An integrate study of the Central High Atlas diapiric province in Morocco

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The Central High Atlas of Morocco is a Jurassic salt-related rift basin inverted during the Alpine orogeny characterized by an intricate polygonal network of salt walls separating minibasins. Field data on both structural geology and sedimentology of halokinetic sequences, thermal modelling and subsidence analysis, analogue modelling, diagenetic studies as well as balanced and restored cross-sections on Jurassic-aged diapiric structures and minibasins provide an integrated interpretation of Central High Atlas as well as multiple examples of the impact of syn- and post-rift diapiric activity on the evolution of the Jurassic basin of the Central High Atlas at different scales.

The subsidence evolution of the basin from Early to Middle Jurassic time was characterized by a Sinemurian-Pliensbachian rifting followed by long post rift phase. In the central part of the basin, the early Jurassic extension triggered salt-tectonic activity that spanned from Pliensbachian to Callovian times. The initial reactive-active diapir phase linked to the extension phase after 199 Ma was followed by a long period of passive diapiric growth that spanned roughly up to 167 Ma. The passive diapirism caused the development of very well exposed halokinetic geometries including bed thinning, onlaps and truncations that comprise composite stacks of halokinetic wedges and hook sequences flanking the diapir ridges (salt walls).

Subsidence analyses from the rift axis of the Central High Atlas Jurassic rift basin, where diapiric salt ridges and minibasins were developed, showed subsidence evolution characterised by high subsidence rates (tectonic subsidence up to 0.2 mm yr-1 and total subsidence up to 1 mm yr-1), spatial and temporal migration of subsiding depocentres, and anomalous subsidence amounts during post-rift phase. By using analogue and numerical modelling we established that, during the rifting phase, the tectonic subsidence related to salt withdrawal could be around 25% whereas during the post-rift phase this percentage increases up 65 to 80%. These subsidence patterns as well as a diachronic evolution between extension and diapirism were also reported in other diapiric areas along the Atlas system.

The present-day outcrops of Jurassic halokinetic strata in the Central High Atlas represent excellent analogues of the Triassic-Jurassic successions in other diapiric provinces of the Atlas system localized under a thick Mesozoic and Cenozoic sedimentary pile and only revealed in seismic lines in Atlantic Morocco and Atlas in Algeria and Tunisia.

Keywords: Diapirism, salt-related rift basins, Central High Atlas, North Africa

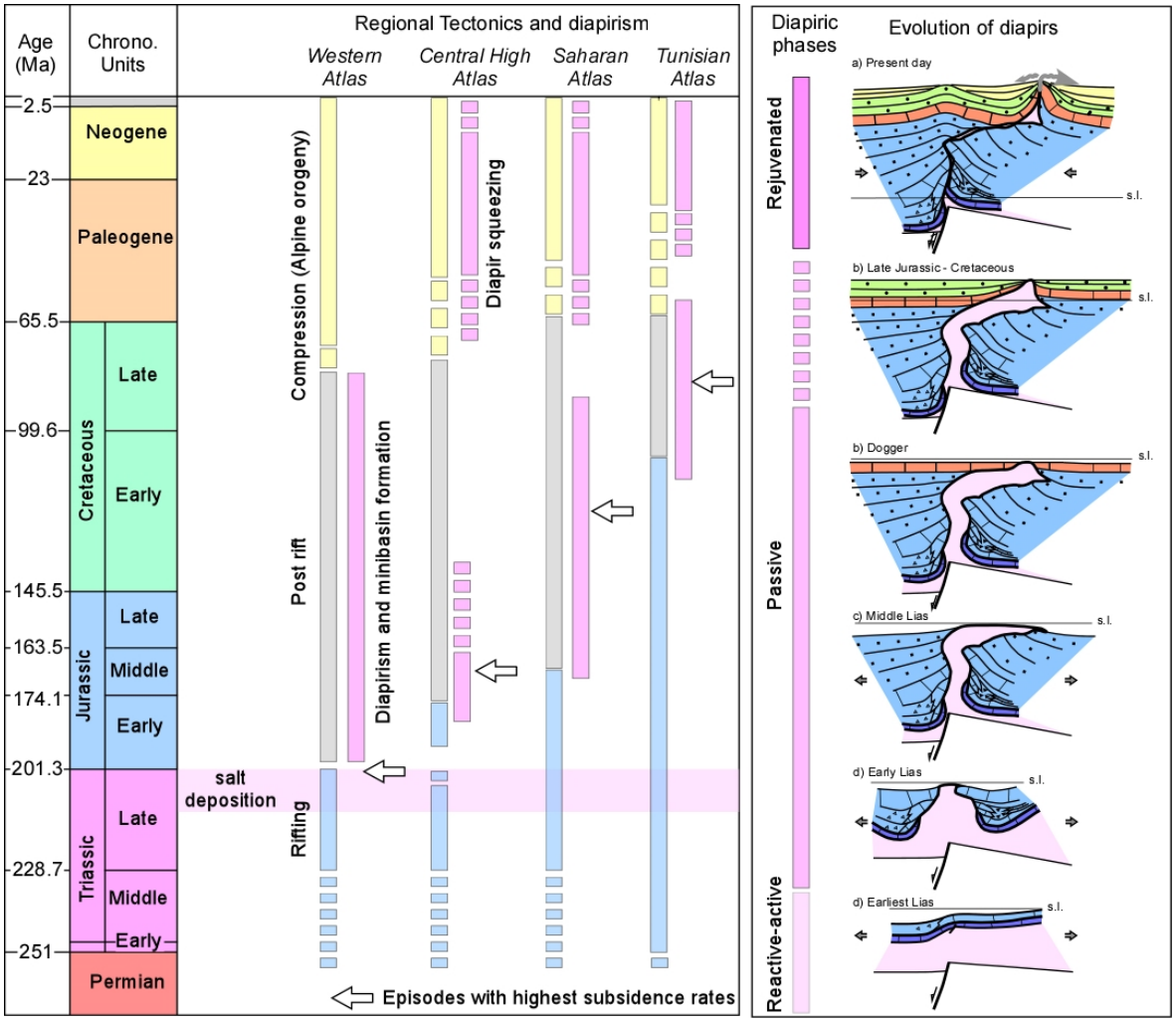

Fig. 1 Chart showing the timing of the tectonic events and diapirism in the Atlas system, from the Atlantic margin (west) to the Tunisian Atlas (east), including the age of the episodes with highest subsidence rates. This chart is a compilation from numerous authors listed in Moragas et al. (2017). The time scale is according to Gradstein, Ogg, Schmitz, and Ogg (2012). Redrawn from Vergés et al. 2017

EUROPE EVENTS

Alpine Folded Belts and Extensional Basins

15-16 March 2018 | Granada, Spain

Details | Program | Activities | Location | Pricing

Thursday March 15, 2018

8:30 AM - 8:55 AM REGISTRATION AND COFFEE BREAK

9:00 AM - 9:15 AM **Open Ceremony and Greetings**

9:15 AM - 9:45 AM **Invited Talk**
Joseba Murillas

9:45 AM - 10:15 AM **Tectonics of the Western Alpine Foreland: A Review**
Jon Mosar and Anna Sommaruga

Parallel Sessions

Session 1: (Room A) Alpine Folded Belts
Session 2: (Room B) The Messinian in the Mediterranean

10:20 AM - 10:40 AM
Room A **From Subduction to Collision in the Mediterranean Realm**
César Ranero

Room B **The Late Messinian Event: A Worldwide Tectonic Revolution**
Daniel Aslanian

10:40 AM - 11:00 AM
Room A **Tectonic Evolution of the Betic-Rif Orogen as Recorded by FIA**
Domingo Aerden

Room B **The Messinian Salinity Crisis (MSC) Occurred East off the Alboran Volcanic Arc Archipelago That Formed a Land-Bridge For Biota Exchange Before and After the MSC**
Guillermo Booth-Rea

11:00 AM - 11:20 AM
Room A **Northern Pyrenees and Aquitaine Basin: Two Phase Inversion of a Hyper-Extended Rift**
Mary Ford

Room B **Almeria Pliocene Gilbert Delta, Relationships with the Messinian Salinity Crisis and Offshore Evolution**
Jean-Loup Rubino

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5:20 PM - 6:20 PM NETWORKING AND POSTERS

6:20 PM - 7:20 PM NETWORKING RECEPTION AND DINNER

Friday, March 16, 2018

8:30 AM - 8:55 AM REGISTRATION AND COFFEE BREAK

8:55 AM - 9:25 PM **Frontier Exploration Targets Offshore Greece**
Yannis Bassias

9:25 AM - 9:55 AM **Formation and Reactivation of Hyperextended Rift Systems**
Gianreto Manatschal

Parallel Sessions

Session 4: (Room A) Extension and Hyper-extension in the Mediterranean
Session 5: (Room B) Salt Tectonics in Alpine Folded Belts

	Room A	Room B
10:00 AM - 10:20 AM	**Post-Hercynian Tectonic and Paleogeographic Evolution of SW Iberia and the Gulf of Cadiz** Adrià Ramos	**Structure and Kinematics of the Central Sivas Basin (Turkey): Salt Deposition and Tectonics in an Evolving Fold-and-thrust Belt** Jean-Claude Ringenbach
10:20 AM - 10:40 AM	**Opening of the West Mediterranean with Placa-4D Software: A 16Ma to Present Model** Romain Pellen	**Triassic Basins, Tectonics and Petroleum Systems in the Alpine Folded-Belts of Europe and North Africa** Juan I. Soto
10:40 AM - 11:00 AM	**The Crustal Domains of the Alboran Basin (Western Mediterranean)** Laura Gómez de la Peña	**Salt-like Shale Tectonics, Minibasins on Shales, Huge Blocks in Mélanges?** Gulce Dinc
11:00 AM - 11:20 AM	COFFEE BREAK AND POSTERS	
11:20 AM - 11:40 AM	**Snapshot of Large Active Strike-slip Fault Systems in the Alboran Sea** Eulalia Gracia	**From Atlantic Extensional to Alpine Compressional Salt Tectonics at the Western Iberian Margin** Rui Pena dos Reis
11:40 AM - 12:00 PM	**Low-Angle Extensional Faulting and Mountain Uplift in Central Betics** Juan I. Soto	**An Integrate Study of the Central High Atlas Diapiric Province in Morocco** Mar Moragas
12:00 PM - 12:20 PM	**How Does Tectonic Inversion Initiate? Insights from the Algerian Margin Case Study** Jacques Déverchère	**The Southern Pyrenees: A Salt-based Fold and Thrust Belt** Pedro Camara
12:20 PM - 12:40 PM	**Extreme Mesozoic crustal thinning in the Eastern Iberia margin: The example of the Columbrets Basin (Valencia Trough)** Geoffroy Mohn	**Pervasive and Long Lasting Salt Movements in Southern Pyrenees During Jurassic–Early Cretaceous** Jaume Vergés
12:40 PM - 1:00 PM	**Control of Asymmetry on the Thermal Architecture of Segmented Rift Systems** Rodolphe Lescoutre	**Subsalt Extensional Structure Controls Mesozoic Salt Tectonics and the Betic Inversion** Frederic Oriol Escosa
1:00 PM - 2:00 PM	LUNCH AND POSTERS	
2:00 PM - 2:20 PM	**Tethys Rifting of Valencia Trough Basin** César Ranero	**Allochthonous Triassic and Salt Tectonic Processes in the Betic-Rif Orogenic Arc** Joan Flinch
2:20 PM - 2:40 PM	**Central Mediterranean Early-stage Rifting: Sedimentary Basin Evolution, Extensional Style and Geodynamic Implications** Alfonsa Milia	**Salt Tectonics in the Passive Margin, Foreland Basin and Fold and Thrust Belt of Haute Provence** Rodney Graham