

# SADR 2006 Onshore Oil & Gas Licence Offering

## Regional Geology

The Aaiun Basin remains one of the last frontier sedimentary basins in all of Africa. With limited exploration since the early 1970's advanced technologies are yet to be applied to this vast territory. The hydrocarbon potential of this region, both onshore and offshore cannot be underestimated as exploration levels continue to intensify both north and south of Saharawi Arab Democratic Republic.

The Aaiun Basin is one of a series of mature passive margin basins that lie along the North Atlantic margin of Northwest Africa and the northeast margin of North America. The basin extends for almost 1100km along the margin from the Cap Blanc Fracture Zone in northern Mauritania, north through Western Sahara into southern Morocco to the intersection of the North Canary Island Fracture Zone and the South Atlas Fault.

Rather than a single super-basin, the Aaiun Basin comprises two discrete sub-basins separated by the Dakhla Fracture Zone. The northern compartment, the Boujdour sub-basin, is largely characterised by an absence of Senonian aged sediments in the slope region, the result of major Early Tertiary canyon incision and the erosive effects of contour currents that developed across the slope and upper rise. Onshore the sub-basin is characterised by over 3km of Early Cretaceous deltaic sediments. Conversely, the southern compartment, the Dakhla sub-basin, is characterised by the presence of a thick (up to 1km) Senonian sand-rich succession in the deepwater portion and the absence of Cenomanian-Paleocene sediments onshore.

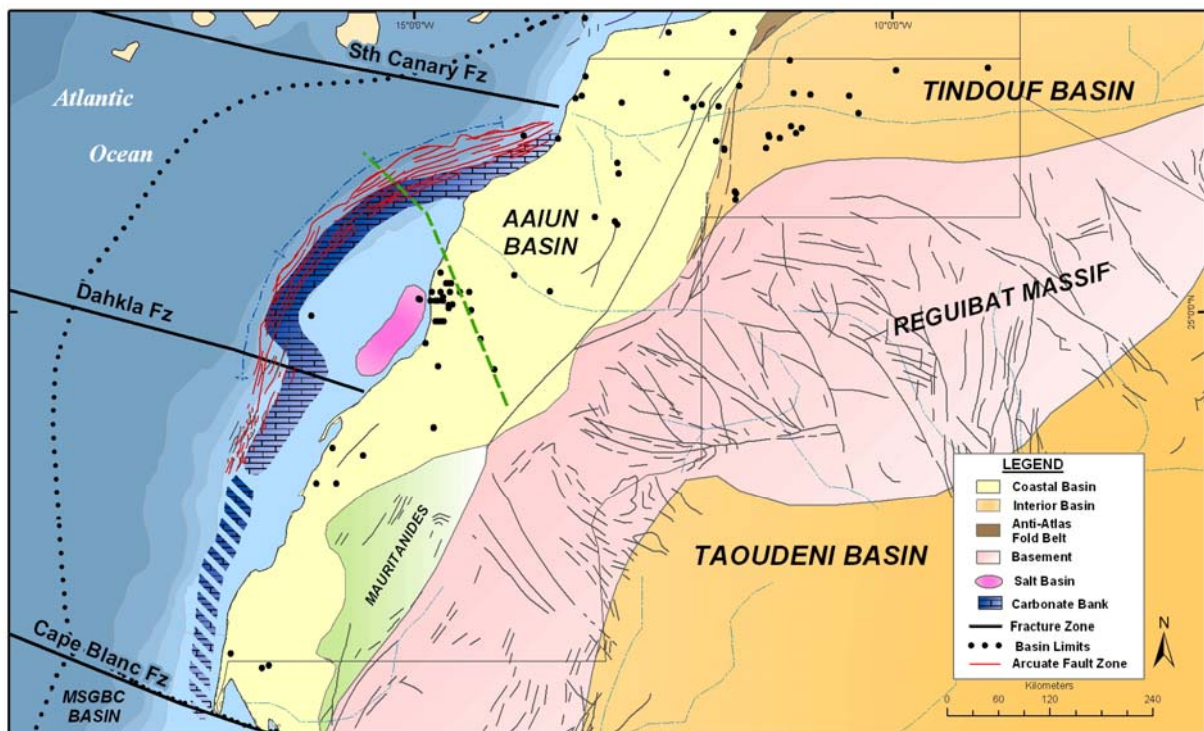


Figure 1. Structural Elements and Well coverage of the Aaiun Basin, Western Sahara.

## Onshore Stratigraphy

The onshore portion of the Aaiun Basin, which is the focus of the 2006 licence offering, extends for about 700km (N-S) and ranges between 100 and 250km in width (E-W). The onshore Aaiun basin covers some 125,000 sq km, and is separated from the older Tindouf basin by a swell in the northern extension of the Precambrian Reguibat Massif and Paleozoic fold belt of the Mauritania. The basin comprises Mesozoic and Cenozoic continental and shallow marine sediments overlying basement of Precambrian and/or Paleozoic age.

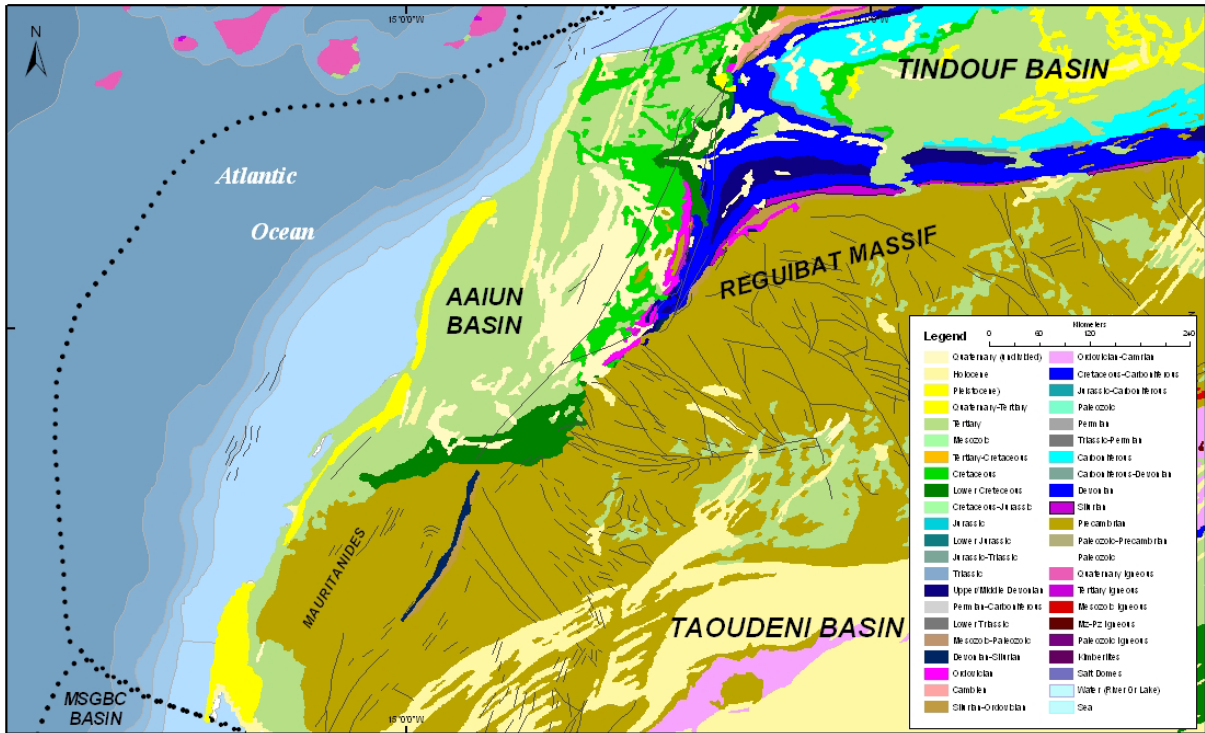


Figure 2. Surface Geology of the Aaiun Basin, Western Sahara (USGS).

The basement, comprising the Paleozoic Mauritanides and Precambrian Reguibat Massif are overlain by Triassic continental sediments. The Triassic sequence, which has been penetrated by several onshore exploration wells, consists of terrestrial sandstones and conglomerates, red beds and possibly some (Late Triassic to) Early Jurassic evaporites. Indications of an Early Jurassic marine transgression onto Triassic sediments are evident in the northern most part of the basin (north of the township Daora), where silty sandstones, limestones, dolomitic limestones and dolomites have been penetrated in several wells. These sediments are overlain by a thick sequence of upper Jurassic neritic marly limestones and calcarenites, intercalated with marl, shale and sandstone. At the eastern margin of the basin the marine sediments grade into near-shore and continental facies.

Onshore, the thickness of the pre-Cretaceous sediments is difficult to determine but estimates of 2km or more have been proposed, while offshore below the present day slope and rise the sequence may reach 8km in thickness.

The build-up of the Jurassic carbonate platform was terminated in the Early Cretaceous with the deposition of a thick regressive sequence of continental to marine-deltaic clastic sediments. In the central part of the basin, clastic sediments were deposited in an alluvial plain environment, while to the west, littoral and shallow marine deltaics were deposited between the present coastline and shelf break. Offshore, beneath the present slope, a thick sequence of deltaic forest and laminated prodelta sediments were rapidly deposited (Tan-Tan and Bojador Deltas).

The Early Cretaceous regressive delta facies were unconformably overlain by Late Cretaceous transgressive shallow marine to lagoonal sediments, which eastward, graded into continental facies. As water depths increased during the Late Albian to Early Cenomanian, facies zones migrated landward. In the Late Cenomanian and Turonian an expanded oxygen minimum zone and regional upwelling generated organic rich marls, equivalents of the 'mid-Cretaceous' black shales.

The Late Cretaceous rocks were unconformably overlain by Paleogene sediments which exceed 1000m thickness in the central Aaiun Basin. The sequence comprises several formations initially dominated by marine conditions which was followed by major clastic input during an Eocene regression. The Neogene sequence is

extremely thin (<100m) comprising transgressive sandy limestones, calcarenites and sandstones which grade eastward and northward into continental facies.

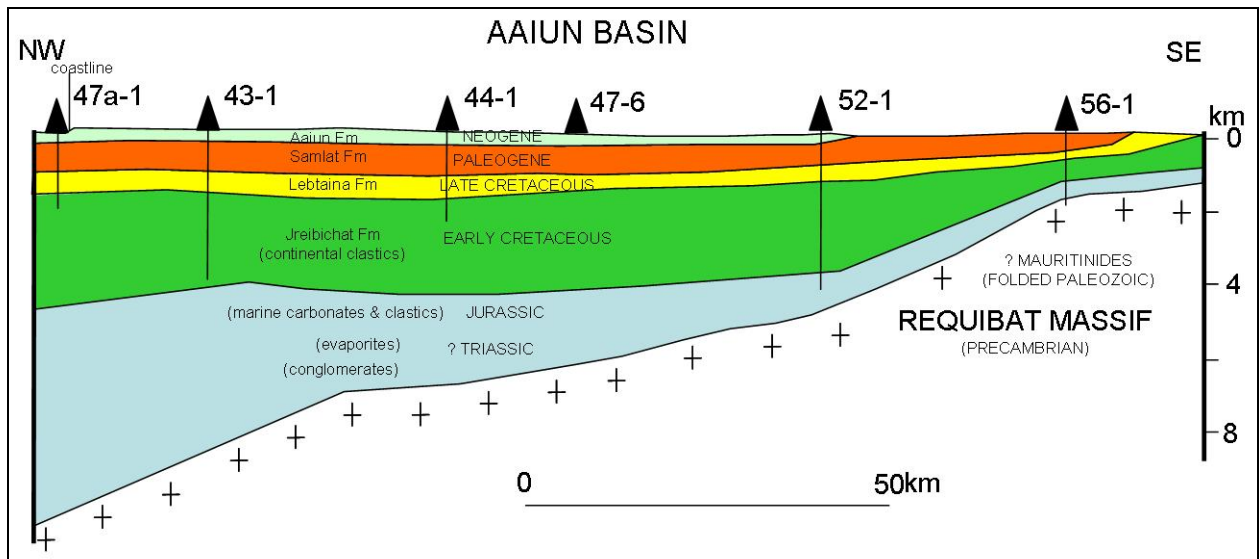


Figure 3. Highly generalised SE-NW cross-section of the Onshore Aaiun Basin (after von Rad *et al*, 1979) – see Fig 1 for line location

### Exploration History

Onshore petroleum exploration activity in the Aaiun Basin started in the early 1960's, where under Spanish Administration the onshore area was divided into more than 100 permits. By 1964 almost 50 wells had been drilled by various companies, including Gulf Oil, Amoseas, Atlantic Richfield (Arco) and Unocal. Although no discoveries were made, gas shows and good quality Cretaceous reservoirs were reported in several wells. In the Tindouf Basin, several companies including Phillips were active, drilling almost 20 wells between 1960 and 1967, with gas shows reported in two wells. The last reported onshore activity was undertaken by Société Nationale des Pétroles d'Aquitaine in 1973.



Figure 4. Landscape on the Precambrian Reguibat Massif