

A Review of Oil Potentials in the Triassic-Jurassic Rocks in West Bank and Jordan Indicating Sites for Future Exploration

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ABSTRACT

Triassic-Jurassic rocks are either outcropping along the Eastern side of the Dead Sea- Zerqa River up to Jerash Bridge or mostly penetrated in West Bank and north and northeast of Jordan. Some oil shows have been reported from deeply drilled wells.

Areas of future oil exploration probably occur in the West Bank north of Daya well (in Israel) towards Halhul and north of the Wadi Huni between S-90 and Kh-1 wells in Jordan.

Keywords: Triassic, Jurassic, Dead Sea, Zerqa River, Jerash, West Bank, Wells.

1. INTRODUCTION

The Triassic-Jurassic succession in Jordan and West Bank lands have been examined by many European and local geologists who have traced their outcroppings and their sedimentary distributions. The Triassic rocks are widely exposed at the eastern side of the Dead Sea from north wadi Mujib, as a strip passing by the Zerqa Ma'in, Wadi Hirri, Ayun Musa, Wadi Hisban, and Suwiema sites, then plunging downward to the Jordan valley up to the Zerqa River course at the Wadi Huni; the Jurassic sequences outcrop at the Eastern side of the Jordan Valley crossing the Ghore Kabid, the Jordan University farm, and the Arda area, including Ain-Khuneizier site; then exposed at the Dier-Alla, passing by the Zerqa River course up to Jerash Zerqa Bridge (fig.1).

Geological Setting

Most of the geological sequences of Jordan have been greatly affected by the Jordanian transform which was responsible for the creeping of Arabian plate towards northwards by 72 km or more with respect to Palestine-Sinai plate where same sequences are out crop at the Naqab area, southern Israel (Bender, 1968, 1974) The tracing of the Triassic-Jurassic rock outcrops is generally outlined in figure (2) and (3), (modified, Author 1981,

1983).

However, the Triassic-Jurassic sequences have been also drilled in the north and north East Jordan, namely the wells; Suwieleh (Sw-1, Jr. 250m +Tr. 250m), Safra (Sa-1, Jr.590m. + Tr.90m); Ramtha (S-90, Jr.415m+ Tr.500); Khaldiya (Kh-1, Jr.67m. Tr.380m.); South H-5 Iraq Pump Oil Station (SH-5, Jr.100m.+Tr.230m.); Wadi Hazim (Wh-1, 165m.Jr. + Tr. 66m.) ;and at the Risha area (Rh-3, Jr.100m.+Tr. 100m.); in addition to the West Bank wells namely the Ramallah (R-1, Jr.3000m+ Tr. 400m.); and the Halhul, near Al-Khalil (H-1, Jr.540 m.+ Tr.400m.), as well as the Daya of the Israel (Fig.4). It seems that the Triassic-Jurassic paleogeological shore lines run parallel to each other Fig. (5), (modified, Author, 1981, 1983).

It is obvious that the drilled Jurassic sedimentary sequences increase in thickness westwards and decrease towards Jordan/Iraq borders as it has been reported from the well Rh-3=100m, which is characterized by sandy facies, carbonates, interbedded with thin streaks of gypsum indicating near shore environment, whereas the Triassic is characterized by thick shales, sandy layers, limestones and dolomites overlain westwards by thick massive gypsum lense centered north of the Wadi Huni, and terminated towards SH-5 well.

Consequently, the petrophysical analysis of the Triassic-Jurassic dolomite sequences possesses, porous, permeable character, and containing some oil shows in addition to the capping gypsum lense, as it has been substantiated by the Ramtha S-90 well where reported oil spots during the course of the drilling mud.

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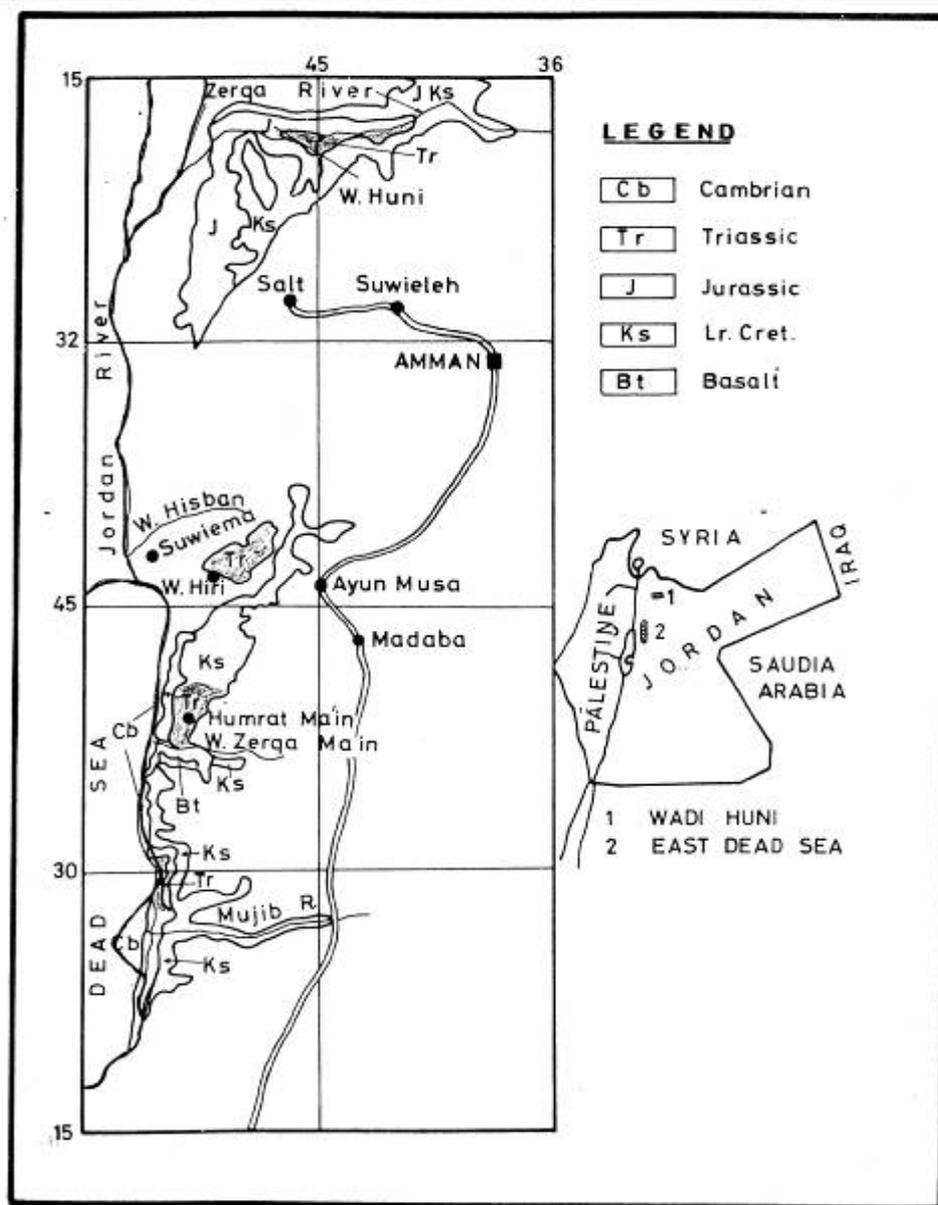


Fig. 1. Triassic – Jurassic Outcrops in Jordan

Oil Possibilities

The tectonic-stratigraphic framework of the Levant has been discussed by Henson (1951), Weber (1963), Hotckiss (1965), Powers (1966), Bender (1966), and Baydoun (1977) who have considered Israel and West Bank Lands, most of north and north east Jordan lies within the stable shelf. Recent studies and drilling operations in Jordan and near by countries proved its occurrence within the unstable shelf Fig. (6), (modified, Author, 1981).

Accordingly, the main objects for oil exploration should include the studies of the depositional environments of sediments, their porosity, permeability, source and cap rocks. Oil shows have been reported from

some wells penetrating Triassic rocks in Israel, namely the Heimar well; asphalt and heavy oil from Qannaim-3, and high amount of gaseous hydrocarbons from the Heimar-1, Lot-1, Zohar-8 and Nafha wells of the Naqab area , on the other hand oil shows also have been reported from the Triassic after deepening the Halhul well (H-1) at the West bank (Druckman, 1974, and et al., 1975), and gaseous reservoir was encountered in the lower Cretaceous sandstones , in the drilled well at the shore of Gaza strip. A correlation between some drilled wells in Jordan and nearby countries showed the possibility of a future oil Triassic penetration in the area north of the Wadi Huni gypsum lense between the S-90 and Kh-1 wells if the gypsum lense is well oriented (Fig.7).

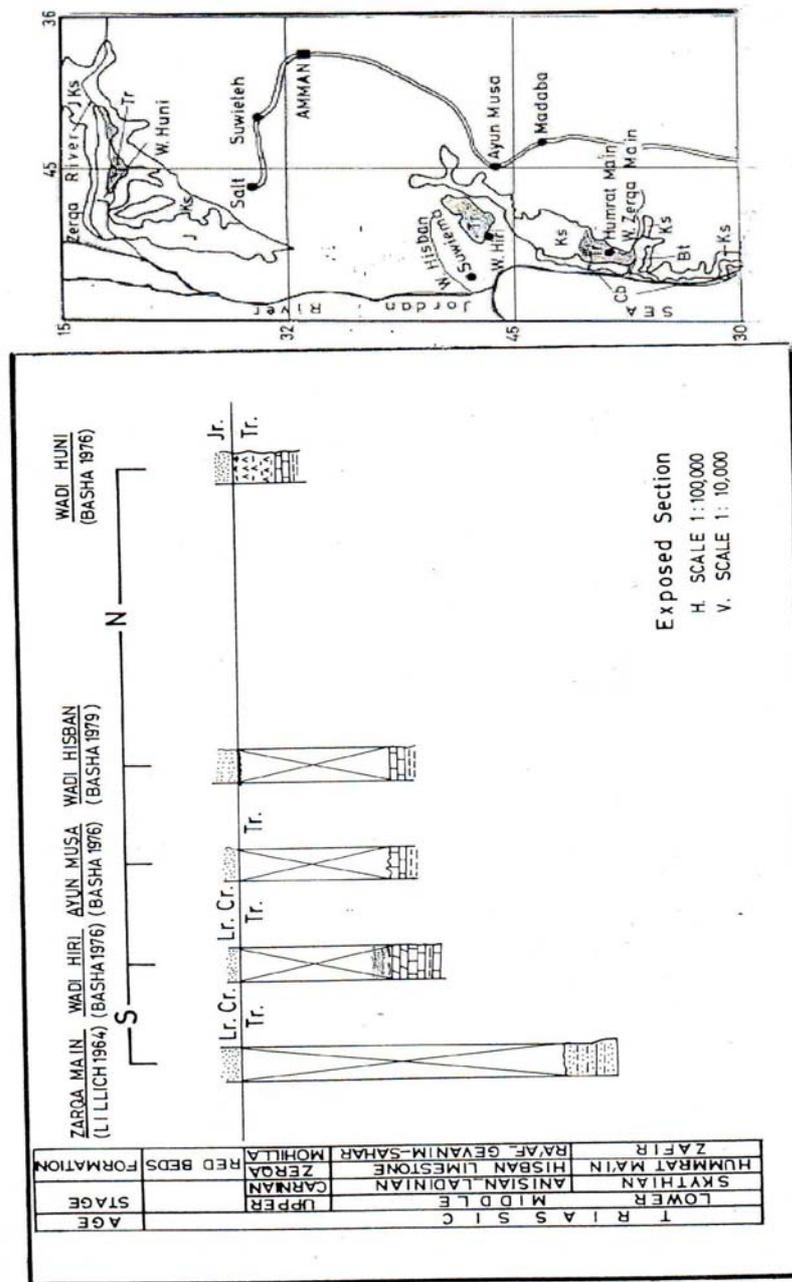


Fig.2: Triassic outcrops in Jordan(Author (modified, author 1983)

On the other hand, the Jurassic sequences either outcrop or drilled, composed of sandy dolomites, and cavernous dolomitic limestone underlain by shales and overlain by marls-marly limestones probably oil shows producing. A tentative intopulation between the wells of Daya-4 in Israel, H-1,R-1 of West Bank, and Jordan up to RH-3 indicate the possibility of oil occurence between Daya and H-1 structure, and possibly north of the Huni site up to S-90 Kh-1 wells (fig.8).

In Jordan, petroleum exploration was carried out by Philips Co. in 1956, where five wells were drilled namely

R-1,H-1, Jv-1, Sa-1, Sw-1, and Lisan-1 in both the West and East Banks; followed by Mecom Co. 1964, who carried out the deepening of H-1 who left Jordan without declaration; later followed by INA Naftha Co. 1965-1969, who drilled WG-1,WR-1, WH-1,WS-1; and lastly Filon Co. 1970, drilled Er-1 well in the Ramtha area; the Natural Resources Authority (N.R.A.) drilled the S-90 well in 1968/1969. None of the previous drilled wells were oil producing, except one well that produces a small quantity of oil from the Turonian dolomites in the Hamza field, in the Azraq area ,drilled by the N.R.A.

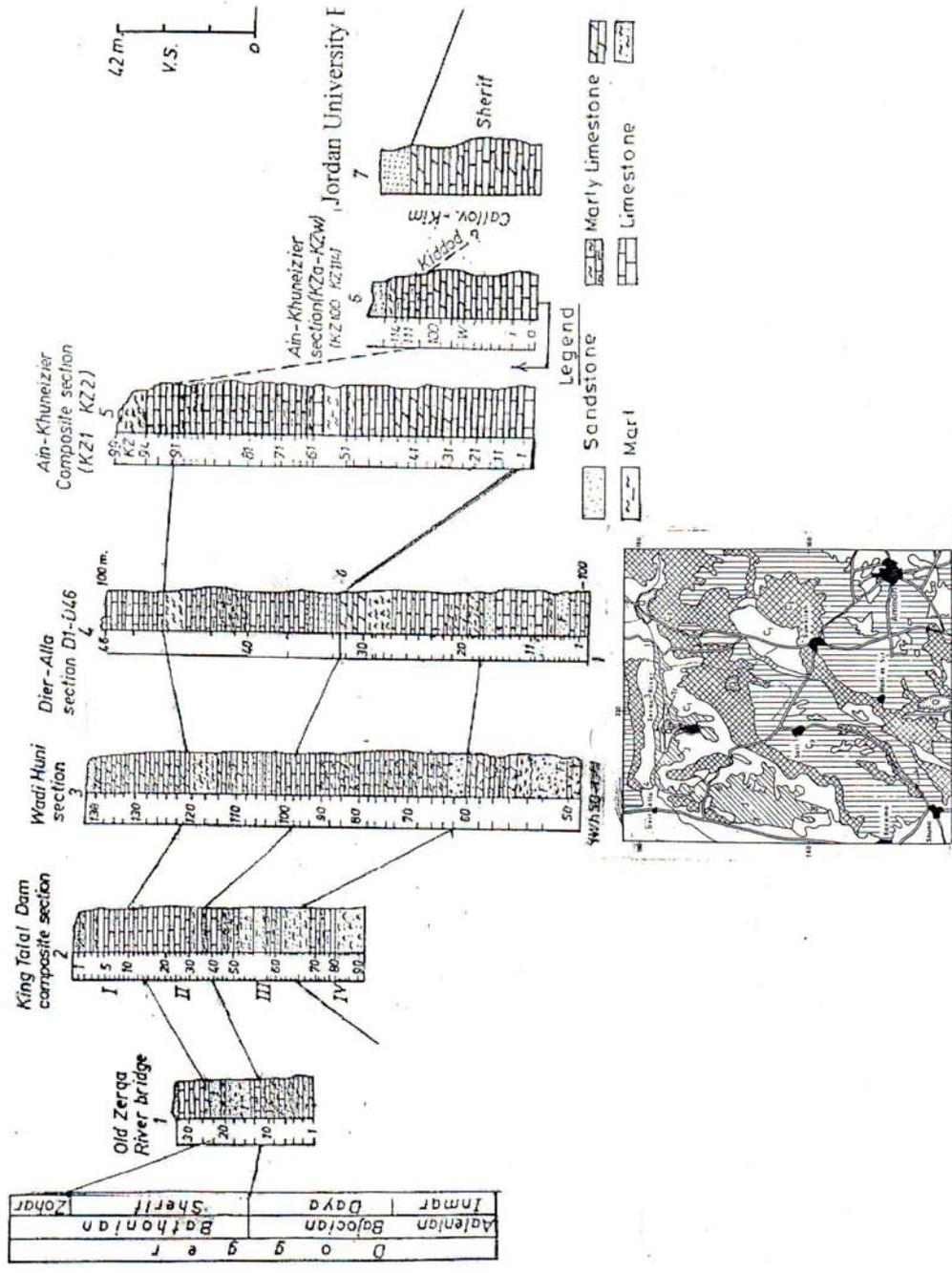


Fig. 3. Jurassic Outcrops in Jordan (Modified, Author (1981))

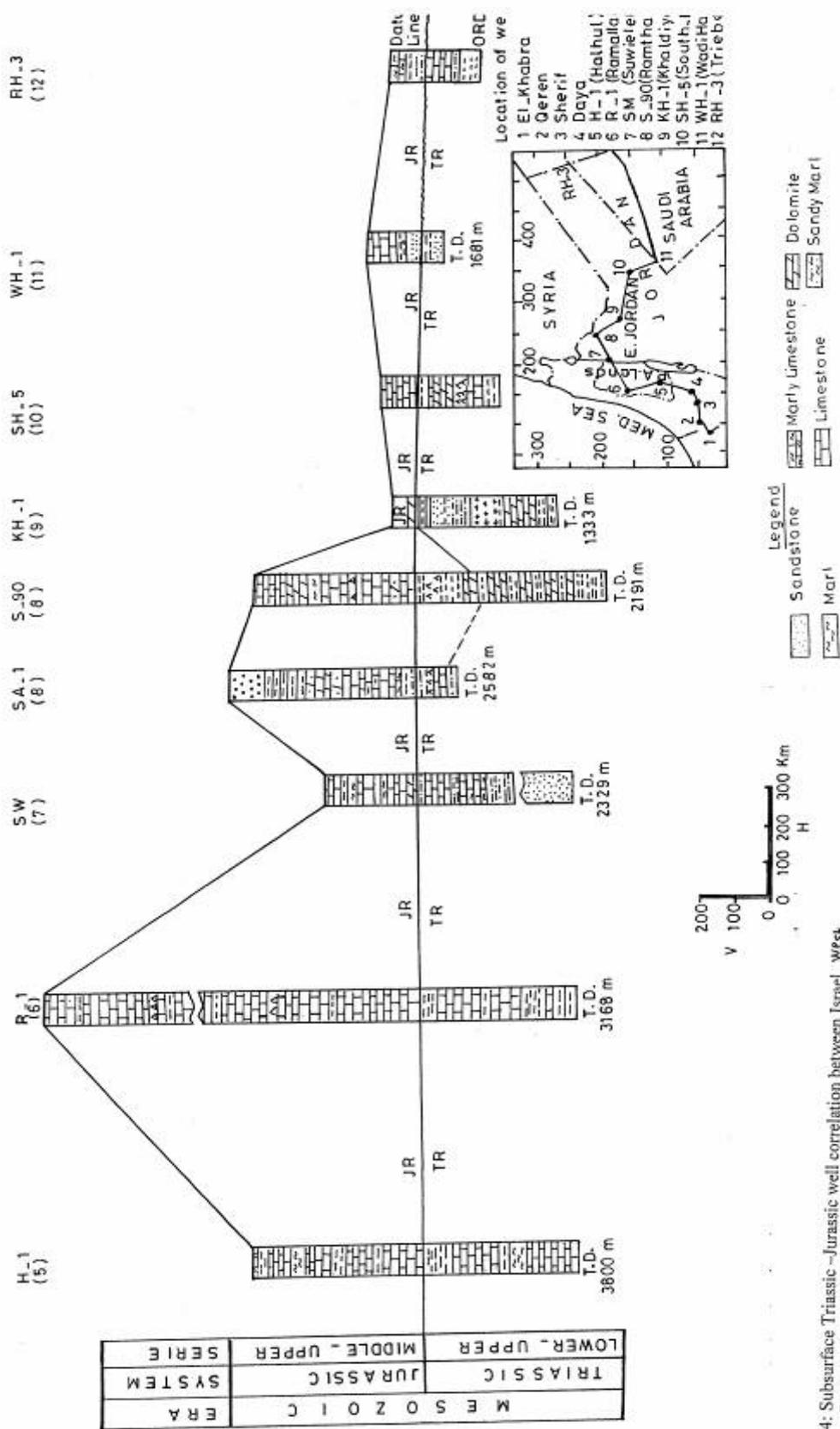


Fig-4: Subsurface Triassic -Jurassic well correlation between Israel, West Bank, and Jordan (Author 2007)

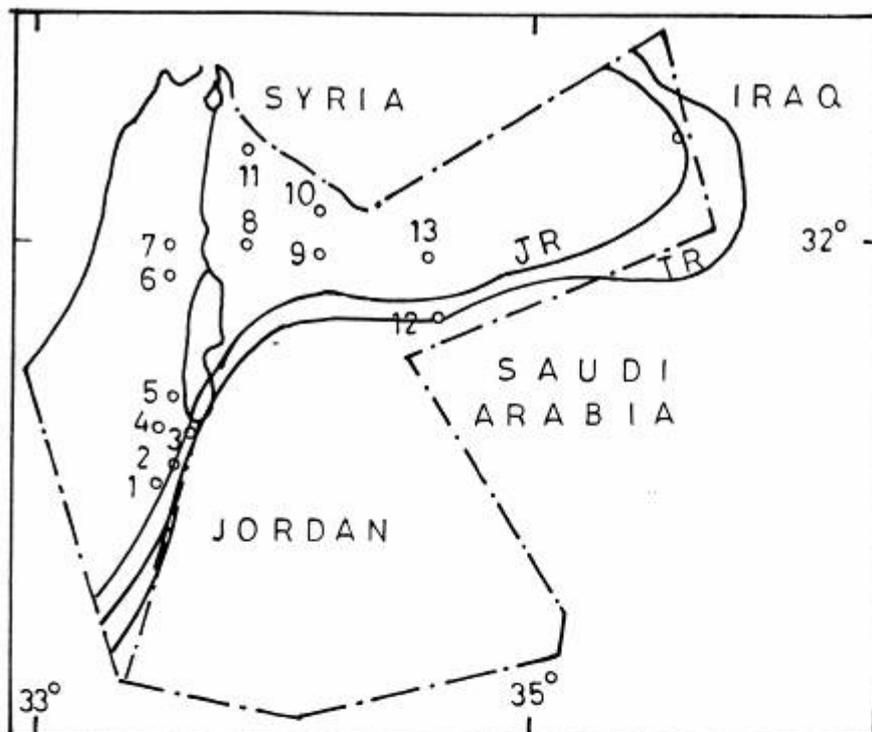
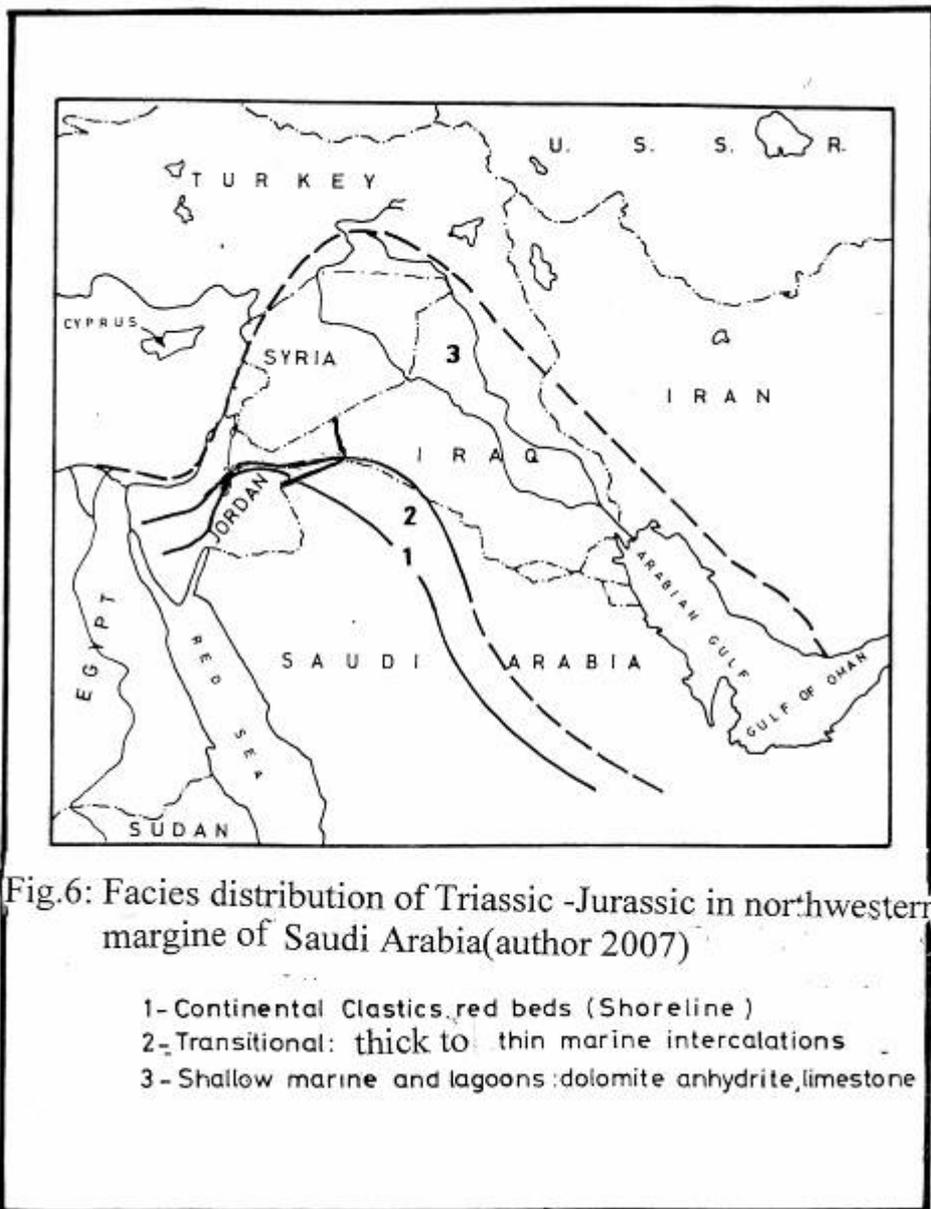


Fig. 5: Delineation of Triassic-Jurassic shorelines with respect to drilled wells in Israel, West Bank, and Jordan (author 2007)

- Selected well locations in Israel (1-5), West Bank (6-7), and Jordan (8-14).

- 1-Nafha-1
- 2-Daya
- 3-Heimar-1
- 4-Zohar-8
- 5-Lot-1
- 6- Halhul,H-1
- 7-Ramallah, R-1

- 8-Suwieleh, Sw-1
- 9-Safra, Sa-1
- 10-Khaldiya ,Kh-1
- 11-Ramtha, S-90
- 12-Wadi Hazim, Wh-1
- 13-South-H5
- 14-Risha ,Rh-3



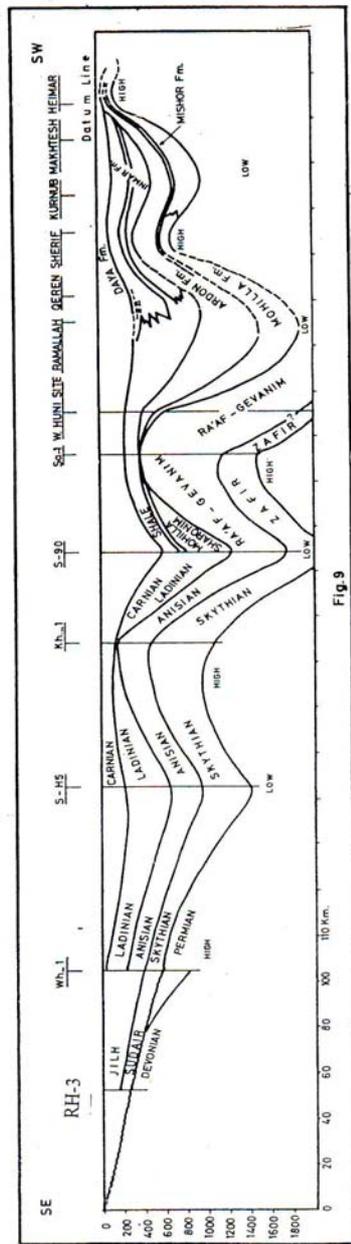


Fig. 9

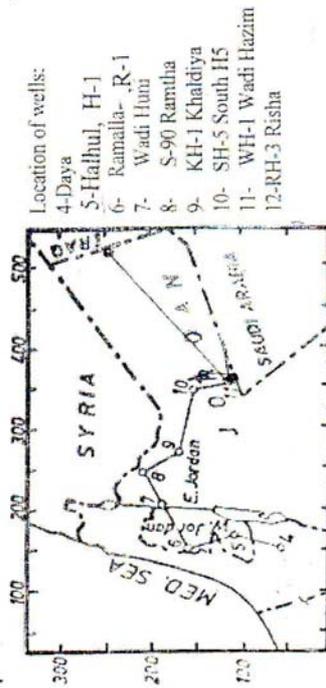


Fig. 7: Subsurface Triassic correlation in Israel, West bank, and Jordan

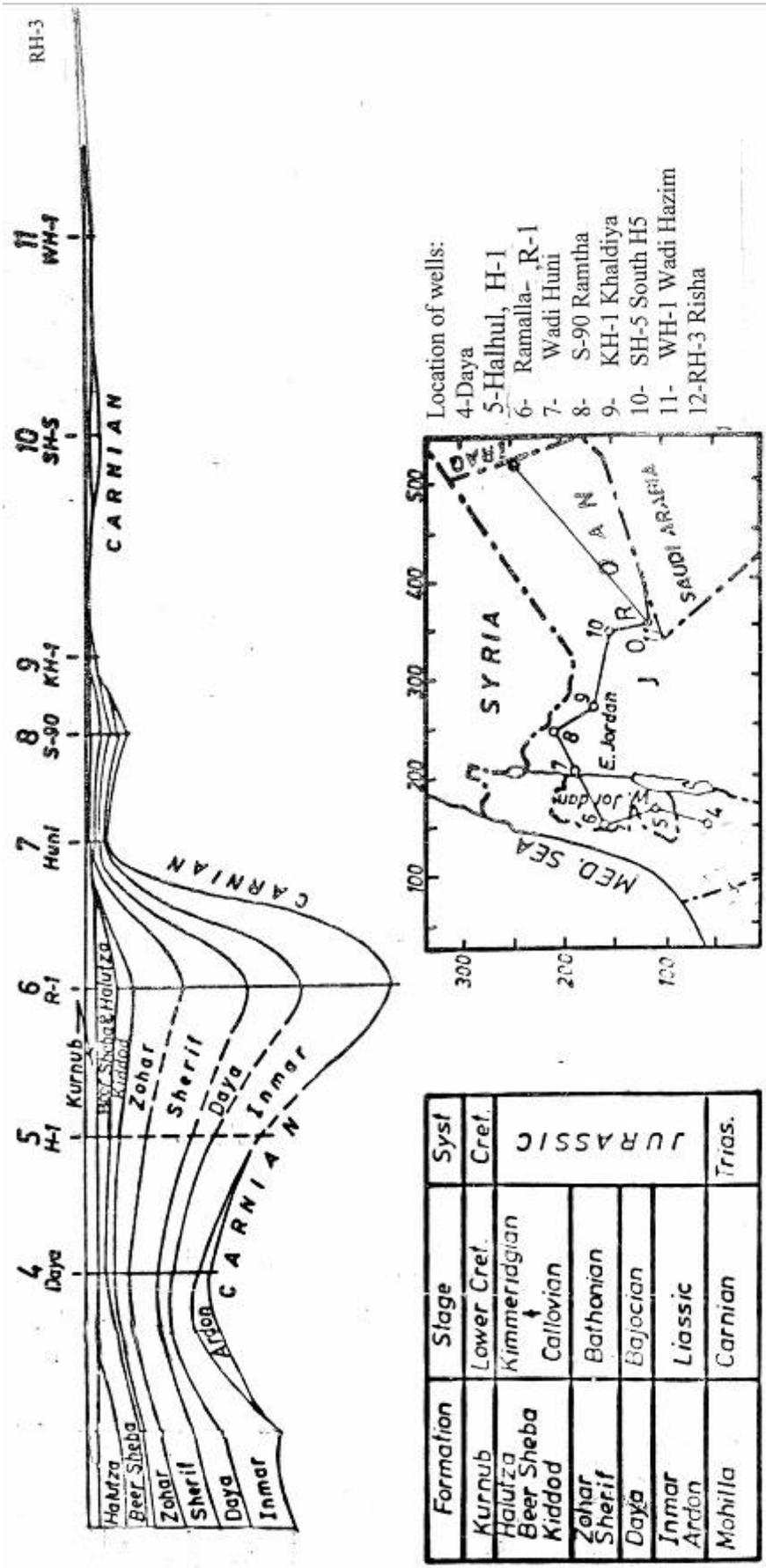


Fig.8: Subsurface Jurassic correlation in Israel, west Bank , and Jordan

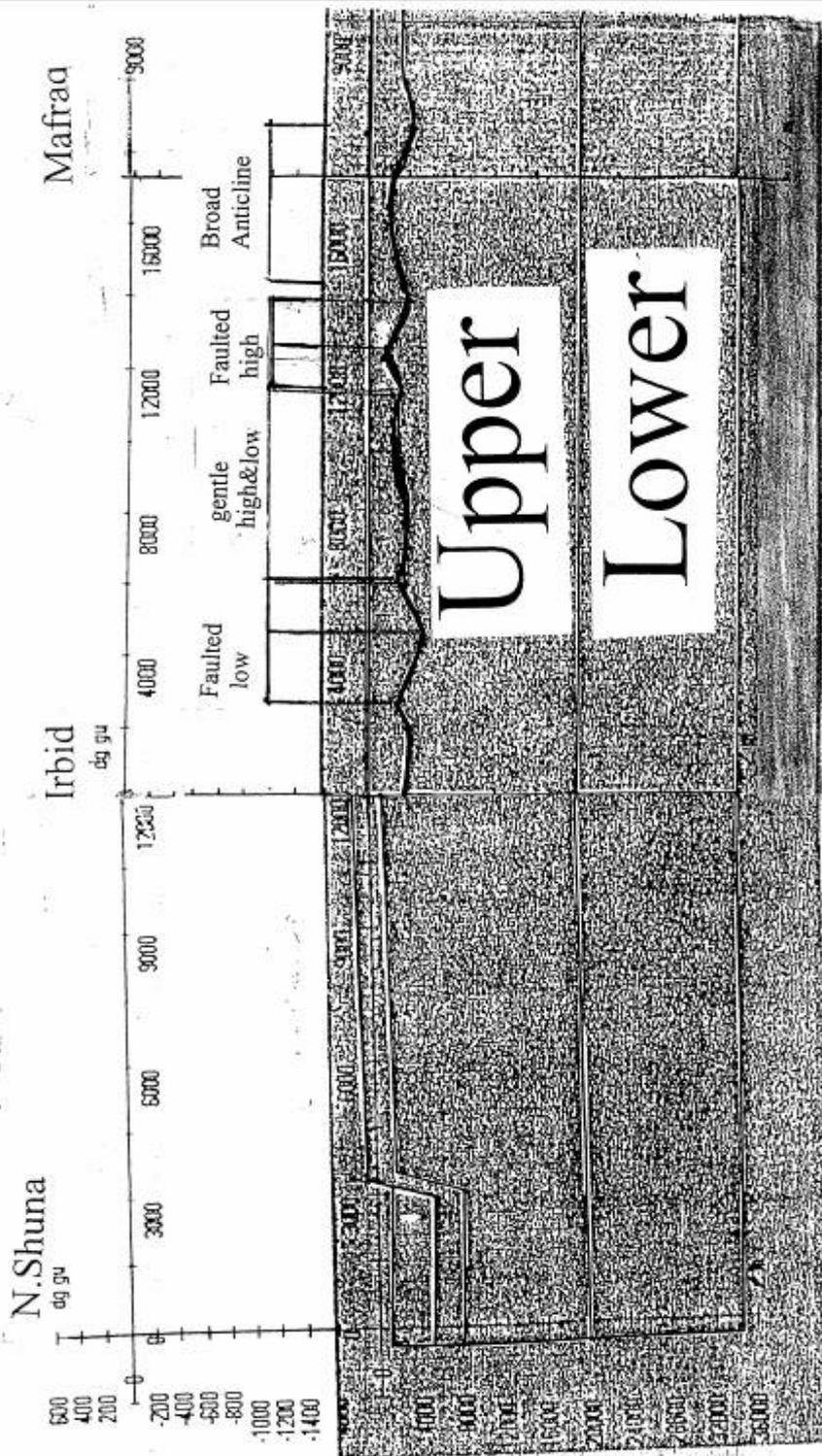


Fig.9: Tentative crustal model beneath Mafraq-Irbid area(modified after Abu-Hamiedah 2000, author 2007)

2. CONCLUSIONS

By considering the stratigraphy of both the outcropping and the subsurface drilled Triassic rocks -composed of green-black shales layers interbedded with sandstones followed by partly bituminous marl-marly limestone (Source rocks), followed by cavernous fractured

dolomites (Reservoir rocks), and overlain by gypsum and clays (Cap rock); possible oil may be identified by carefully deliniated the configuration and the extension of the gypsum lense north of the Wadi Huni site.

On the other hand, similar petrophysical properties have been reported from the drilled Jurassic rocks in East Bank of Jordan.

A similar approach was adopted in the Zohar Kiddod and Hakanaim structures of the Naqab of Israel where gas is produced from fractured limestone interbedded with sandy layers of Middle Jurassic (Druckmann, 1975).

Also a subsurface Jurassic ridge was in connection with that of Jordan before the occurrence of Jordan transform, adding to the fact that the paleogeography of the Triassic and Jurassic shorelines, that ran parallel passing by Israel, and outlines clearly that the northwestern portion of Jordan was deeply submerged by the transgressed seas which is characterized by shallow neritic sediments same as that of Jurassic-Triassic sequences at southern Naqab of Israel. It mainly composed of sandstones, marly limestones, clays as well as reefal crystalline limestones; such facies produce oil

and gas (in Israel) and might be promising for oil exploration in Jordan with reference of light hydrocarbons migration to subsurface dome like structures along the Syrian-Jordanian borders from the cooking basin of Damascus .

Abu-Hamiedah, (2000), ran a gravimetric-magnetic surveys along the Irbid-Iraqi highway; and delineated subsurface structures. A gentle undisturbed anticline extended west of the Mafraq- followed by faulted high, gentle high and low and faulted low-up to the Irbid town. The anticlinal structure is possibly a promising site for further geophysical studies since its location near the Jordan-Syrian borders provide a suitable site for oil exploration that might have been migrated from the cooking Damascus basin (fig. 9).

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