

Upper Triassic-Middle Jurassic Salt Deposits of the Saharan Platform*

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Abstract

The Upper Triassic to Middle Jurassic evaporites of the Saharan Platform in eastern Algeria, Tunisia and western Libya are a key element of the North African petroleum systems. They form a regional seal to both Palaeozoic (Hassi Messouad) and Triassic (TAGI) hydrocarbon reservoirs. The restricted conditions needed for evaporite formation were controlled by deep crustal lineaments and Palaeozoic intraplate tectonics. Deformation of the evaporite sequence is restricted to the area north of the Medenine-Jifarah High.

Sequence 1 consists of five evaporitic cycles dominated by mudstone and halite, which represent the main salt deposits of the Berkine Basin. At this time the Berkine-Ghadames Basin was a restricted evaporitic basin with a barrier to the north (Medenine-Jifarah High) separating it from peri-Tethys. These evaporites were formed by the marine flooding of the eastern margin of Pangaea. Sequence 2 saw the basin-wide development of a carbonate platform ('B Marker') in Pliensbachian times in response to relative sea level rise and tectonic adjustment associated with the emplacement of magmatic rocks of the Central Atlantic Magmatic Province (CAMP). Sequence 3 comprises five cycles that are predominantly mudstones, fine-grained carbonates and anhydrites and were formed as global sea level rose. They show cyclostratigraphic changes on a variety of scales which probably relate to astronomical fluctuations. The depositional style contrasts with Sequence 1, the presence of carbonates, occasional patch reefs and sabkha-type anhydrites indicating a marine carbonate-evaporite ramp setting. Similar thickness variations to those observed in Sequence 1 continued through Sequence 3 and reflect the on-going influence of differential subsidence along basement lineaments. Sequence 3 salt deposits are restricted to Algeria and progressive westward onlap resulted in Liassic salt being deposited on north-south basement ridges. A number of factors controlled the development of this evaporite basin. These include Late Triassic sea level rise and flooding of a sub-sea level fluvio-lacustrine basin, combined with globally warm climatic conditions, on-going break up of Pangaea and the emplacement of the CAMP. The evaporite deposits contain the records of these major global tectonic and climatic changes at the Triassic-Jurassic boundary.

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Upper Triassic-Middle Jurassic Salt Deposits of the Saharan Platform



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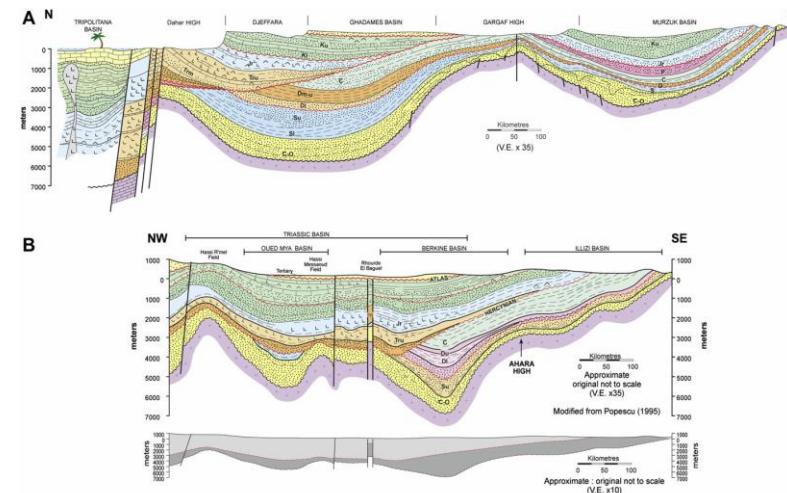
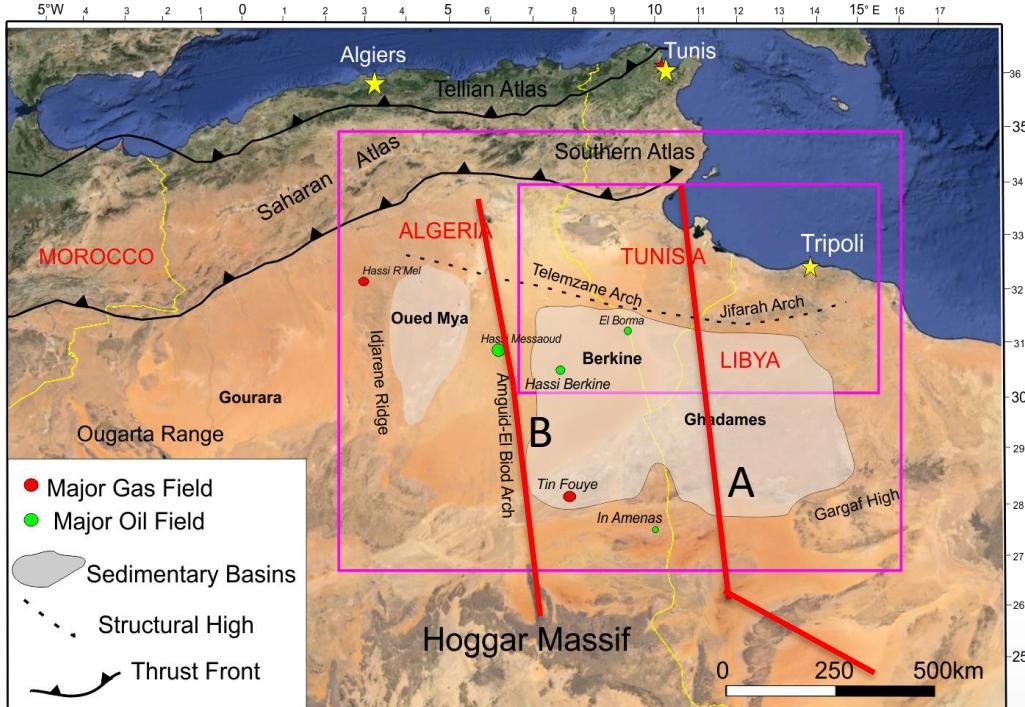
AIMR

School of Engineering and Applied Science
Aston University, UK

Summary

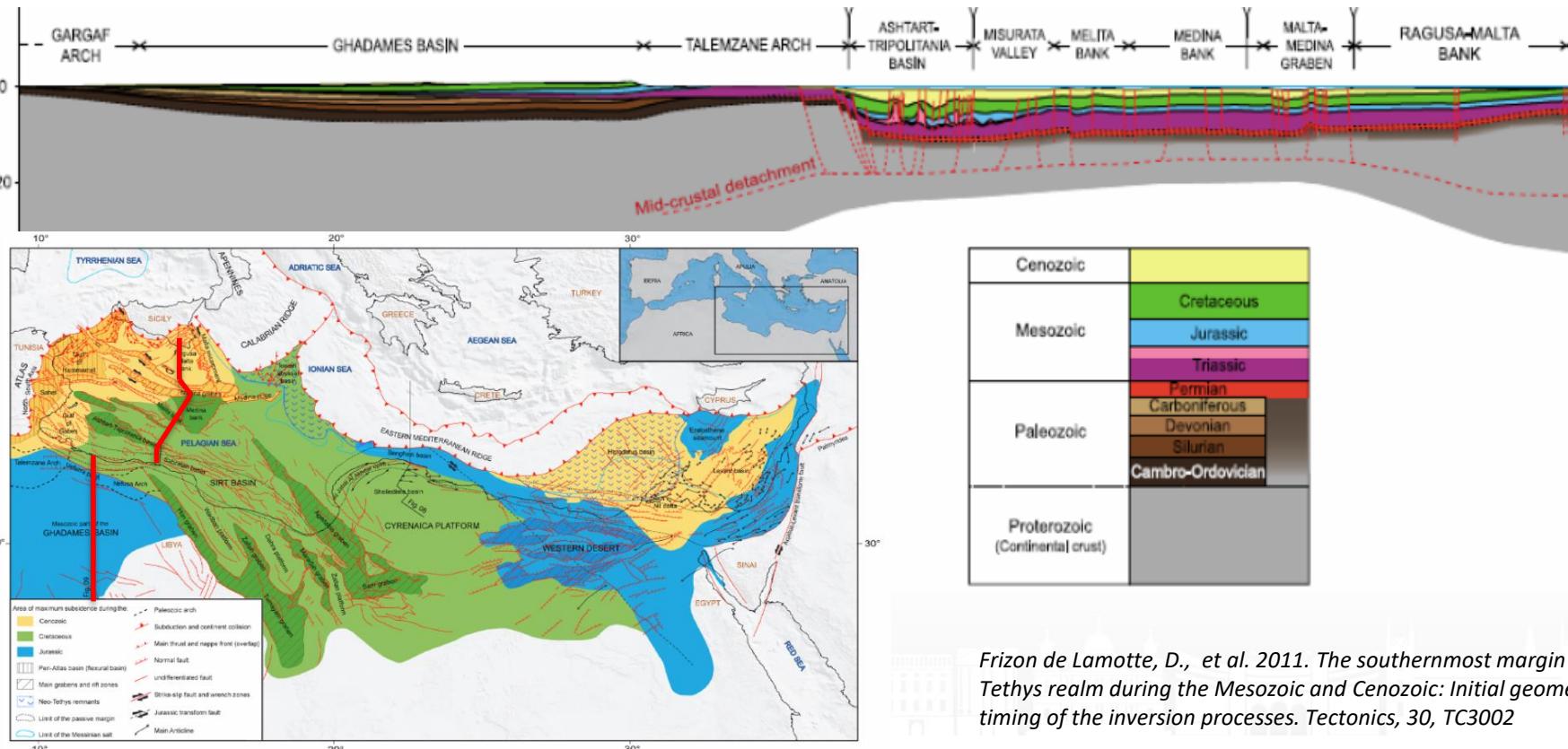
- Palaeozoic and Mesozoic Intraplate Basins
- Over 7km sedimentary record with a number of world class source rocks and petroleum systems with > 39bboe
- Triassic-Jurassic comprises ~1.5km clastic and carbonate-evaporite sequences
- The evaporites form important seals to both Palaeozoic and Triassic (TAG-I) reservoirs
- They also show complex internal stratigraphy and basin geometries which mimic intraplate tectonic activity and the major Palaeozoic lineaments
- Mainly un-deformed, in contrast to the northerly Atlas zones, but localised thickness variations occur in response to Triassic faulting
- Major changes through late Triassic-Mid Jurassic reflect the opening of the central Atlantic and peri-Tethys

Mesozoic Basins and Regional Structure



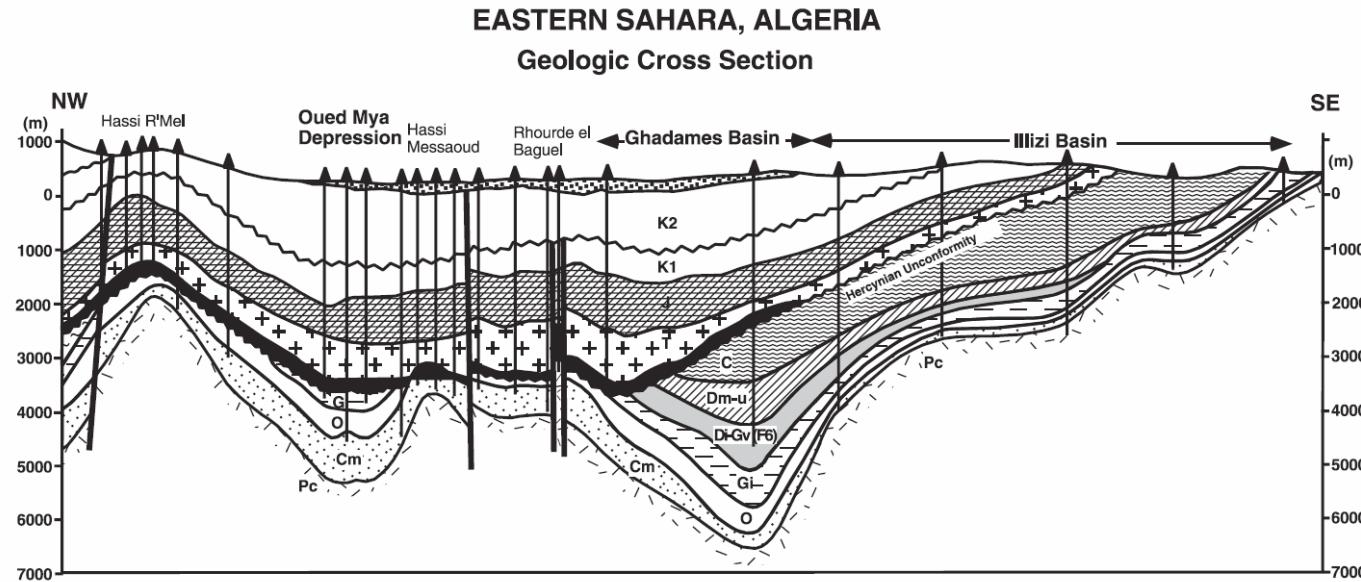
Illustrates the two Supercycles:
TETHYAN
HERCYNIAN

African Plate: Gargaf High - Southern Sicily



Frizon de Lamotte, D., et al. 2011. The southernmost margin of the Tethys realm during the Mesozoic and Cenozoic: Initial geometry and timing of the inversion processes. *Tectonics*, 30, TC3002

Classic Oil Accumulations

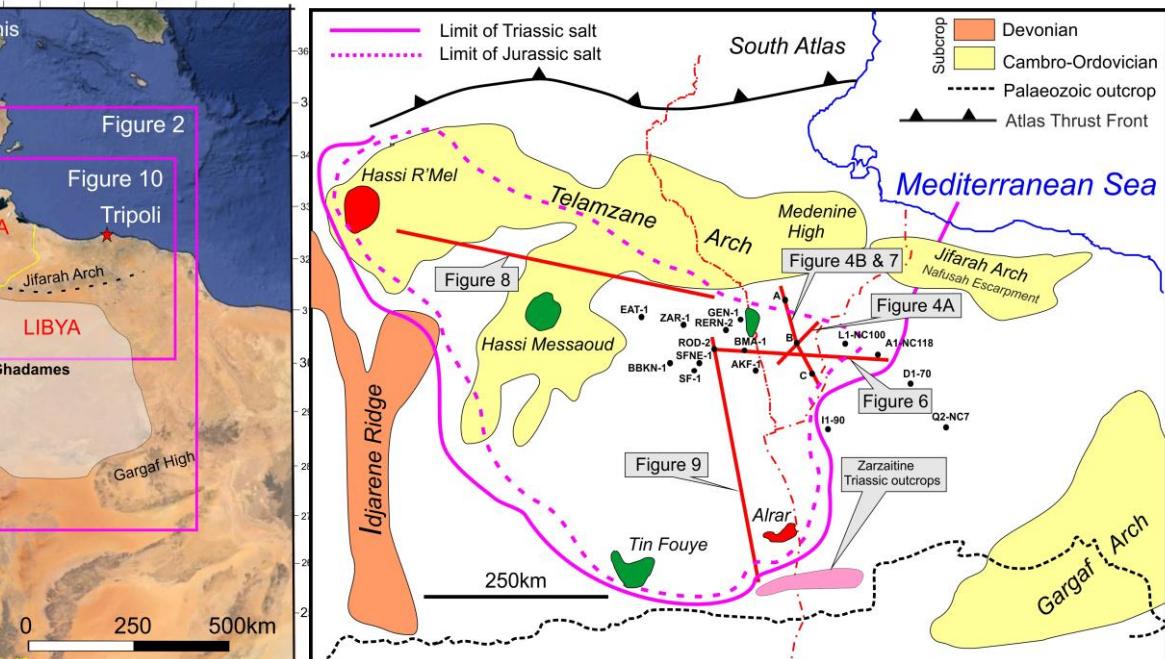
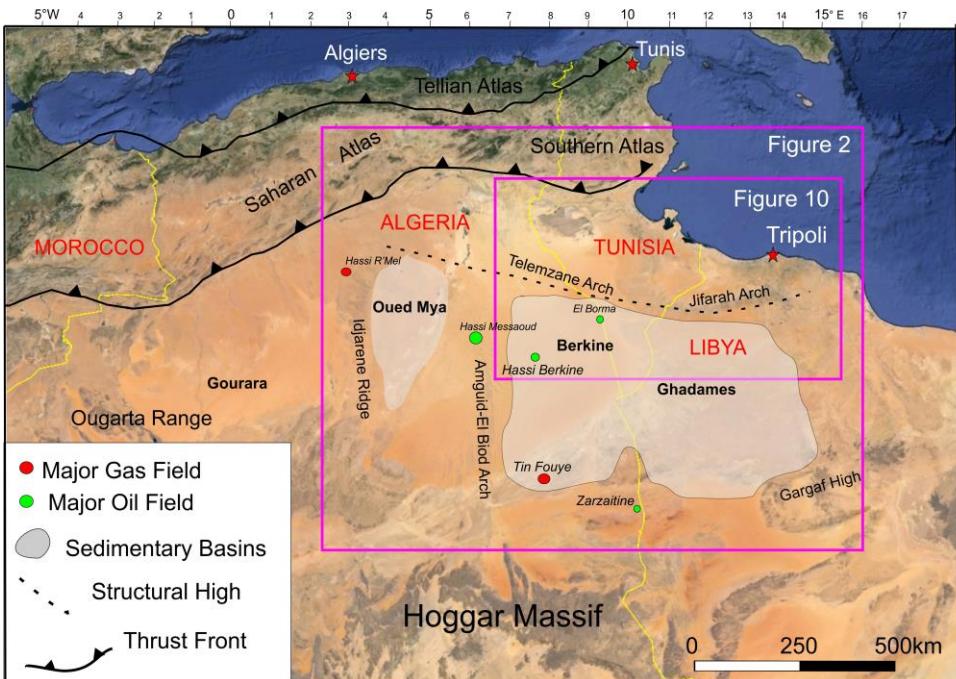


LEGEND

[K2]	Cretaceous	[T]	Lower Triassic	[Dm-u]	Lower Devonian	[Cm]	Cambrian
[J]	Jurassic	[C]	Carboniferous	[-G]	Silurian (Gothl)	[Pc]	Precambrian
[U+]	Upper Triassic						

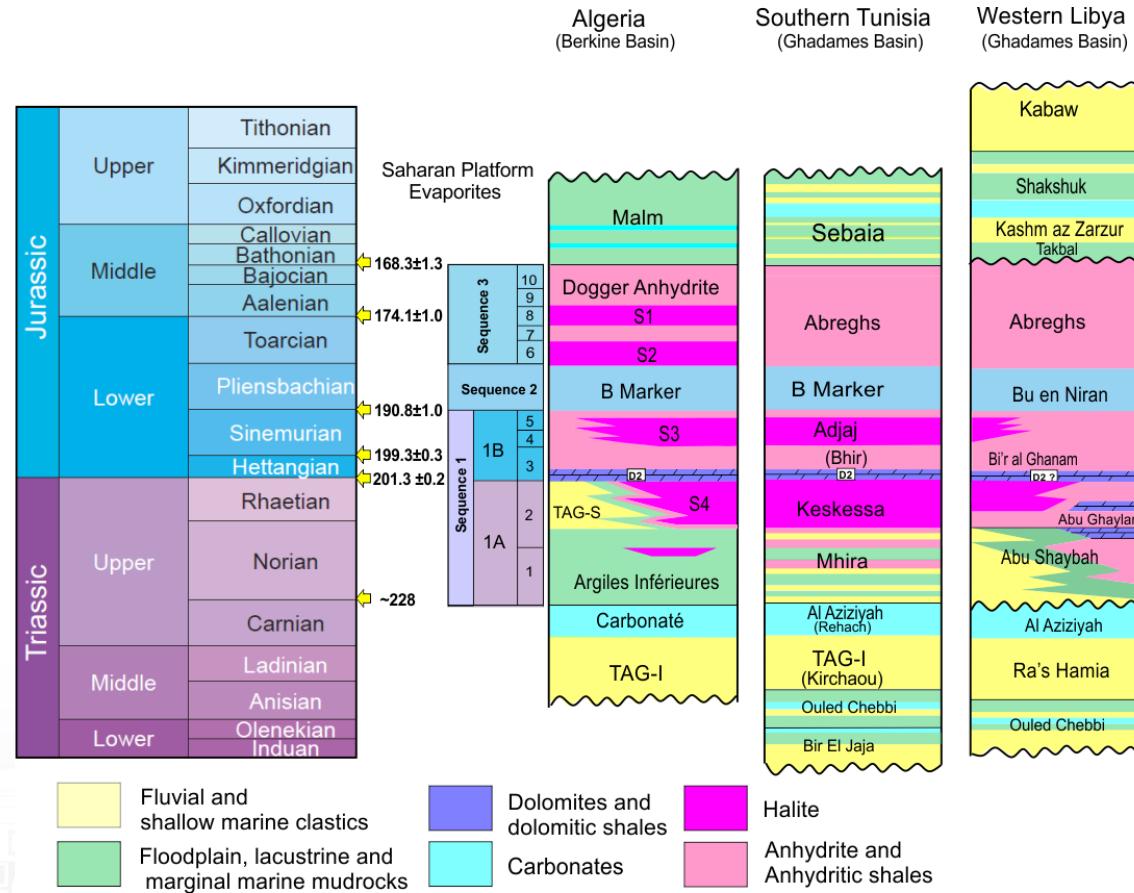
Mitra, S. and Leslie, W. 2003. AAPG Bulletin, v. 87, 231–250

Study Area and Database

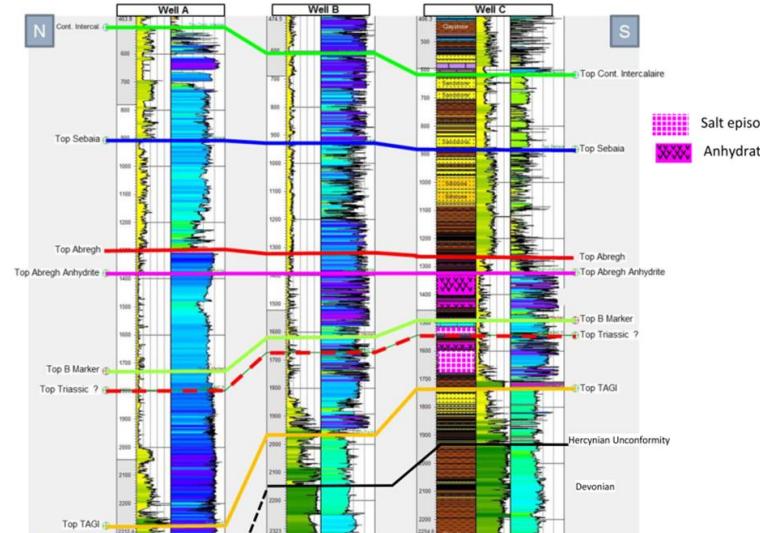
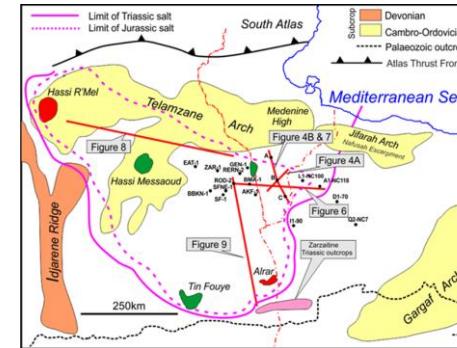
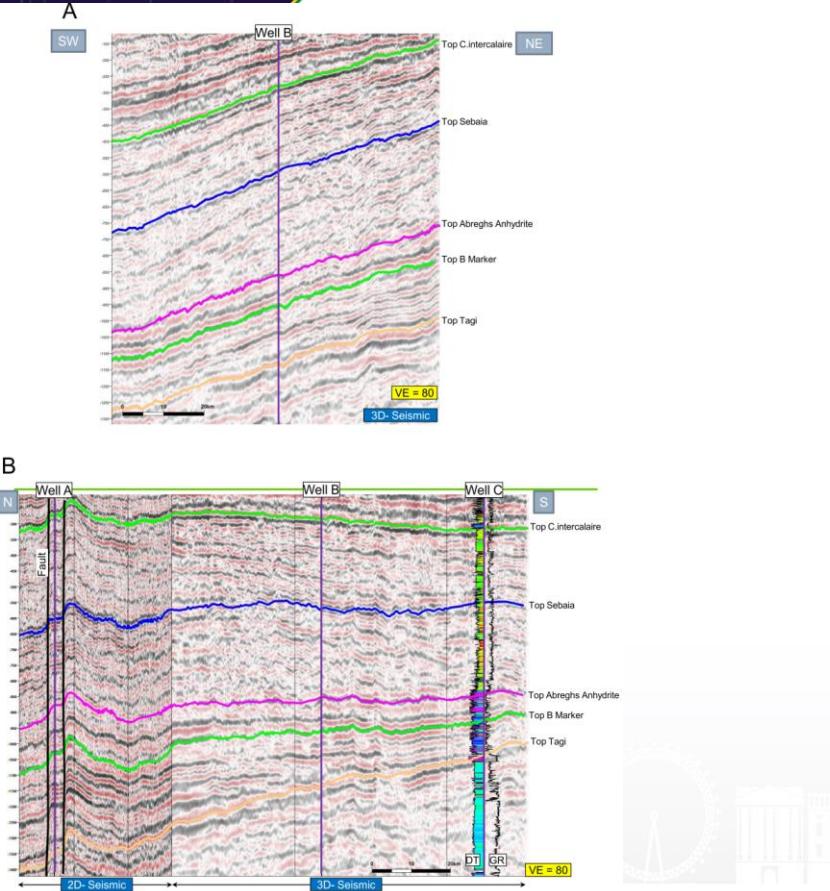


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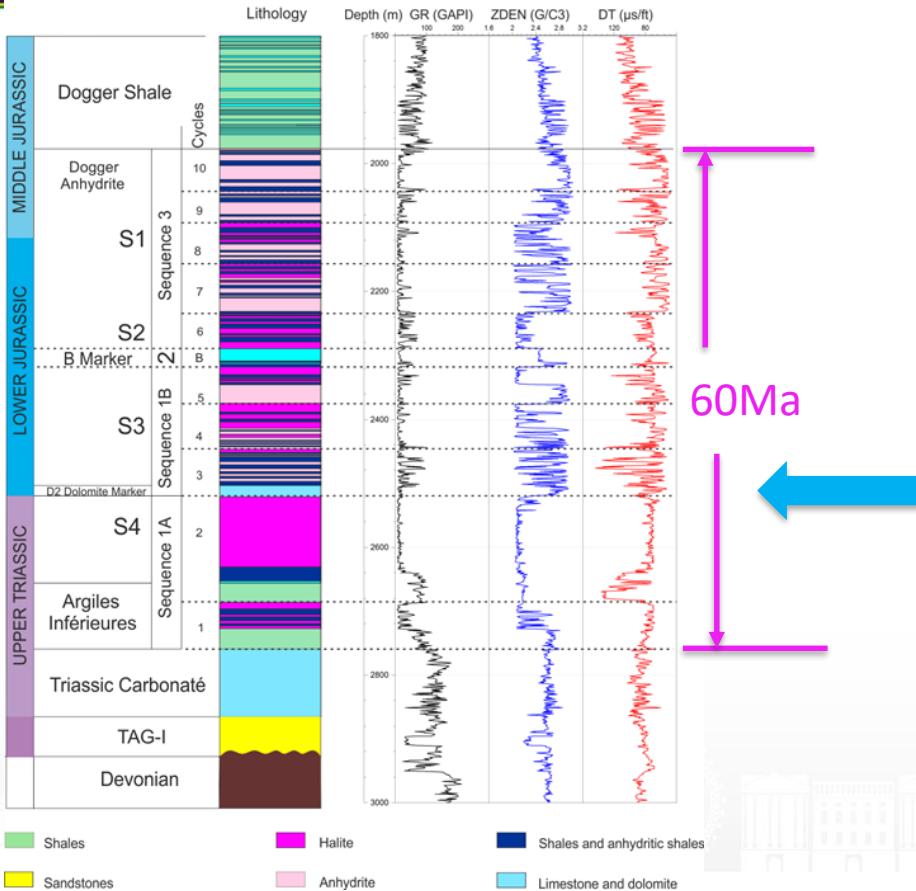
Stratigraphy - NW Libya- NE Algeria



Southern Margin of Salt Basin in Tunisia

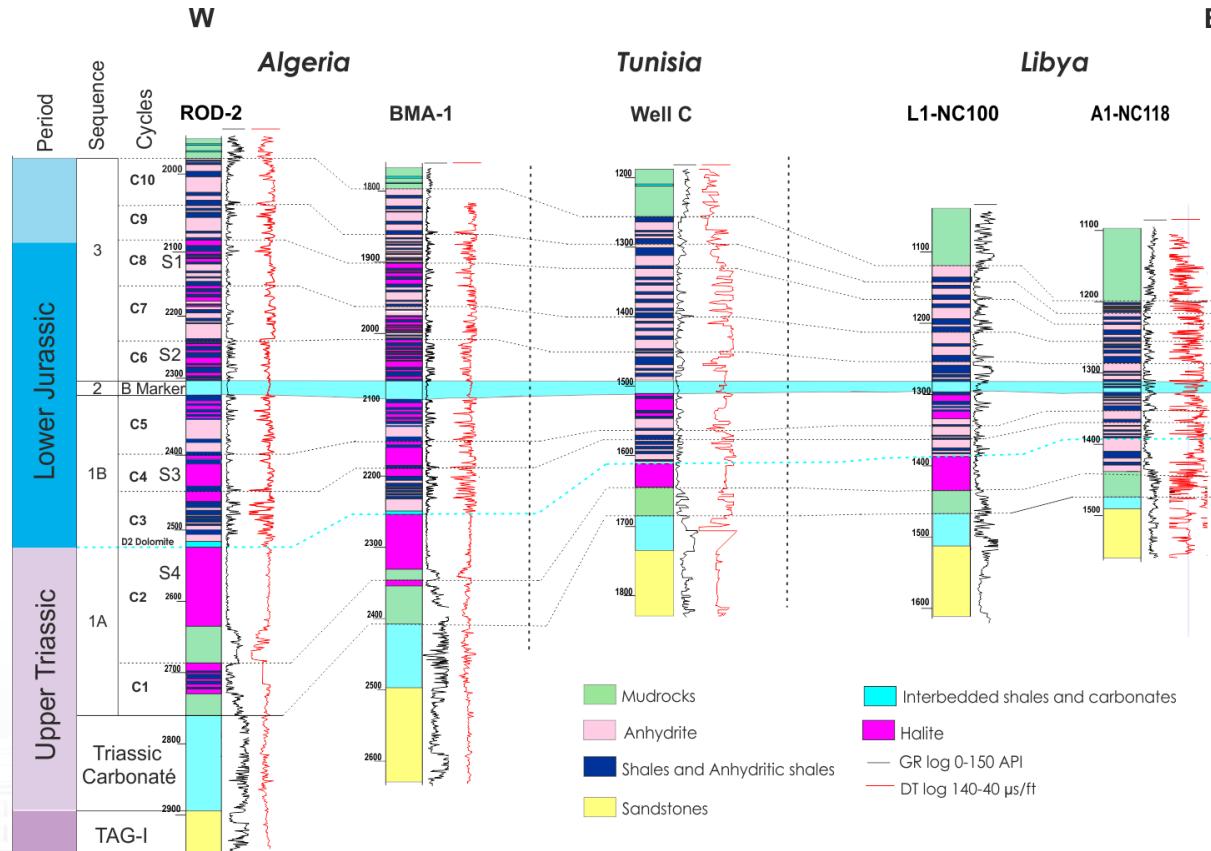


Detailed Evaporite Stratigraphy- ROD-2

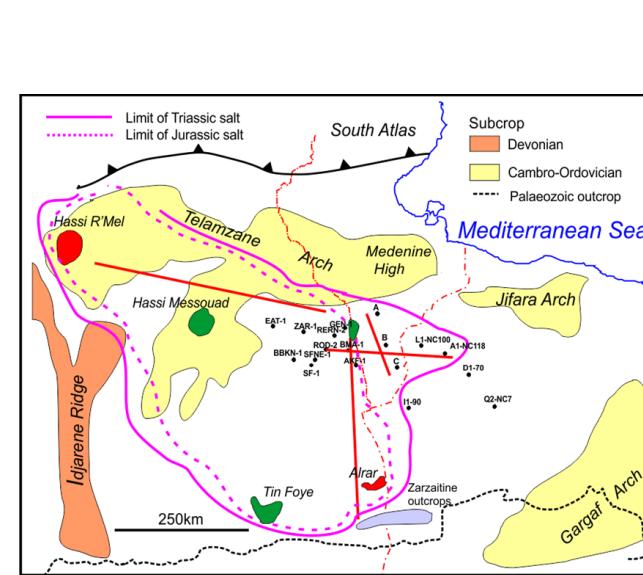
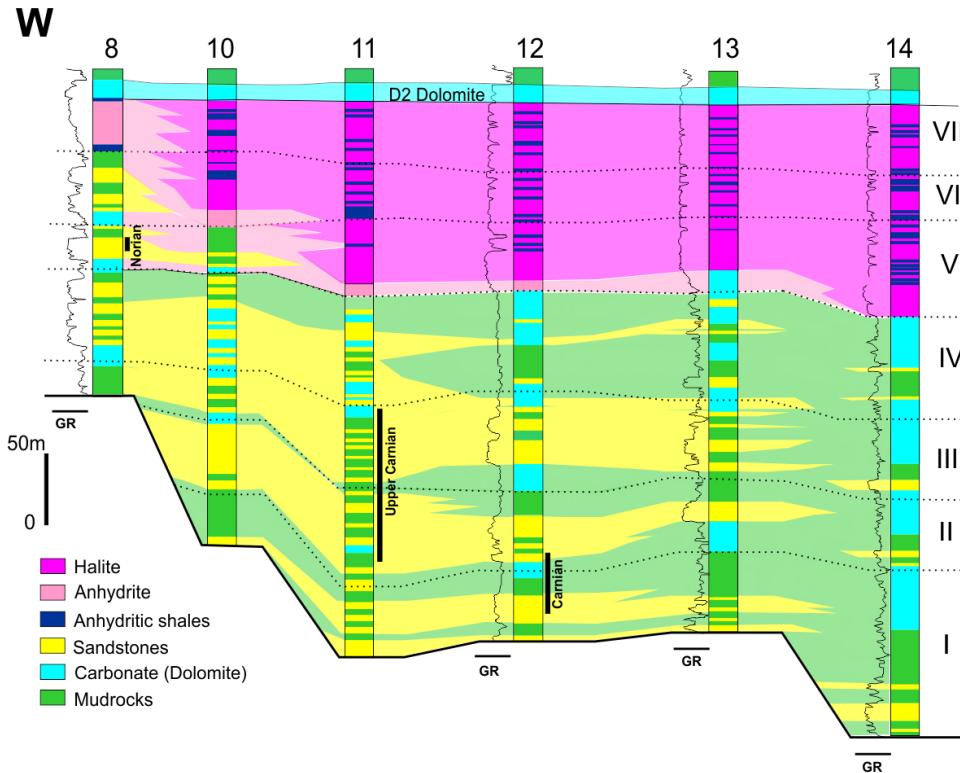


Turner, P & Pelz, K. 2017. Chapter 27. In: Soto, J.I. Flinch, J.F & Tari, G. (eds). Permo-Triassic Salt Provinces of Europe, North Africa and the Atlantic Margins. Elsevier

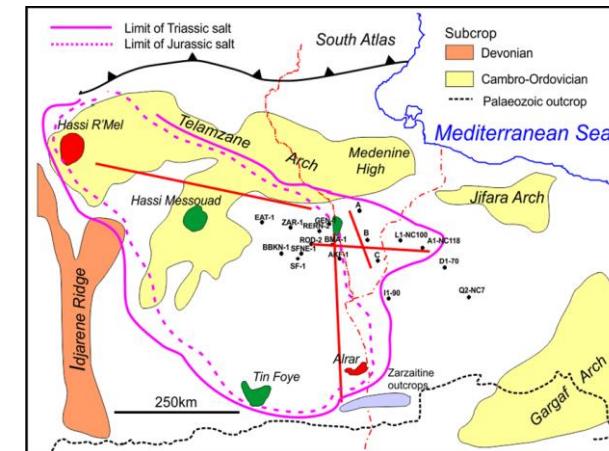
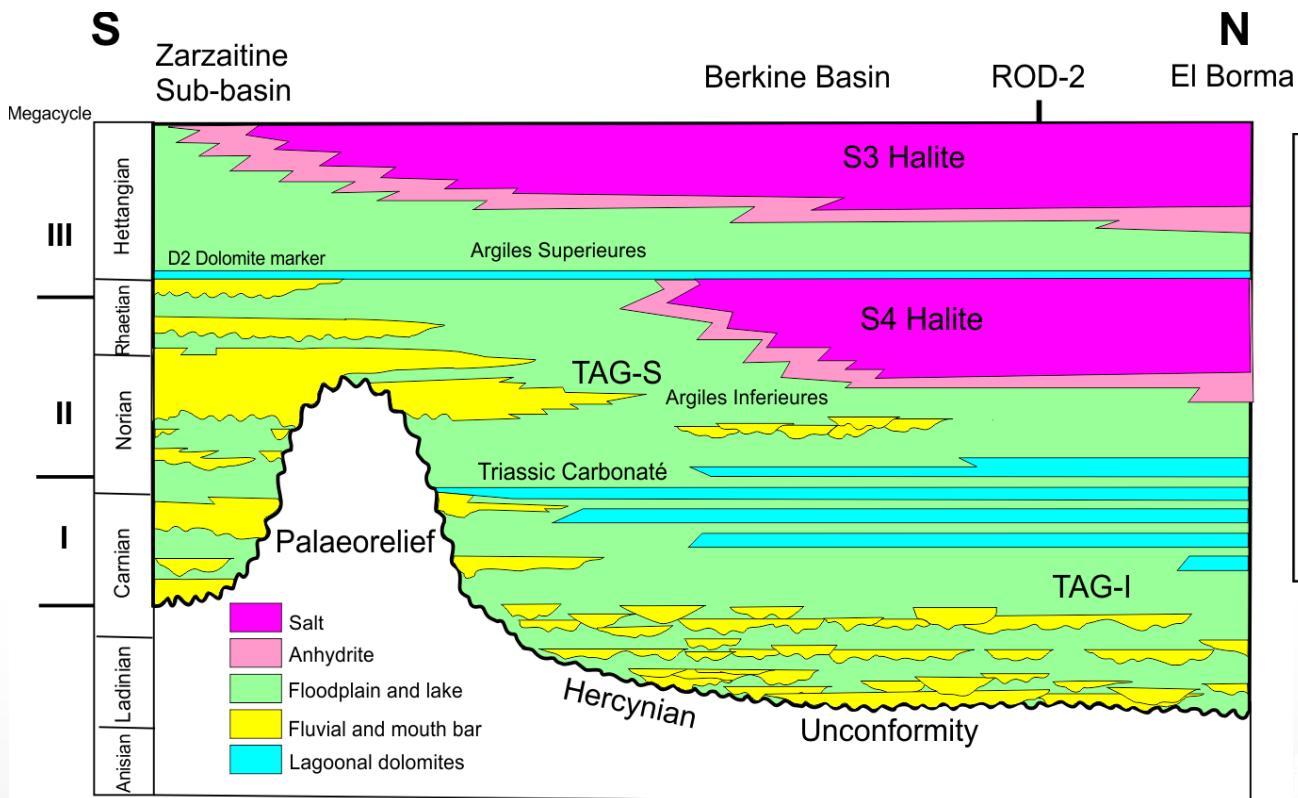
Cycle Correlation W-E



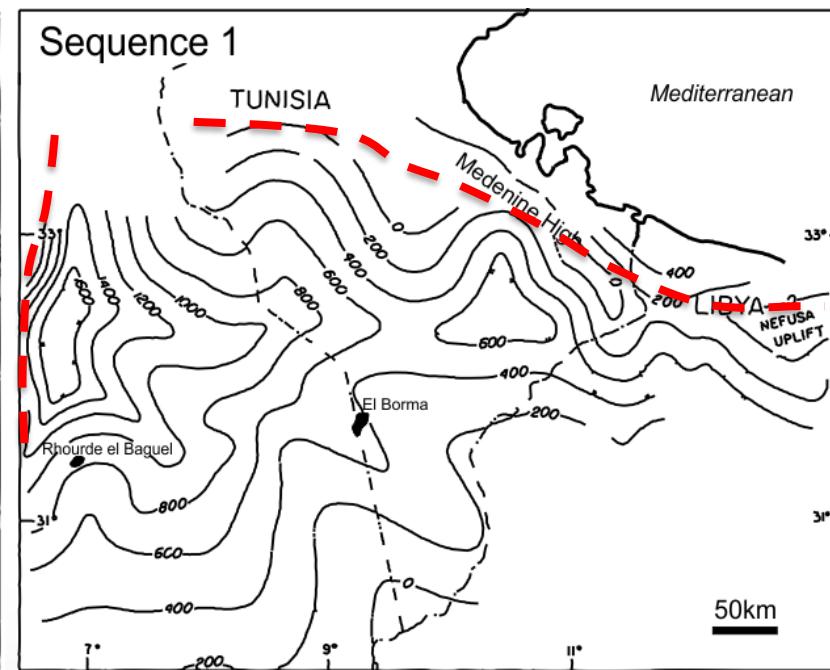
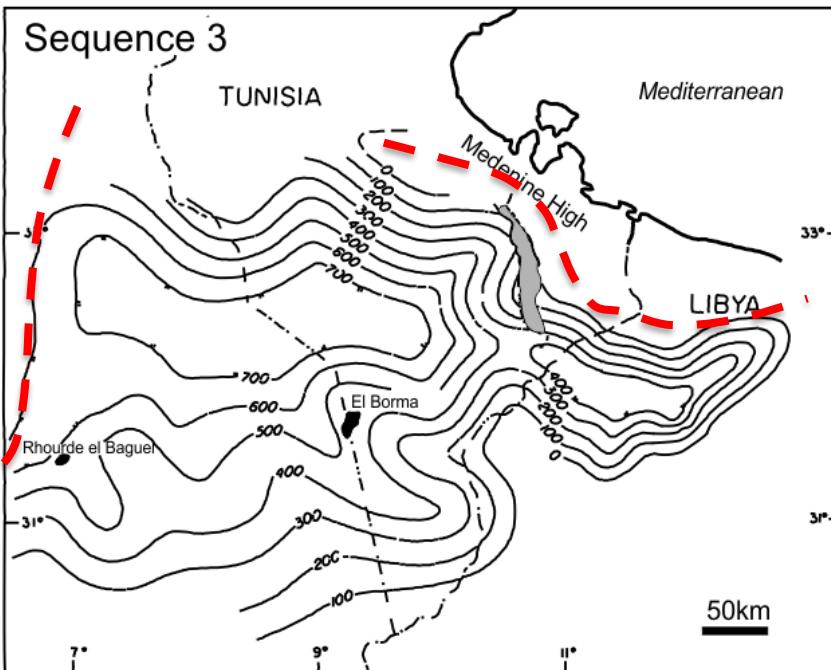
Onlap of Salt Deposits onto Idjarene Ridge



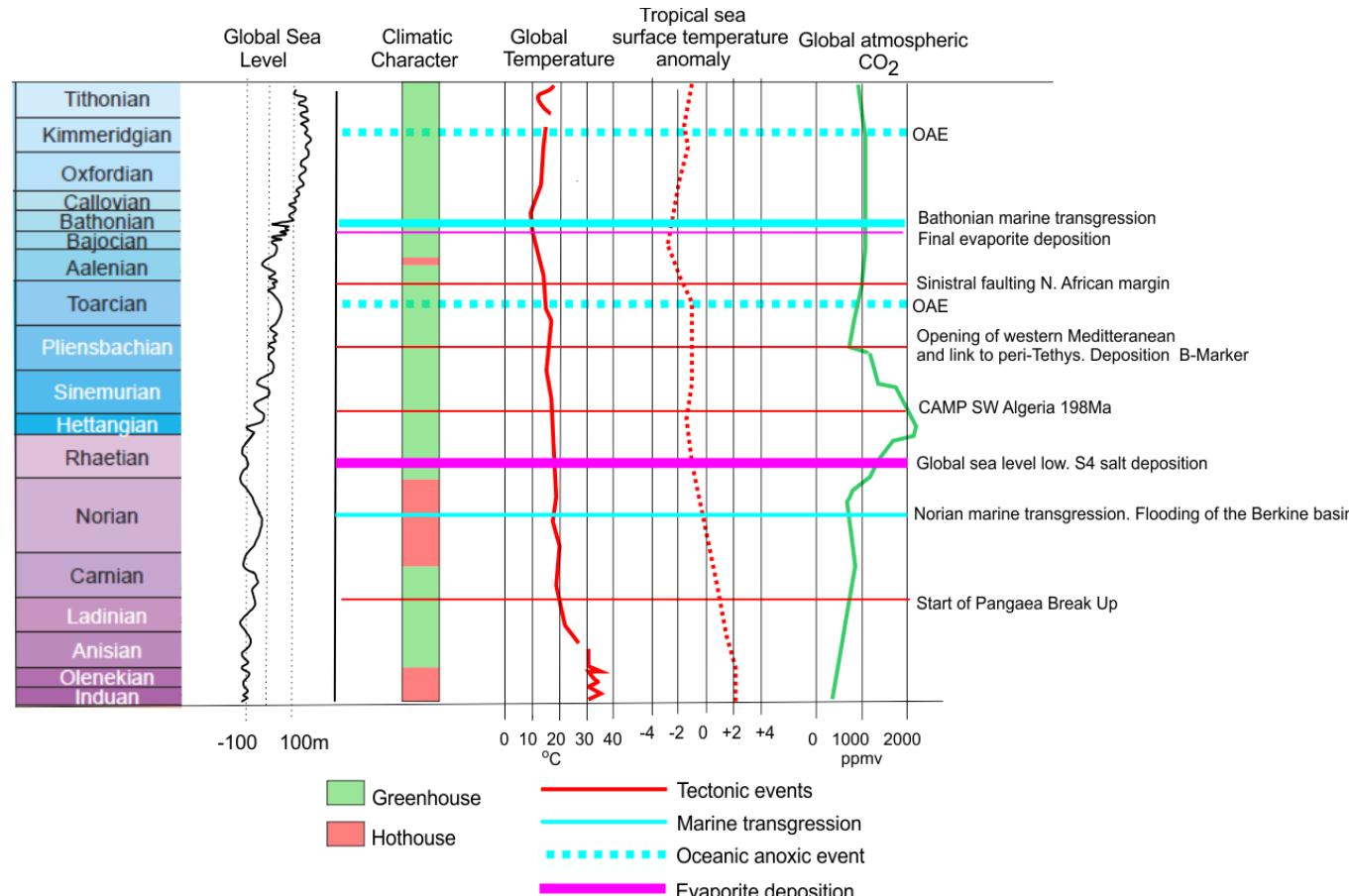
Onlap toward the Gargaf High



Isopach maps and Palaeozoic Lineaments



Summary Chart of Main Global Events



Conclusions

- Accumulation controlled by differential intraplate sag
- Palaeozoic lineaments (Jifarah, El Biod, Idjarene, Gargaf) acted as basin margins and sills to inflow
- Salts largely un-deformed but localised subsidence and reactivation in response to Triassic faulting and inversion
- Sequence 1A, 1B due to marine flooding of a sub-sea level basin
- Sequence 2 (Pliensbachian ‘B Marker’) was a period of carbonate deposition following the link-up of peri-Tethys with western Mediterranean
- Sequence 3 reflects carbonate ramp type deposition with a high frequency of evaporitic units. 10 Megacycles are formed of 10-20 multiple evaporitic units which are likely eccentricity cycles