Important Conclusions on the Messinian Salinity Crisis Depositional History of the Eastern Mediterranean Basin

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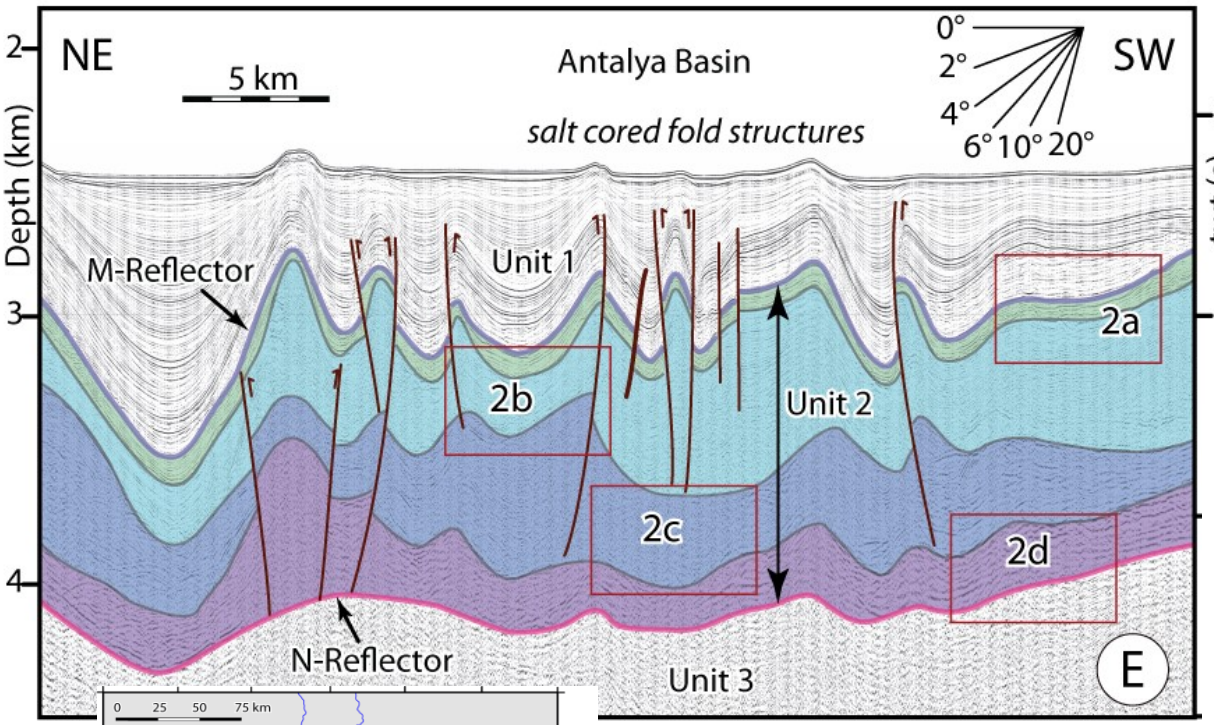
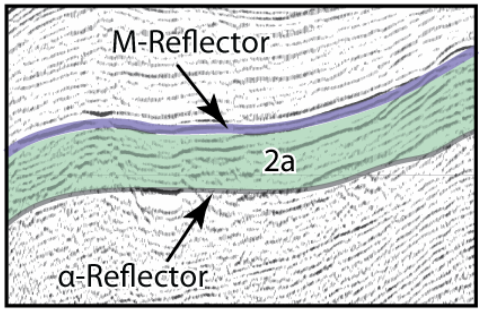
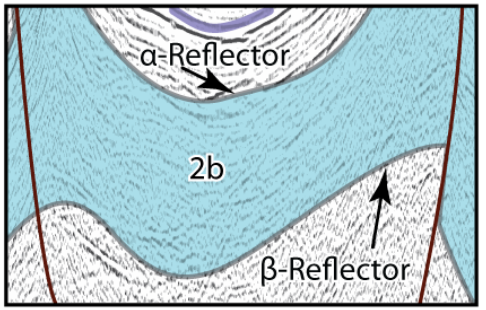
➢ Critical Contributions -Seismic Stratigraphic Approach to MSC Deposits

❑ *Internal seismic stratigraphy of the Messinian evaporites; Unit 2:Messinian*

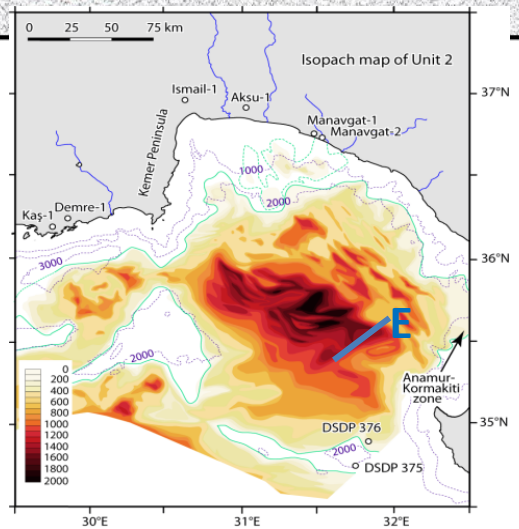


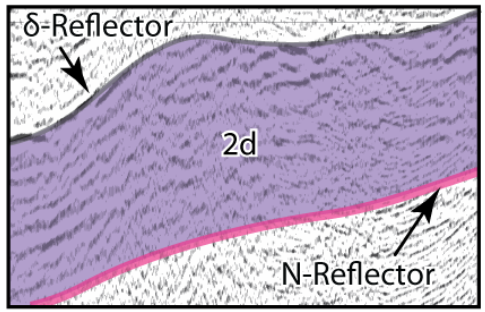


UU= Upper Unit



MU-1= Mobile Unit 1-Salt





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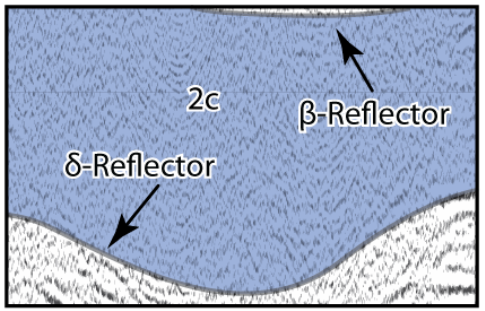
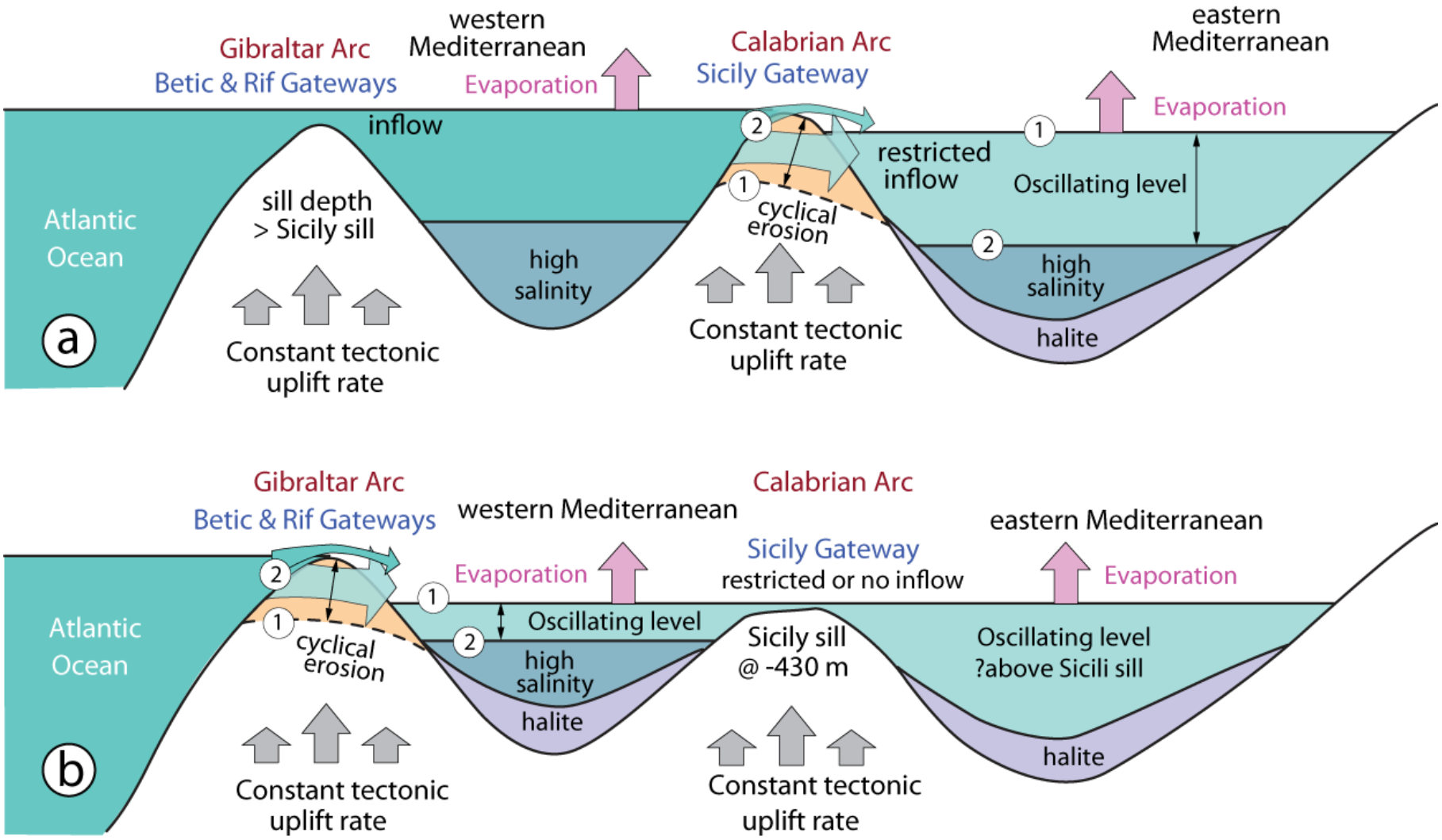


MU-2= Mobile Unit 2-Salt + intercalated siliciclastics

Messinian Salinity Crisis Depositional Model (Combined Model)

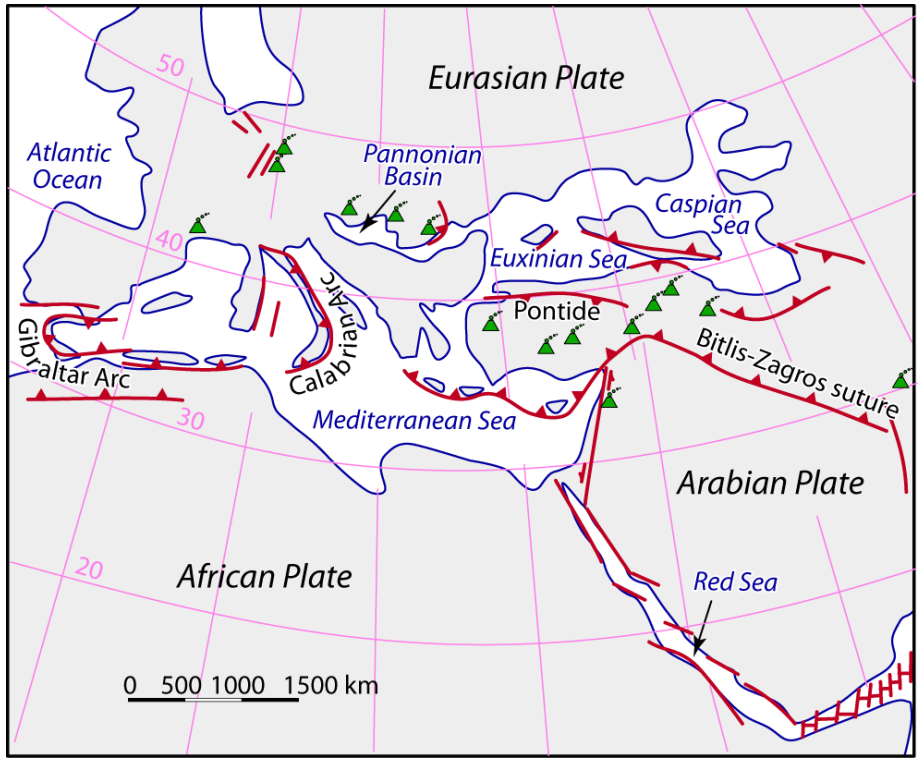
2 Minutes Madness



❖ *Depositional process was similar but was not time equivalent in the EM and WM-salt first deposited in the EM and then WM*

➢ I. Introduction - Messinian Salinity Crisis

❑ *Why did the Mediterranean become isolated from the global ocean?*

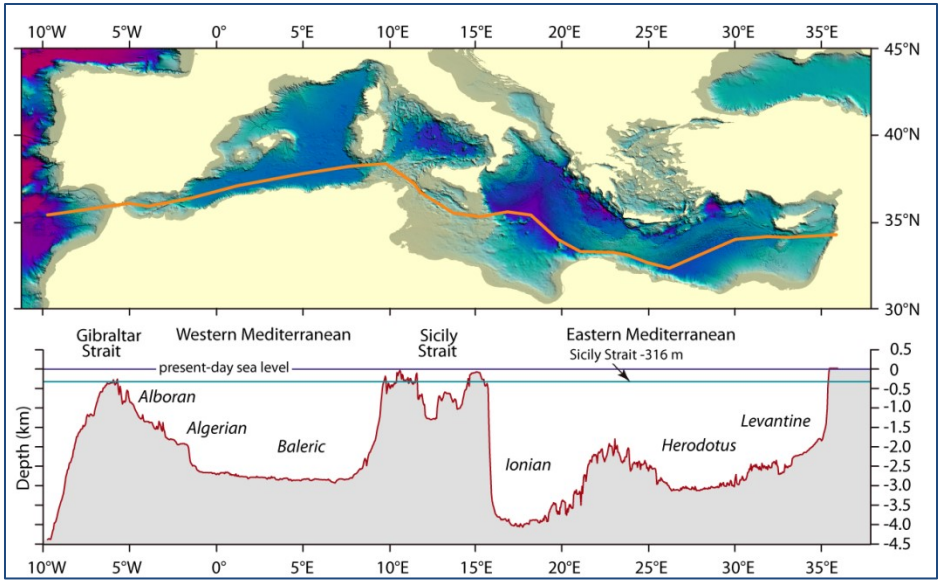


- *~ 6 Ma, closure of the water connection between the Mediterranean Sea with the Atlantic Ocean*
- *Desiccation of the Mediterranean Sea*
- *Significant amounts of evaporation across the Mediterranean Sea*

❖ *The tectonic evolution of two regions are critical for the MSC*

➢ *Lithospheric slab detachment and roll back possible cause for this protracted Gibraltar Arc uplift which initiated the MSC*

➢ *The lithospheric slab detachment and roll back across the Calabrian Arc and the subsequent uplift of the Sicily created a major topographic block separating the EM and WM seas(Resenbaum et al., 2002)*



Güneș et al. (2017)

➢ II. Data and Methods

Güneş. et al. (2017)

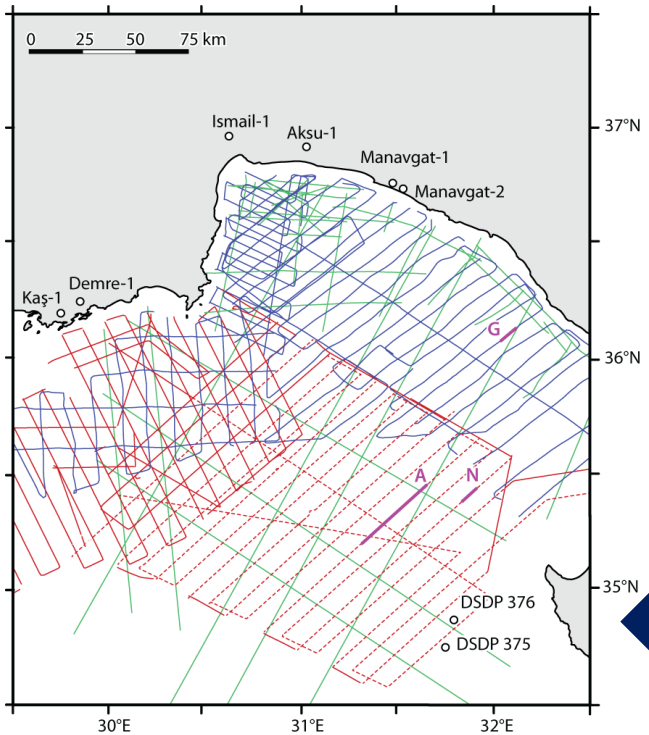
- *High Resolution Seismic Reflection Data Collecting*
- *Data Processing (~3000 km)*
- *Data Interpretation (~10000 km)*

✓ *Multibeam Data (IFREMER)*

✓ *Deep Penetrating seismic data*

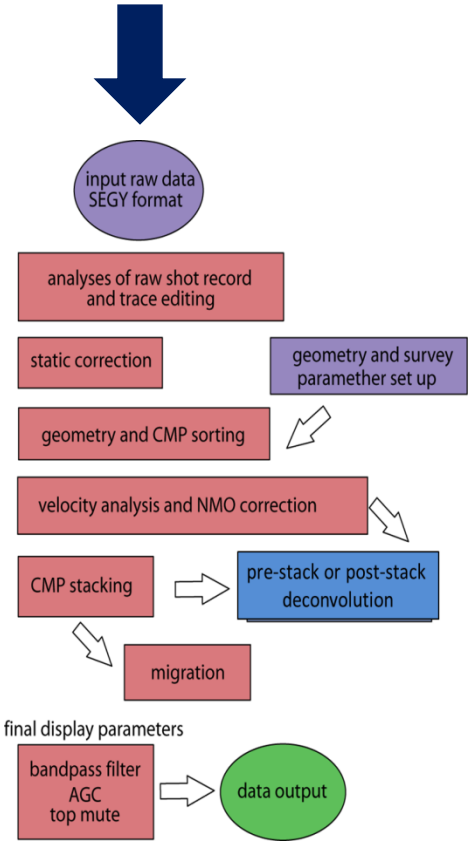
✓ *Onshore and offshore well data*

❑ Data Collecting

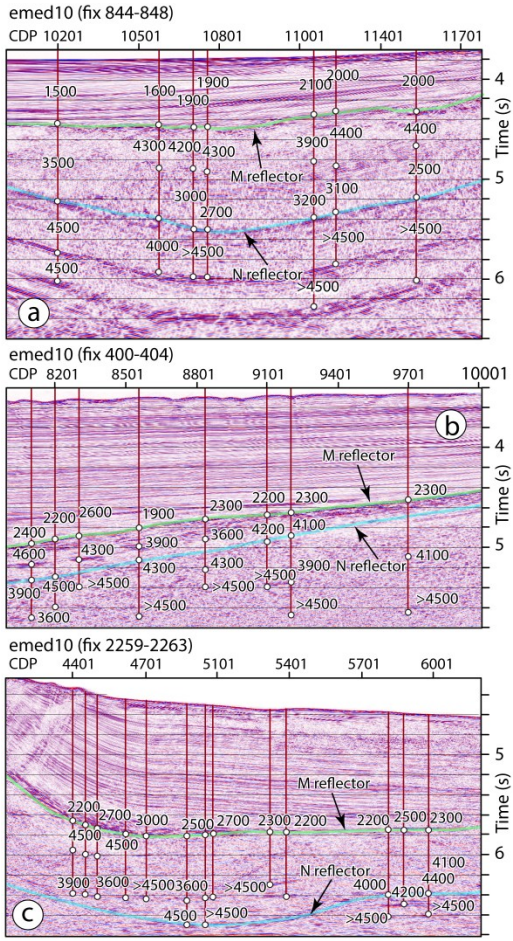


❑ Data Processing

❖ *sequences of the seismic processing steps.*



❖ *Interval velocities*



❖ *Locations of the multi-channel seismic reflection profiles and the onshore /offshore well data used in this study.*

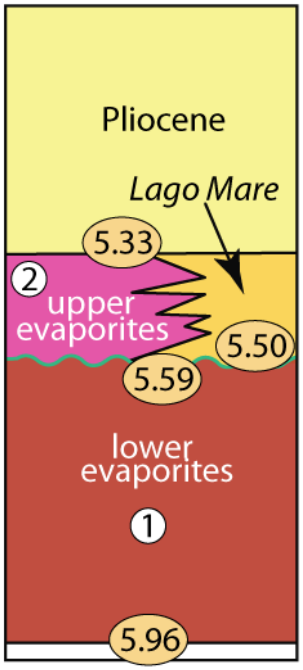
➢ III. Messinian Salinity Crisis

Güneş et al. (2017)

❑ Previous MSC Depositional Models

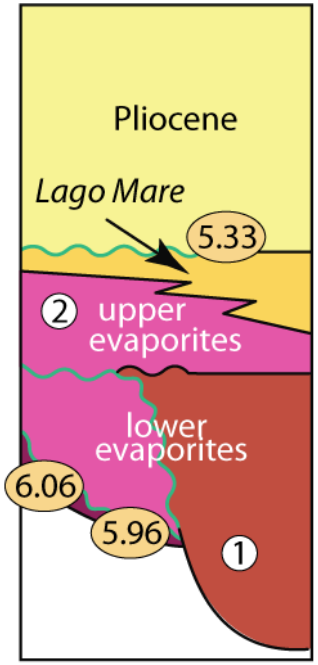
Model I

Krijgsman et al. (1998)



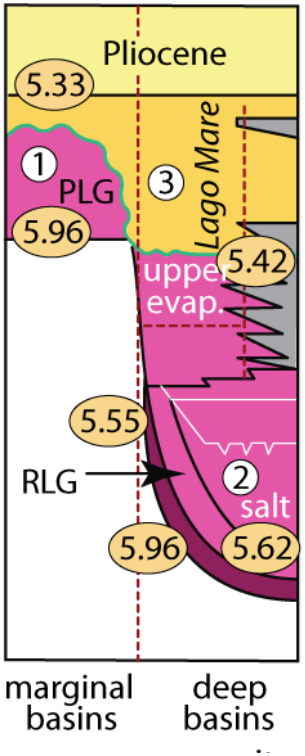
Model II

Rouchy & Caruso (2004)

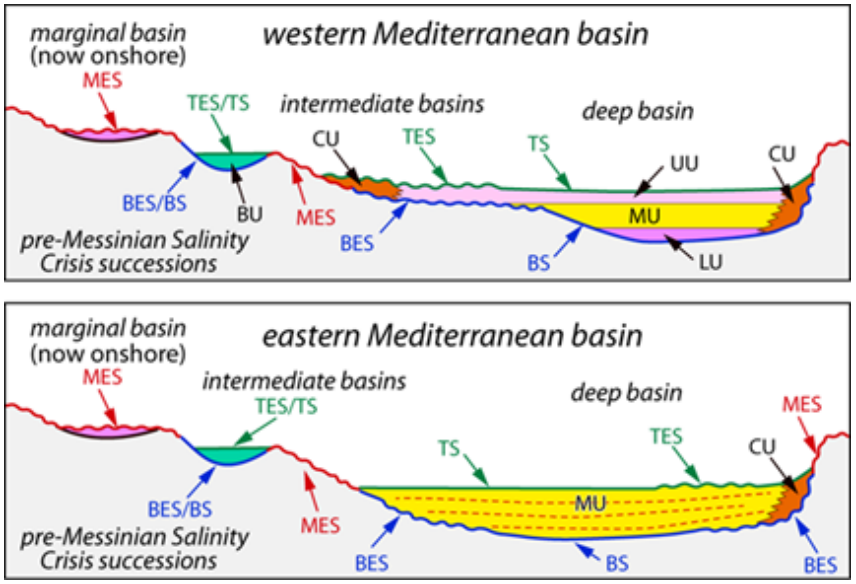


Model III

Roveri et al. (2008a,b, 2014a,b)



❑ Messinian Salinity Crisis Successions in the eastern and western Mediterranean



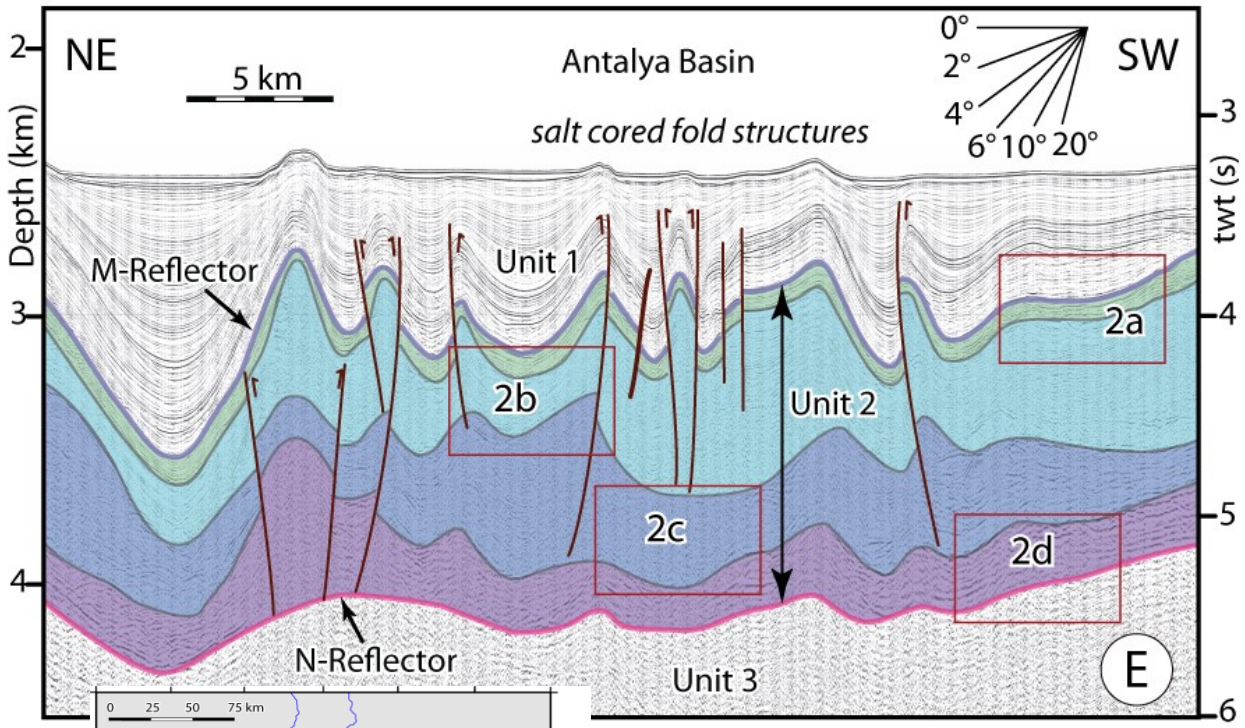
Roveri et al. (2014)

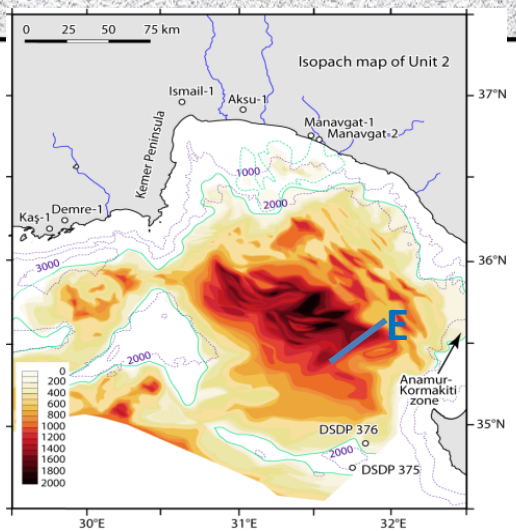
- ❖ *Model I ;a synchronized deposition*
- ❖ *Model II; a diachroneous deposition*
- ❖ *Model III; a slight diachroneity*

Recent studies and also this study favor diachroneous deposition Model III

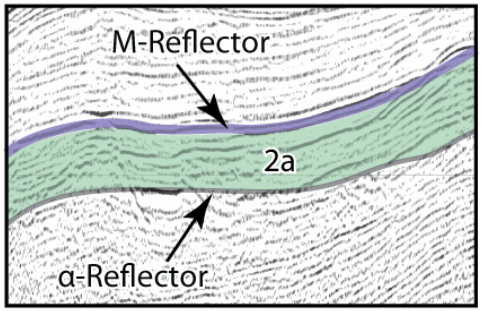
➢ III. Results-Seismic Stratigraphic Approach to MSC Deposits

❑ *Internal seismic stratigraphy of the Messinian evaporites; Unit 2:Messinian*





Güneş. et al. (2017)



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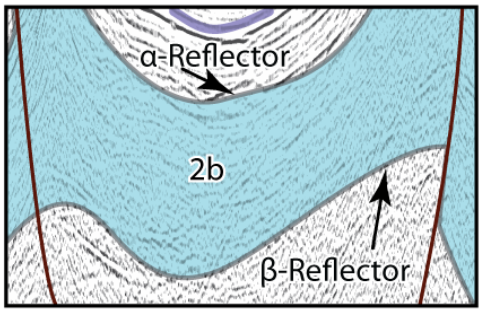

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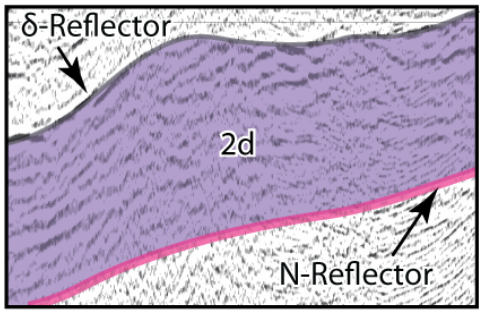

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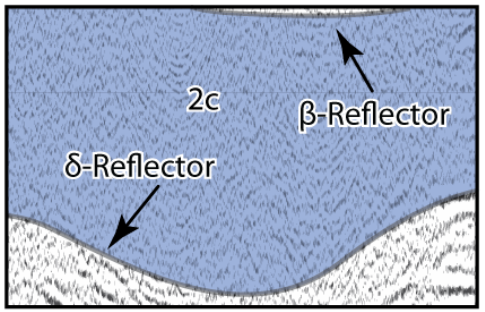
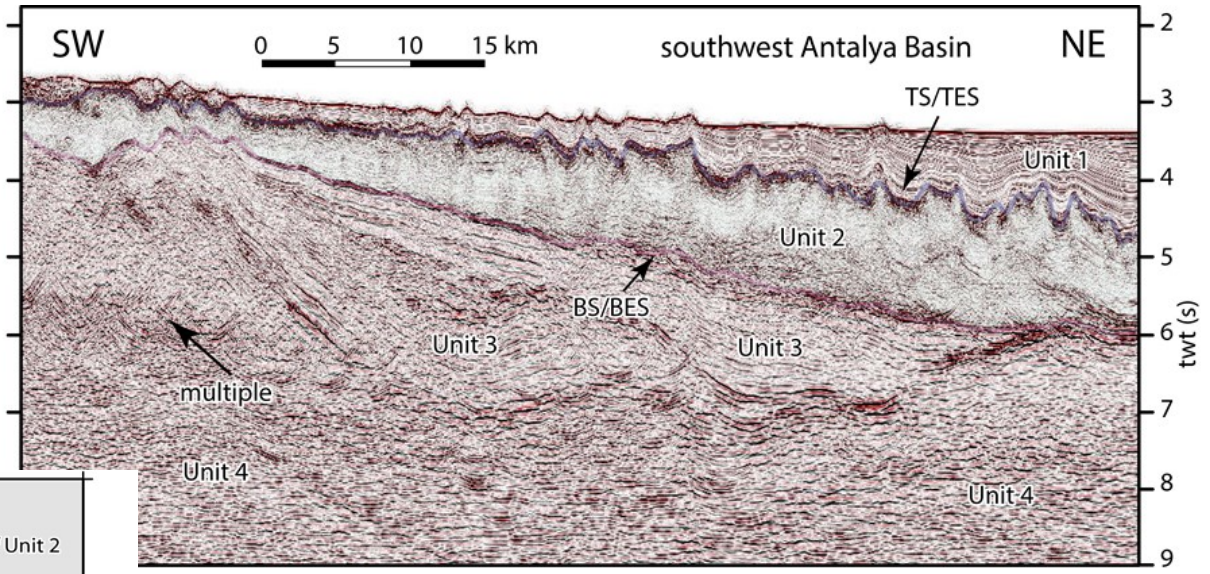


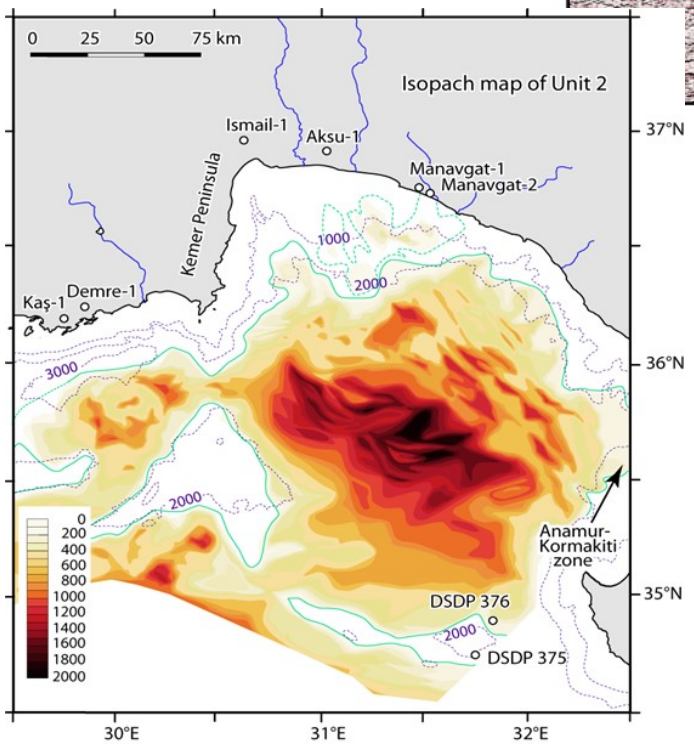
MU-2= Mobile Unit 2-Salt + intercalated siliciclastics

➢ III. Results-Seismic Stratigraphic Approach to MSC Deposits

❑ Distribution of the Messinian evaporites (Unit 2) along the study area

➢ *The isopach map of the Messinian evaporites of Unit 2 shows the presence of a very prominent Messinian depocentre which was nestled between the northern foothills of the Florence Rise and the southern continental margin of the Antalya Basin.*





➢ *1000 ms twt is ~ 2000 m of Messinian sediment.*

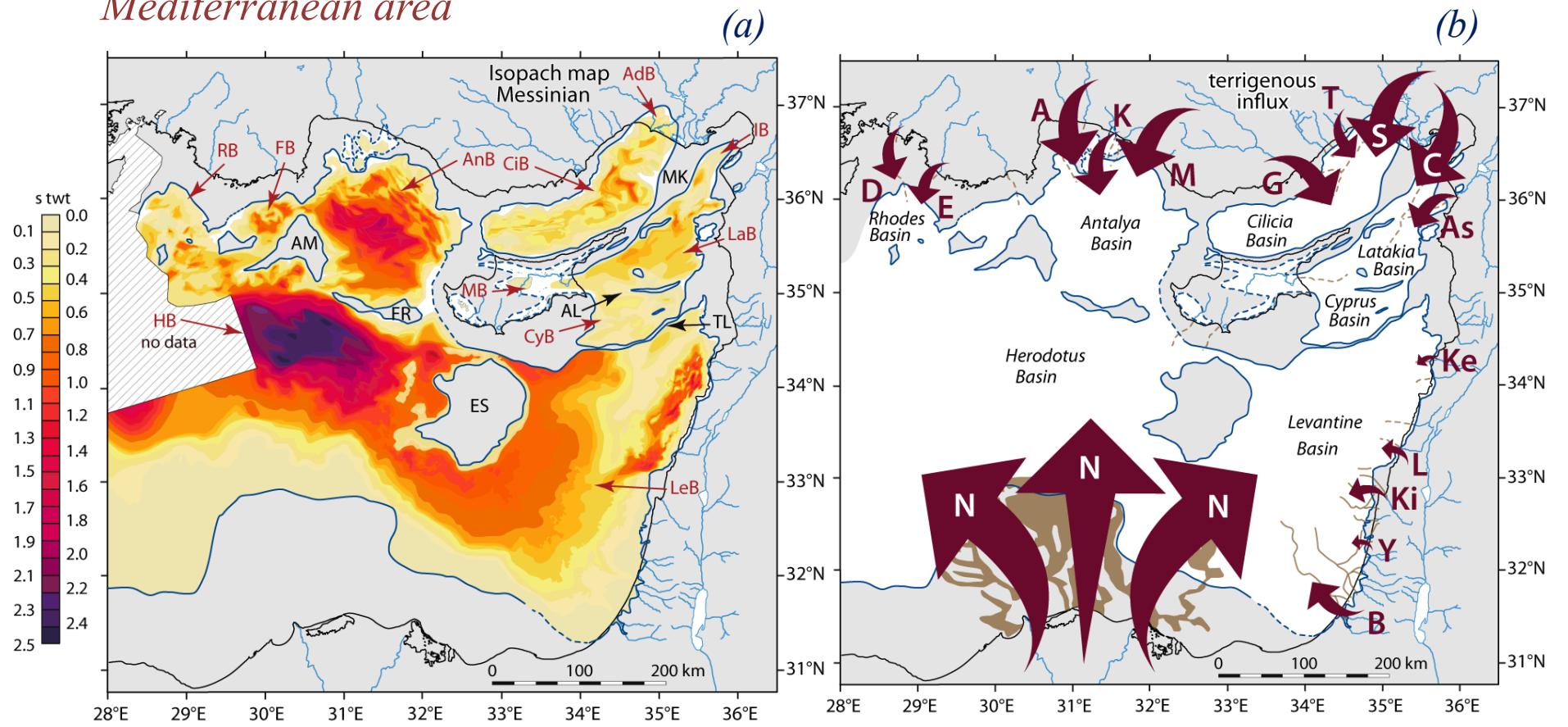
➢ *Thickest sediments exceeding 2000 ms occur across the Southern Antalya Basin.*

➢ *Messinian evaporites of Unit 2 largely absent across the continental shelf and continental slope.*

Güneş. et al. (2017)

➢ IV. Discussion-MSC in the big picture

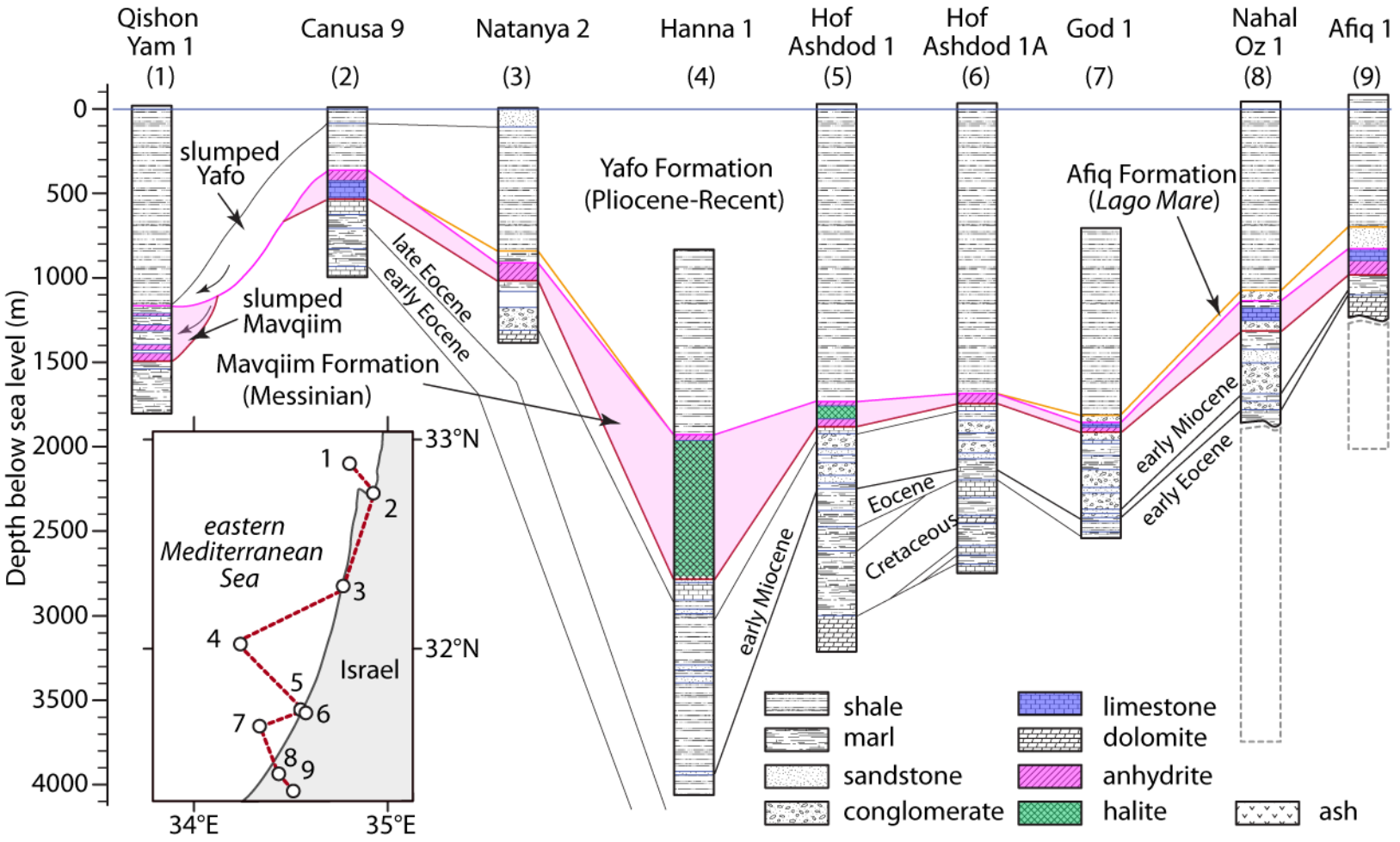
❑ Unit 2: Distribution of the Messinian Salinity Crisis deposits –entire eastern Mediterranean area



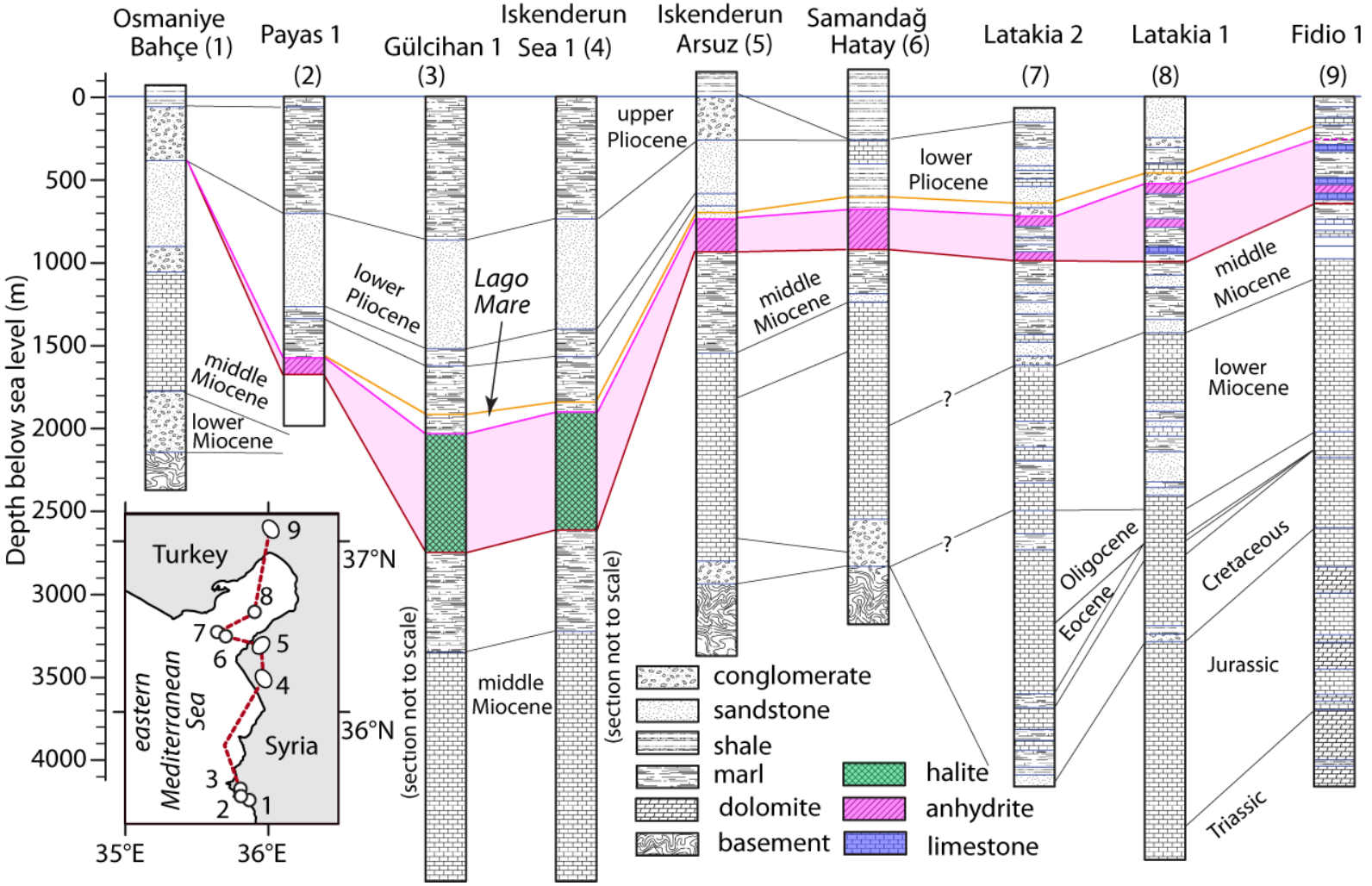
- *The sedimentation during the MSC was characterized by two critical and competing modes*
  - *(a) evaporative sedimentation leading to the deposition of carbonates, gypsum and halite*
  - *(b) siliciclastic sedimentation associated with the rivers entering into the eastern Mediterranean*

Güneş. et al. (2017)

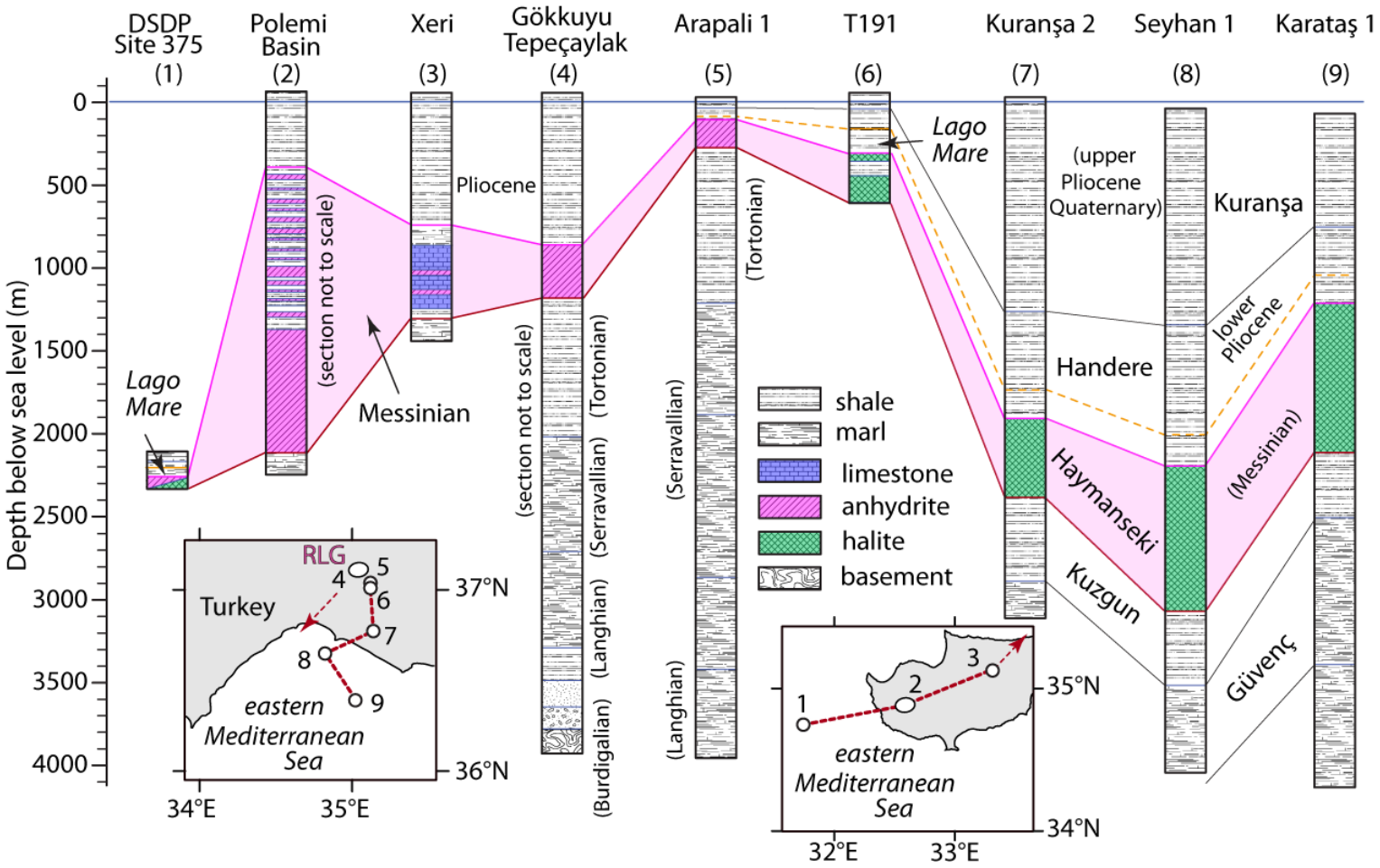
➢ *IV. **Discussion** – Intermediate and marginal basins across the eastern and northeastern Mediterranean experienced evaporative sedimentation during the MSC-Israel*



➢ *IV. **Discussion** - Intermediate and marginal basins across the eastern and northeastern Mediterranean experienced evaporative sedimentation during the MSC – Southeastern Turkey and Syria*



➢ *IV. **Discussion** - Intermediate and marginal basins across the eastern and northeastern Mediterranean experienced evaporative sedimentation during the MSC – northeastern Mediterranean and Cyprus*

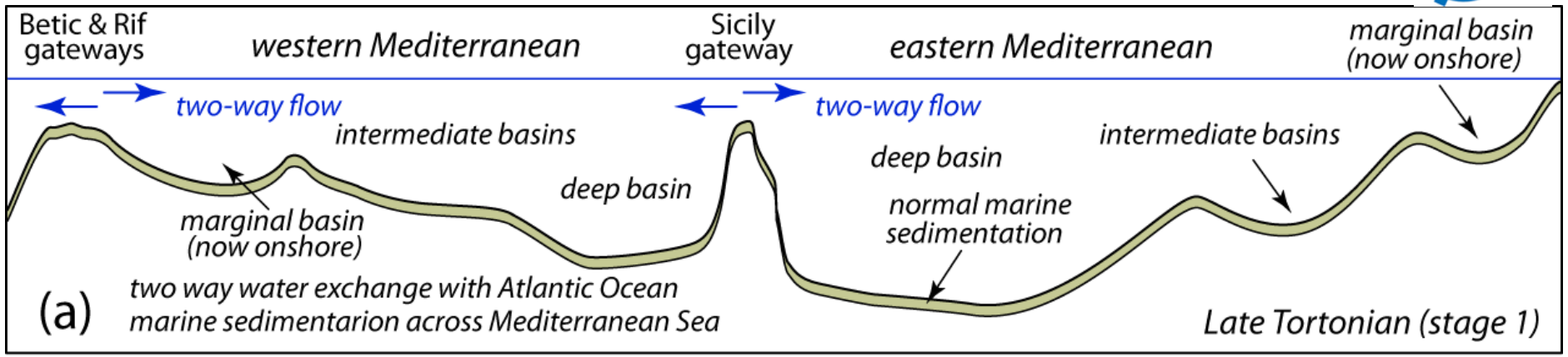


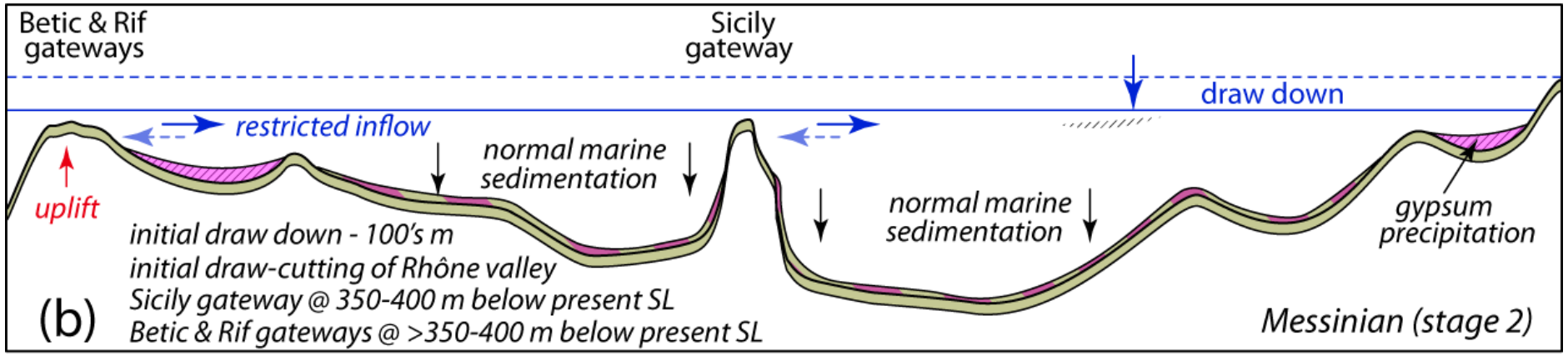
❑ ***IV. Discussion*** *- The evolution of the distinctive sedimentary successions associated with the Messinian Salinity Crisis has several unique features and requirements…*

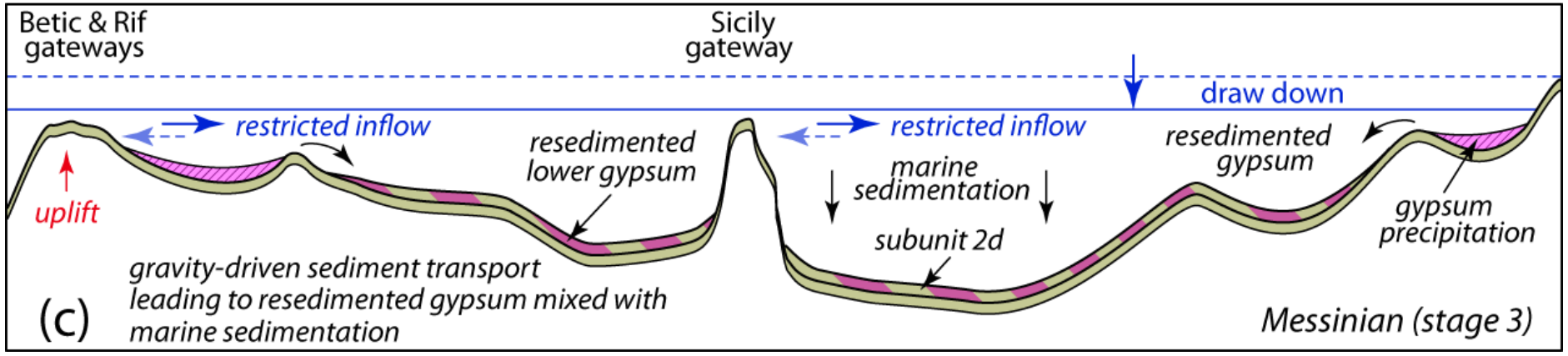
- ✓ *If salty water only comes from Atlantic Ocean*
- ✓ *If salt (2b+2c) in the EM older than the WM, eg. Blanc, 2000*
- ✓ *Enormous quantities of evaporites precipitated during the Messinian Salinity Crisis, which requires the evaporation of 75–100 times the volume of the Mediterranean (This study)*
- ✓ *A 4-unit stratigraphy (including sub-units 2a–2d) developed across the western and eastern Mediterranean region (This study)*
- ✓ *Largest rivers flowing into the nearly-desiccated Mediterranean excavated deep gorges exceeding like Nile delta (Barber 1981) and Rhône River*
- ✓ *Strontium isotope data indicate that the deposition of sub-unit 2c took place in a restricted Mediterranean with reduced connectivity with the Atlantic, whereas that of sub-unit 2b occurred in predominantly continental waters with little or no connection to the ocean (Flecker and Elam, 2006).*

- ➢ *A geologically feasible mechanism is needed for the closure of the Betic and Rif gateways,*
- ➢ *For the volume of evaporites deposited across the Mediterranean Sea dictates that the Betic and Rif gateways must have been very shallow, but leaky,*
- ➢ *The development of evaporites across the eastern Mediterranean and the strontium isotopic data require a geologically feasible mechanism for the closure of the Sicily Gateway,*
- ➢ *The development of massive quantities of evaporites across the eastern Mediterranean dictates that the Sicily Gateway must have been very shallow, but leaky, and*
- ➢ *The development of massive gypsum deposits at the basin margins indicating minor sea-level drawdown, and the massive salt deposits across the deep basins requiring kilometre-scale sea-level drawdown clearly document that multiple phases of filling and drawdown must have taken place, requiring a strong mechanism for these large-scale sea-level oscillations.*

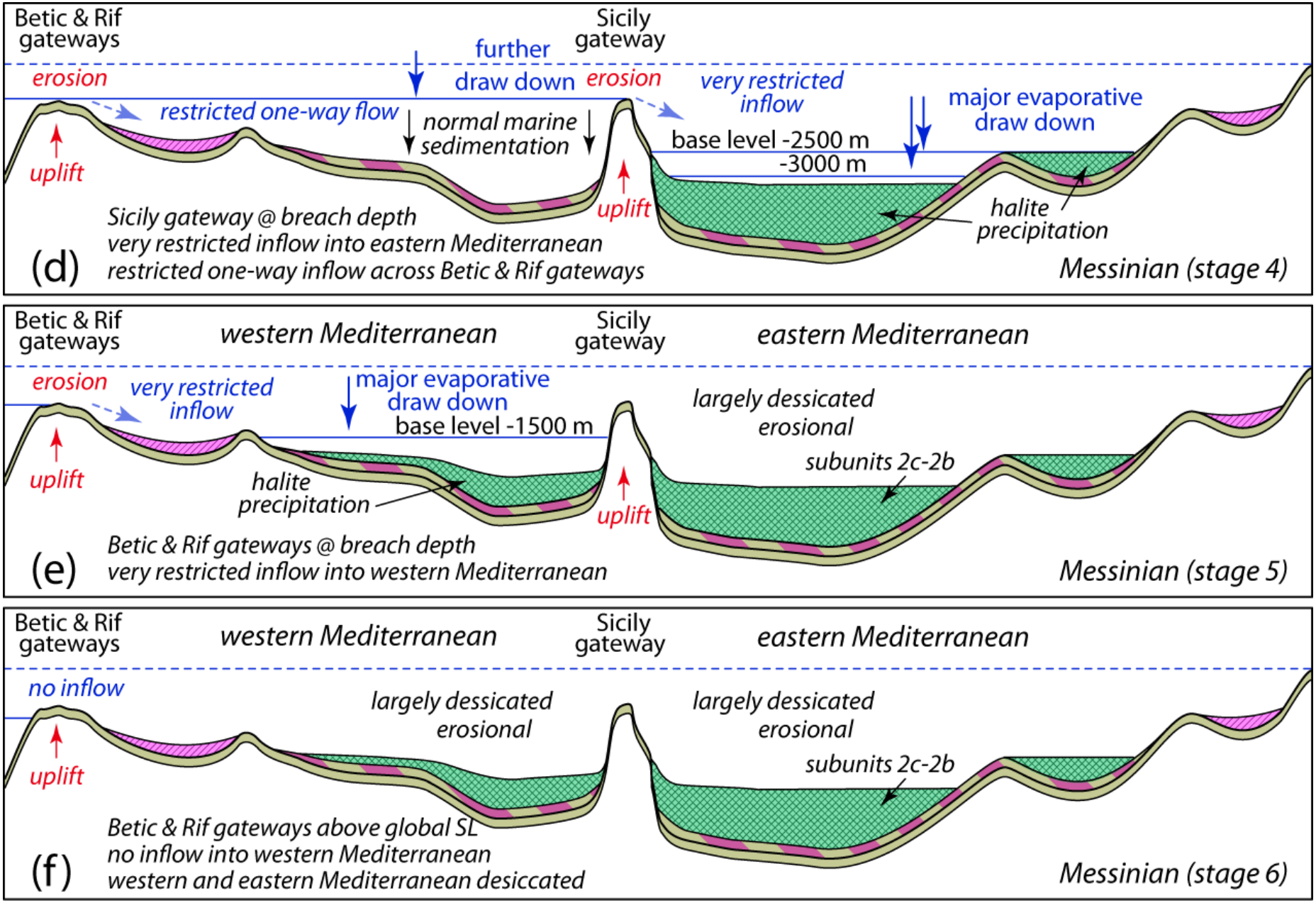
➢ V. Messinian Salinity Crisis Depositional Model (a-c)



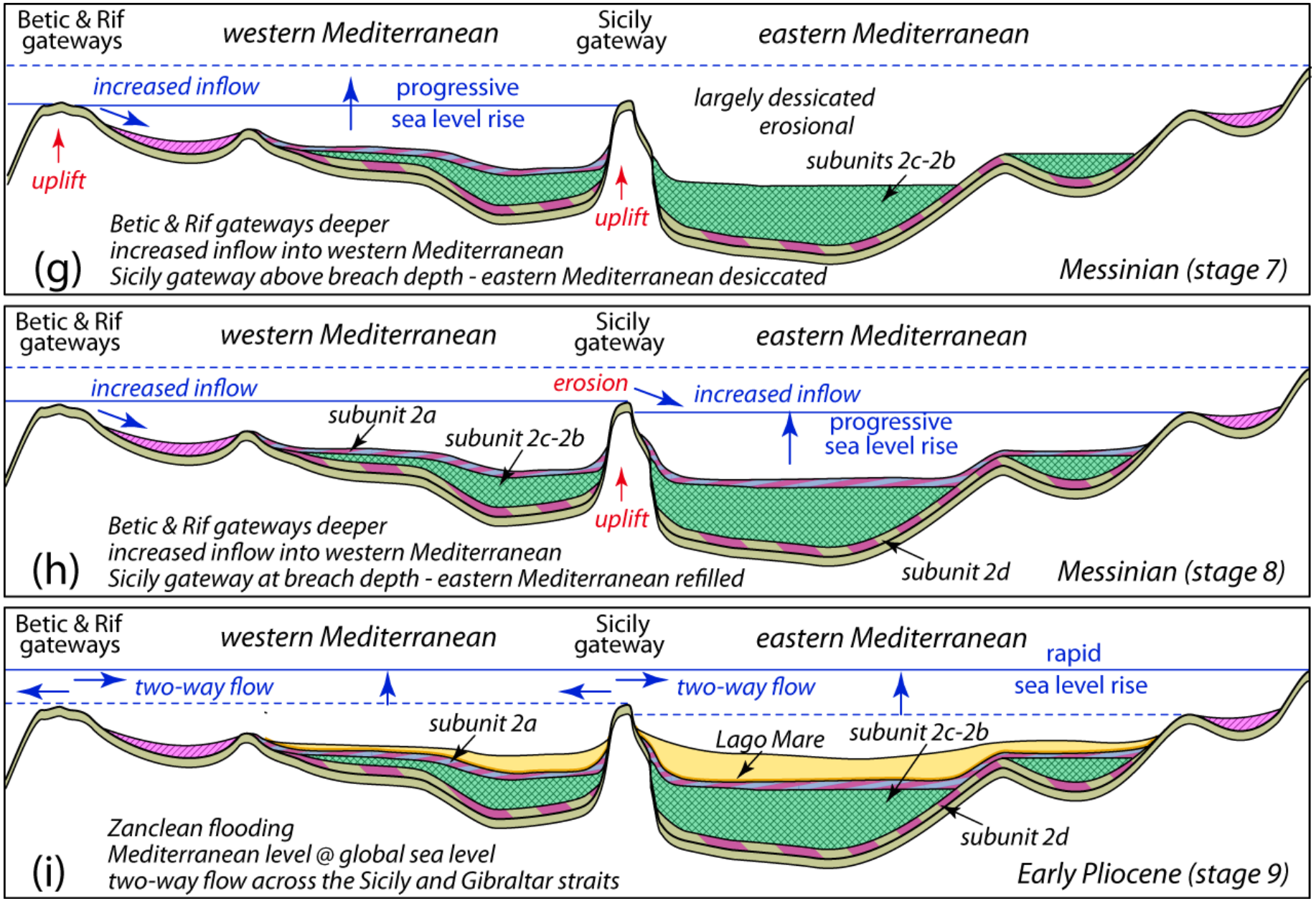




➢ V. Messinian Salinity Crisis Depositional Model (d-f)



➢ V. Messinian Salinity Crisis Depositional Model (g-i)



➢ VI. Summary and Critical Contributions - Messinian Salinity Crisis Depositional History and related Geodynamics

Previous studies suggested that;

- *Margin basins and deep basins are not time equivalent*
- *No similar depositional process in the eastern Mediterranean and western Mediterranean*
- *Single depositional model along the Mediterranean*

This study suggests that;

- *Depositional process was not time equivalent in the eastern and western Mediterranean - salt first deposited in the EM and then shifted to WM!*
- *Depositional process was very similar-4 subunit in both eastern and western Mediterranean !*
- *Complex mechanism instead of a one single model!*

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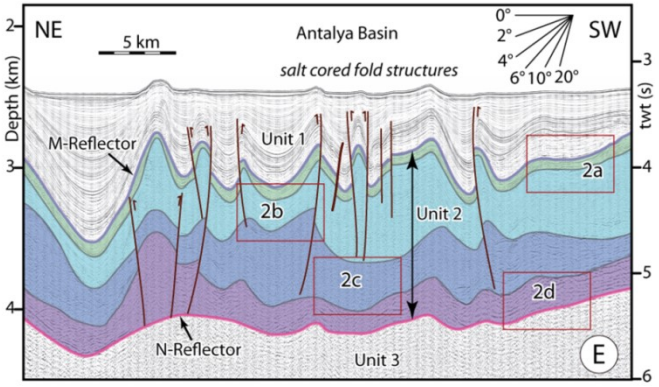

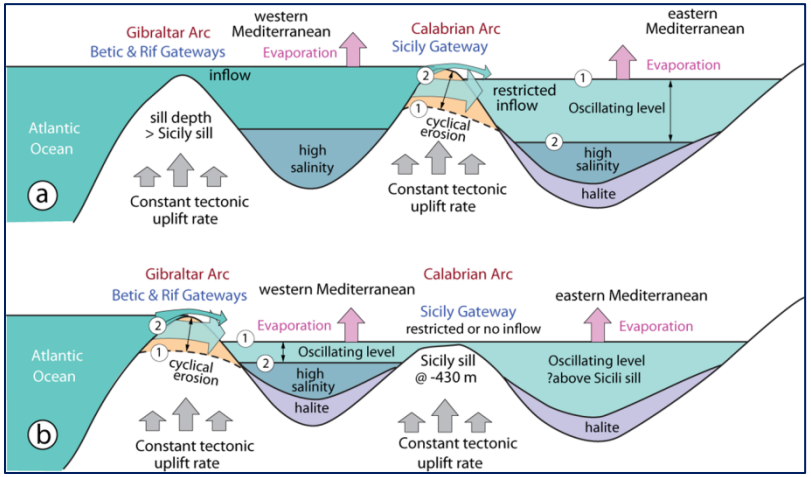

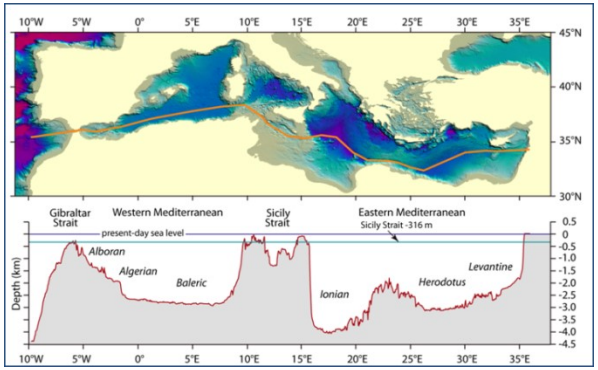

Thanks…

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