



Cyprus

Eratosthenes

Levant basin

Jonah high

The origin and evolution of the Jonah high and its significance to the Levant Basin rifting history

Sagy et al., 2015

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NW

Line IS-2035

SE

Yam-Yafo-1

MSL

1.0

3.0

5.0

7.0

Two way travel time (sec.)

Jonah high

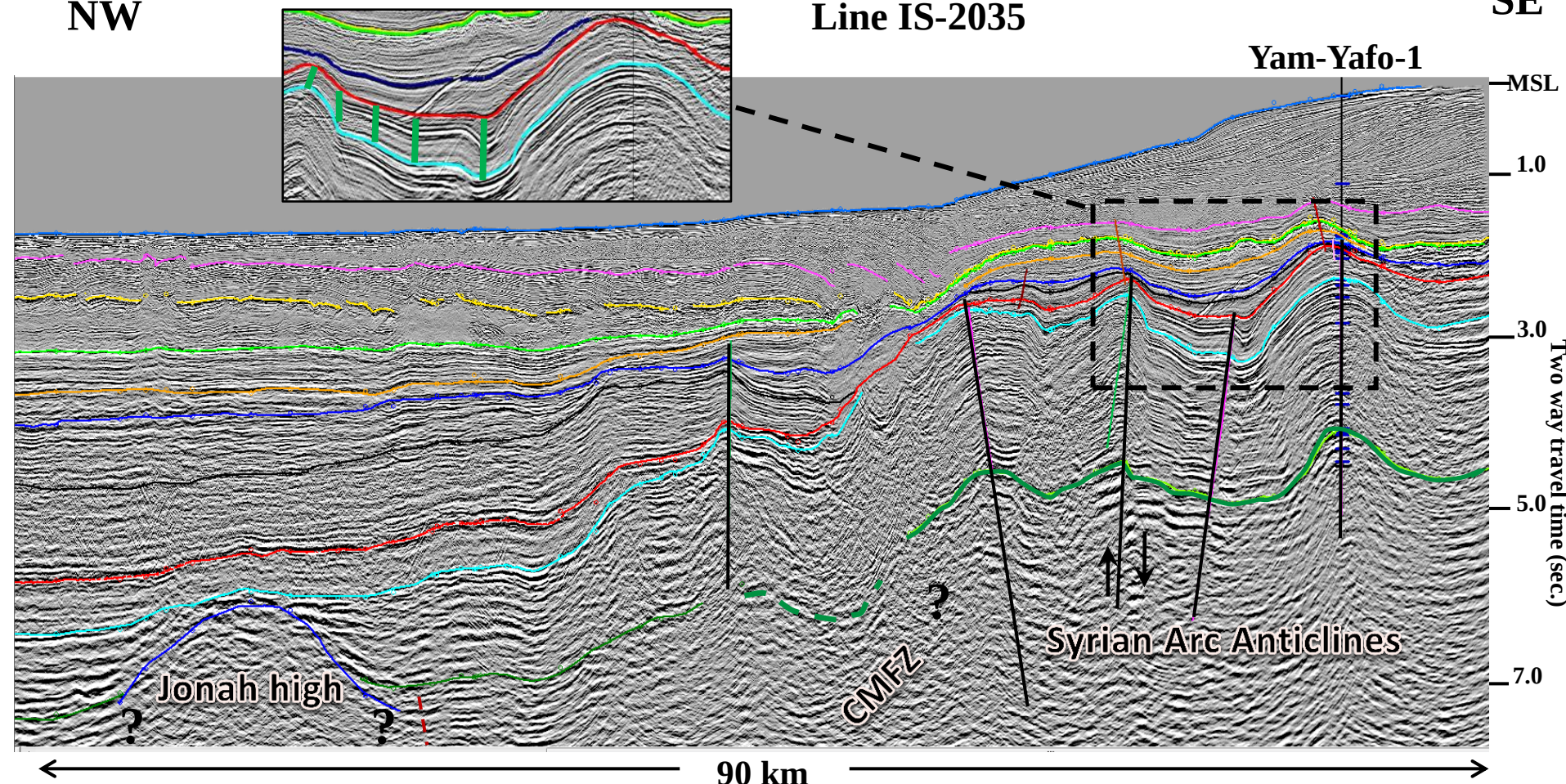
CMFZ ?

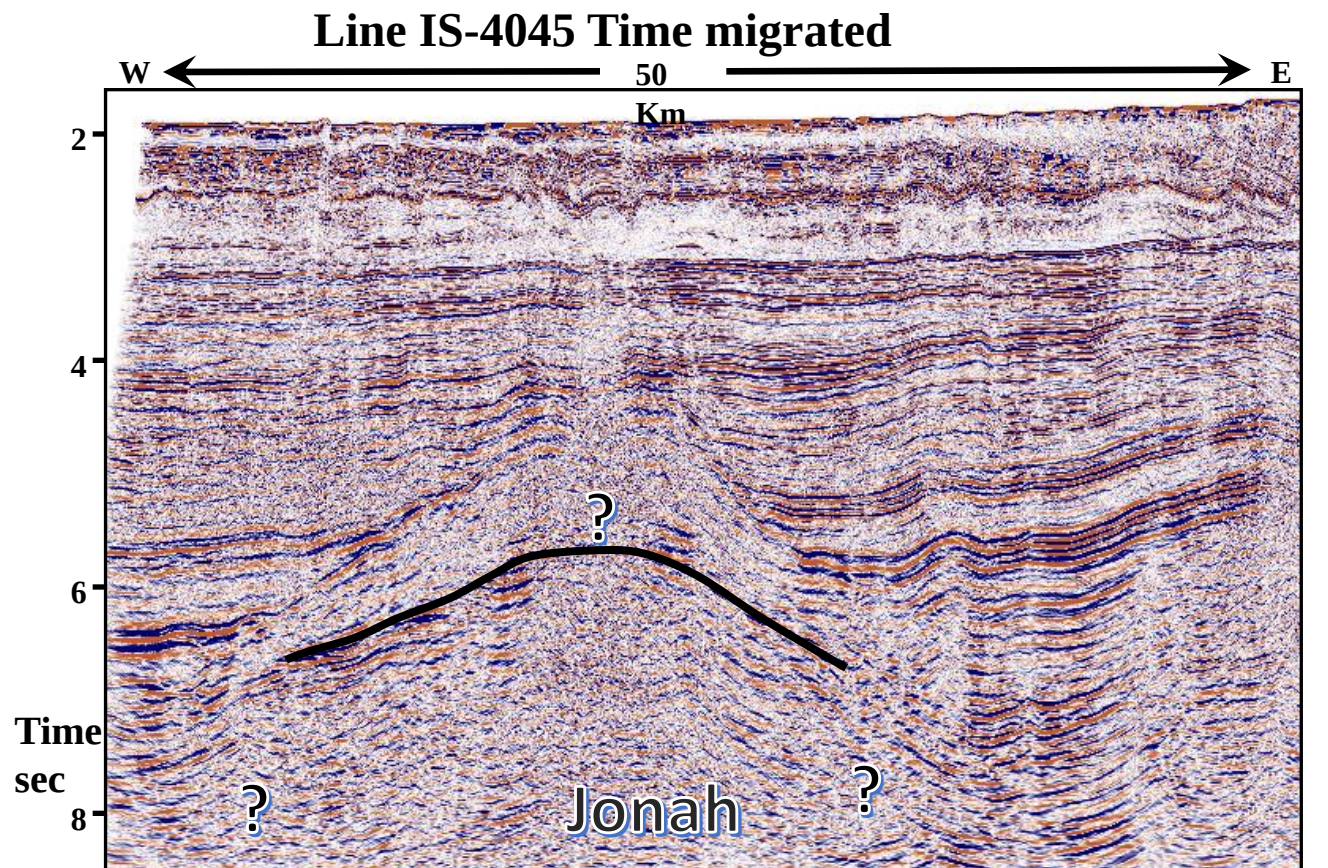
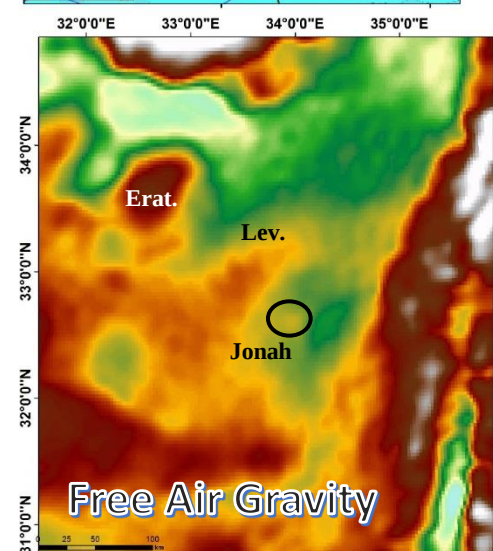
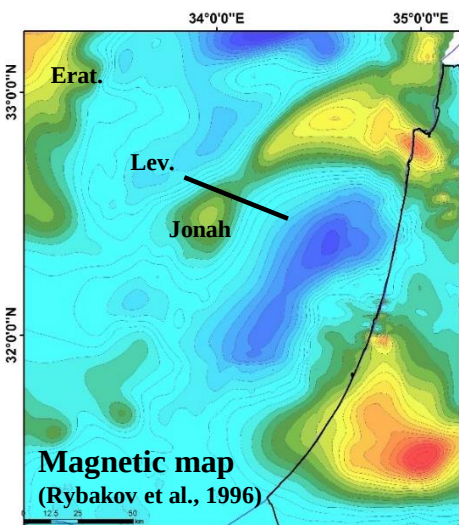
Syrian Arc Anticlines

90 km

- | | | | |
|---------------------|----------------------|----------------------|--------------------------|
| — Sea Floor (10) | — Base Messinian (7) | — Base Miocene (4) | — Base Late Jurassic (1) |
| — Mid. Pliocene (9) | — Late Miocene (6) | — Base Saqiye (3) | — Top Jonah |
| — Base Pliocene (8) | — Mid. Miocene (5) | — Base Santonian (2) | |

Modified from Steinberg et al., 2011; Sagy et al., 2015





Ancient horst?
(Gardosh et al., 2008)

Syrian Arc fold?
(Gardosh et al., 2008)

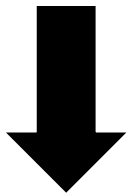
Deep seated magmatic intrusion?
(Ben-Gai and Folkman, 2004)

Volcanic edifice?
(Rybakov et al., 2011)

Mud diapir?
(Ben-Gai and Druckman, 2013)

The Enigma of Jonah high:

Horst?



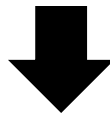
Rifting stage

Amount of extension

Heat flow

Reconstruction of plate's fragments

Fold?



Post rift contractional phase –

the equivalent of the onshore

Syrian Arc fold system?

Magmatic body?



Rift related magmatism?

Early Cretaceous magmatism?

Tertiary magmatism?

Objective:

Explore the origin and evolution of Jonah high

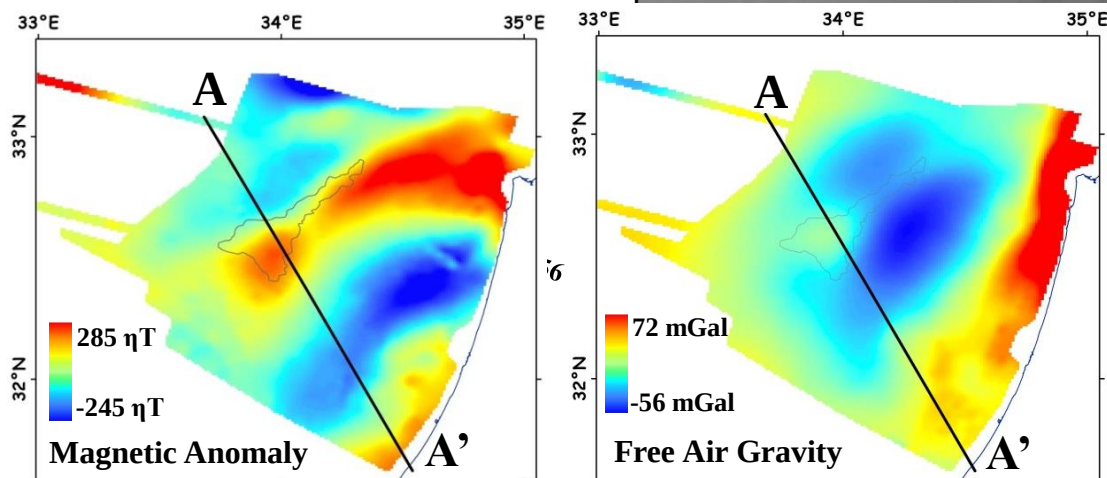
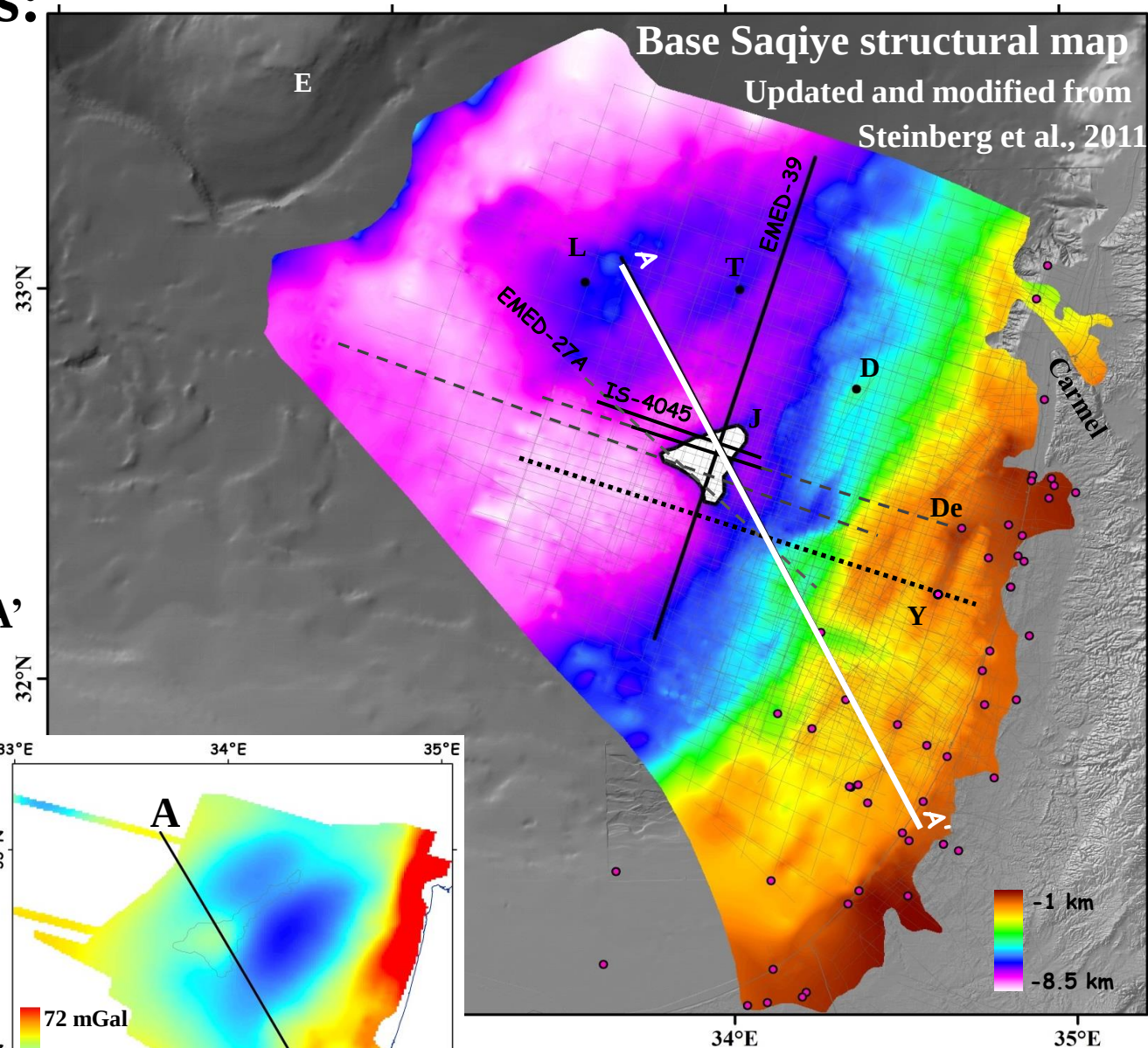
Specific aims:

- Internal reflections: artifact? flat? folded? intrusive?
- Geometric relationship - between structure and bordering reflectors
- Deeper boundaries: defining the bordering faults
- Gravity and magnetic data: do they fit to the proposed model?

Main tool: Seismic imaging and interpretation

Data and Methods:

- ★ Regional interpretation on ~27, 000 km of 2D seismic lines
- ★ Processing raw data of 5 seismic lines performing Pre-stack Depth Migration (PSDM)
- ★ Gravity and magnetic modeling along profile AA'



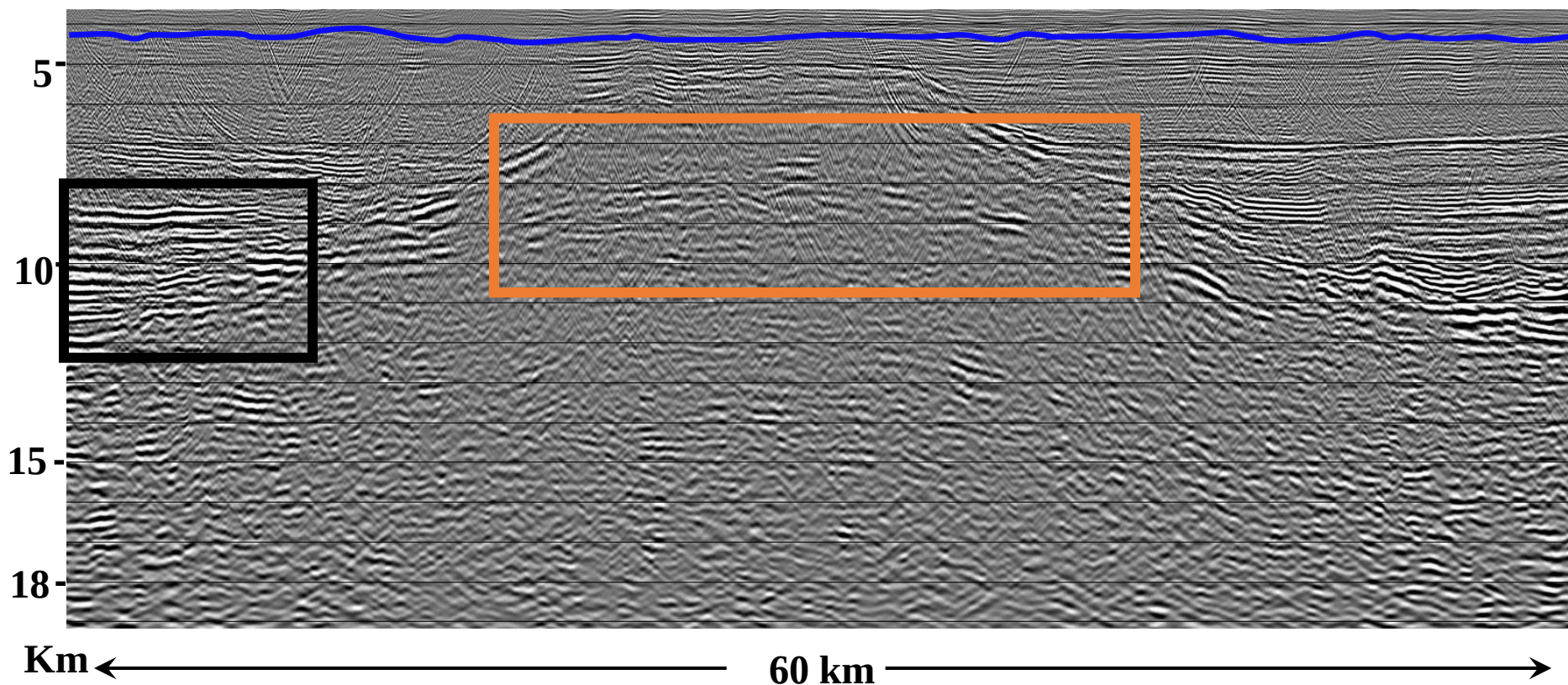
Pre-Stack Depth Migration (PSDM)

Line EMED-39

S

$V = 4000$ m/s below mid. Miocene

N



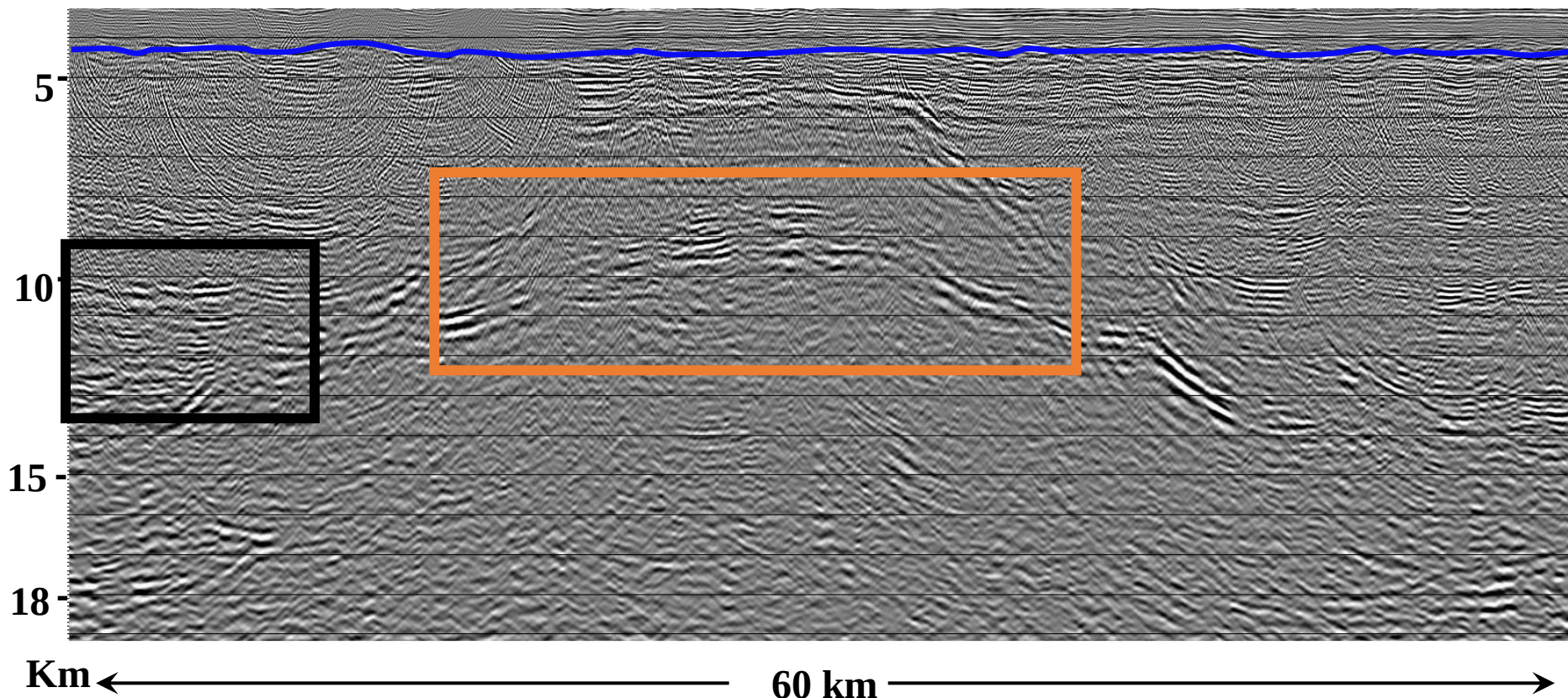
Pre-Stack Depth Migration (PSDM)

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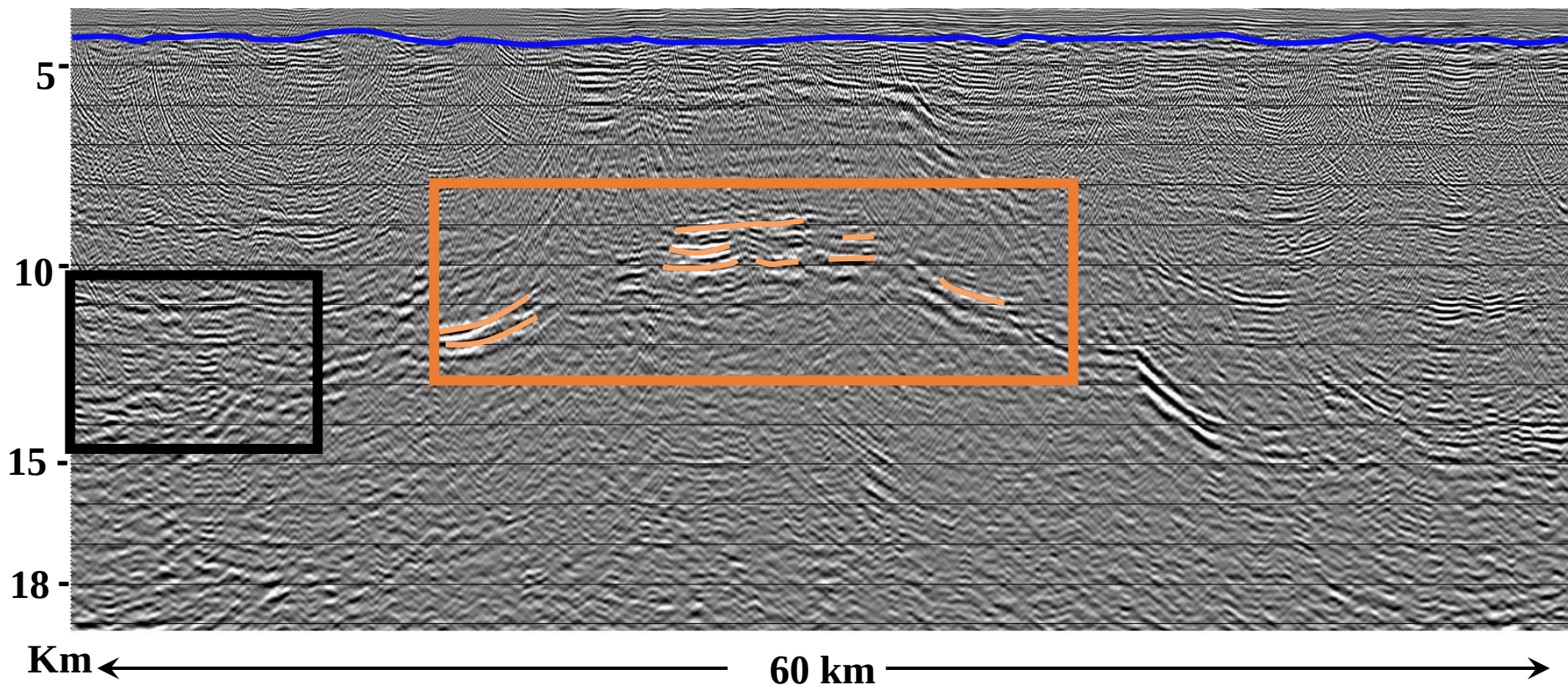
Pre-Stack Depth Migration (PSDM)

Line EMED-39

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N



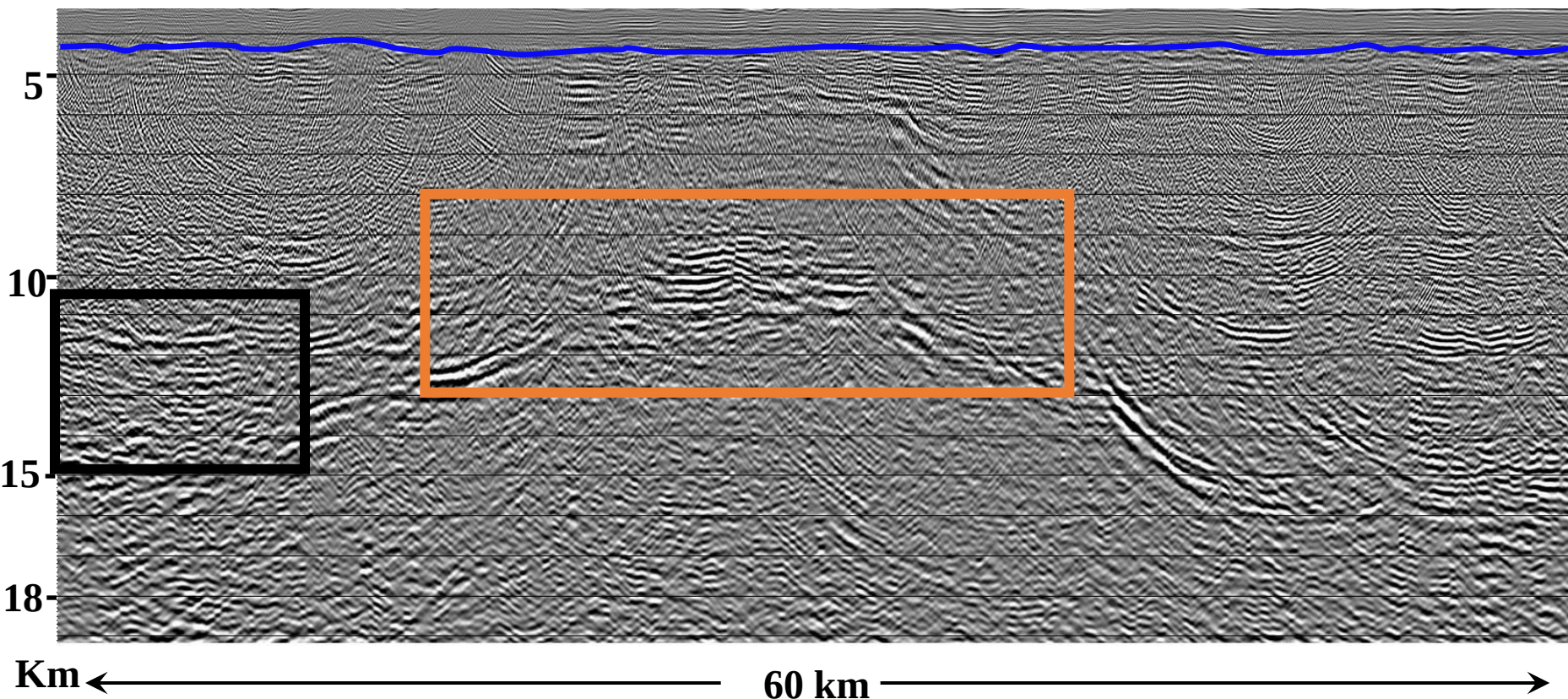
Pre-Stack Depth Migration (PSDM)

Line EMED-39

S

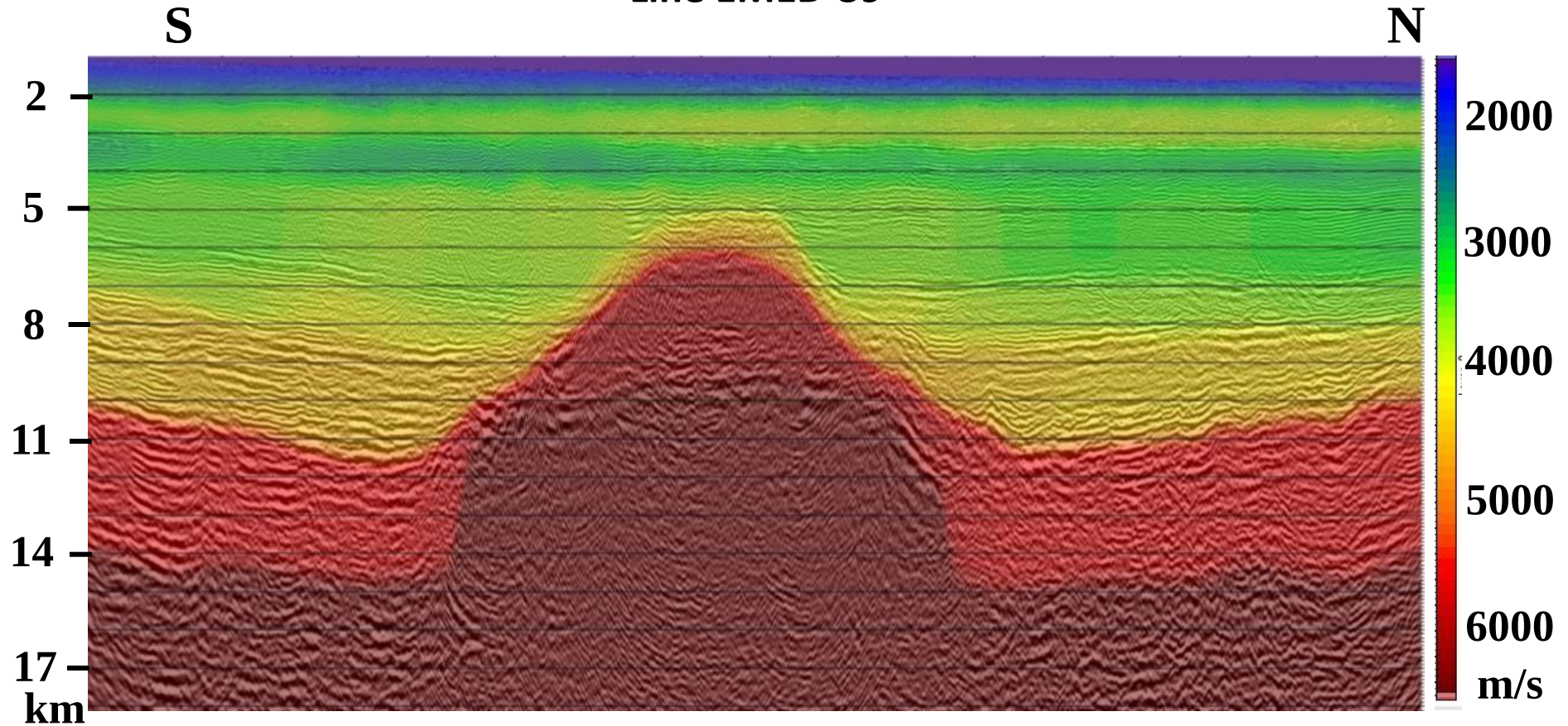
$V = 6000$ m/s below mid. Miocene

N

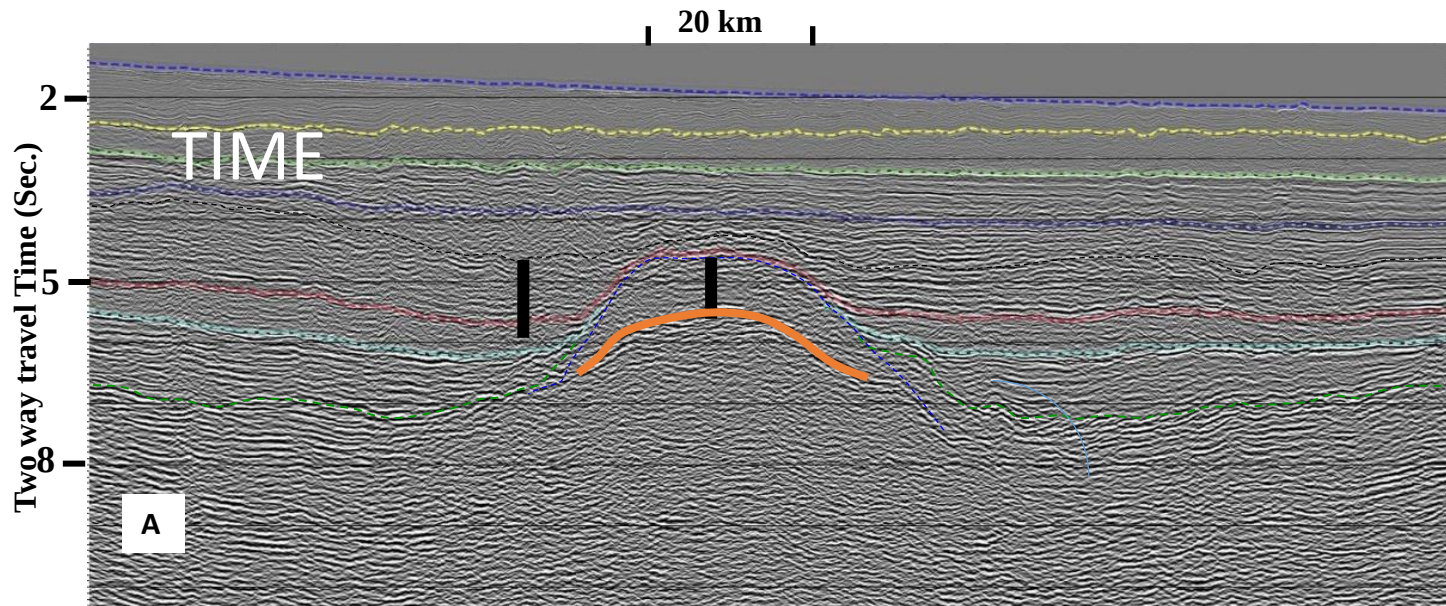


Final interval velocity model

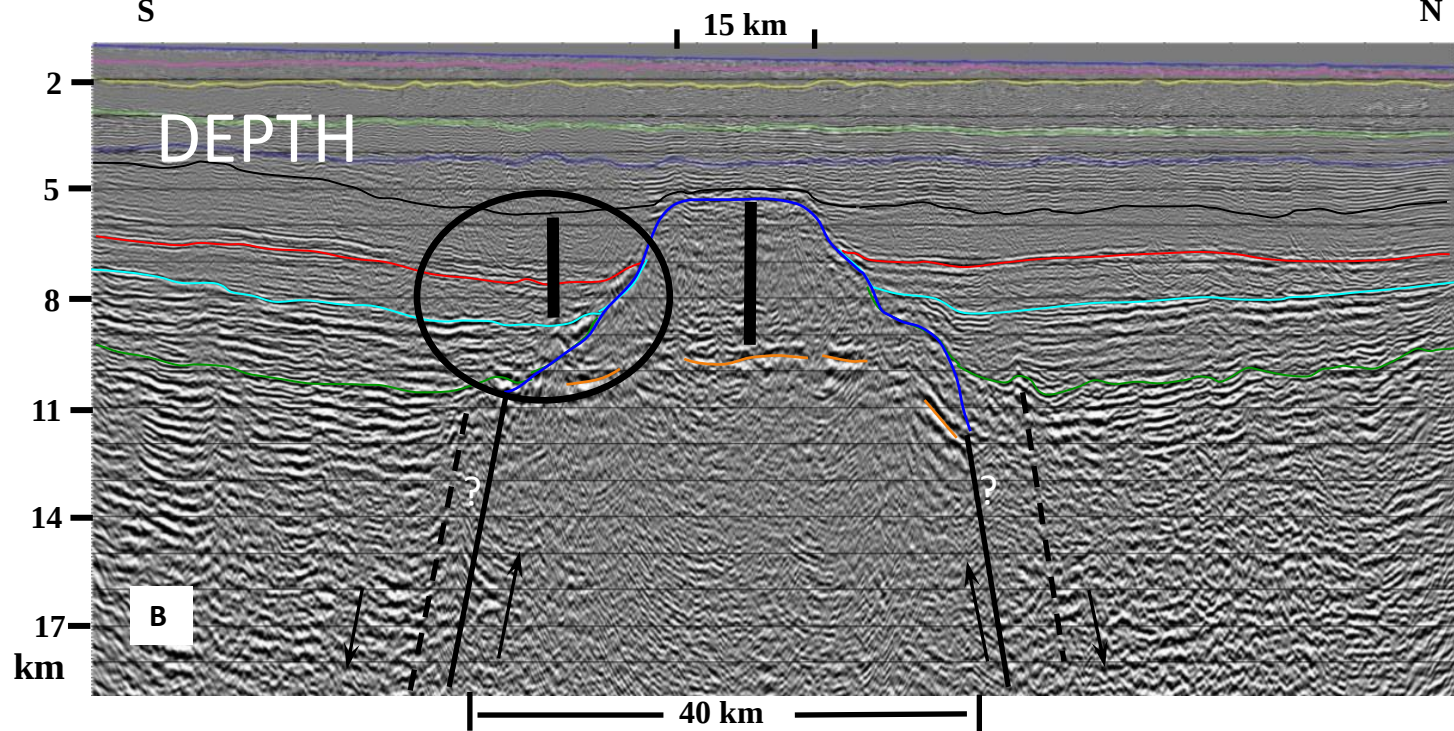
Line EMED-39



Time versus Depth



116 km
S N

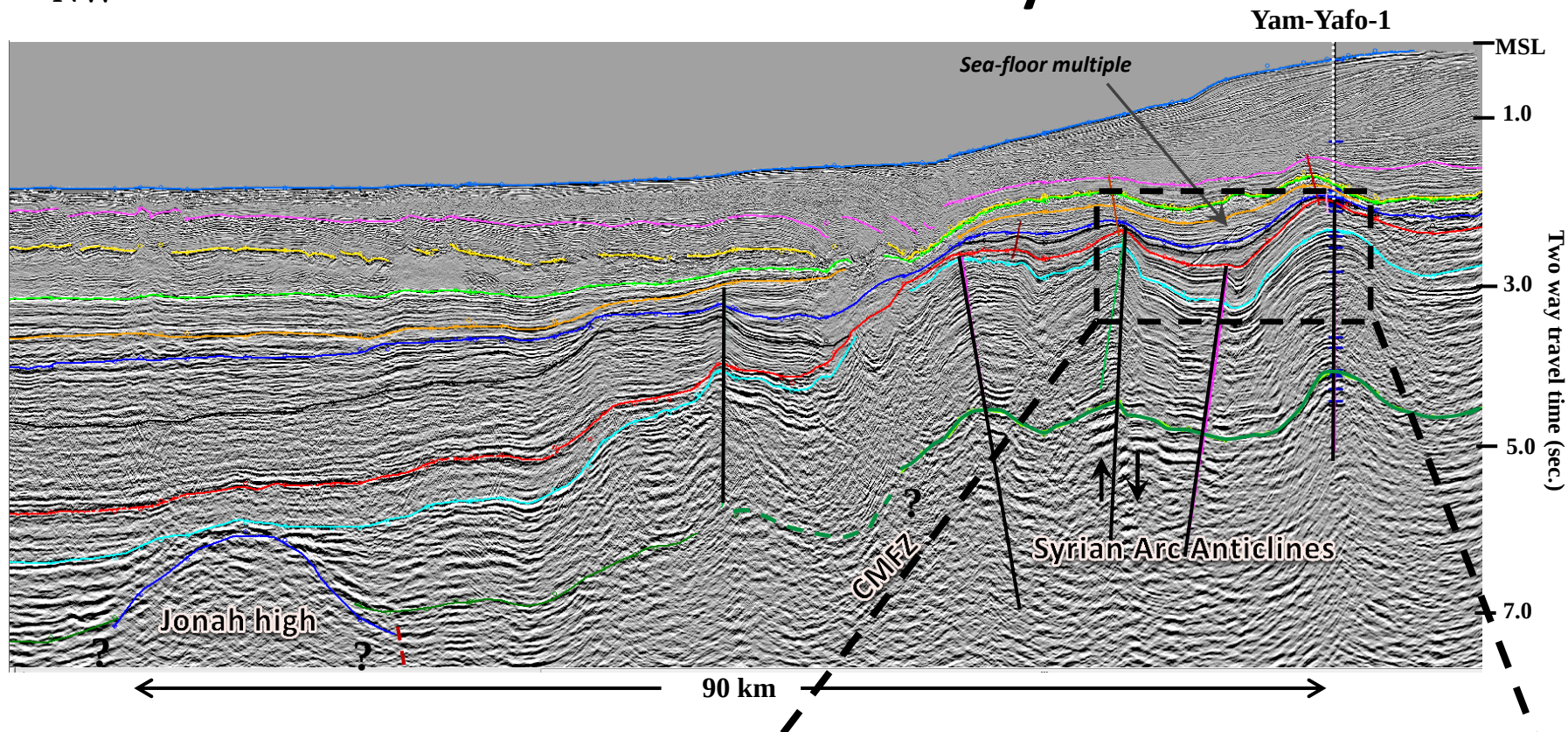


- Sea Floor
- Base Pleistocene
- Base Pliocene
- Base Messinian
- Mid Miocene
- Base Miocene
- Base Saqiye unconformity
- Base Santonian
- Base Late Jurassic
- Top Jonah
- Intra-Jonah reflector

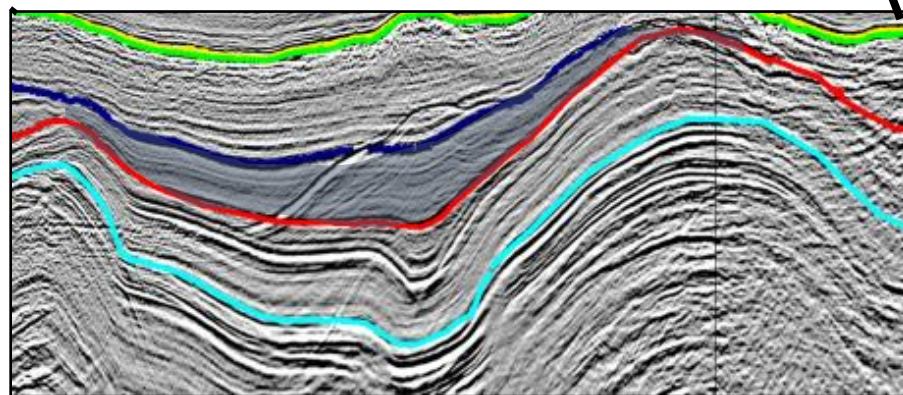
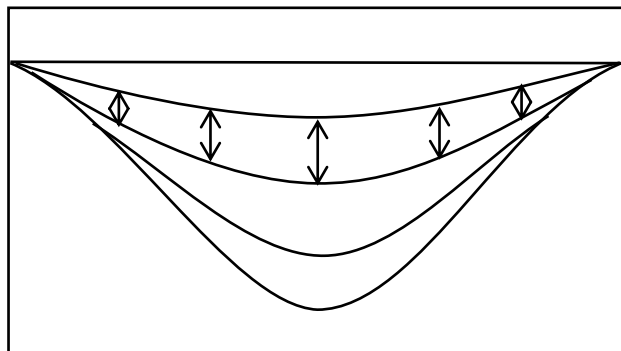
NW

Thickness variation analysis

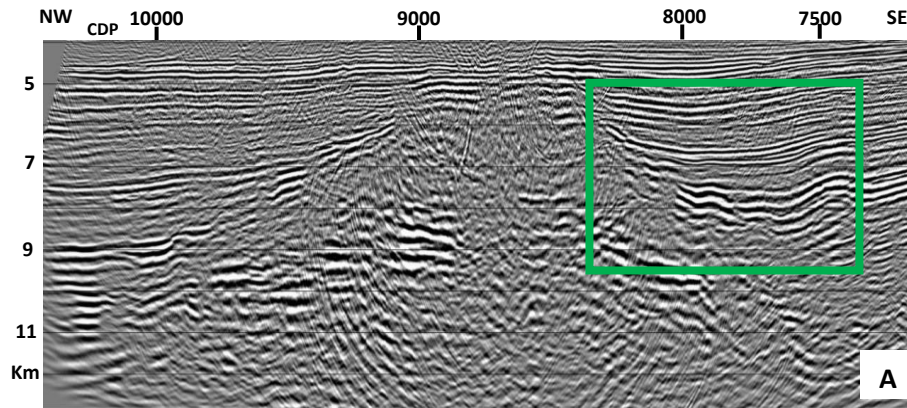
SE



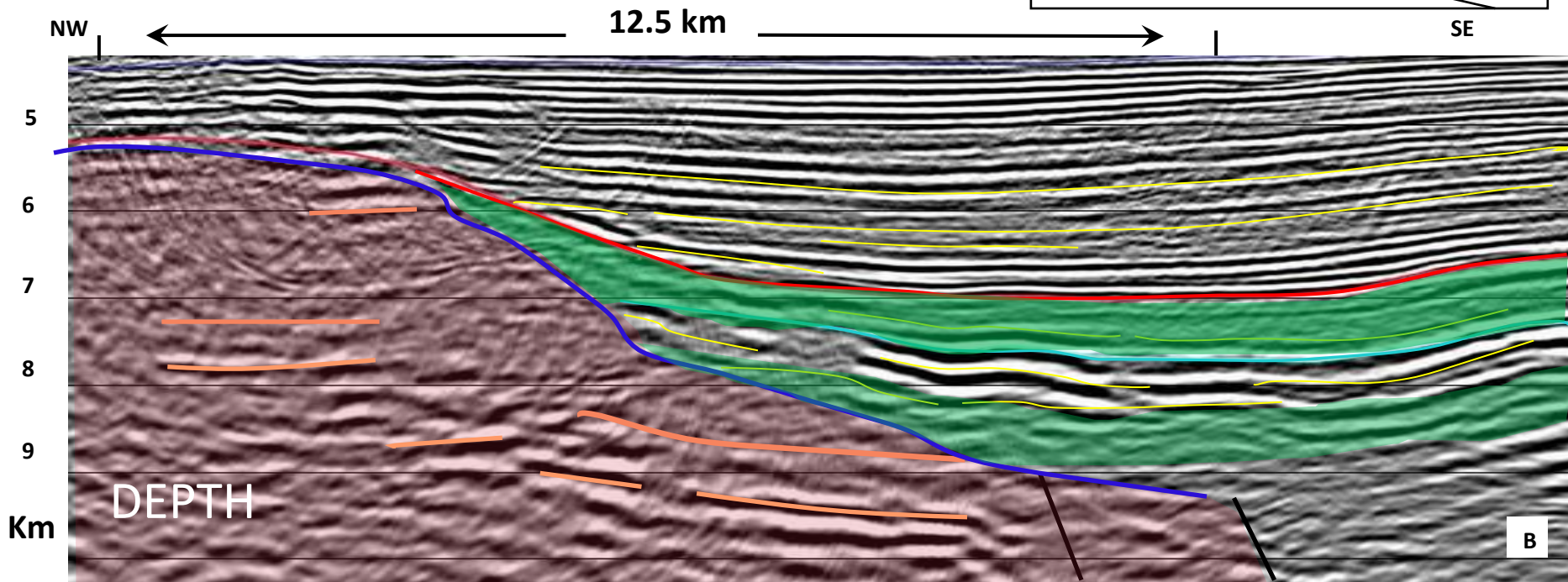
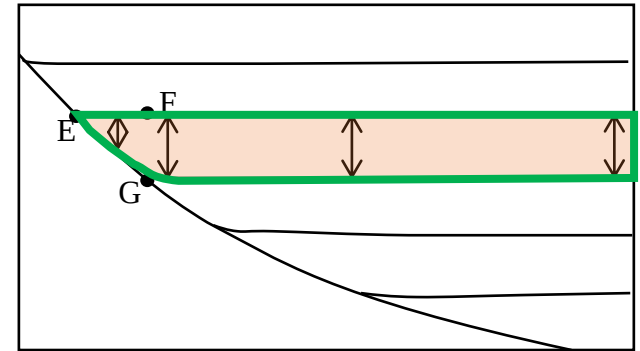
Typical Syrian Arc
syn-tectonic deposition



Example from line IS-4045



Gradual burial of pre-existing relief by onlapping strata



Horst not reactivated

Burial history of Jonah high

NW

SE

Yam-Yafo-1

MSL

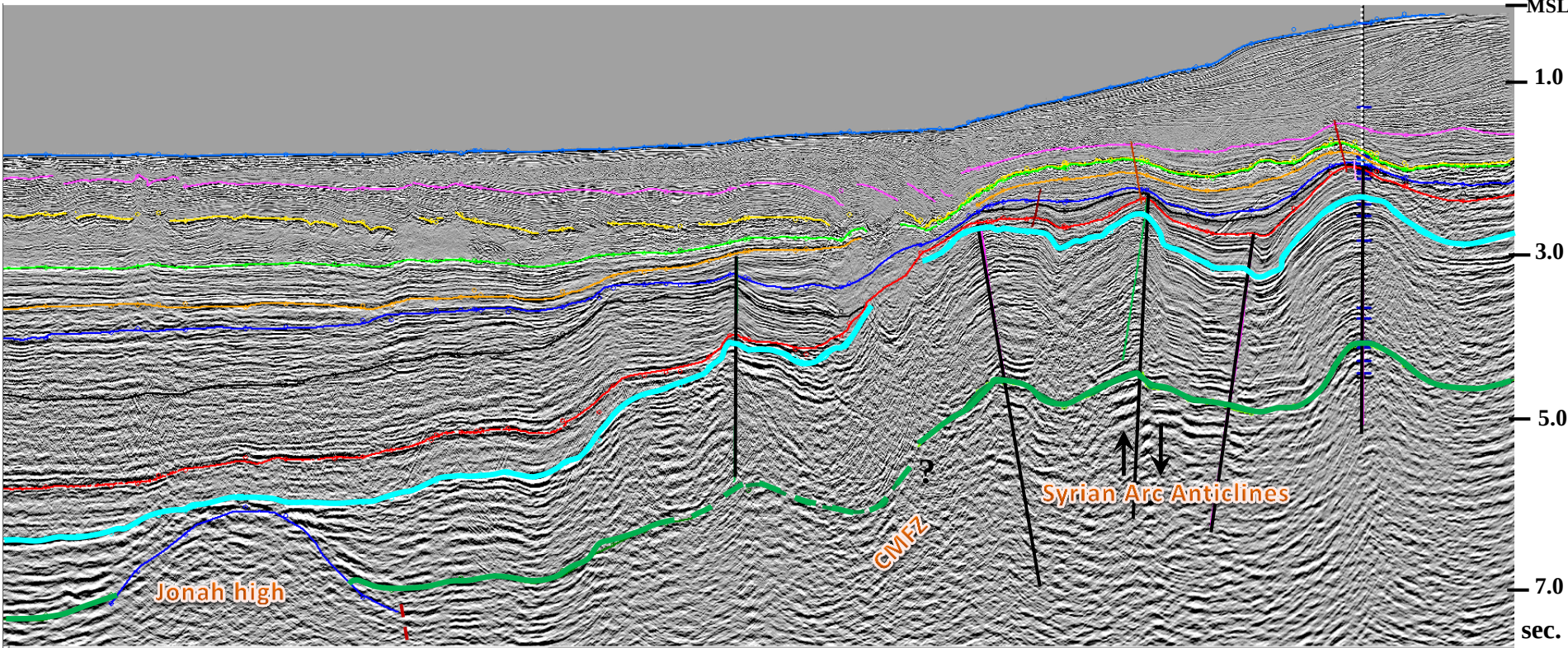
1.0

3.0

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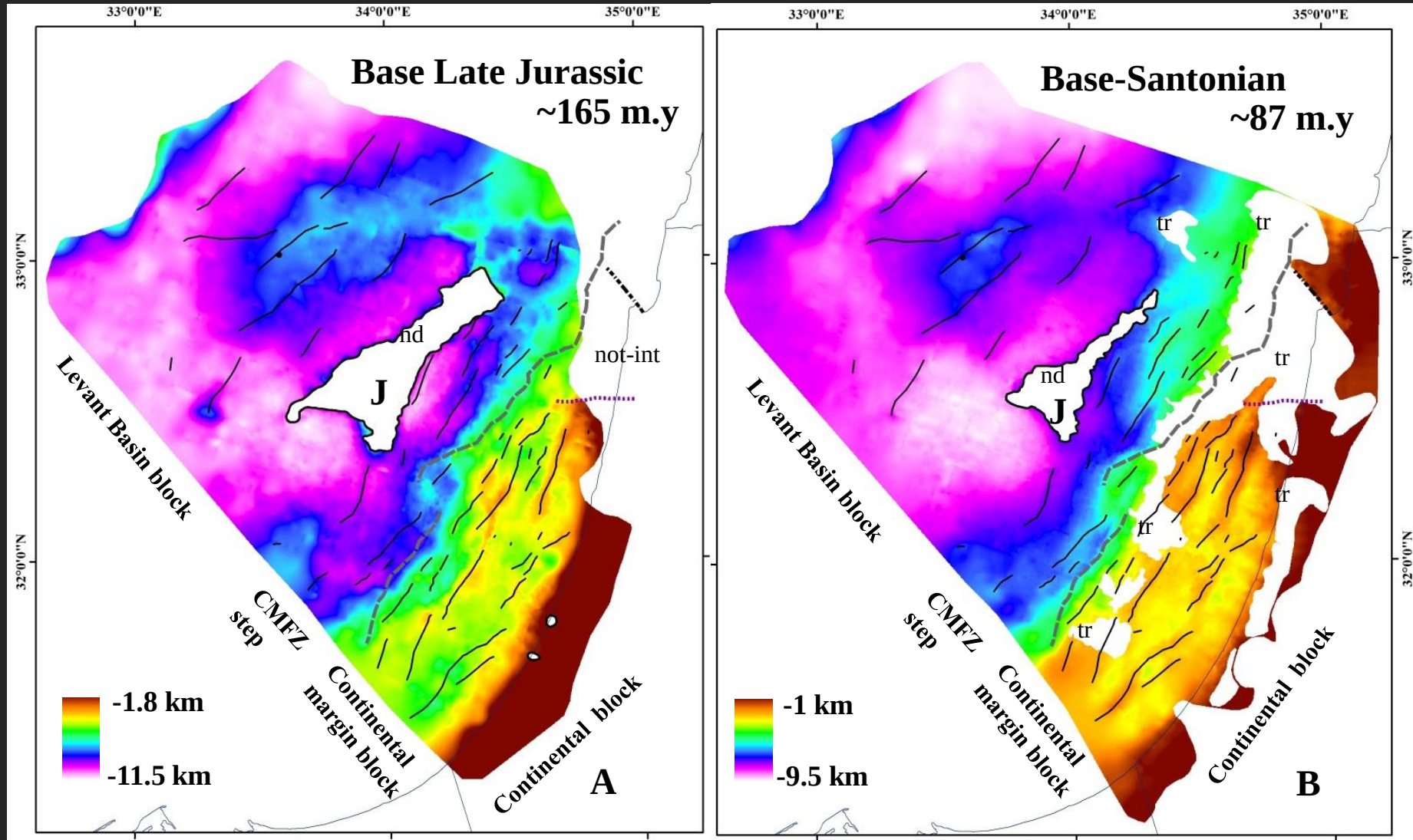
sec.



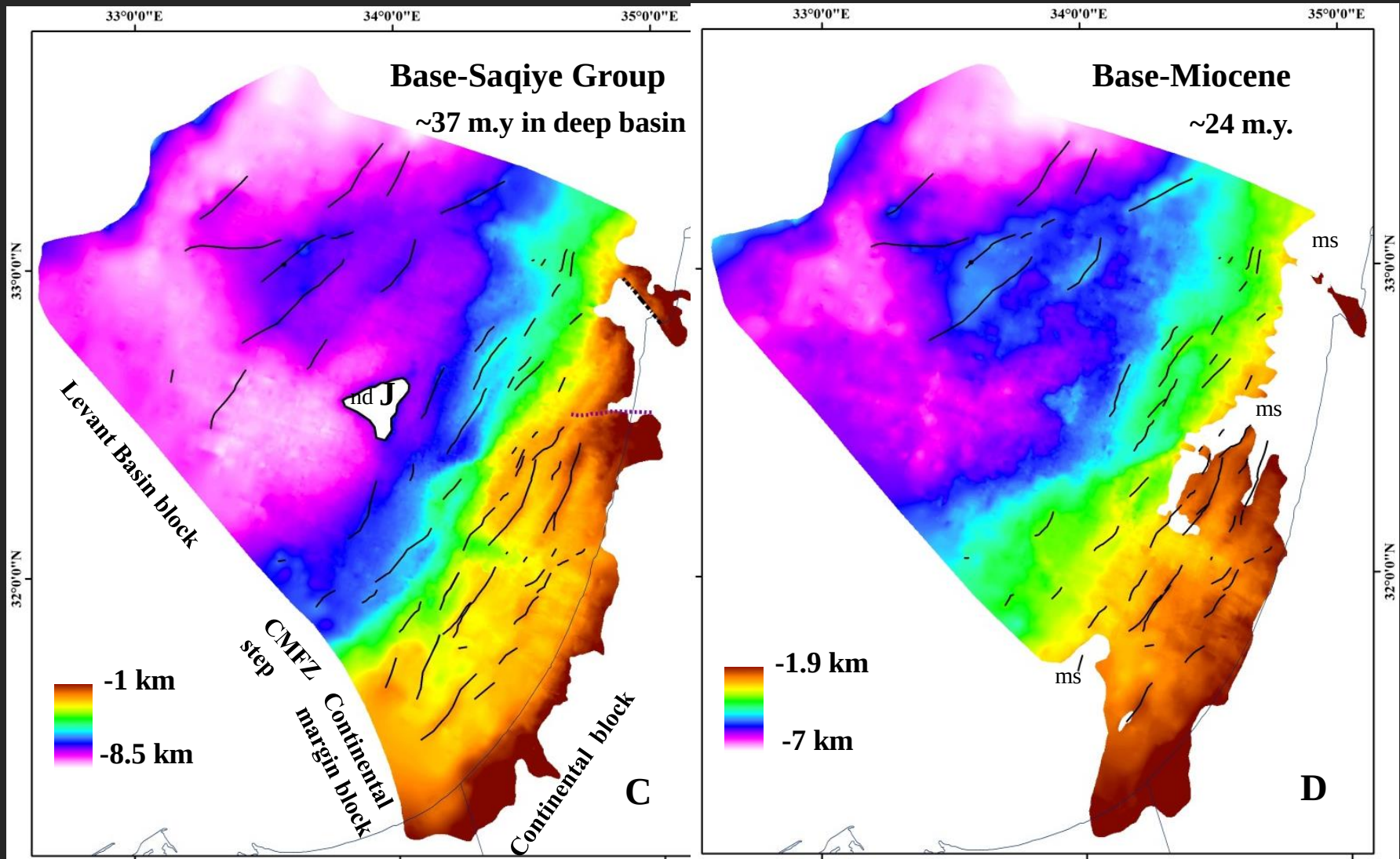
← 90 km →

Sea Floor (10)	Base Pliocene (8)	Late Miocene (6)	Base Miocene (4)	Base Santonian (2)	Top Jonah
Base Pleistocene (9)	Base Messinian (7)	Mid. Miocene (5)	Base Saqiye (3)	Base Late Jurassic (1)	

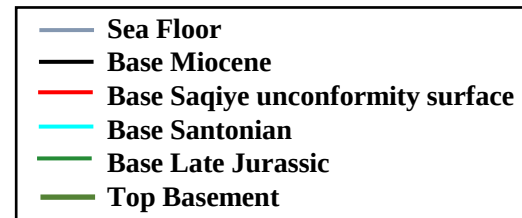
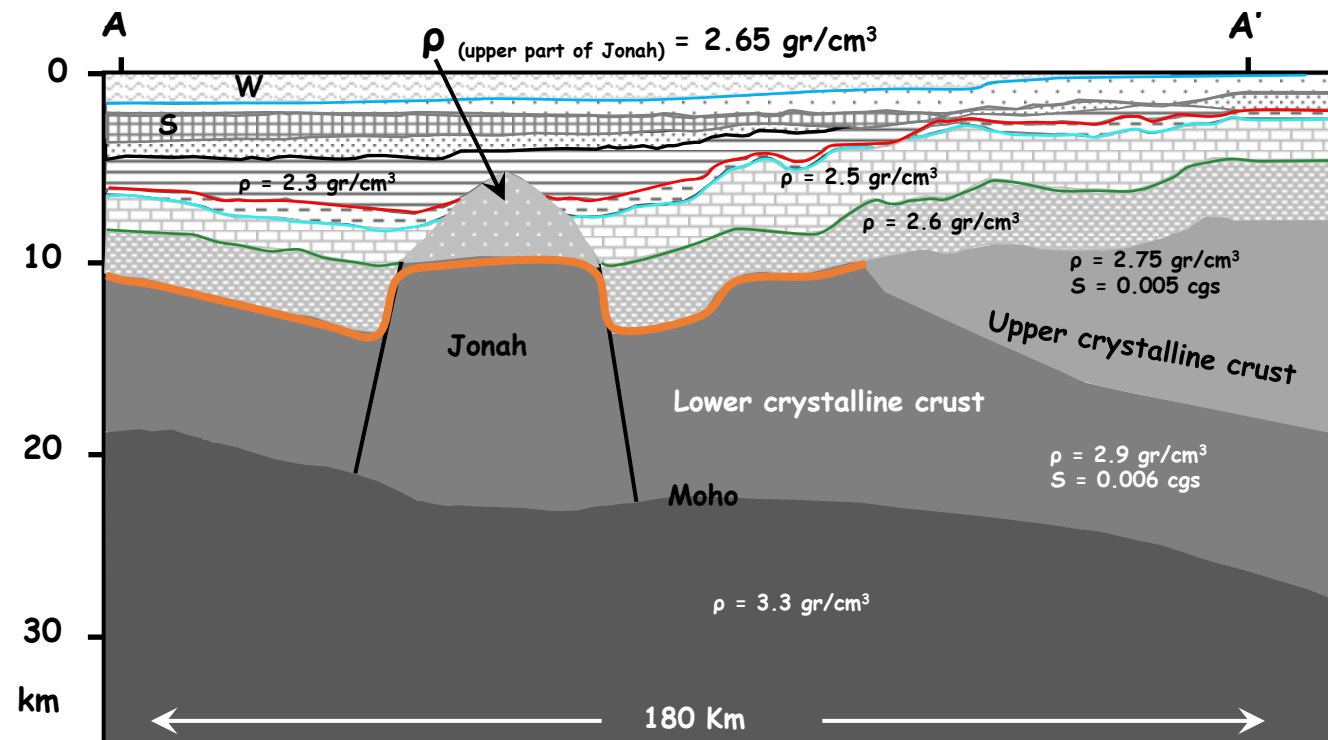
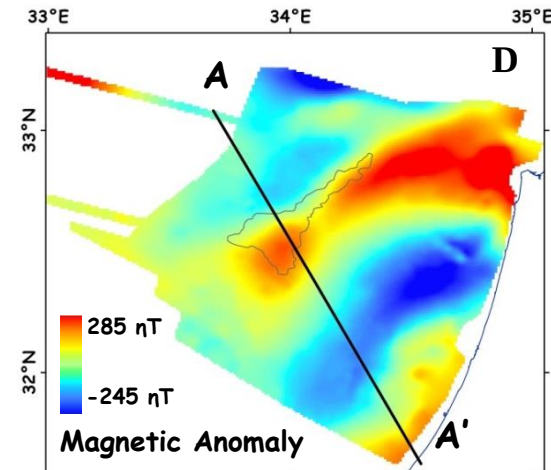
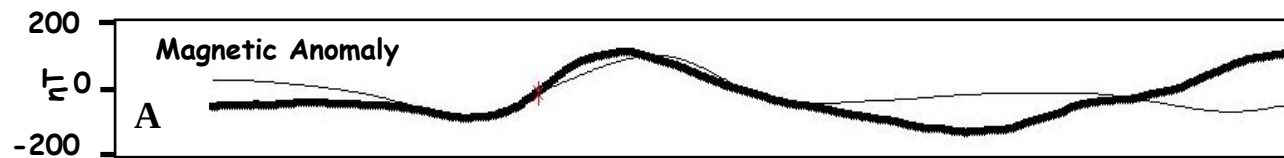
Structural Maps



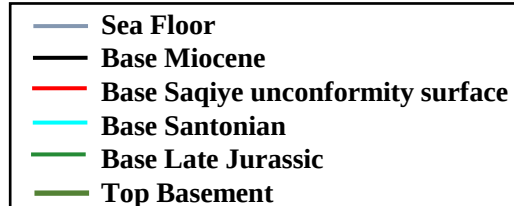
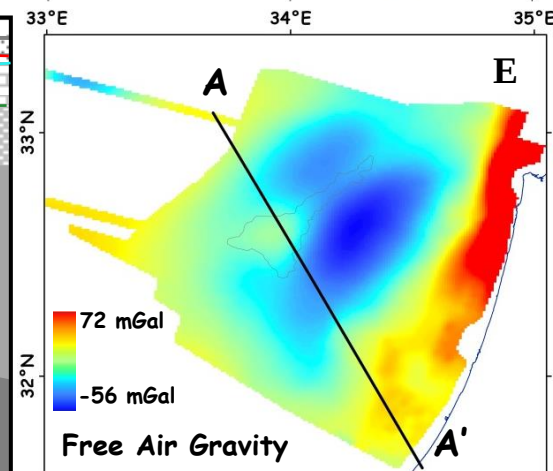
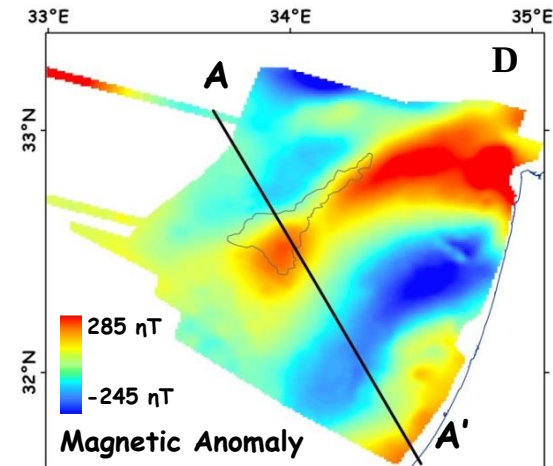
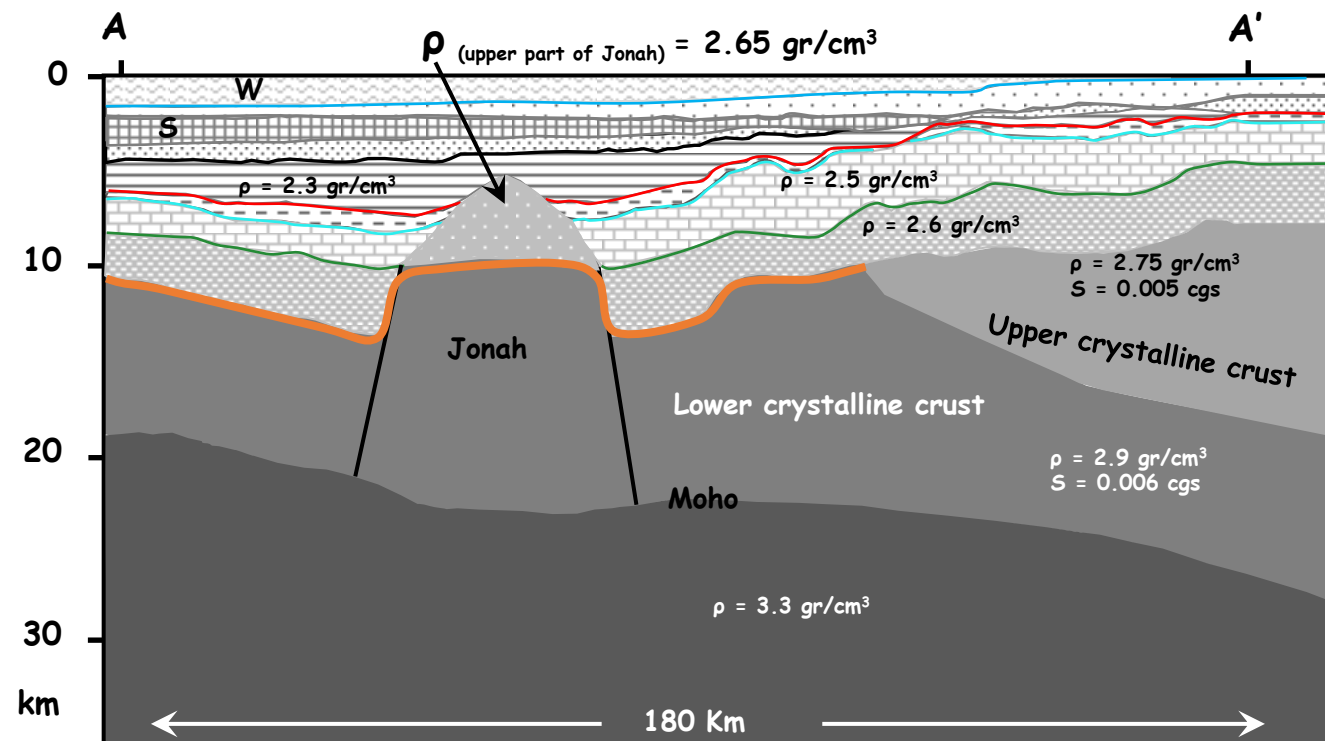
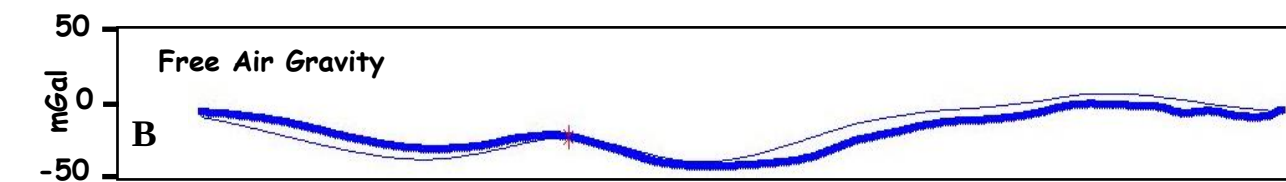
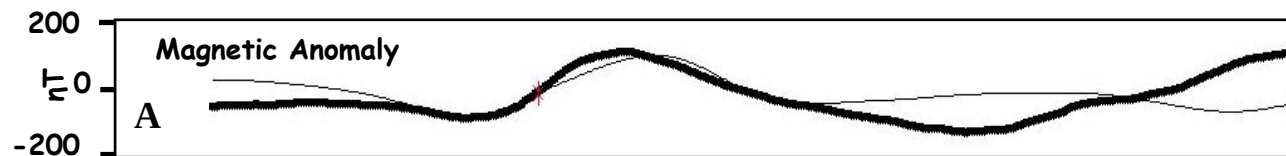
Structural Maps



Gravity and Magnetic modeling

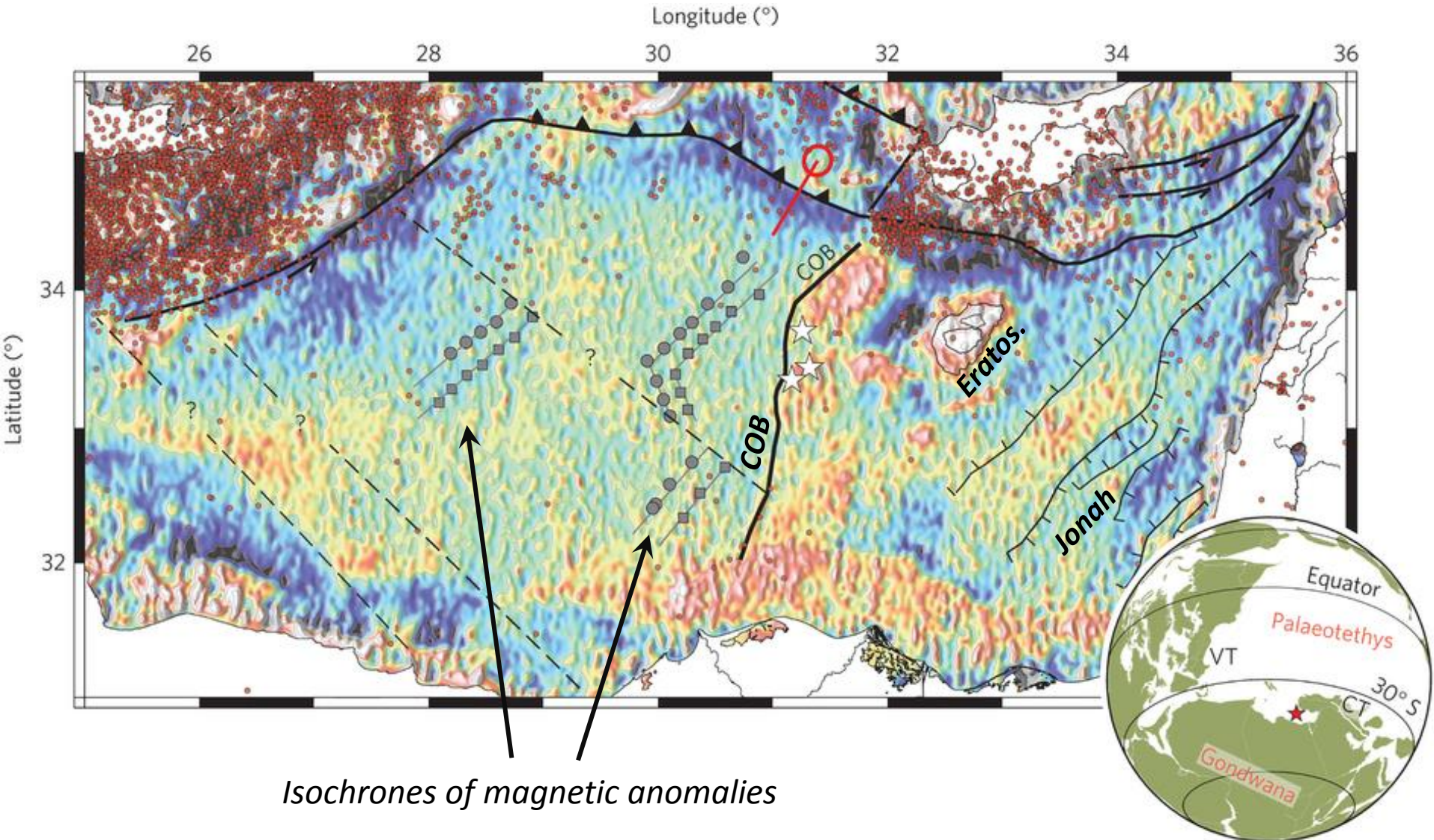


Gravity and Magnetic modeling



Granot, 2016

Tectonic map of the eastern Mediterranean



Conclusions

- Ancient horst probably formed during the rifting stage.
- Never reactivated tectonically
- Seamount that lasted ~140 m.y. until the Early Miocene (25 Ma)
- Gradually buried by onlapping sediments and coevally, was shrinking due to lateral retreat of its walls.
- It probably was occasionally growing upward by carbonate buildup that kept it high relative to its surrounding seafloor.

HORST & GRABEN STRUCTURE

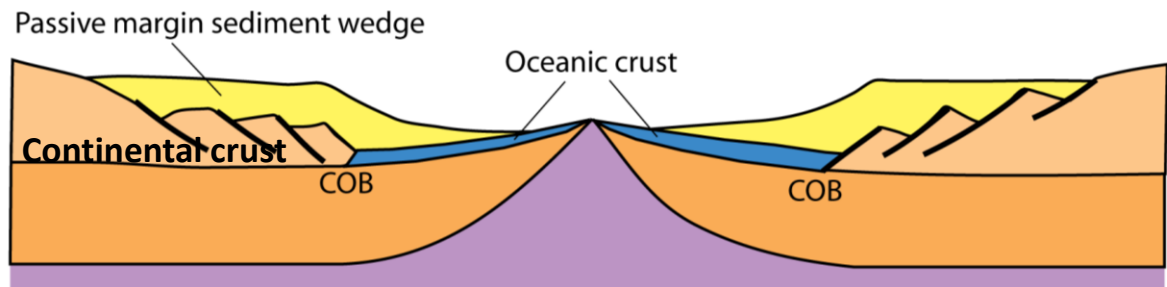
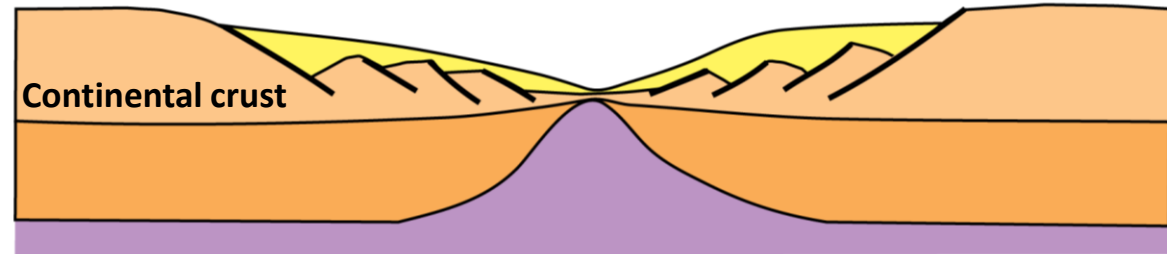


**The lithosphere was not ruptured during the
Early Mesozoic rifting**

**A thinned continental crust underlie the Levant
basin and not an oceanic one**

Horst and grabens indicate extended thinned continental crust

Extension



Lithospheric
rupture

Levant Basin Extension

Lithospheric rupture

