ELECTRICAL RESISTIVITY IMAGING FOR QUATERNARY AQUIFER IN WADI MURAYKHAT AND WADI SA’A, AL AIN AREA, UAE.

By:

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Figure (##) Map of Al Jaww Plain and locations of Wadi Muraykhat and Wadi Sa’a (modified from Warrak, 1986).
Objectives

These wadis originate from the Oman Mountains range and form the catchment and feeding area of the water resources. So, from the hydrogeological point of view, subsurface investigation of these wadies is very important for better understanding of the Quaternary aquifer system.

To Map the subsurface conditions of the Quaternary alluvial aquifer system at Wadi Muraykhat & Wadi Sa’a, Al Jaww Plain through (2-D) electrical Resistivity tomography survey.
To achieve these Objectives

Reviewing the Geology of study area. A series of data including:

- Borehole data
- Geophysical Investigations
  - (2-D Resistivity, TEM Data)
GEOLOGICAL ASPECTS
A-Geomorphology

Fig. (2.2) Physiographic subdivisions of eastern study area.
B-Geological Map of the Study Area, showing the different rock units
C-Surface Lithologic units at Al Jaww Plain
Bouguer anomaly map of Al Jaww Plain showing gravity anomaly lows in the centre and gradual increase to the east of the survey area (After Ali et al 2008).
Amoco seismic lines and uphole-survey locations (after Woodward, 1994).

Generalized subsurface structural features in Al Ain area (after Woodward, 1994).
Interpreted seismic lines at Al Jaww Plain and north of Al Jaww Plain, (modified after Woodward, 1994).
Combined interpretation of the data, which is consistent with all available geological and geophysical data. The position of folds and reverse faults are shown. Also shown are the approximate positions of the Hawasina and Semail Ophiolite thrust fronts, (After Ali et. al 2008).
HYDROGEOLOGICAL ASPECTS
A-Different Aquifers in UAE.
### Geologic Framework of the Eastern Region of Abu Dhabi Emirate (after Bright, 1998)

<table>
<thead>
<tr>
<th>Age</th>
<th>Geologic Sequence</th>
<th>Approximate Thickness (m)</th>
<th>Hydrologic Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaternary</td>
<td>Eolian Sand</td>
<td>25</td>
<td>Unsaturated overburden</td>
</tr>
<tr>
<td></td>
<td>Alluvium</td>
<td>30</td>
<td>Surficial Aquifer system</td>
</tr>
<tr>
<td>Pliocene-Miocene</td>
<td>Post-Fars Upper Fars</td>
<td>200</td>
<td>Basal Confining system</td>
</tr>
<tr>
<td>Miocene-Oligocene</td>
<td>Lower Fars Fm. Asmari Fm.</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Paleocene-Eocene</td>
<td>Dammam Fm. Rus Fm. Umm er-Radhuma Fm.</td>
<td>1,200</td>
<td></td>
</tr>
<tr>
<td>Cretaceous</td>
<td>Simsima Fm. Qahlah Fm. Juweiza Fm.</td>
<td>3,000</td>
<td></td>
</tr>
</tbody>
</table>

- Eolian Sand
- Quaternary Alluvium
- Altered Tertiary Deposits
- Unaltered Tertiary Deposits
- Deep Limestone
- Pre-Tertiary Deposits
C-Quaternary Aquifer Geometry
Geophysical Investigations
A-2-D Resistivity Data Acquisition
Typical TEM data from sounding Zarub-2-2 and Zarub-2-11.

The observed data and the model response

Interpreted layer resistivity.
Base map showing the Electromagnetic survey at Al Qura'a area north of Al Ain (after US Geological Survey, 1993)
Resistivity model of typical resistivities for interdune soundings at Al Qura’a, north of Al Ain (after US Geological survey, 1993).

<table>
<thead>
<tr>
<th>DEPTH (m) Below land surface</th>
<th>LITHOLOGY</th>
<th>RESISTIVITY (Ohm.meters)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>3.000</td>
<td>R1: Surface resistive layer (aeolian sand and alluvium, dry)</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>2.6</td>
<td>C1: Upper conductive layer (mostly clay and silt)</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>75.3</td>
<td>R2: Upper resistive layer (alluvial sand and gravel; possible calcareous cement)</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>587.3</td>
<td>R3: Primary resistive layer (alluvial sand and gravel; good permeability; fresh water where saturated)</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>8.4</td>
<td>C2: Conductive layer (mostly clay and silt)</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>2.7</td>
<td>C3: Conductive layer (mostly clay and mudstone; poor water quality)</td>
</tr>
</tbody>
</table>
Well GWP-18 log information. The solid and dashed lines (green & red) are the deep and medium induction logs. The heavy line (Blue) is the blocked resistivity model based upon the induction logs. Layer lithology is shown (After Fitterman, et al. 1991).
Figure (#) 2-D Resistivity profile along line 1-1`

Figure (#) 2-D Resistivity profile along line 11-11`
Conclusions

- 2-D resistivity tomograms of the Thirteen profiles indicate clearly the different hydrostratigraphic units of Quaternary aquifer along the eastern margin of Al Jaww plain.

- Erosional unconformities at the base of the Quaternary alluvium are traced along some of the (2-D) profiles. These unconformities represent the paleochannels in the bed rock that were formed in the geological past by the ancient wadies.

- These paleochannels are promising targets for fresh groundwater, as they contain appreciable thickness of water-bearing formations that are recharged from the surrounding mountain region. *Channel Deposits serve as both storage reservoirs and recharge zones for the shallow aquifer system in Al Jaww Plain.*

- This contribution will provide the technical support for planners, decision makers, and researchers in the field of groundwater development and management. Especially, Nowadays Aquifer Storage and Recovery system (ASR) Projects are implemented in Al Ain area and elsewhere at UAE.
Thank You
For your attention