EGU21-13593, updated on 23 Jan 2022
https://doi.org/10.5194/egusphere-egu21-13593
EGU General Assembly 2021

Interplay between tectonic inheritance and salt tectonics in the tectono-sedimentary evolution of the Sahel basin (eastern Tunisia): implications for hydrocarbon prospectivity

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The Sahel basin in eastern Tunisia has been subject for hydrocarbon exploration since the early fifties. Despite the presence of a working petroleum system in the area, most of the drilled wells were dry or encountered oil shows that failed to give commercial flow rates. A better understanding of the tectono-sedimentary evolution of the Sahel basin is of great importance for future hydrocarbon prospectivity. In this contribution, we present integration of 2D seismic reflection profiles, exploration wells and new acquired gravity data. These subsurface data reveal that the Sahel basin developed as a passive margin during Jurassic-Early Cretaceous times and was later inverted during the Cenozoic Alpine orogeny. The occurrence of Triassic age evaporites and shales deposited during the Pangea breakup played a fundamental role in the structural style and tectono-sedimentary evolution of the study area. Seismic and gravity data revealed jointly important deep-seated extensional faults, almost along E-W and few along NNE–SSW and NW-SE directions, delimiting horsts and grabens structures. These syn-rift extensional faults controlled deposition, facies distribution and thicknesses of the Jurassic and Early cretaceous series. Most of these inherited deep-seated normal and transform faults are ornamented by different types of salt-related structures. The first phase of salt rising was initiated mainly along these syn-extensional faults in the Late Jurassic forming salt domes and continued into the Early and Late Cretaceous leading to salt-related diapir structures. During this period, the salt diapirism was accompanied by the development of salt withdrawal minibasins, characterized important growth strata due the differential subsidence. These areas represent important immediate kitchen areas to the salt-related structures. The later Late Cretaceous - Cenozoic shortening phases induced preferential rejuvenation of the diapiric structures and led to the inversion of former graben/half-graben structures and ultimately to vertical salt welds along salt ridges. These salt structures represent key elements that remains largely undrilled in the Sahel basin. Our results improve the understanding of salt growth in eastern Tunisia and consequently greatly impact the hydrocarbon prospectivity in the area.