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

By:

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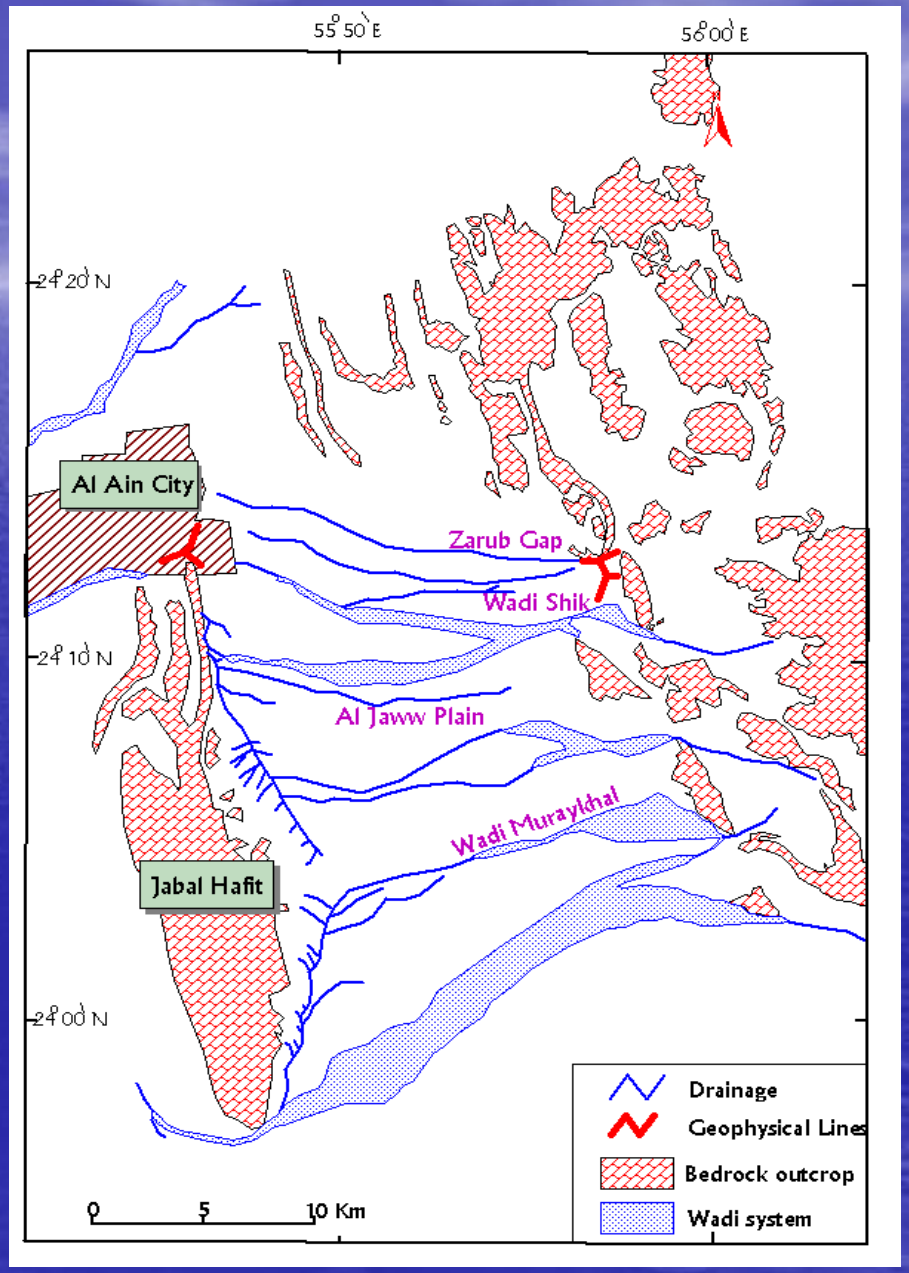


Figure (#) Map of Al Jaww Plain and locations of Wadi Muraykhat and Wadi Sa'a (modified from Warrak, 1986).

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:

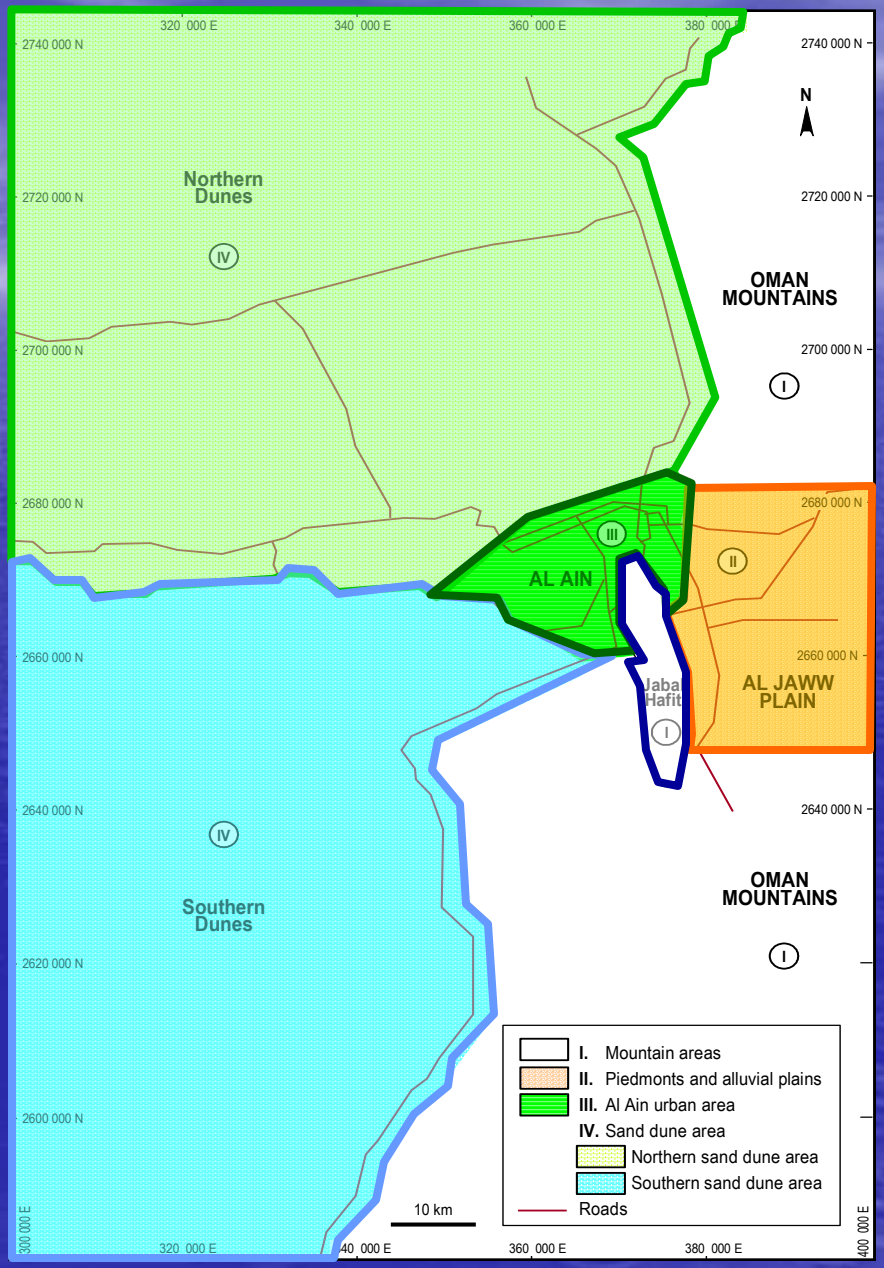
Borehole data

Geophysical Investigations

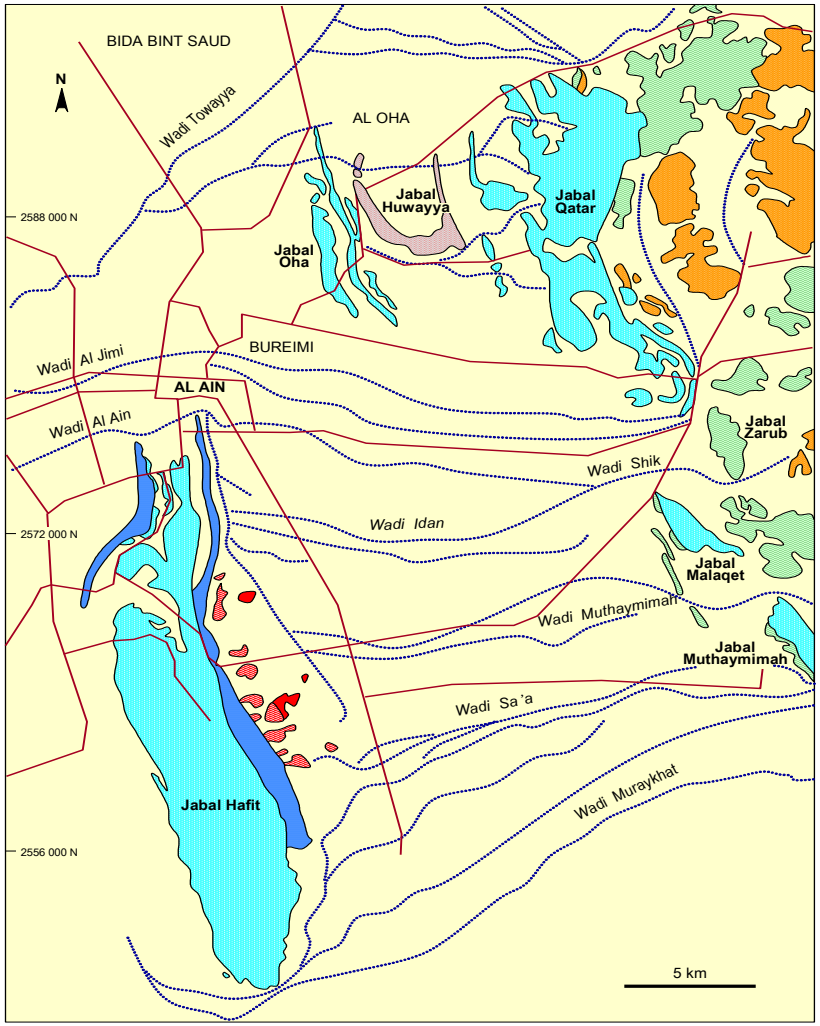
(2-D Resistivity, TEM Data

GEOLOGICAL ASPECTS

A-Geomorphology

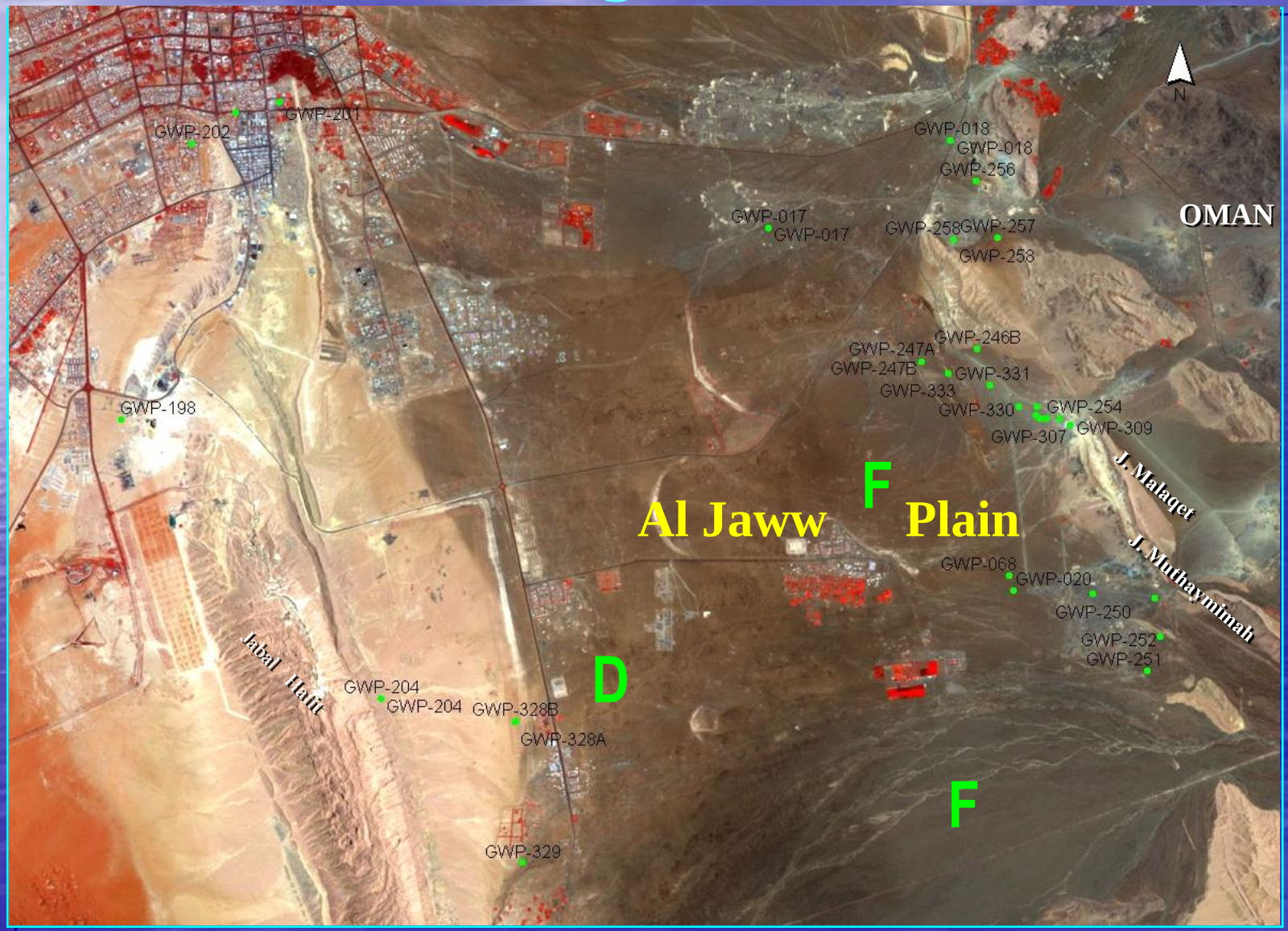


B-Geological Map of the Study Area, showing the different rock units

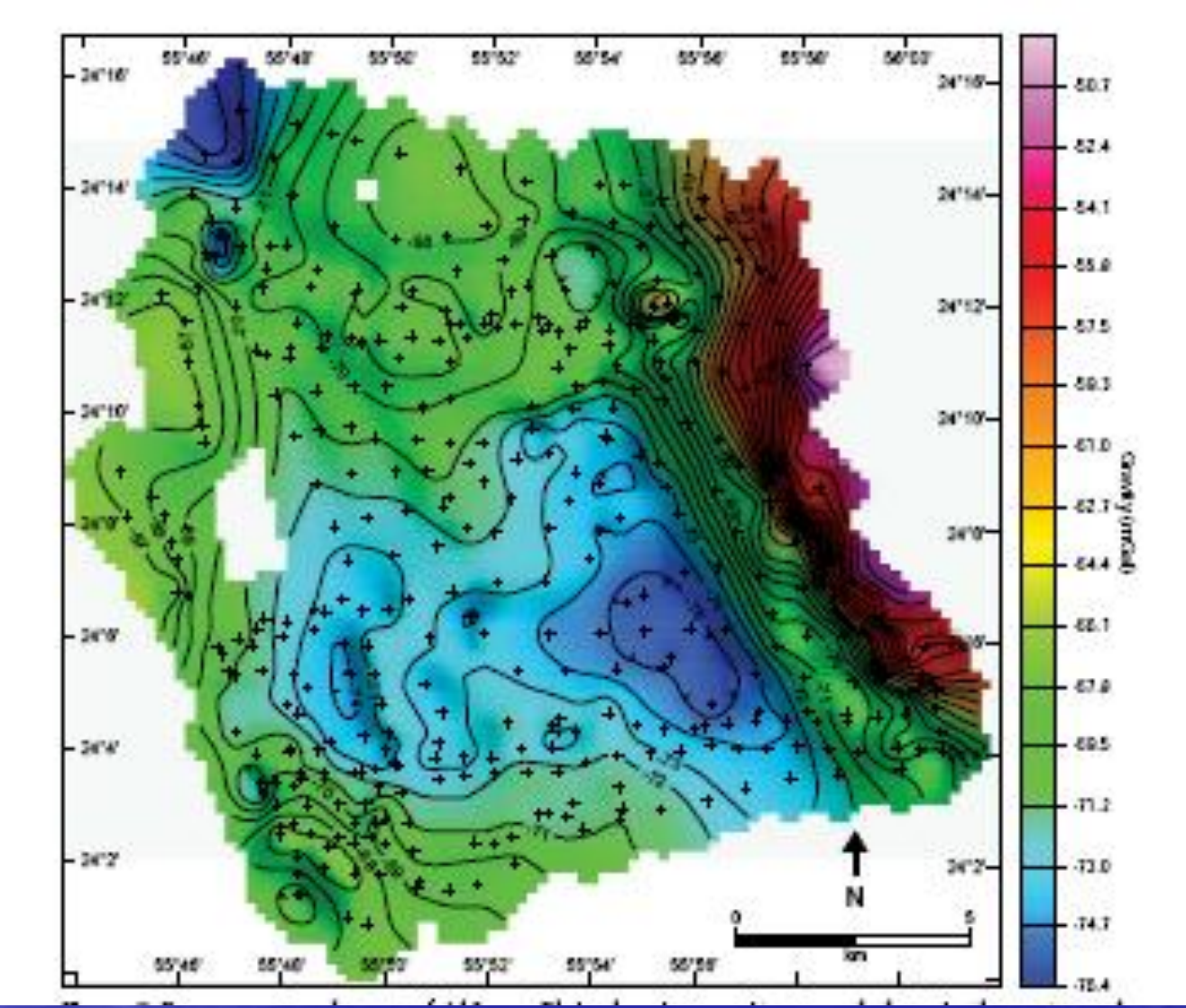


Quaternary alluvium
Unconformity
Upper For a Formation
Lower For a Formation
Unconformity
Asmari Formation
Unconformity
Eocene and Paleocene rocks
Unconformity
Simsima Formation
Unconformity
Semail Nappe Formation
Thrust fault
Haybi Complex and Hawasina Series
Thrust fault
Road
Wadi
Geologic contact

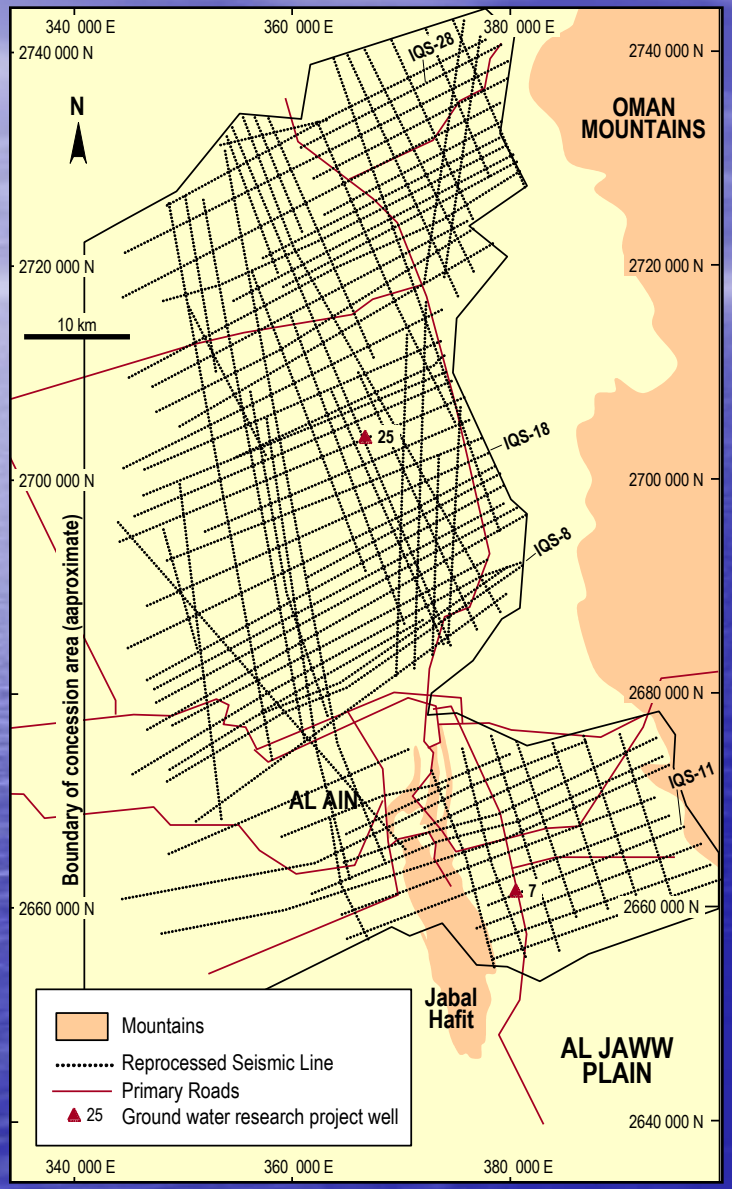
C-Surface Lithologic units at Al Jaww Plain



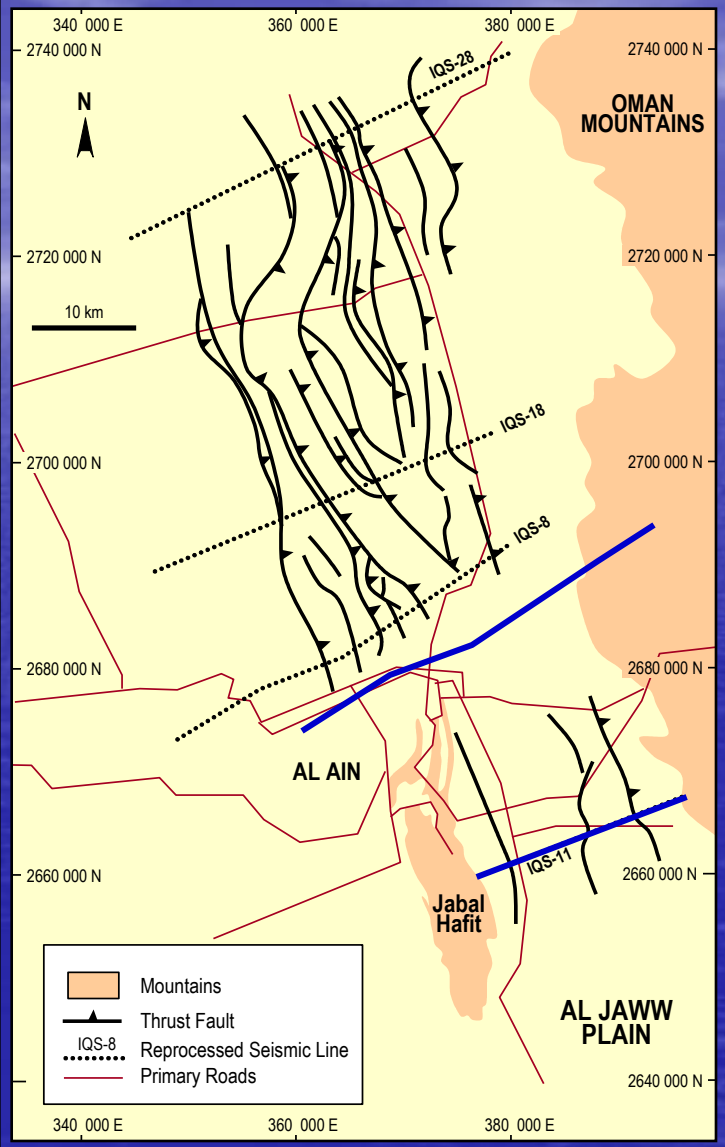
D-Structure Setting



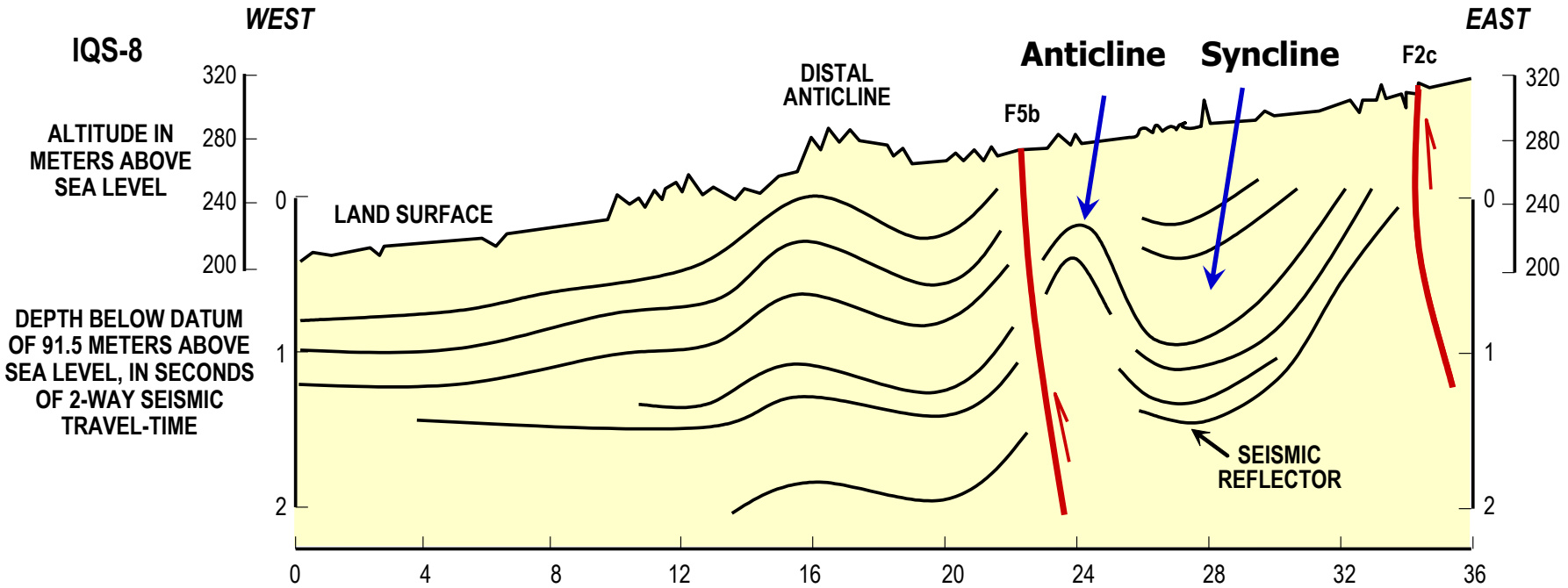
Bouguer anomaly map of Al Jaww Plain showing gravity anomaly lows in the centre and gradual increase to the east of the survey area (After Ali et. al 2008).

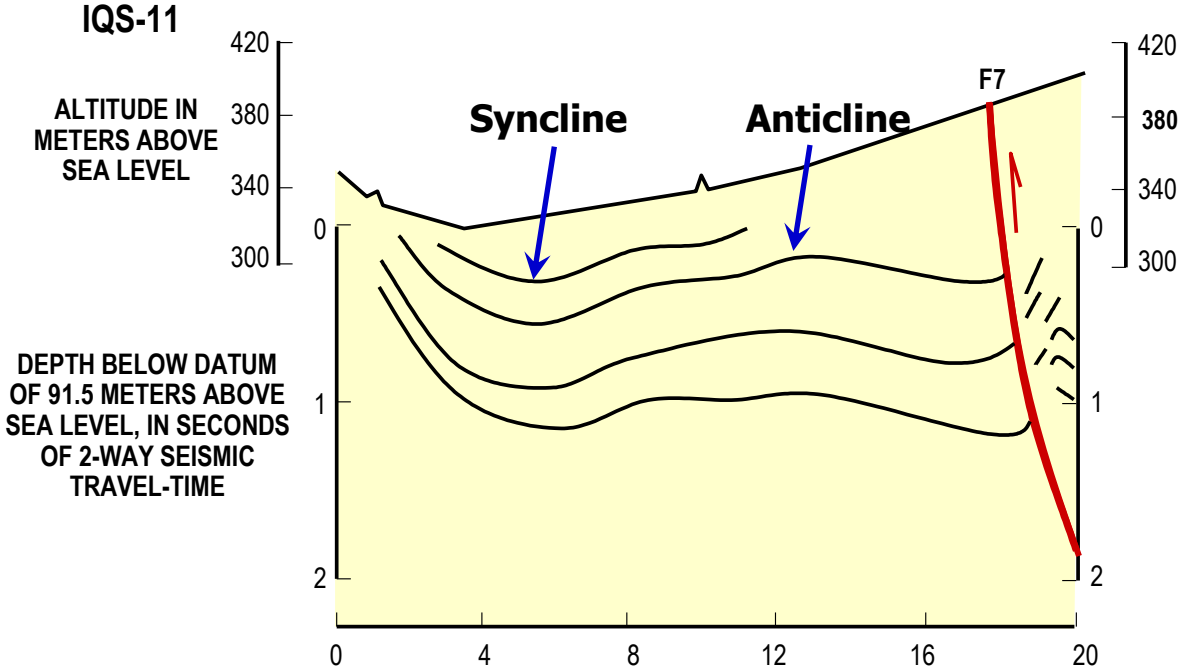


Amoco seismic lines and uphole-survey locations (after Woodward, 1994).

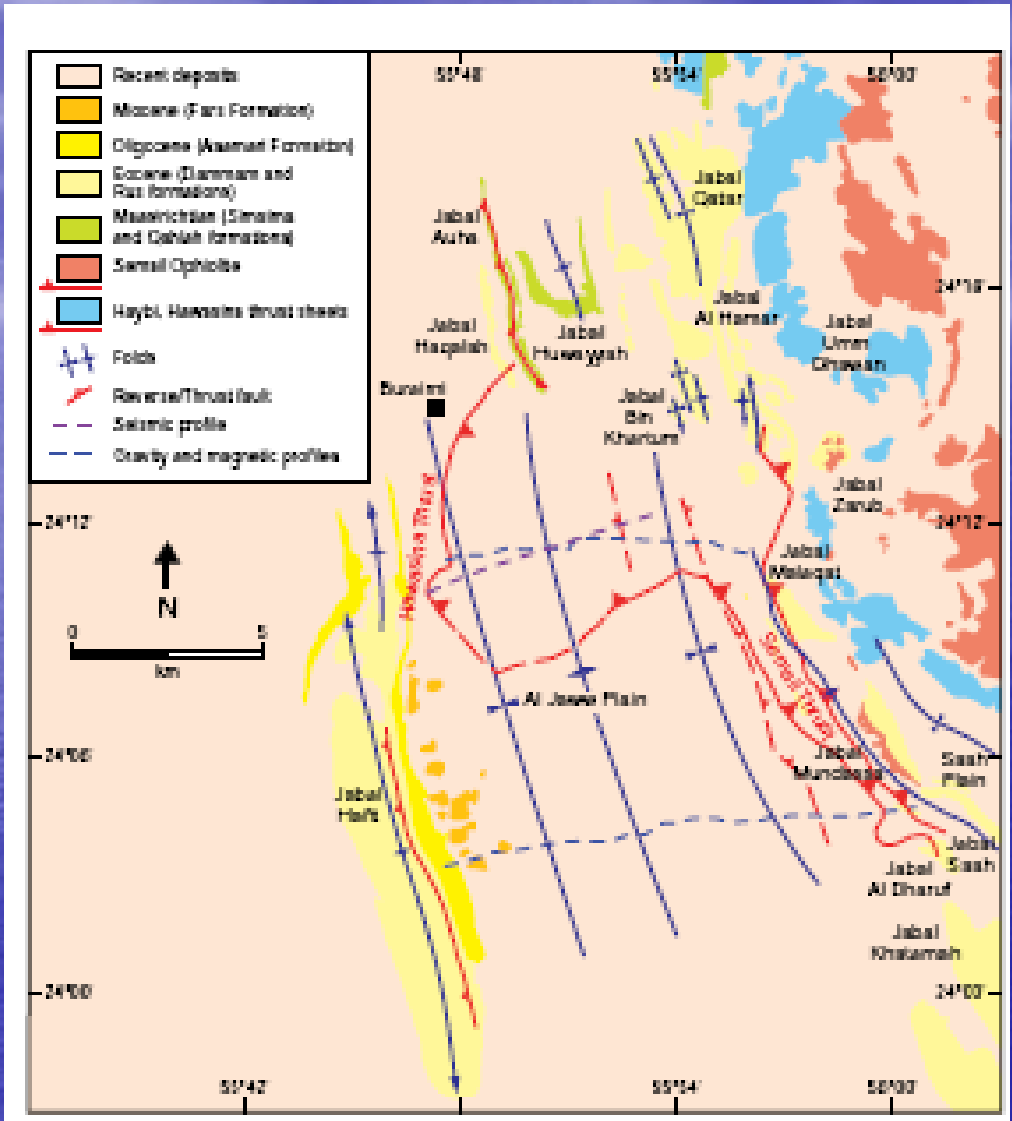


Generalized subsurface structural features in Al Ain area (after Woodward, 1994).





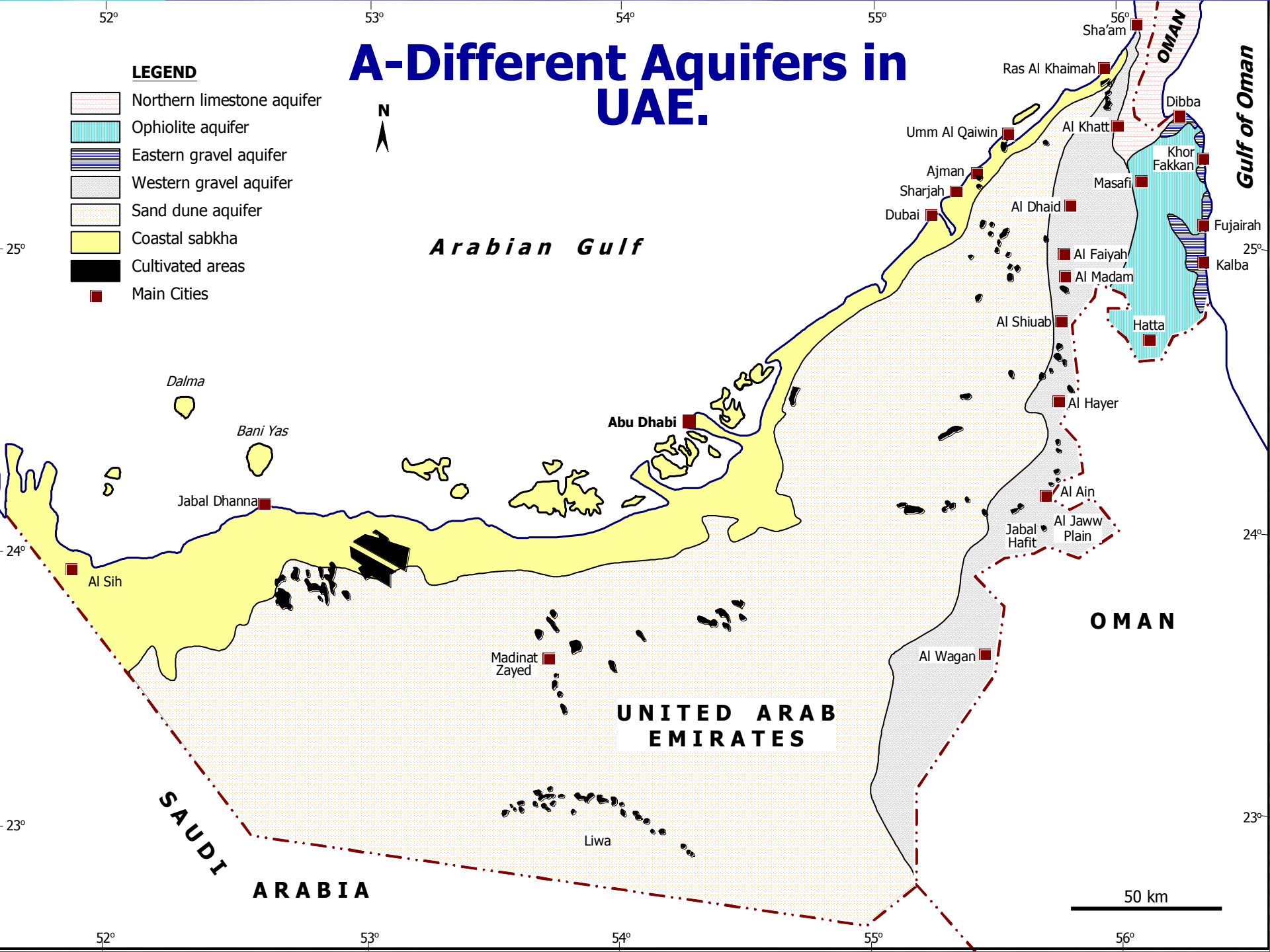
Interpreted seismic lines at Al Jaww Plain and north of Al Jaww Plain, (modified after Woodward, 1994).



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

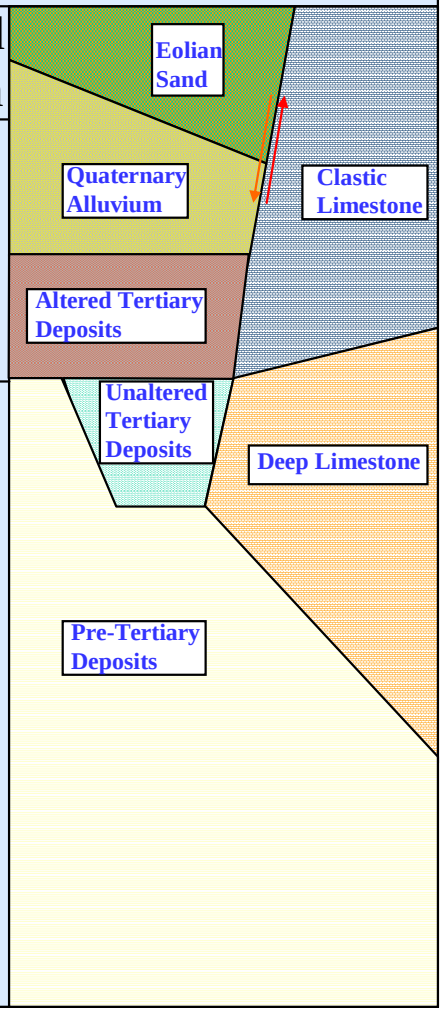
A-Different Aquifers in UAE.



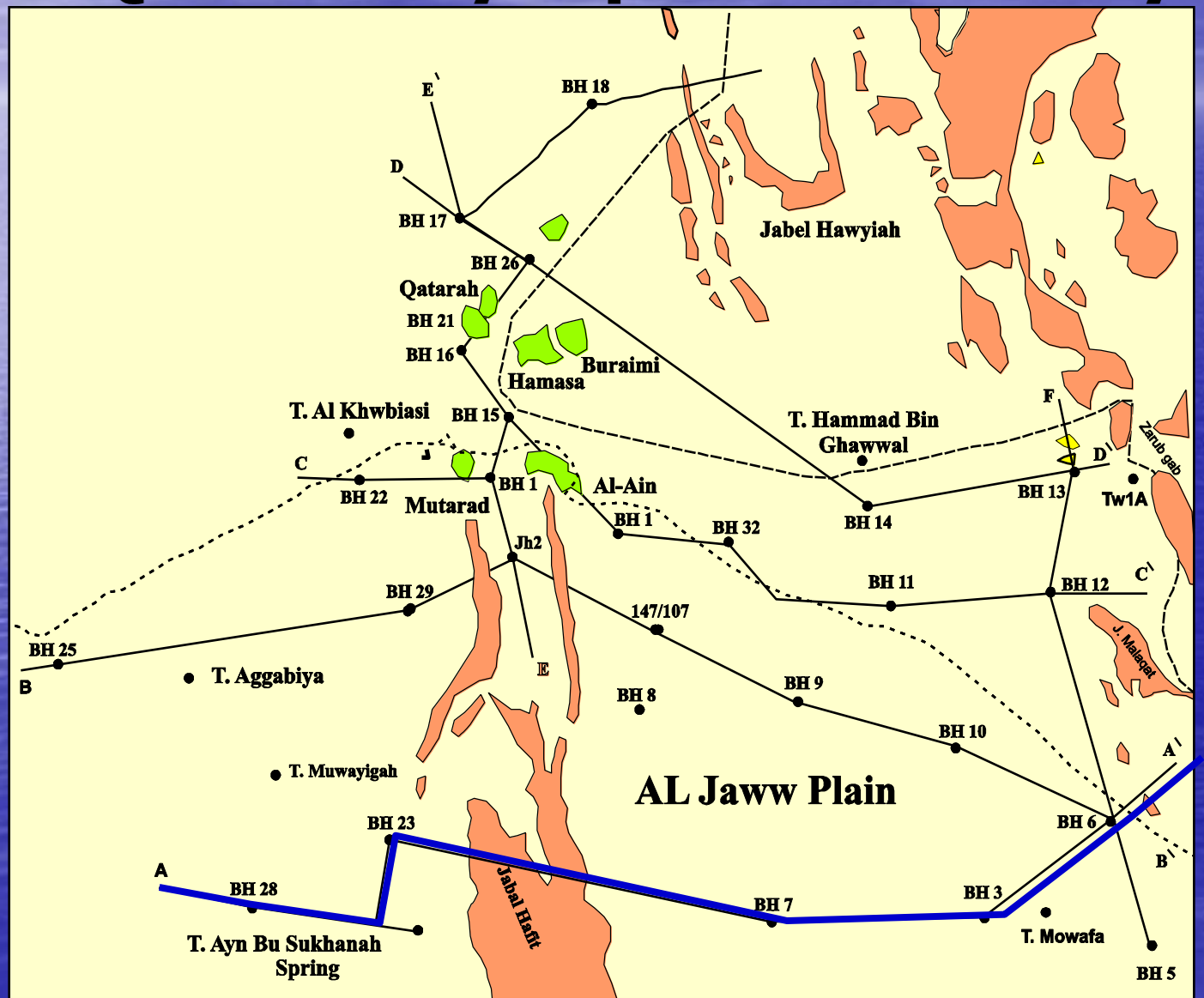
B-

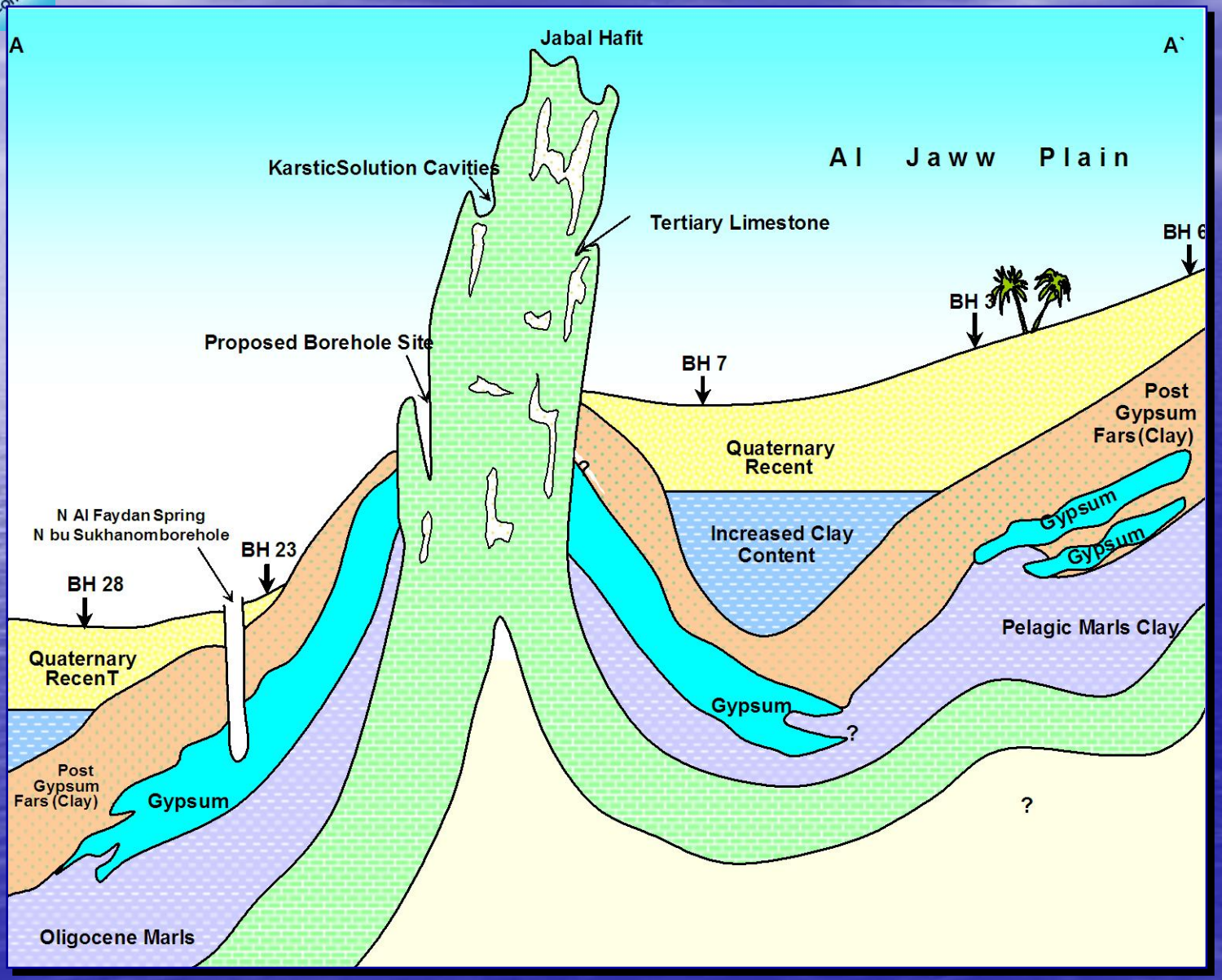
Geologic Framework of the Eastern Region of Abu Dhabi Emirate (after Bright, 1998)

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

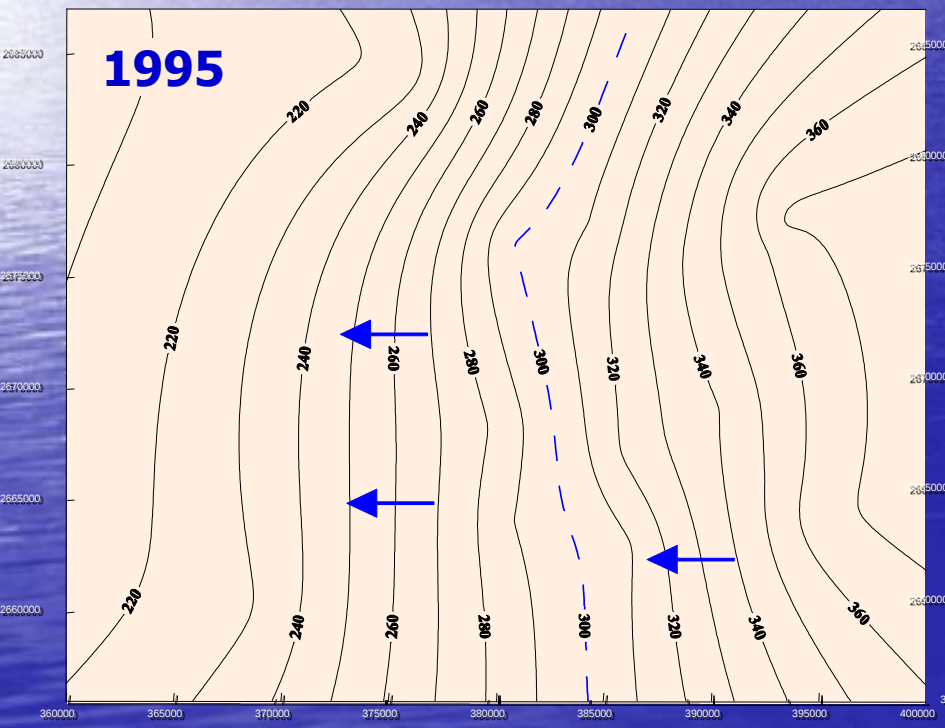


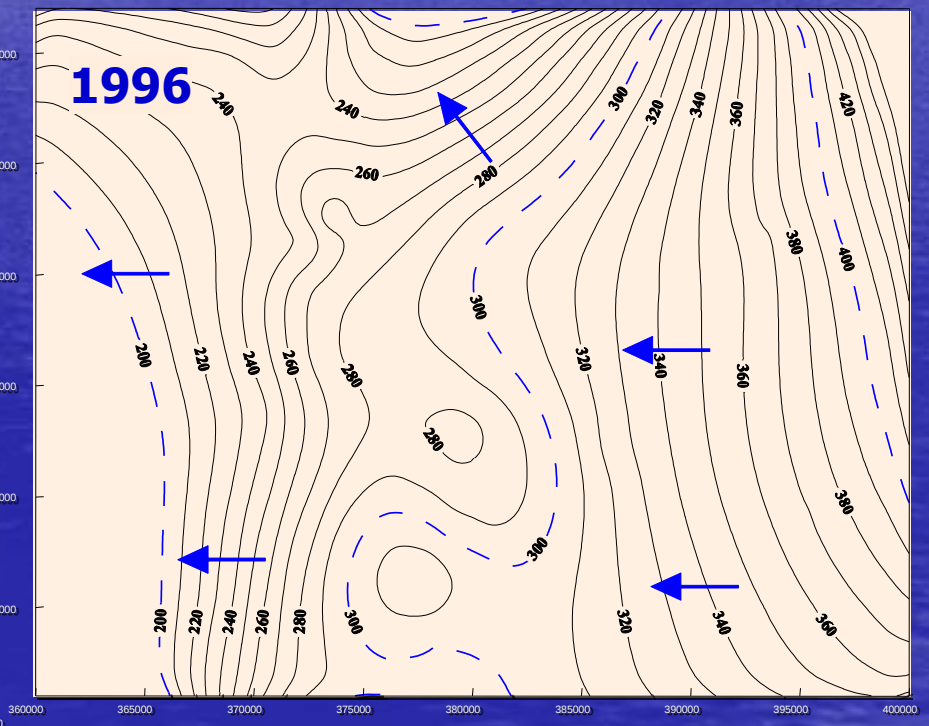
C-Quaternary Aquifer Geometry




A
A`
Jabal Hafit
Al Jaww Plain
KarsticSolution Cavities
Tertiary Limestone
BH 6
BH 3
Proposed Borehole Site
BH 7
Post Gypsum Fars (Clay)
Quaternary Recent
N Al Faydan Spring
N bu Sukhanomborehole
BH 23
BH 28
Increased Clay Content
Gypsum
Gypsum
Pelagic Marls Clay
Quaternary RecenT
Gypsum
?
Post Gypsum Fars (Clay)
Gypsum
?
Oligocene Marls

D-Flow System and water level assessment (After Al Nuaimi, 2003)

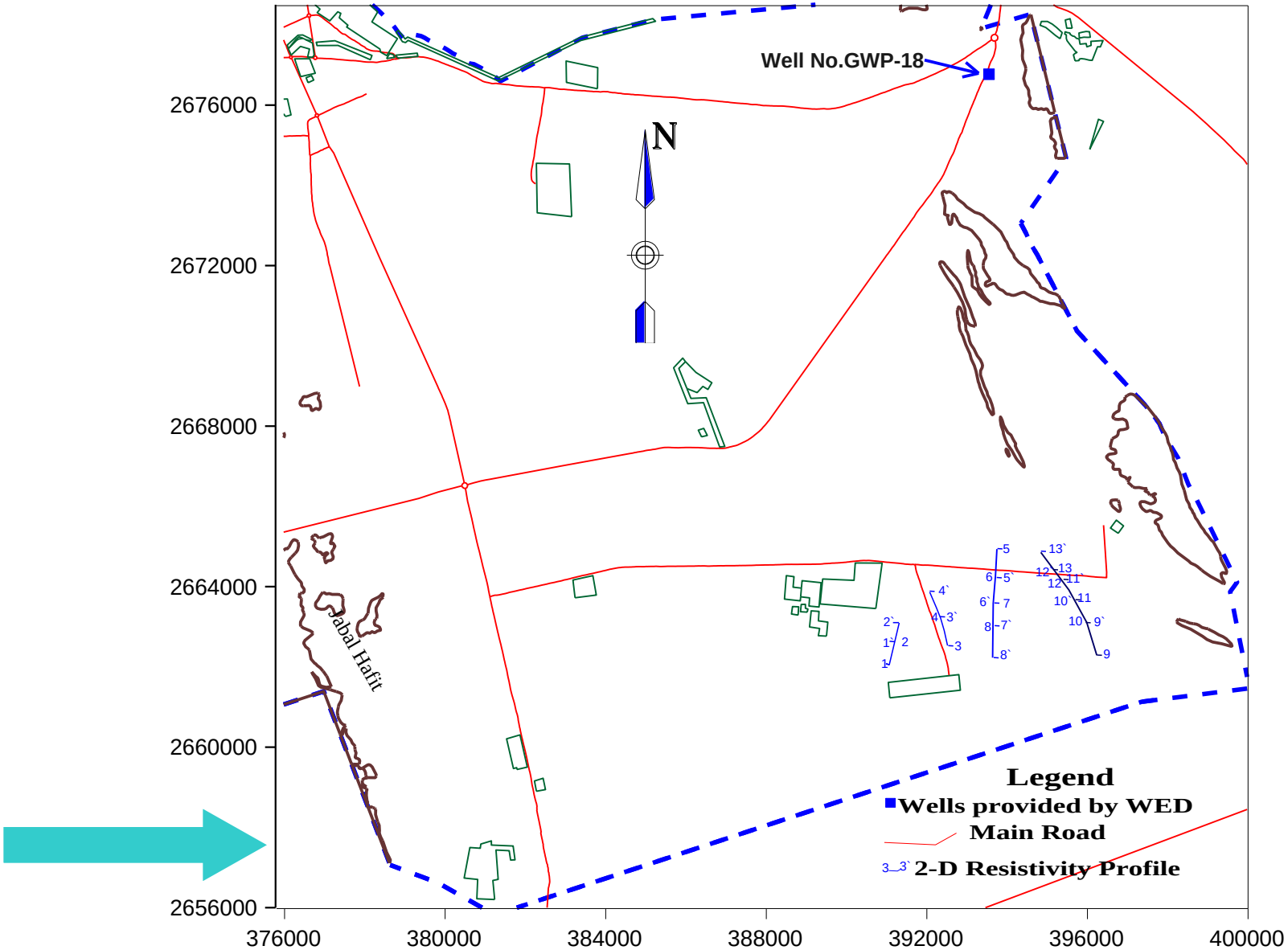




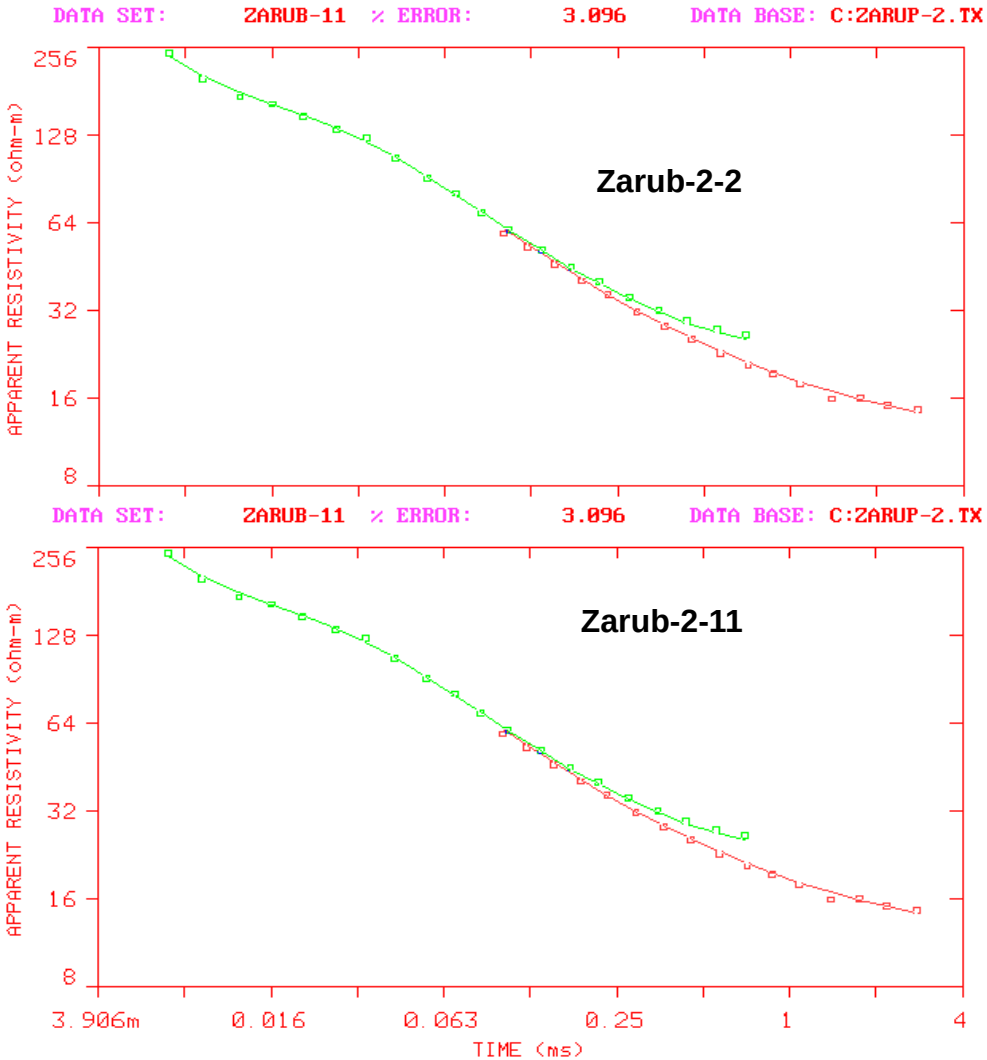
Geophysical Investigations

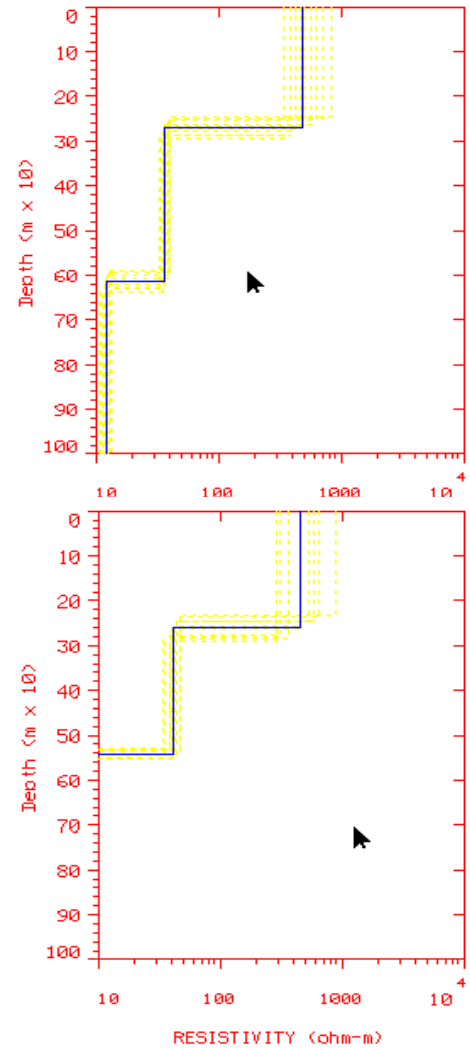
A-2-D Resistivity Data Acquisition

Base Map of 2-D Resistivity Profiles



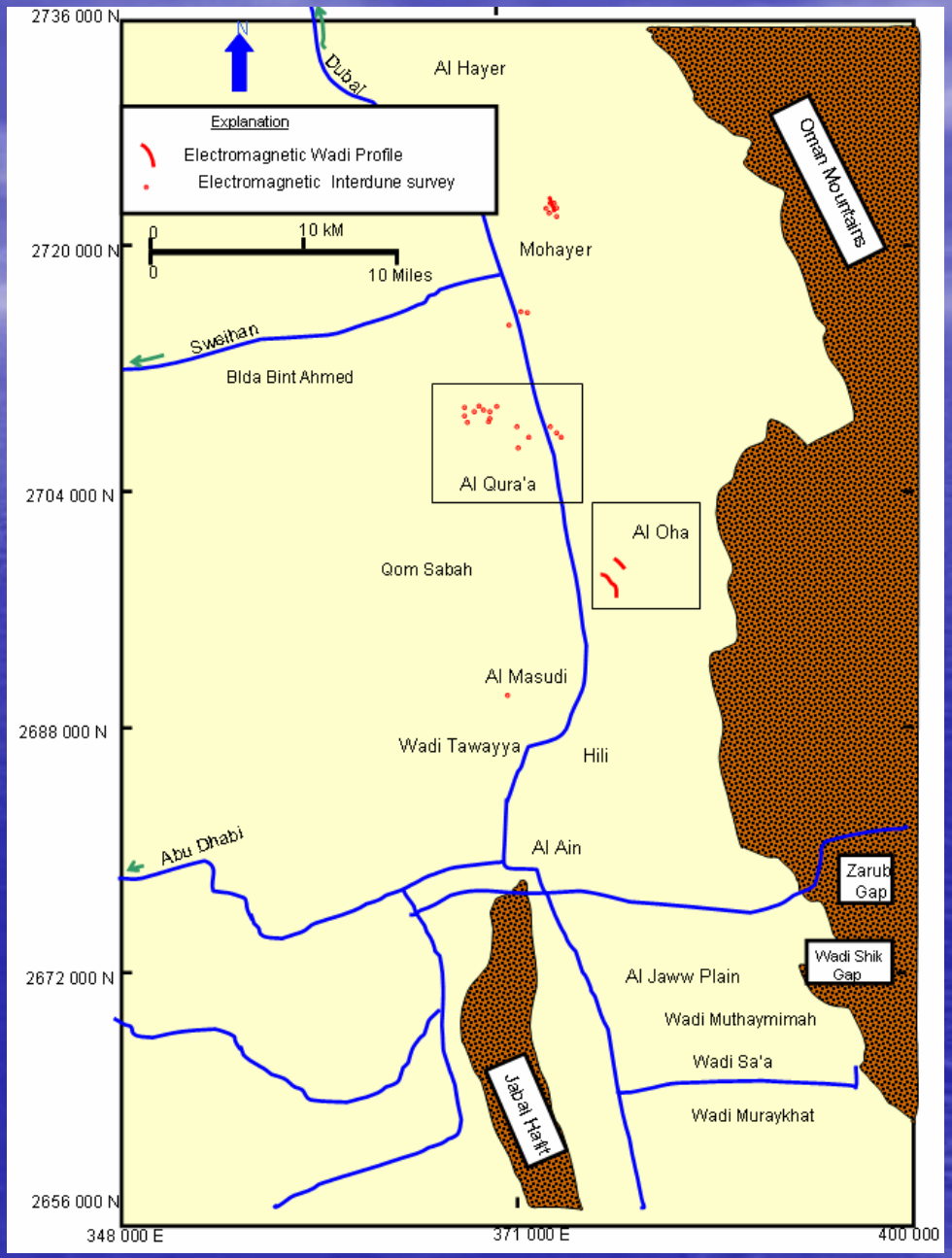
Typical TEM data from sounding Zarub-2-2 and Zarub-2-11.





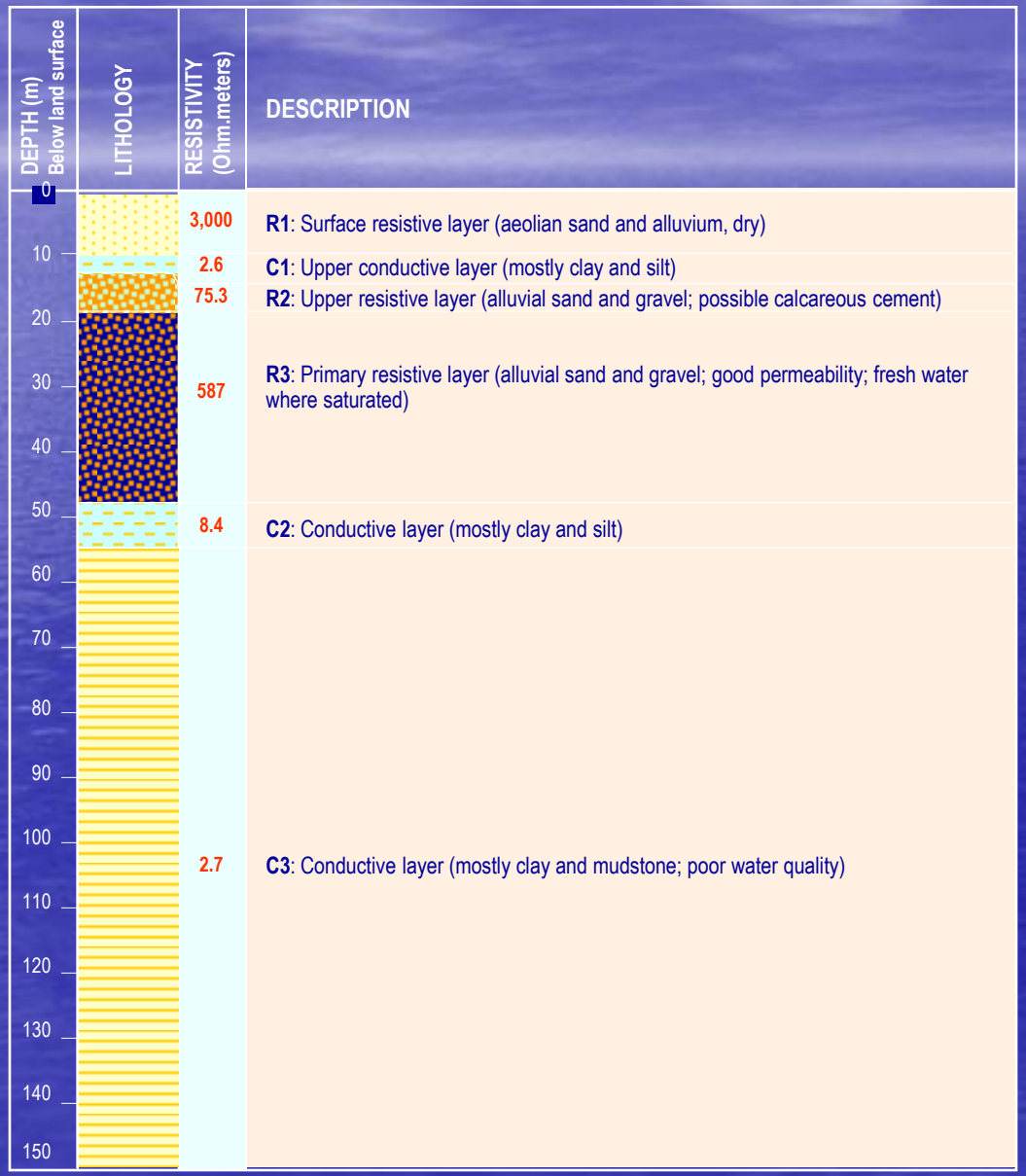
The observed data and the model response

Interpreted layer resistivity.

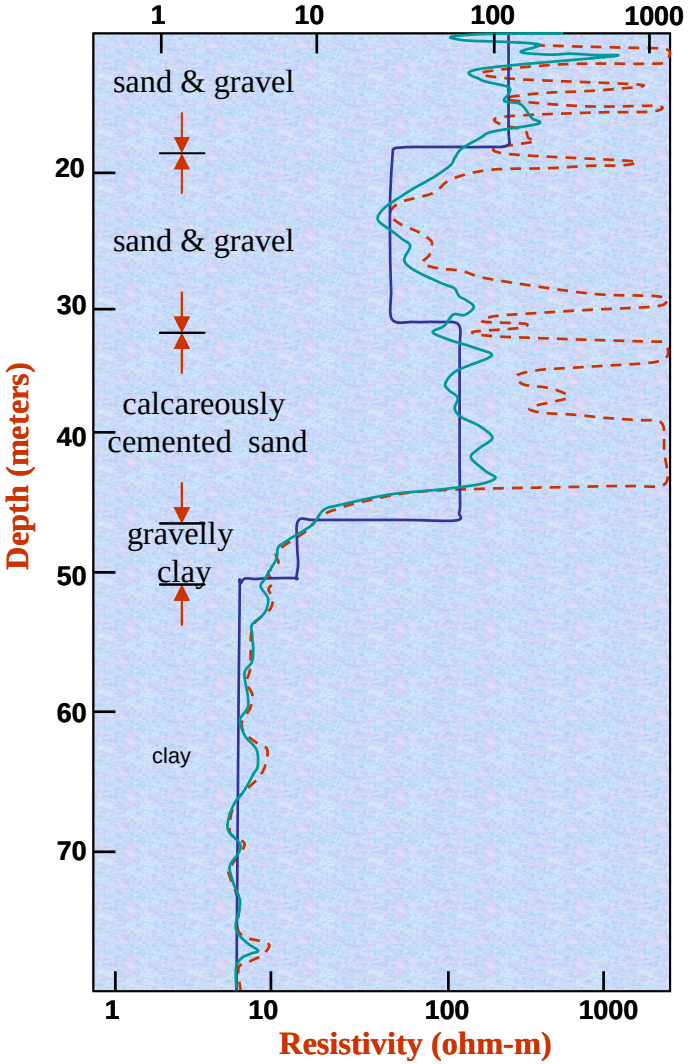


Base map showing the Electromagnetic survey at Al Qura'a area north of Al Ain (after US Geological Survey, 1993)

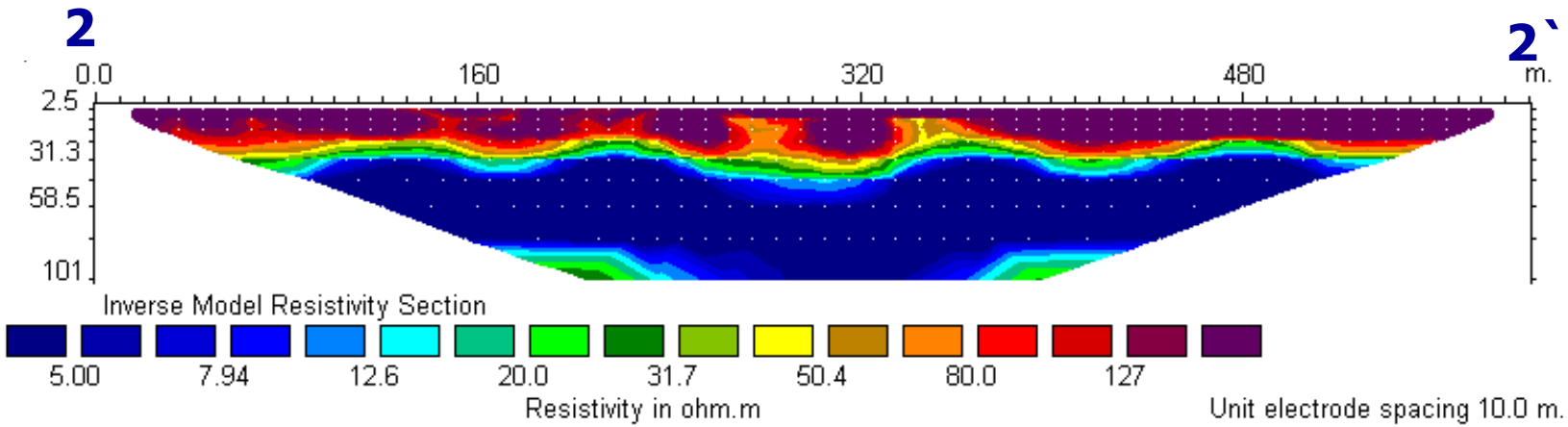
Resistivity model of typical resistivities for interdune soundings at Al Qura'a, north of Al Ain (after US Geological survey, 1993).

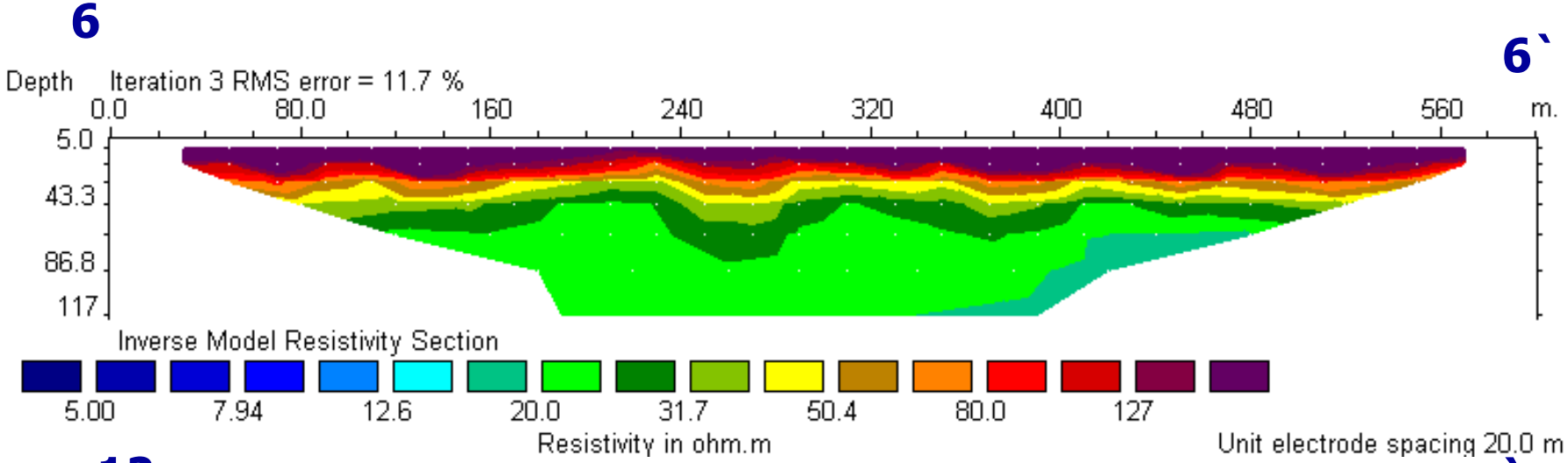


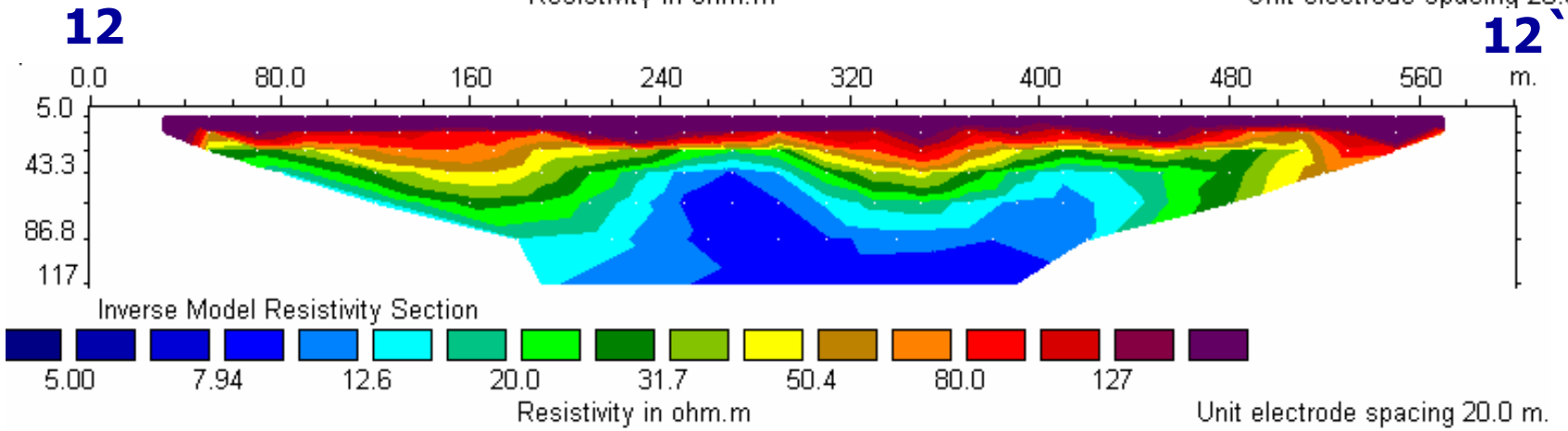
GWP-18



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).


2
2`
0.0
160
320
480
m.
2.5
31.3
58.5
101
Inverse Model Resistivity Section
5.00
7.94
12.6
20.0
31.7
50.4
80.0
127
Resistivity in ohm.m
Unit electrode spacing 10.0 m.


6
6`
Depth
Iteration 3 RMS error = 11.7 %
0.0
80.0
160
240
320
400
480
560
m.
5.0
43.3
86.8
117
Inverse Model Resistivity Section
5.00
7.94
12.6
20.0
31.7
50.4
80.0
127
Resistivity in ohm.m
Unit electrode spacing 20.0 m


12
12`
0.0
80.0
160
240
320
400
480
560
m.
5.0
43.3
86.8
117
Inverse Model Resistivity Section
5.00
7.94
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20.0
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127
Resistivity in ohm.m
Unit electrode spacing 20.0 m.

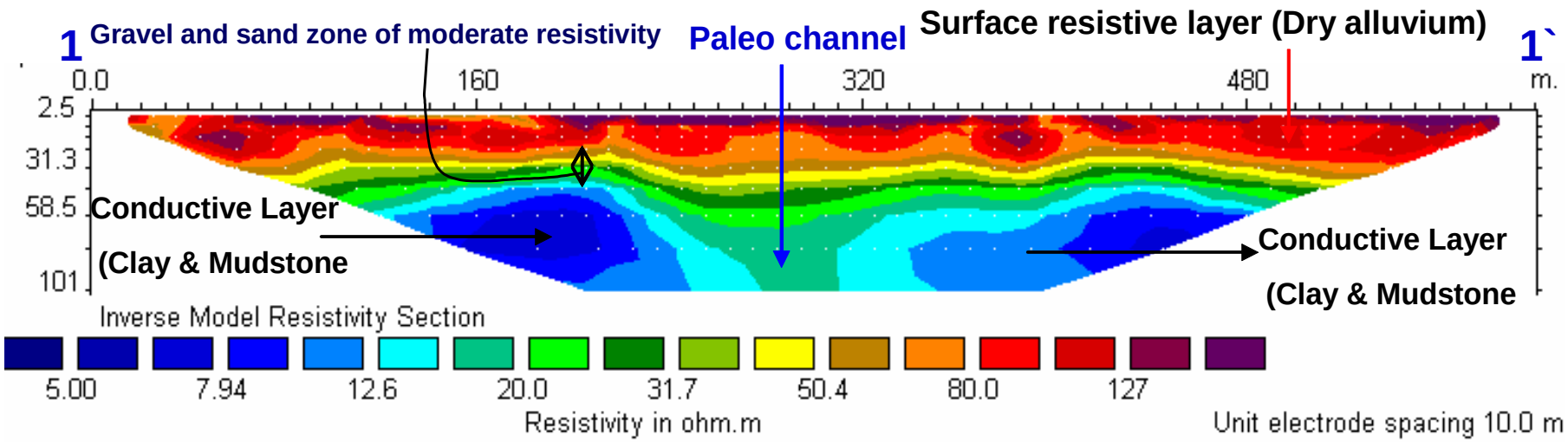

Figure (#) 2-D Resistivity profile along line 1-1`

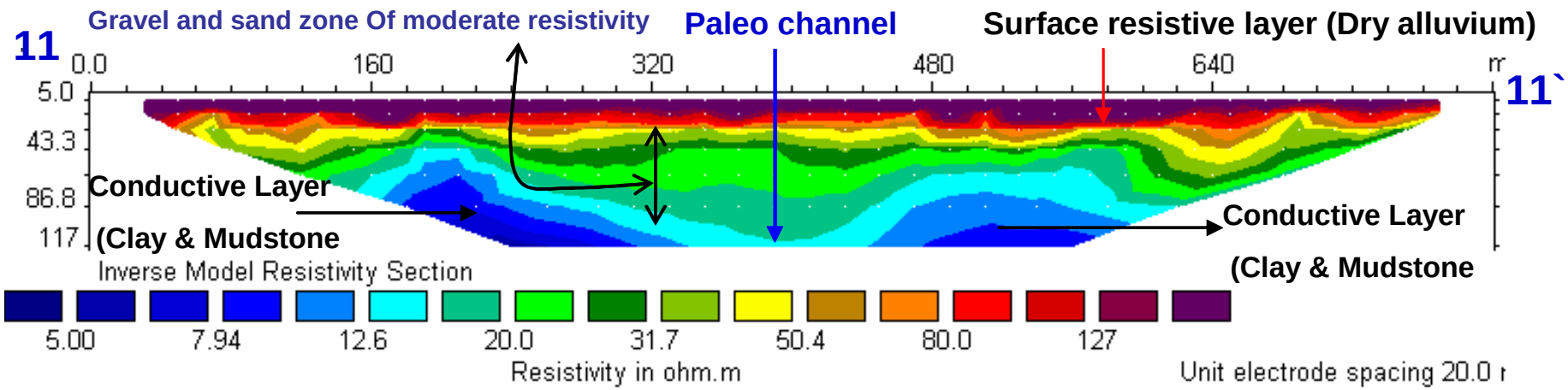

Figure (#) 2-D Resistivity profile along line 11-11`

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, Now days Aquifer Storage and Recovery system (ASR) Projects are implemented in Al Ain area and elsewhere at UAE.

Thank You
For your
attention