# THE UPPER JURASSIC PETROLEUM SYSTEM OF NE IRAQ

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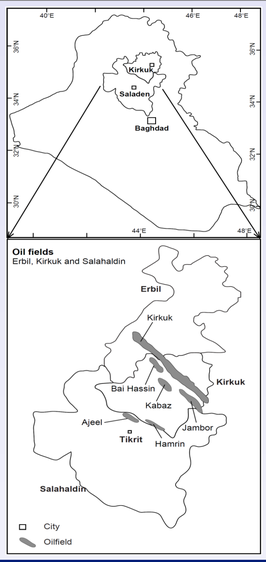
## Motivation of study

Iraq is one of the few countries with significant potential for discovery of major oil and gas fields. Two major petroleum systems occur in Mesozoic strata, the Mid-Upper Jurassic and the Basal Cretaceous. These petroleum systems in Arabia are generally well separated by widespread evaporites of the Hith Fm., its equivalents in central to NE Iraq being the carbonates/anhydrites of the Gotnia Fm. Where missing or replaced by the clastic Barsarin Fm. a differentiation of the two Petroleum Systems becomes difficult. We here report on the Ajeel field of northern Iraq, covering the time interval from the Mid-Jurassic (Aalenian) to the Early Cretaceous (Barremian) to identify source intervals, determine maturity and conduct oil/source rock correlation with Miocene (Euphrates/Jeribe Fm.) oil reservoirs.

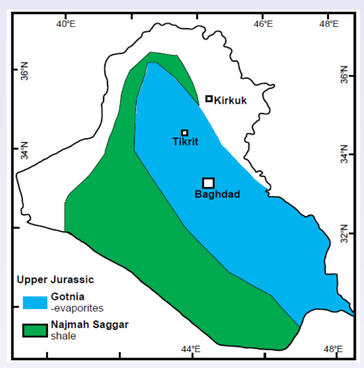
## Objectives

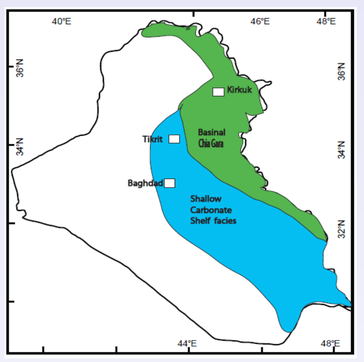
1. Describe the depositional regime of the Mid-Jurassic to Lower Cretaceous sedimentary sequence
2. Identify potential source rocks within this interval
3. Determine thermal maturity of source units and oil generation potential
4. Fingerprint source rocks bitumens for correlation with reservoir oil composition.

## Study Area

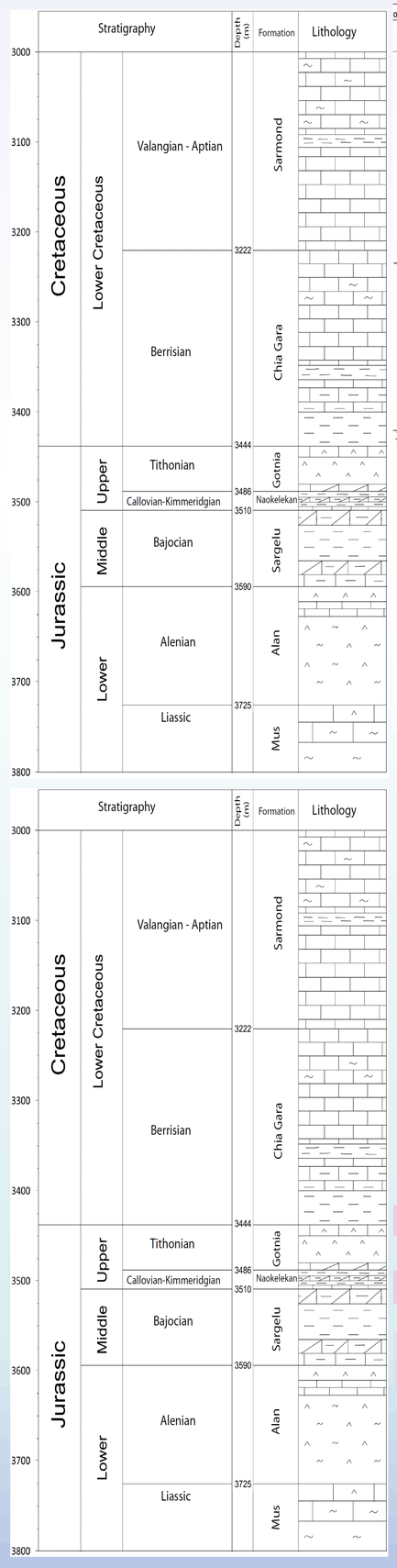



The studied oil fields and wells are located in the Autonomous Region of Kurdistan, NE Iraq, south-west of the Kirkuk supergiant oil field. During the Upper Jurassic and Lower Cretaceous the paleogeographic setting comprised a shallow water shelf with several shale basins within an wide carbonate platform possessing several evaporitic depo-centres.

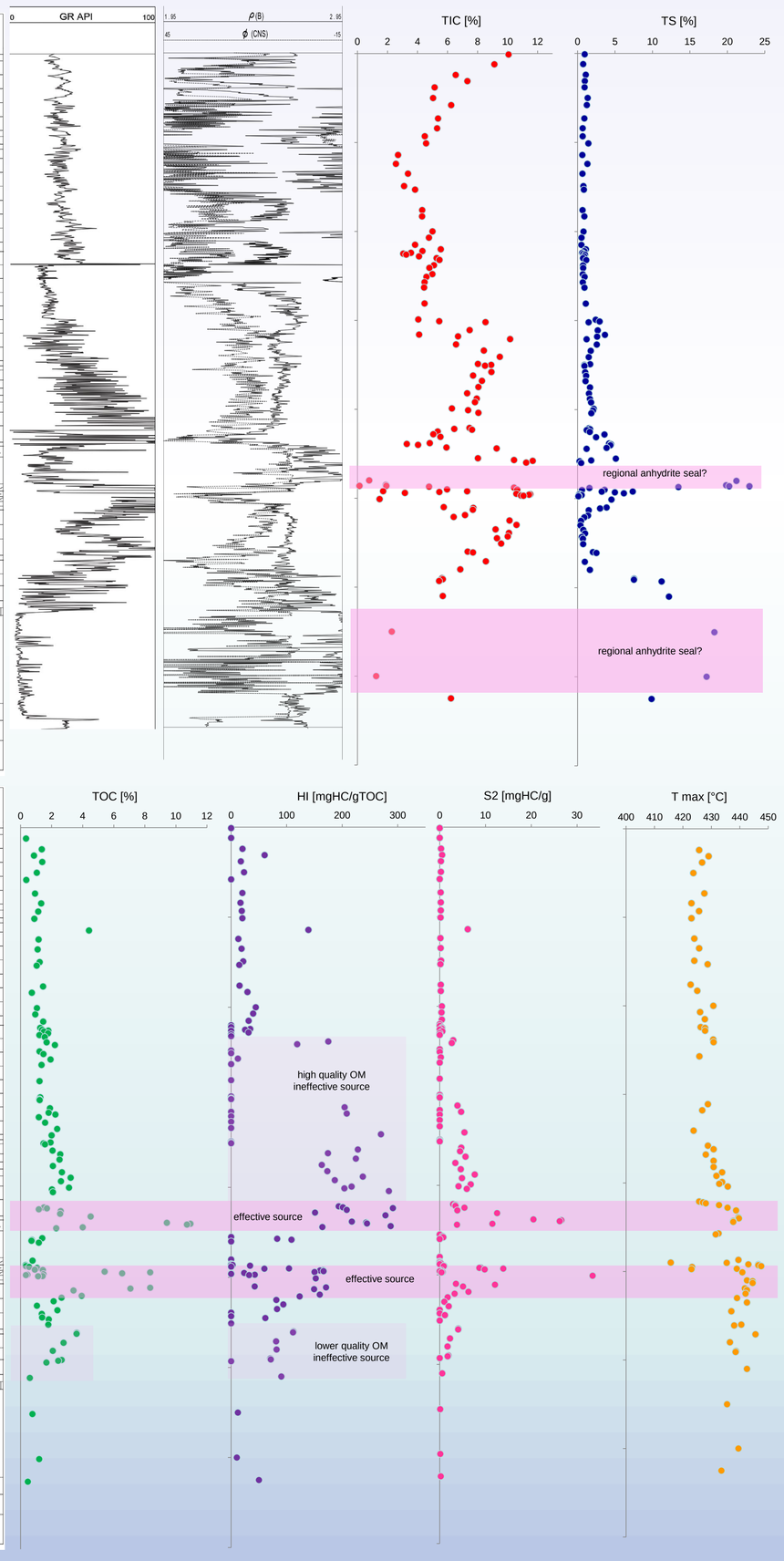



## Lithostratigraphy




## Bulk geochemical analyses

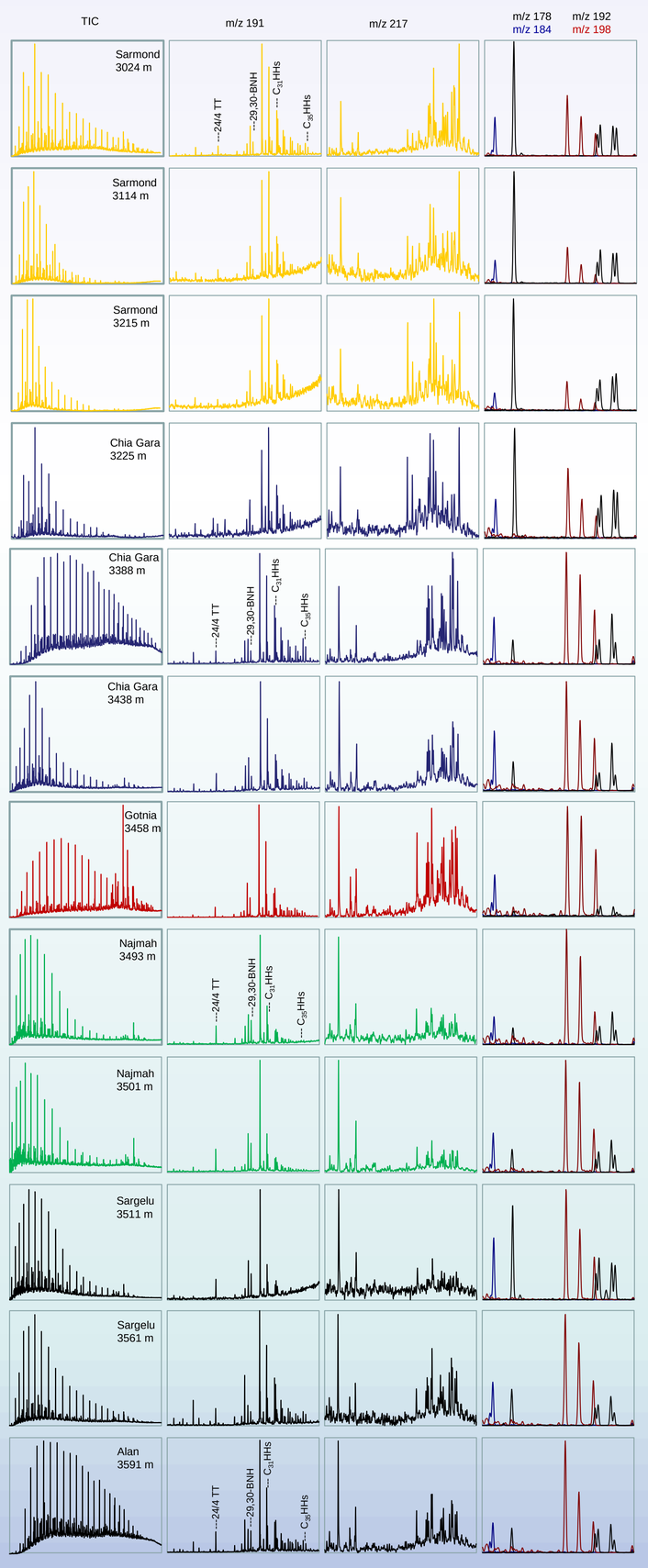






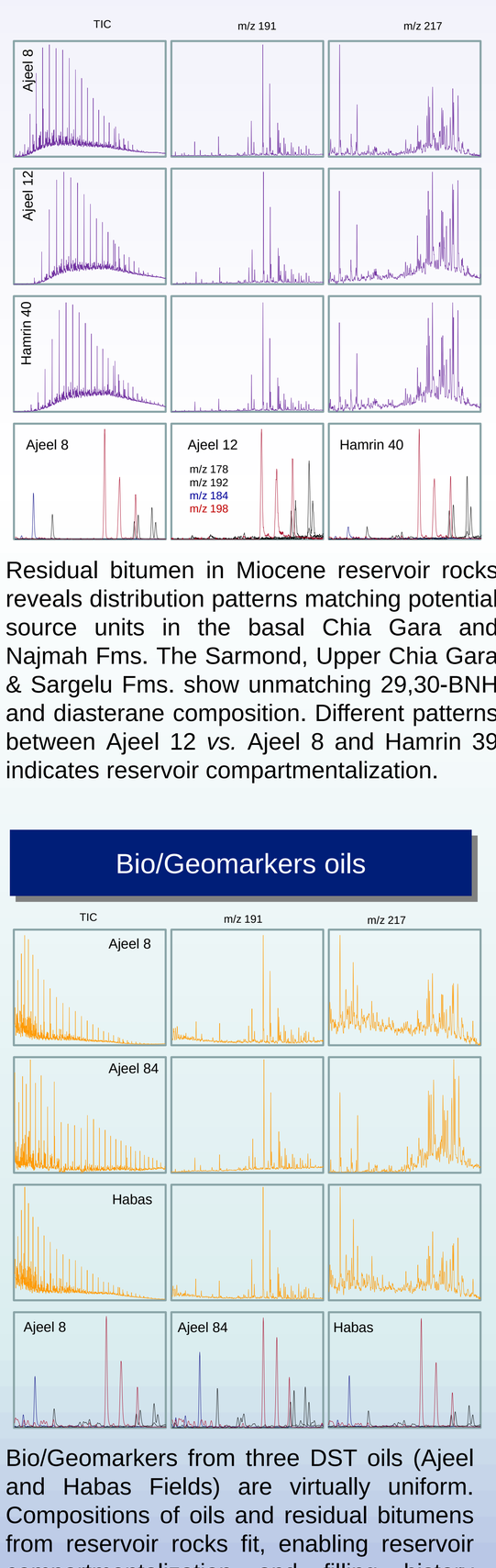
Sedimentation regime in the Jurassic-Triassic petroleum systems is governed by salinity changes, resulting in cyclic accumulation of shale, marl, carbonate, and anhydrite. Highest source potential occurs in the basal Chia Gara, the Najmah/Naokelekan and uppermost Sargelu Fms. The central Chia Gara and Lower Sargelu Fm. contain less effective source units. Maturity of source rocks is in the (lower) oil window allowing for charging Miocene reservoirs. Thermal maturity of source and oil is not fully complaint arguing for additional deeper sources or kitchen areas. Anhydrites of the Gotnia Fm in other areas may provide a effective seal but seem to be permeable for Jurassic oils to reach the Miocene reservoirs in the greater Kirkuk area.

## Bio/Geomarkers potential source rocks



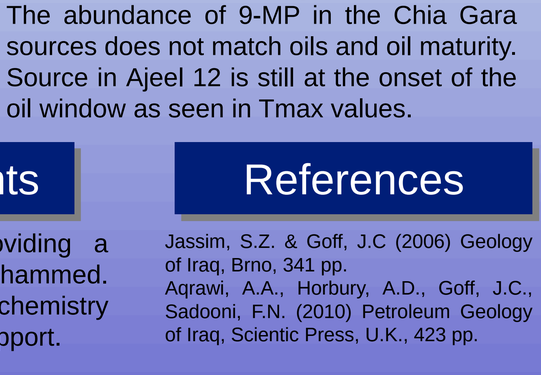

Terpane biomarker and (thio)aromatic geomarker signatures reveal origin from similar source and facies regimes concordant with carbonate/evaporitic cycles. Preservation conditons were best in Lower Chia Gara and Sargelu Fm. 29,30-BNH found in oils and reservoir bitumen is lacking in Gotnia, Lower Najmah and Upper Sargelu Fm arguing for lower contributions from these units.

## Bio/Geomarkers reservoir rocks




Residual bitumen in Miocene reservoir rocks reveals distribution patterns matching potential source units in the basal Chia Gara and Najmah Fms. The Sarmond, Upper Chia Gara & Sargelu Fms. show unmatching 29,30-BNH and diasterane composition. Different patterns between Ajeel 12 *vs.* Ajeel 8 and Hamrin 39 indicates reservoir compartmentalization.

## Bio/Geomarkers oils




Bio/Geomarkers from three DST oils (Ajeel and Habas Fields) are virtually uniform. Compositions of oils and residual bitumens from reservoir rocks fit, enabling reservoir compartmentalization and filling history studies. Note subtle differences in Ajeel 12 and Ajeel 8 wells pointing to these options. The abundance of 9-MP in the Chia Gara sources does not match oils and oil maturity. Source in Ajeel 12 is still at the onset of the oil window as seen in Tmax values.

## Conclusions

Oils are generated from the Sargelu, Naokelikan/ Najmah and Chia Gara Fm. type II-S kerogen. Residual oils from reservoir rocks and production oils from Ajeel, Habas, & Hamrin fields show distributions of terpanes and (thio)aromatics identical to the multiple source units. Triterpane show low tri- vs. pentacyclic terpanes, a predominance of the $C_{29}$-hopanes, presence of 2-methylhopanes, lack of gammacerane, and occurrence of a 29,30-bisnorhopane (29,30-BNH). A clear source-reservoir relations could thus be established.

## Acknowledgements

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## References

Jassim, S.Z. & Goff, J.C (2006) Geology of Iraq, Brno, 341 pp.

Aqrawi, A.A., Horbury, A.D., Goff, J.C., Sadooni, F.N. (2010) Petroleum Geology of Iraq, Scientic Press, U.K., 423 pp.