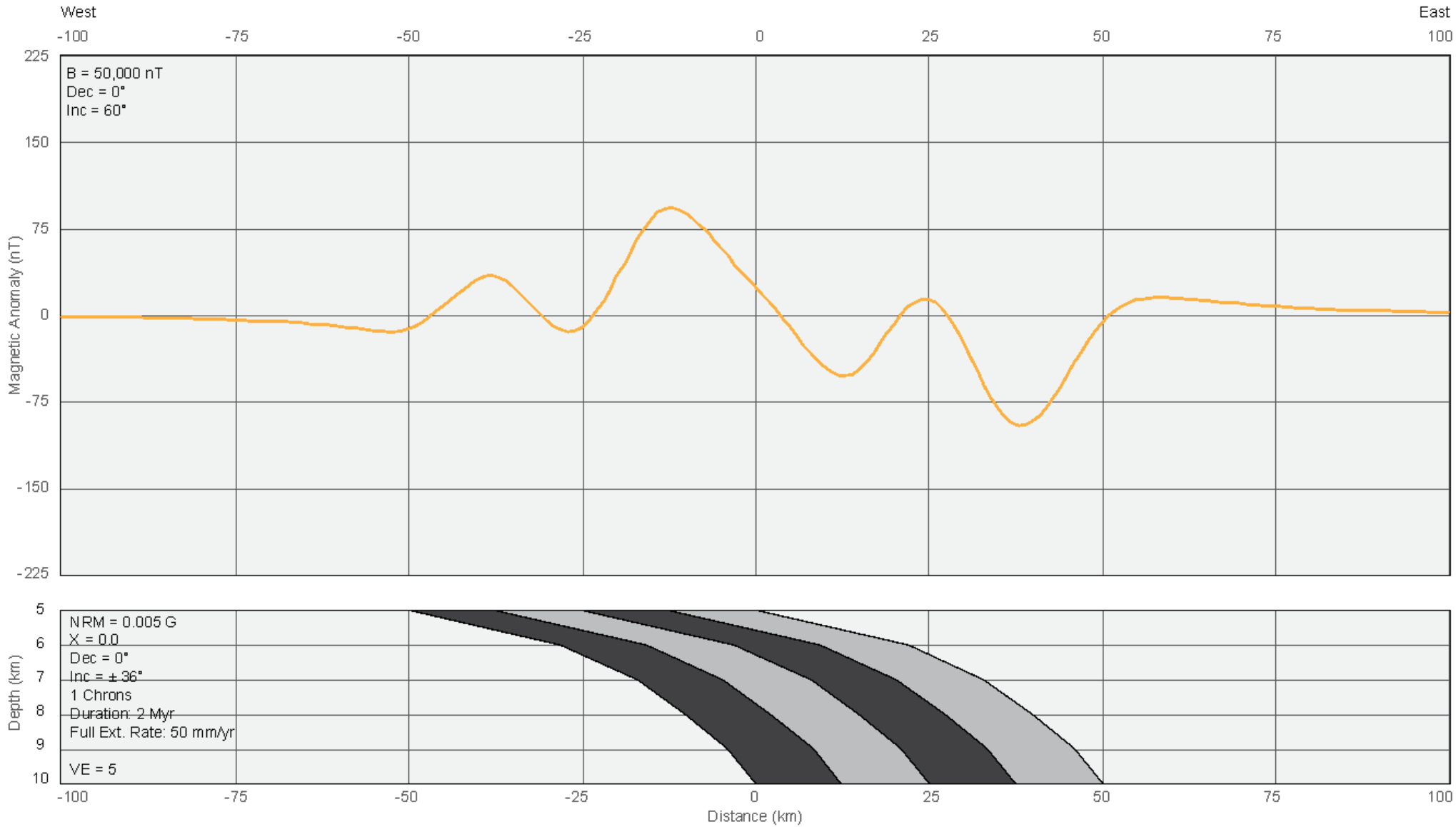
200 mm/yr = 50 km / 0.5 Myr * 2 (half to full)



100 mm/yr


West
East
-100
-75
-50
-25
0
25
50
75
100
225
150
75
0
-75
-150
-225
Magnetic Anomaly (nT)
B = 50,000 nT
Dec = 0°
Inc = 60°
5
6
7
8
9
10
Depth (km)
NRM = 0.005 G
X = 0.0
Dec = 0°
Inc = ± 36°
1 Chrons
Duration: 1 Myr
Full Ext. Rate: 100 mm/yr
VE = 5
Distance (km)

50 mm/yr


West
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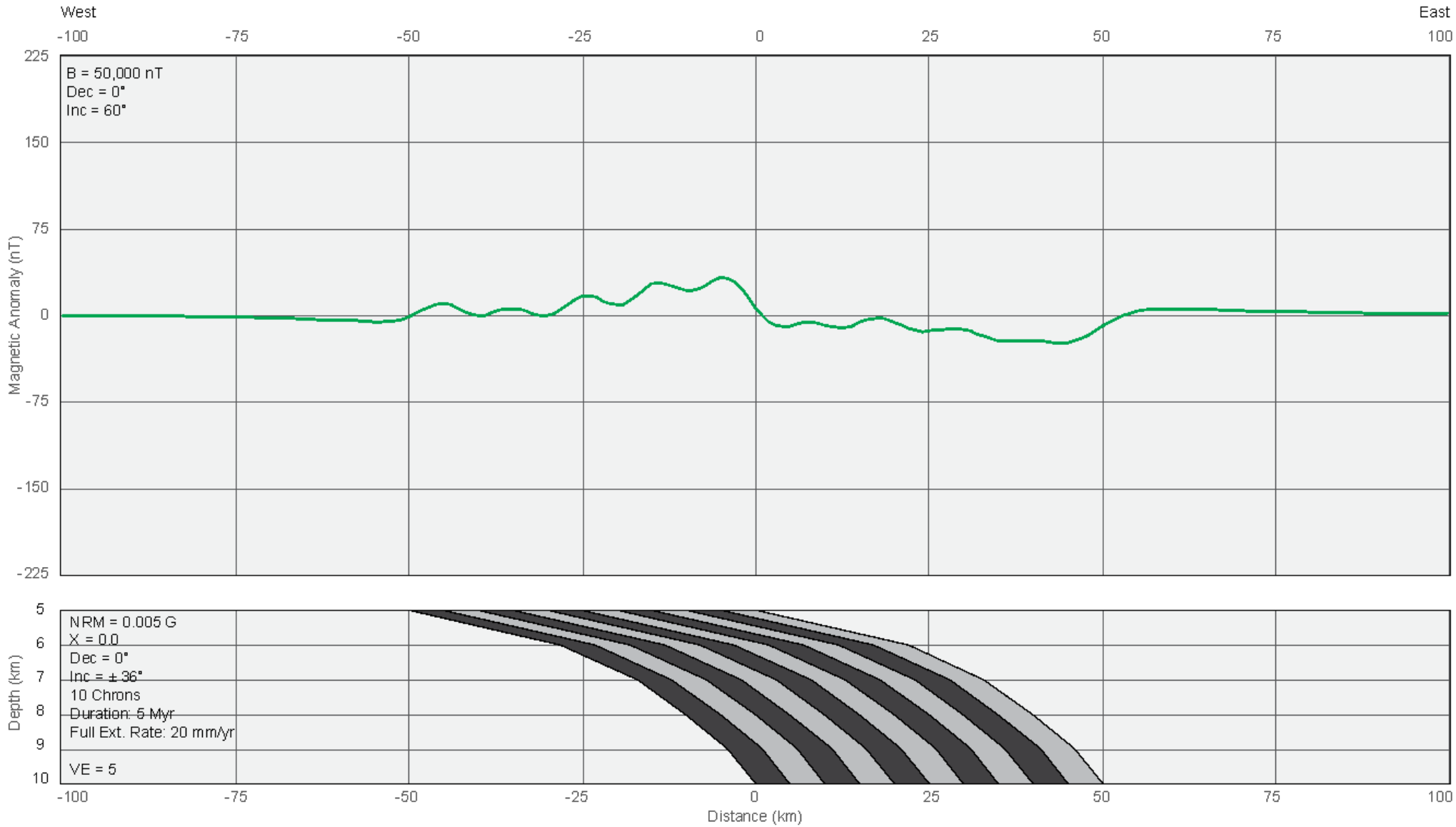
100
225
150
75
0
-75
-150
-225
Magnetic Anomaly (nT)
B = 50,000 nT
Dec = 0°
Inc = 60°
5
6
7
8
9
10
Depth (km)
NRM = 0.005 G
X = 0.0
Dec = 0°
Inc = ± 36°
1 Chrons
Duration: 2 Myr
Full Ext. Rate: 50 mm/yr
VE = 5
Distance (km)

20 mm/yr


West
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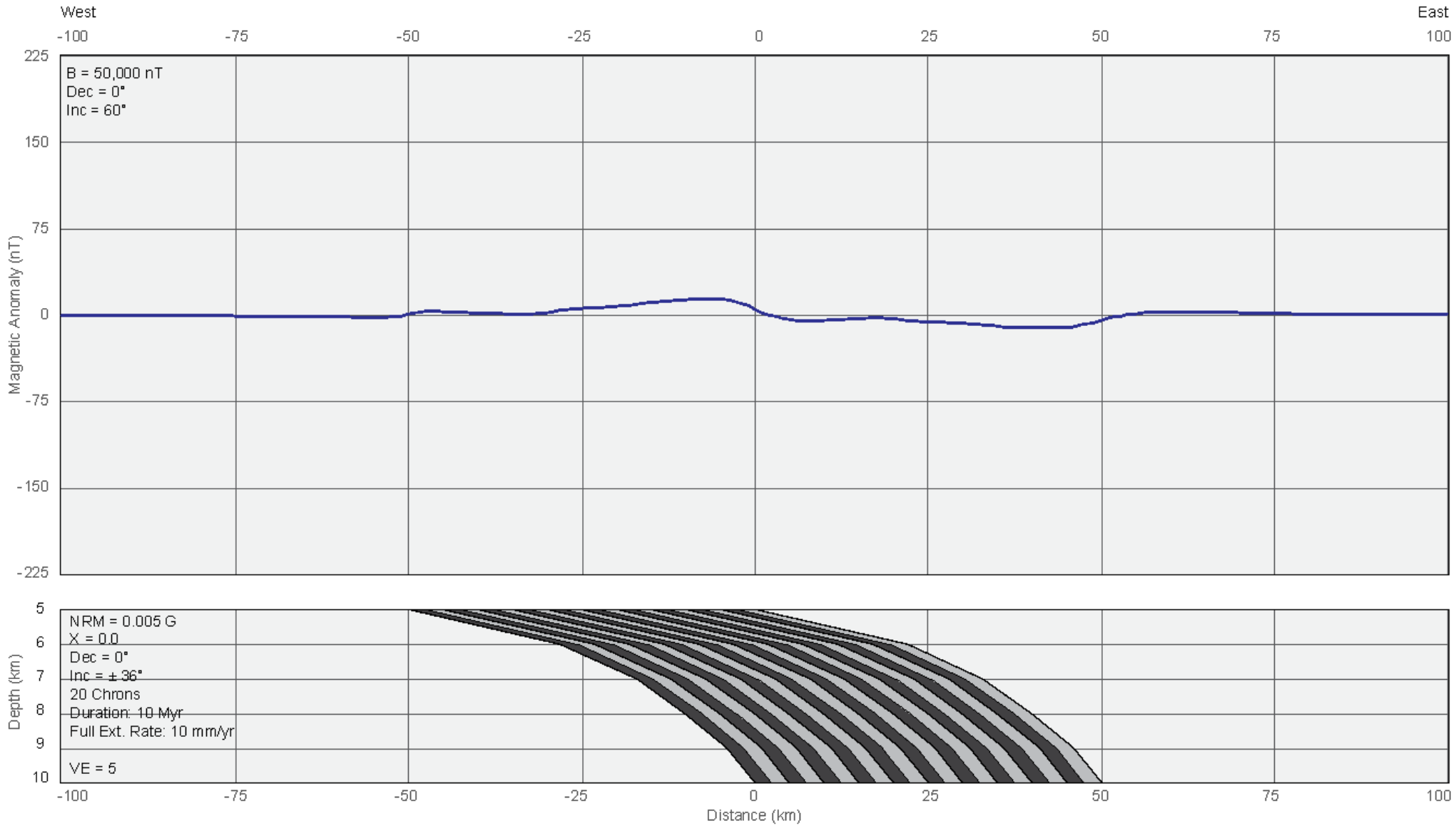
100
225
150
75
0
-75
-150
-225
B = 50,000 nT
Dec = 0°
Inc = 60°
Magnetic Anomaly (nT)
5
6
7
8
9
10
NRM = 0.005 G
X = 0.0
Dec = 0°
Inc = ± 36°
10 Chrons
Duration: 5 Myr
Full Ext. Rate: 20 mm/yr
VE = 5
Depth (km)
Distance (km)

10 mm/yr


West
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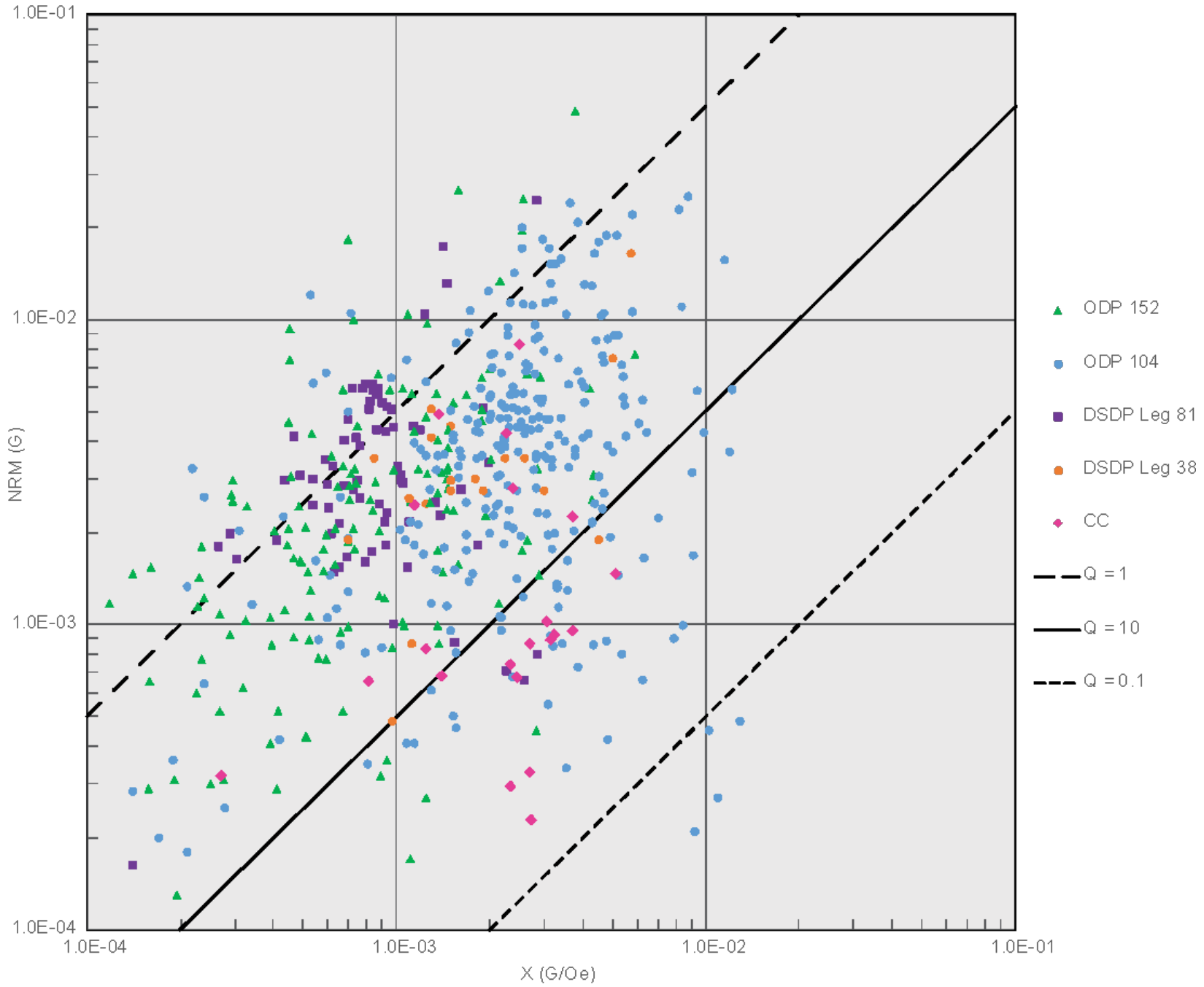
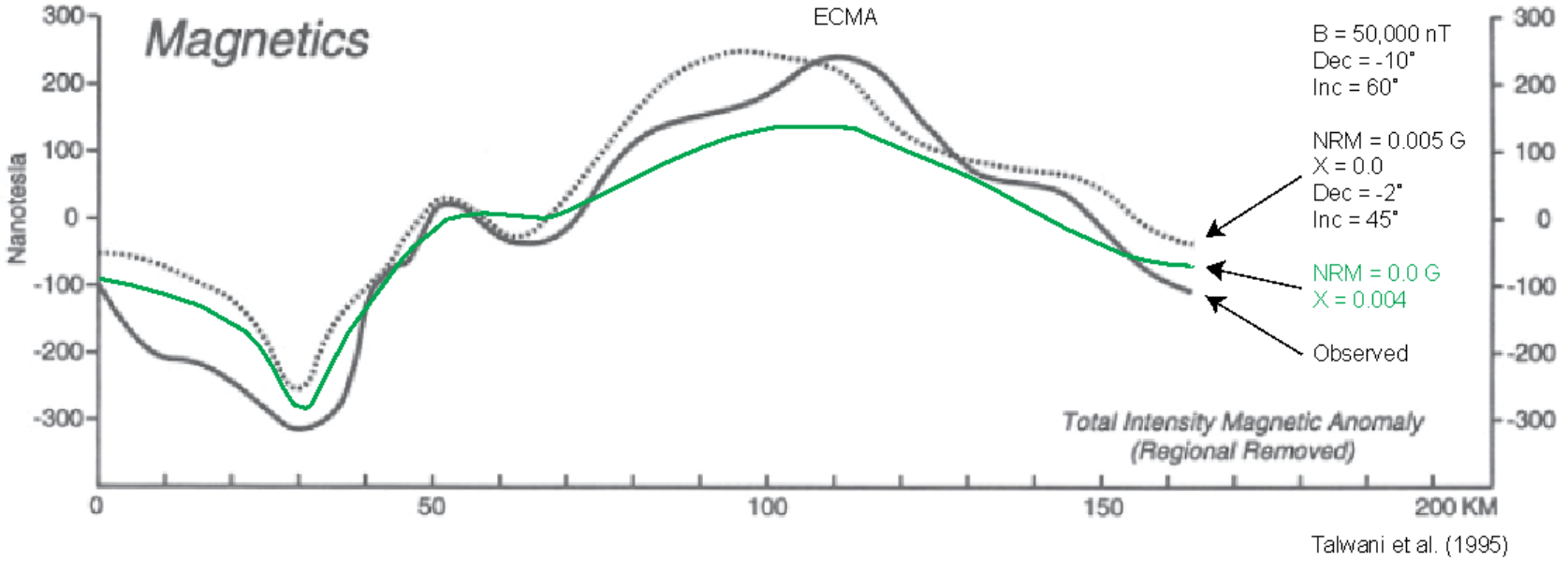
75
0
-75
-150
-225
Magnetic Anomaly (nT)
B = 50,000 nT
Dec = 0°
Inc = 60°
5
6
7
8
9
10
Depth (km)
NRM = 0.005 G
X = 0.0
Dec = 0°
Inc = ± 36°
20 Chrons
Duration: 10 Myr
Full Ext. Rate: 10 mm/yr
VE = 5
Distance (km)

SDR Magnetic Properties

- NRM cancels out at reasonable rates due SDR flow geometries
- SDR basalts have high susceptibilities
- High susceptibility materials will produce a positive anomaly when exposed to Earth's field



- ECMA is an <u>induced anomaly</u>
- ECMA produced by:
  - Thick (5-10 km) & wide (50-100 km) extrusive package
  - Susceptibility contrast with continental crust
  - Elevated basement
- Formed at
  - Rates of ~10-20 mm/yr
  - Over 5-20 Myr
- Explains the global lack of large negative anomalies over SDRs



Talwani et al. (1995)