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The enigma of the Jonah high in the middle of the Levant basin and its significance to the history of rifting
Magnetic map (Rybakov et al., 1996)

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

Ancient horst? (Gardosh et al., 2008)

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

Volcanic edifice? (Rybakov et al., 2011)
The Enigma of Jonah high:

**Horst?**  **Fold?**  **Magmatic body?**

- **Rifting stage**
- Amount of extension
- Heat flow
- Reconstruction of plate’s fragments

**Post rift contractional phase** –

the equivalent of the onshore Syrian Arc fold system?

- 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?
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 A A’
PSDM of line EMED-39

\[ V = 4000 \text{ m/s below mid. Miocene} \]
PSDM of line EMED-39

V = 5000 m/s below mid. Miocene
PSDM of line EMED-39

V = 5500 m/s below mid. Miocene
PSDM of line EMED-39

\[ V = 6000 \text{ m/s below mid. Miocene} \]
Line EMED-39 final interval velocity model
Typical Syrian Arc
syn-tectonic deposition
Gradual burial of pre-existing relief by onlapping strata

Typical Syrian Arc syn-tectonic deposition
Typical Syrian Arc:

Syn-tectonic deposition

Gradual burial of pre-existing relief by onlapping strata

Horst not reactivated
Burial history

Yam-Yafo-1

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

Mid-Late Jurassic transition
~165 m.y

Base-Santonian
~87 m.y

-1.8 km
-11.5 km

-1 km
-9.5 km
The diagram illustrates various geophysical data and geological layers along a transect A-A'.

- **Magnetic Anomaly (A)**: Shows a series of magnetic anomalies labeled A' to D'.
- **Free Air Gravity (B)**: Displays gravity anomalies in milligals (mGal).

The geological layers include:
- **Moho**: The boundary between the crust and the mantle.
- **Lower Crystalline Crust**
- **Upper Crystalline Crust**

The density values (ρ) and magnetic susceptibility (S) are specified for different layers:
- **Moho**: ρ = 3.3 gr/cm³, S = 0.005 cgs
- **Upper Crystalline Crust**: ρ = 2.75 gr/cm³, S = 0.005 cgs
- **Upper part of Jonah**: ρ = 2.65 gr/cm³
- **Base Santonian**: Approximate mid-late Jurassic
- **Base Saqye unconformity surface**: Base Miocene

The density values for specific layers are:
- **ρ (upper part of Jonah)**: 2.65 gr/cm³
- **ρ (lower part of Jonah)**: 2.5 gr/cm³
- **ρ (unconformity surface)**: 2.3 gr/cm³

The gravity and magnetic data are color-coded, with different ranges indicating variations in density and magnetic susceptibility.
Conclusions

• Jonah is an ancient horst probably formed during late Paleozoic – Early Mesozoic rifting.

• During its long history (~140 m.y.) it was never reactivated tectonically.

• 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.

The lithosphere was not ruptured during the Early Mesozoic rifting

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